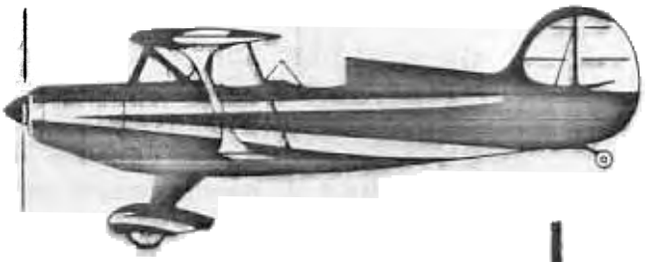

SKYBOLT NEWS

12026 S. TOMI DR.
PHOENIX, AZ.85044

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SERIES #3 VOL. #6
MAY 1978

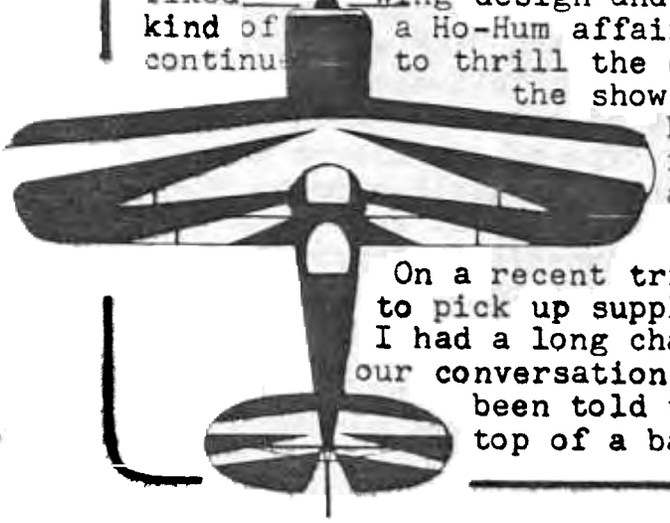
FIRST CLASS MAIL

TO:

HANGAR FLYING with MAC

Oshkosh is now history but the attendance records live on in the minds of everyone. 400,000 plus for 1978 so I'm told. What is the "Red Line"?

Once again there appeared many beautiful custombuilts but not as many Skybolts as in '76 & '77 when there were 17 to 20 on the flightline. All in all there wasn't really anything new in fixed wing design and the evening aerobatic shows were kind of a Ho-Hum affair except for a few oldtimers that continue to thrill the crowds. There was no real finale to the show due notably to the absence of the Flying Professor, Art Scholl. Now it's time to roll up our sleeves and make 1979 the best ever.



On a recent trip to Calif. and a stop at Riverside to pick up supplies at Stits Aircraft Coatings,Inc. I had a long chat with Ray Stits the founder. During our conversation it came out that builders have been told that DuPont Imron is OK to use on top of a base of Stits Poly-Brush and Poly-

Spray when in-fact DuPont has a dis-claimer in their literature. Sure, the Imron looks beautiful when first applied, but just give it time and you'll be sorry to have used it. While we are on the subject of fabric finishes I have heard many times that the best way to start a fabric finish is to make the first coat nitrate dope. This is true if you are going butyrate the rest of the way and you are working with cotton fabric. If you try this approach on Stits Poly-Fiber (Dacron) and then proceed with Poly-Brush and Poly-Spray you can bet your bottom dollar that the finish is going to peel. Few good cover jobs have ever come about with the use of mixed finishes. When you have selected a particular manufacturers process, stay with it right down to the pin stripes. Stits has been and continues to be, an outstanding covering process. Our thanks to Ray for the Imron info.

TAILWHEEL LOADING (3 point static weight)

In attending the April, Skybolt Fly-in at Porterville,CA. I had planned to take along a bathroom scale to check the tailwheel weight on each of the Skybolts present. Alas, I drove off from home without the scales and have kicked myself ever since. Most builders can quote right off the top of their head the exact weights of each wheel that were taken at empty weight weigh-in time. The weights that they remember are those taken with the aircraft in the level flying position. Few builders really know what the weight is as the "Bolt" sits on the ground in the 3 point position. One thing they know for sure is, it usually takes the help of the second person to lift it. In being a little bit offbeat, I'll venture a thought that more Skybolt and Starduster Too owners have had a hernia operation than the rest of the homebuilders put together.

While addressing the after dinner crowd at Porterville I made the statement that I was getting sick and tired of being forced to install $257 Scott Tailwheels on the Skybolt. After having done a lot of recent work on the drawing board with the Marquart type of cantilever gear and producing the parts necessary to install same on the Skybolt ala Doc Hall, I am forced to repeat that same comment. There are other good tailwheels at approx.$100 that will do the job but it mandatory to start at the landing gear to get the job done.

Just recently I have started on a dedicated effort to weigh every Skybolt tailwheel that I can get my hands on.

I started while on my trip to Calif. by weighing Doc Hall's Bolt. It has an empty weight of 1284 lbs., a 200 Lyc. and constant speed prop. The day I weighed it there was approx. a half tank of fuel. The extras in the tail of his bird amount to about 5 pounds of Marker beacon Antenna, Strobe powersupply and E.L.T. His tailwheel tipped the scales at 131 lbs.

The second Bolt to be weighed was that of Dennis Jones. It's a beautiful Bolt with an IO-540 Lyc., 80" constant speed prop and elec. system. There are no other frills such as interior or floor boards. Empty weight is 1298 lbs. This Bolt tipped the scales at 178 lbs. on the tail wheel with 10 gallons of fuel and a parachute in each seat. His tailwheel is a 6" hard rubber Maule and has worked just fine according to Dennis. The tailwheel on the Hall Skybolt is a 3200 Scott.

My dedicated effort to weigh a lot of Skybolts is over. To weigh anymore would be a waste of time. The reason to stop my quest is apparent in the 2 paragraphs above.

Lets get down to the specifics of the case. The reason for the difference in these two Skybolts lies in the landing gear. Doc has axles which are approx. 8½" aft of what is called out in the plans while Dennis has a gear built to the plans. Doc's engine mount is 3" shorter than a plans mount while Dennis with his larger 540 selected an 11" mount and has a dimple in the firewall to provide room to remove and replace the oil filter. I had estimated that the tailwheel weight on the Jone's Skybolt would be 180 lbs. before we placed it on the scales. How right I was. The optimum weight for the Skybolt would be 115 lbs. weighed in the 3 point position with oil, no fuel or baggage. In other words just like it would be when you had lowered the tail to the ground after completing empty weight C.G. procedure. It's no wonder that the Scott #3200 tailwheel has become a way of life with Skybolt builders. Plans built Skybolts with 180 and 200 Lyc's installed must be tipping the scales at close to 200 lbs. on the tailwheel. It's time to take action and I am doing so on all future Skybolts that I build. From here on in, I will install the cantilever gear. Not only will it get rid of excessive tailwheel weight, but you can put decent fairing on the gear legs and expect to get approx. 6 to 8 mph gain in cruise. For a little more reading on the subject you might like to refer to the Aug./Sept. 1977 Part 1 of the Skybolt News or the Feb. 1978 issue. An additional airfoil that you can consider for fairing on the cantilever gear is the NACA 66_2015.

LAST ISSUE IN SERIES #3 OF THE SKYBOLT NEWS (Vol.#6)

With this issue (Series #3, Vol. #6) we come to the end of Series#3. Series #4 will start in Sept. 1978. The price remains the same. $15 for U.S.A. & Canada and $20 for subscribers in other countries. A subscription re-newal form is enclosed here-in. For U.S.A. subscribers, a postage paid return envelope is also enclosed.

In the coming issues of Series #4 we will cover Part 2 of the Single Place Canopy installation, the 2 place Canopy (flush mounted, slides straight back with only 1 parting line at the front windshield), Installation of the Cantilever landing Gear. These articles are but a few of the features. Current subscribers will continue to be eligible for 20% discount on Stits fabric and coatings.

At Starfire Aviation we have 2 prototype biplanes in the process. The first is the Firebolt which is a further modification of the Skybolt. The objective of this aircraft is to properly locate the C.G. for ALL engines without resorting to high tail weighting for the 540 series Lyc., putting the Landing Gear where it belongs, improving the Aileron system to further reduce the possibilities of flutter, getting the slave strut out of the breeze (installed inside the "I" strut), move both seats aft 3" for better C.G. control and to greatly improve the entry and exit to the front seat, improved tie wire pulls on the empenageplus a host of other subtle refinements. Plans will be available only after successful flight test and submission of the plans to the National Association of Sport Aircraft Designers for approval in Class 3. This aircraft will be powered with a 260 hp. Lyc. and constant speed prop.

The second prototype is the "SUN DEVIL", Now on the gear. This 2 place bipe is a new generation concept. It's an exciting project. You will receive up date info in the Skybolt News in the form of a supplementary insert page as we progress with both aircraft.

N.A.S.A.D. (National Association of Sport Aircraft Designers)

This fine organization is "Dedicated to all whose interest lies in the design, development or improvement of light aircraft or related components". It is led by people who are eminent professionals in the light air-

craft field. Membership is open to anyone with the same interests whether he be professional or amateur. One of it's major functions is a plans evaluation committee. This committee operates to protect the homebuilder from plans sellers whose designs are unproven, designs which are dangerous or too complicated for the average builder. In the near future I hope, I will send to each of you a copy of their brochure. In the meantime if you care to join the organization, membership is $25 per year. Write to the Secretary, Mr. Robert Rautenstrauch at NASAD, 1756 Hanover St., Cuyahoga Falls, Ohio 44221. You will be welcomed.

I have learned from Mr. Harvey Swack of Barney Oldfield Aircraft, President of NASAD, that our Skybolt designer Mr. Steen will be submitting the Skybolt plans for approval. Mr. Steen is to be commended for his action. We look forward to seeing the NASAD seal of approval on the Skybolt plans which is an excellent combination aerobatic, sport biplane.

HEAT TREATED LANDING GEAR BOLTS (Front Bolts)

For what it is worth, I give you the words of a Skybolt builder and Skybolt News subscriber in Indiana who only recently completed his "Bolt" and flew it to "Mecca '78".

"Hi!
Please find a check for $7.00 enclosed. Send me a pair of Heat Treated Bolts for the front gear legs of my "Skybolt". You are so darned right, mine bent when a friend flying my Skybolt got confused & missed a grass runway, & landed in a clover field! I didn't see how they could bend but they do ! "

One of the"flies in the pie" is the angle of the front leg. It is 17 degrees as shown in the plans. If this angle was reduced to 7 degrees and the front leg length increased 1", it would accomplish 3 important improvements. 1. It would reduce the leverage that is working on the front gear bolt. 2. It would raise the nose 2" for a better landing attitude. 3 It would move the axle aft approx. 5½" and materially reduce the heavy tailwheel loads in the 3 point position, with no nose heavy tendencies during heavy braking. The Skybolt and the Starduster Too which employ almost the same gear design and placement have the same problems. The axles are too far forward. I can tell you from personal experience with N77BG the 1974 Grand Champion Starduster Too, when we built the new gear, I moved the axles back 5" and the static tail weight went from an original weight of 210 lbs., to 136 lbs.

At this point in the history of the Starduster, it is not un-common to see builders move the axles aft 6" with resulting benefits. In any event, it would be wise to contact the designer of the Skybolt for his comments on the subject.

ELECTRICALLY OPERATED TRIM TAB (Some safety comments)

This author is not a proponent of electrically operated trim tabs and especially those which are combination servo-trim tabs, more correctly called balance tabs. After the ill-fated crash of the Cessna Citation I am even more opposed. Specifically, I offer the following dis-advantages of such a system. 1. In certain elec. systems it is wise to turn off the Alternator or Generator during aerobatics to prevent pressure build up in batteries that have only the non-spill caps as a means of preventing acid loss. 2. During inverted aerobatics, even positive for that matter, physiological and psychological events leave little time for the co-ordination of it's use. 3. Electrical failure or component failure can leave you with heavy elevator load which can seriously effect recovery to normal attitude. 4. Just suppose that the up travel or down travel limit switch fails to stop the motor drive assembly. What happens then? (The system MUST employ mechanical stops) 5. The electrically operated system usually adds to much additional weight and complexity.

Just recently a local builder brought in a set of plans for a well known,2 place,side by side, all wood. high performance, low wing retractable gear, 260 hp. aircraft. He wanted my assistance in building the engine mount which also in-corporates the nose wheel trunions. As I looked through the plans my eyes latched on to the electrically operated trim tab assembly. I saw no evidence of mechanical stops on the plans nor did I see any evidence of limit switches. The coupling between the shaft on the gear reducer and the shaft that drives the trim tab (a male threaded shaft inside a female threaded shaft) is called out as a hard rubber coupling that is merely epoxied to the 2 shafts. The builder was not sure if mechanical stops were designed into the gear reducer and I was unable to discern this point from the plans. The only form of a stop that I did see, was the depth of the threads in the female shaft

and this is in the "nose down" position. At the present time, only the prototype and one other copy of this design have flown.

Before I close this article on trim tabs,I would like to caution those builders who are planning to use an extra lever on the throttle quadrant to operate a manually controlled tab. This is also a dangerous practice. For maximum safety, the trim system should be an isolated system of it's own.

If you know of a builder that is installing an elec. trim tab system, please let him read this article so that he can fully investigate the design before the "Band Aid Truck" pulls up to haul him away.

UPPER REAR FLYING WIRE ATTACHMENT (A SAFETY MODIFICATION)

It has been brought to my attention by Mr. Nick D'Apuzzo (designer of the D-260 and the PJ-260) that it would be advisable to attach the fitting to the upper rear spar with a 5/16" bolt instead of a 1/4" bolt. This is the one bolt that is in the center of the re-inforcement plates that attaches the wire pull fitting. Since the bolt is subject to bending as well as shear, the 5/16" bolt would give us an extra measure of safety. I highly rec-commend that you make this change. Please refer to the March 1977 issue of the Skybolt News. The fitting is shown on Page 6, FIG. #7 . The bolt that goes through the AN665 Terminal that attaches the wire to the fitting can be reduced in size to 5/16" thereby allowing us to use an AN665-46 Terminal instead of the AN665-61 now required.

At an aerobatic gross weight of 1700 lbs., the total flying wire load is 15300 lbs. at 9 G's. The rear flying wires are carrying approx. 40% of this load or 3010 lbs. per rear wire. Single shear of a 1/4" bolt is 3680 lbs. Since there is a bending moment to allow for, it means that the 1/4" bolt is at design limit. Single shear capacity of a 5/16" bolt (AN5-) is 5750 lbs.

FUSELAGE FIXTURE

As I have mentioned in earlier issues covering wing

EINSEBOIL PISCOTTI' ENG

construction, accuracy of construction doesn't "just happen", it is planned for in advance. The accuracy that goes into the wing bench and spar fixture shows up in the finished wing. The fuselage is no different.

Some well thought out,advance planning of the fuselage sidewall fixture or jig, will allow us to more than merely tack together the sidewall frames. If built properly, it will also serve as a fixture on which we can place the sidewall frames and tack in the intercostals or cross members, position the tailpost and accurately bend the longerons wherever called for. FIG.#1 is a drawing that shows how the above can be accomplished.

To build the fixture we need 2 ea. 2x4's x 16'. These must be straight. Start by surfacing them on a planner-jointer. Next, we need 2 ea. 4'x8'x 3/4" sheets of particle board. Rip the two sheets of particle board lenghtwise so that you now have sheets that are 32 3/8"x 96".

The next step is to rip a quantity of 3/4"x3/4"x4" blocks. Here again, accuracy. Start with an edge on the boards that you are going to rip by running them on the planner-jointer. As you rip off 3/4" strips, run the larger board on the planner-jointer before ripping the next strip. This will produce blocks that are accurate on 3 sides. The condition of the 4th. side is of little importance.

We can now glue (Elmers or equiv.) the 16' base members to the particle board. I suggest that you use flat head wood screws to hold the particle board. Since the Particle Board as received from the mill is quite accurate (Check it anyway) about all that is necessary is to accurately align the mill finished edges so that one side of our fixture is an accurate straightedge. We will use this edge to layout all of the basic lines on the fixture.

When attaching the small 3/4"x3/4"x4" blocks to the surface of the fixture, use wood screws but DO NOT GLUE them in place as we will want to move them around for different operations. Be sure to use the planned edge against the tubing.

When laying out the lines on the fixture I use a .5 m/m drafting pencil and personally wear a pair of magnifying glasses in an attempt to work to a tolerance of 1/64". This pre-occupation with attempts towards accuracy may seem ridiculous to some but I can guarantee that my customers like the finished product.

Some further precautions are in order while laying out the lines on the fixture surface. It is best to sand the surface lightly with some 320 sandpaper before starting the lines. Note that in FIG.1 we use one edge of the fixture as a Master Edge. DO NOT cut any of the welding holes in the surface plate until all lines are laid out. Due to the fact that you will probably be using a retractable type tape measure (most of which have errors in length), check your tape measure with a good 12" machinists scale between the footage marks. If your tape measure checks out as being reasonably accurate, you can proceed to layout the Station locations for the top truss which is shown in FIG.#1 as a series of dotted lines. When doing this, we measure every station from the "0" Station. DO NOT measure in an accumulative manner from one station to the next. To do so usually results in error.

Next we can layout the centerline of the fixture and the longeron lines (top truss). Once the top truss lines have been drawn, proceed to draw the bottom rear longeron lines as shown in FIG.#1 as line "A" - "B" and line "C" - "D". You will notice that these lines intersect in the center of the tailpost whereas the centerlines for the top longerons intersect the periphery of the tailpost. The reason for this is well shown and noted in the Dec. 1976 issue of the Skybolt News, Page 4, FIG. #5. The article is called, "Don't Box Yourself In At The Tailpost".

The next step in construction is to layout the lines that represent the sidewalls of the fuselage. You will notice that we DO NOT install any tubes (Diagonals) aft of Station #137 while we are tacking the sidewalls together. They are installed at a later time when we are tacking the sidewalls together as a complete fuselage and have the longerons tacked to the tailpost.

Next, we screw the fixture blocks to the surface so they will hold the various pieces of tubing in alignment while we fit the tube clusters and tack everything. It is a good idea to actually lay a piece of tubing on the fixture so that the blocks will fit snugly against the tubing.

Since the forward portion of the fuselage is constructed of mostly 7/8" O.D. tubing we will have to make a number of .063 shims on which to lay the 3/4" O.D. that makes up the portion of the fuselage aft of Station #79 - #85. At Station #137 we need a couple of shims that are 1/8" thick since the vertical member at this station is 5/8" O.D.

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We proceed now to the TAILPOST CLAMP BLOCK which is very simple in nature. You can make out of a piece of 4x4 lumber. The important thing is to have all sides a perfect 90 degrees. When you are sure that you have a square block, you can drill the 1" hole that is used to align the tailpost. we next cut a 1/8" slot and drill the 1/4" hole. Install a 1/4" by 4" bolt in this hole. When tightened, this gives us the clamping action we are after to securely hold the tailpost in position. Using a short piece of 1" O.D. tubing for alignment, install the clamp block to the bottom of the Fixture. Notice the Tailpost Block in FIG. #1. It shows a shaded area on the block. DO NOT put any screws in this area.

The next step is to make the welding alignment fixtures which are shown in FIG. #1 as "SIDEWALL SPACING BRACES". It is necessary to make 4 sets of these braces. They are used when we have our sidewalls tacked together and wish to join them with the cross mambers of the fuselage. Start the assembly of the cross member braces "R" by welding part "S" to one end only. We will weld the other end bracket on when we have our fuselage sidewalls standing upright on the fuselage fixture with the upper longerons resting on the surface. In this way we can use the fixture spacing of the longerons to establish the spacing of the angle brackets on the other end of the cross braces "R". It is best to use one location only when tacking the bracket "S" to cross member "R". Be certain that bracket "S" is at 90 degrees to cross member "R"

I am sure that by now you have noticed that there are no legs on our fuselage fixture. The 1x4x28" pieces on the bottom of the fixture is for clamping to the Wing and Spar bench that we showed in the Jan. 1977 issue of the Skybolt News. Check Page #6. The fuselage sidewall and welding fixture as shown in Fig. #1 is now ready for clamping to the wing bench. The fixture must be level in all directions. If it is necessary to shim the fixture to achieve exact level in a particular spot or direction, by all means do so.

FUSELAGE CONSTRUCTION (PART 1)

Now that we have built our fuselage fixture and have it mounted and level on the wing bench, we are ready to cut the tubing for the sidewall frames. The thin wall tubing that we are working with is very easily cut with a Hacksaw, the blade of which, has 24 to 32 teeth per inch. 32 is my personal preference. Do-All or Snap-On is the brand name.

The tools that I use in my shop for fuselage construction are as follows. Hacksaw, Wiss shears - Model M5 (Short compound leverage jaws. Will cut 4130 tubing with wall thickness up to .058), Radial arm saw with cut-off wheel- used for rough cutting tubing to length, Elec. drill with #40 drill bit for drilling welding vent holes, a #753 Eagle Brand Silver Pencil- used for marking 4130 tubing or sheet (available at most stationery stores), a good 24" Carpenters Square, 8"to 12" spirit level, a good supply of 6" Spring Clamps, a good supply of 3" "C" Clamps, Approx. 3 pounds of Ox-weld #7 welding rod, Welding Equip. in good working order(OxyAcetylene)- mine is a Smith torch and Purox 2 stage regulators. Torch tip is #2, Bench Grinder with 2 wheels. 1 is 3/4" w/3/8" radius- the other is a 3/8" thick wheel w/3/16" radius, Tape measure, Machinists Square. Thats about it for the tools.

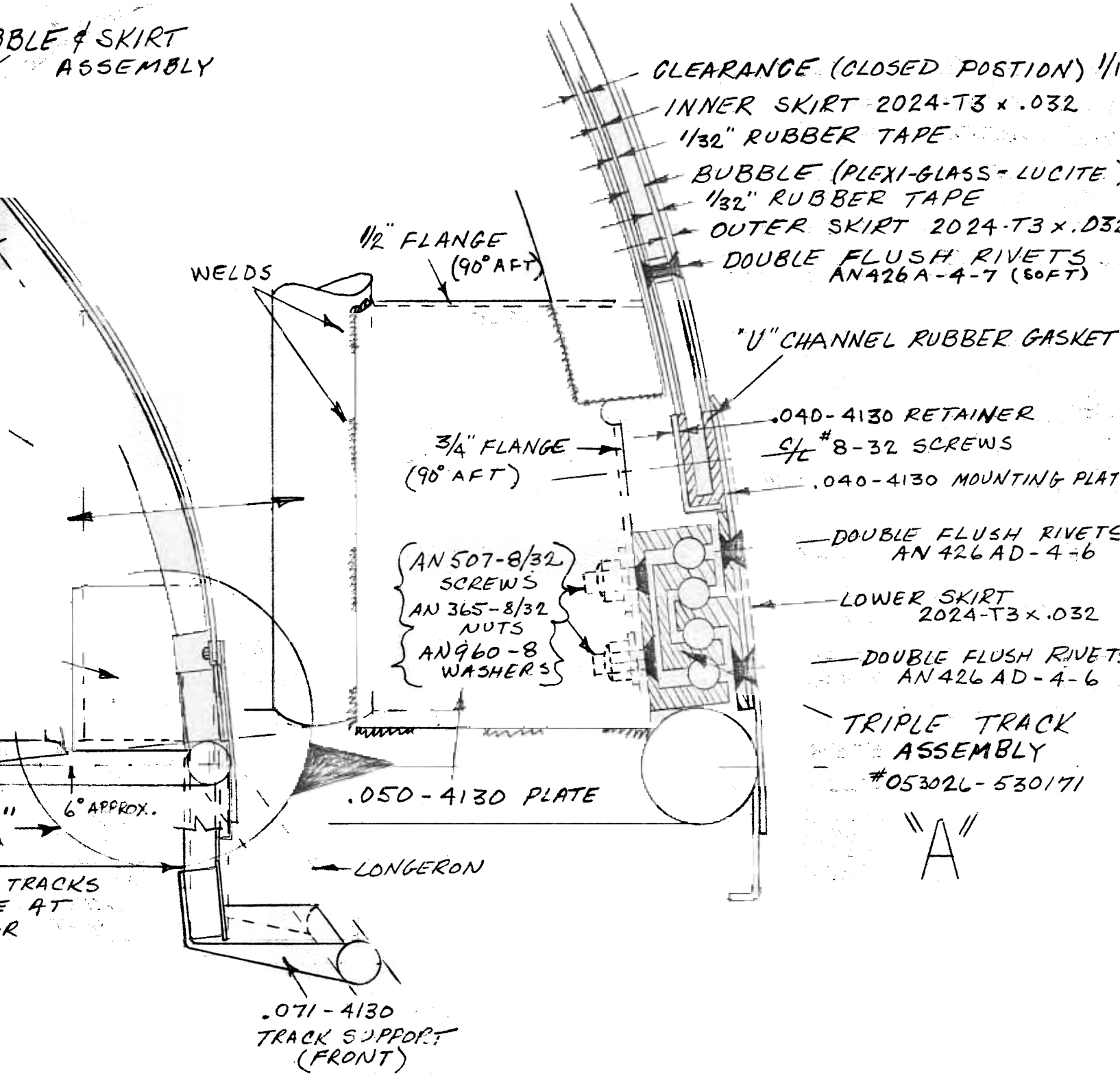
The first step in the actual construction of the sidewall frames is to cut and splice the 4 longerons that are necessary. I tack weld the splices on the fixture as in Fig. #1 since we have shims on the surface to correct the centerlines of the 7/8" and 3/4" tubing, We also have our small blocks screwed to the fixture surface which holds the tubing in alignment. After you have made the splice welds, you can heat and bend the bottom longerons right on the fixture. The bend starts at Station 57 9/16, not at 57 1/8 as the plans would lead you to believe. Before actually heating and bending the tubing, install the upper longeron in place and cut and fit the sidewall member that goes from Station 51 to Station 57 1/8. This will give you a brace against which to push as you bend the longeron. DO NOT try to apply the heat in one small spot and make a tight radius bend. Heat the tubing evenly so the red heat band is entirely around the tube. Move this band of heat gradually aft as you apply hand pressure to the portion of the tube that is bending. Use the lines on the fixture to ascertain the correct angle of bend. Finish putting your small blocks in place for the lower longeron and go to work fitting all of the other members of the sidewall frame. We will pick up in Series#4, Vol. #1 where we have left off in this issue.

SINGLE PLACE CANOPY INSTALLATION (PART 1, Installing the tracks)

Canopies, whether they are single place or dual, are becoming an increasingly popular option of the biplane custom builder. The evidence of this is especially true in the higher performance types such as the Skybolt, Pitts etc. The ranks of the "Wind In Your Face Enthusiasts" is is decreasing. The moment of transition comes at 50 hrs.

CANOPY TRACK INSTALLATION (PART 1)

CROSS SECTION VIEW AT HEADREST



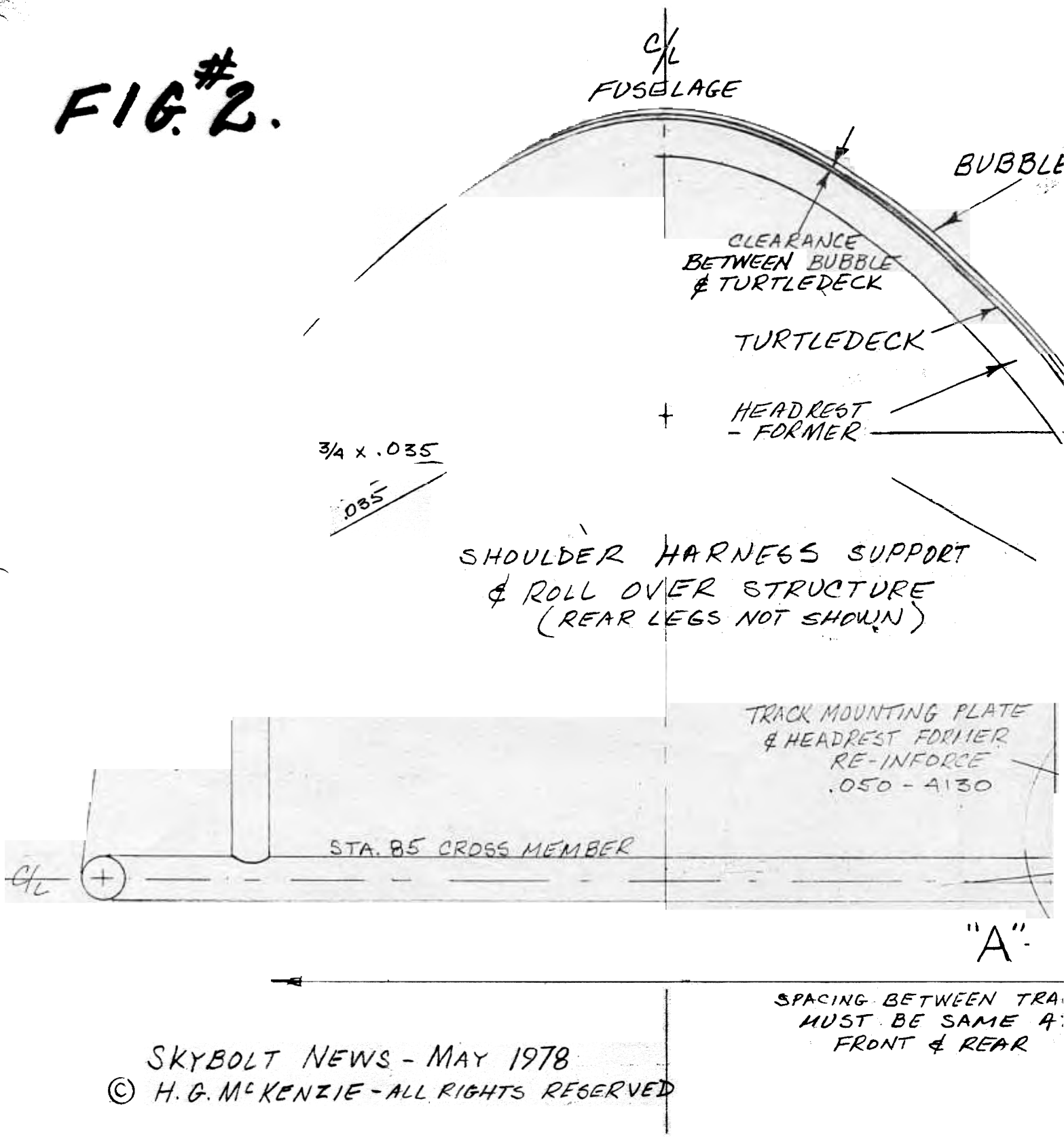
or approx. 50 degrees F. O.A.T. at Sea Level, whichever comes first. A long cross country flight can also be a very potent catalyst in the decision making process. It seems to me that I heard words to this affect at the Skybolt Fly-in, last April when Doc Hall in shirt sleeve comfort led a small formation to the affair. It seems that they had to fly over some mountains on the way and the wingmen were"freezing their tie-down rings off". Of course the wingmen were the hardy types with just a hunk of Rohm & Haas to ward off the blast.

All or any of the above has resulted in the fact that a lot of Canopy installations are of retrofit design, or at least they look that way. There is a miriad of designs as builders attempt to sophisticate the biplane. THE TIME TO PLAN AND START THE CANOPY INSTALLATION IS BEFORE THE COAMING AND INSTRUMENT PANELS ARE MADE. THE TURTLE-DECK HEADREST FORMER MUST ALSO BE DELAYED. To install a flush mounted, straight sliding canopy at a later time certainly results in a lot of retrofit.

In this article, the first of a two part article, we will deal with the installation of the canopy tracks. The tracks employed in my design are of the Triple Track type. They are precision units that have little or no free play between the members of the assembly when fully extended. The members of the assembly started out in life as extrusions in which the ball bearing races were broached. The ball bearings which are retained in a strip type retainer, are 1 1/2" on centers. The length of the ball bearing strips is 11". The closed length is 23" while the extended length is 45". The weight of each assembly is 1 lb. 12 ozs. They can be lightened as I will explain later in the article. They are as a precision mechanism should be, "silky Smooth" in operation. The price of the tracks is $85 a pair and available from Starfire Aviation,Inc. Sometime,in the near future I hope,(Dec. or Jan.) we will offer both the Single Place and the Full 2 Place Canopies as a kit with all necessary materials plus drawings, to fit the Skybolt. The 2 Place (full canopy) is also a flush mounted unit and slides straight back to un-cover both seats. More about this in November.

In FIG. #2 we show the track installation and it's requirements. One of the first things that you will notice is that the tracks extend through the Turtledeck at the headrest former. The track reliefs in the turtledeck are covered in the closed position by the aluminum sheet metal skirt on the back of the canopy assembly. This skirt also acts as a seal.

FIG. #2.



SKYBOLT NEWS - MAY 1978

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