

SKYBOLT NEWS

910 S. HoHoKam DR. BLDG. 107
TEMPE, ARIZ. 85281
602-968-2556

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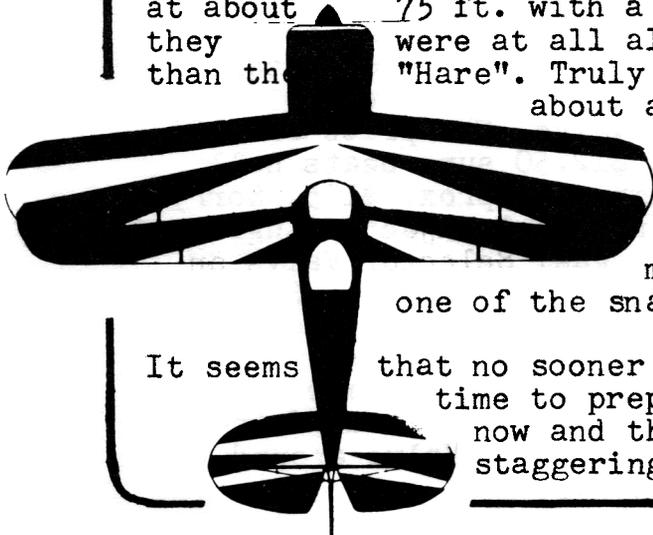


SERIES #5 VOL. #1

First Class Mail

HANGAR FLYING with "MAC"

As I write this section of the "News" it is Feb. 21, 1982, Sun. A.M. and I'm sitting in the den enjoying a beautiful sun shi-ney day (the temp. is supposed to reach 83 degrees today). This edition has been interrupted momentarily to go out in the back yard to snap a couple of pictures. The reason? Well, we live on the 11th. Fairway at Awautukee and a "Hare" has just flown by at about 75 ft. with a pack of 29 "Hounds" chasing him and they were at all altitudes. Some even a little lower than the "Hare". Truly a beautiful sight. There's something



about a Hot Air Balloon Race that's magnificent. This desert valley area in Phoenix is located, is loaded with balloonists. The sight that I witnessed this morning is really a commonplace event in Arizona. I'll put one of the snapshots in next months newsletter.

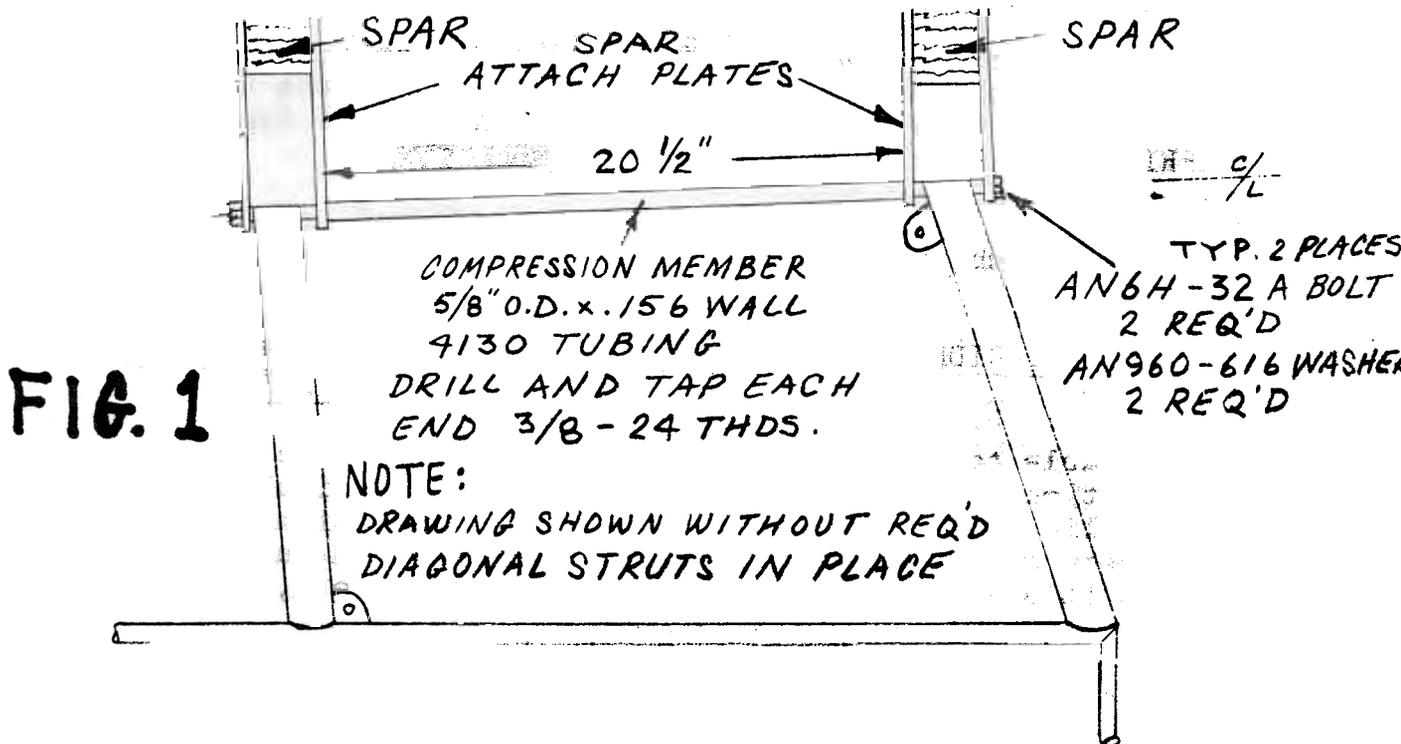
It seems that no sooner than you return from Oshkosh, it's time to prepare to go again. Only 5 months away now and the workload at Starfire Aviation is staggering. The Skybolt (N99MU) that Mike

Udall and I are building, was rolled out for the first time on 7 Feb. We have the fuselage close to completion, most all systems installed, metalwork about done and most everything painted inside and out, so it was time to start checking it out. Mike had picked up a majored O-540-ALC5 with 300 hrs. on it and we were anxious to see if we had a good engine or a pile of junk. Prior to rolling it out for the first time, we had gone through most of the accessories and found many discrepancies. The mags needed one new coil and both sets of impulse coupling cams, not to mention that they were badly out of time and the rubber drive cushions in each mag gear was missing. The starter needed rebuilding and the generator was missing. After modifying the Starter, I put a Bendix Drive in it with more teeth as used on Lyc. engines with a Ring Gear with more teeth and a 9" alternator flange. It now has torque to spare and works beautiful with small batteries. More about the New Battery that we are using in a later issue. I installed a Chrysler Alternator that has a 3" pulley. Alternators work best when running in the 6000 to 8000 rpm range. After all of this, I was ready for anything. We completely flushed the fuel system except the pressure carb., with auto gas, drained everything, put in some AVGAS and pressurized the Carb. The carb had to soak for at least 8 hrs. so the diaphragms would become nice and flexible. I WANT TO CAUTION OUR READERS AT THIS POINT: DON'T EVER PUT A PRESSURE CARB. IN A BUCKET OF GASOLINE TO SOAK. IT WILL MOST LIKELY RUIN THE AIR DIAPHRAMS WHICH WILL NOT TOLERATE FUEL. Since I had installed a Holley Elec. Fuel pump in the lefthand sidewall of the fuselage for the first time, I was anxious to see if it would put out the required min. fuel pressure to operate a pressure carb. I use this same high volume (100 gph) pump in my Smoke systems, so I screwed the pressure regulator that comes with it, in until the adj. screw was flush with the lock nut and lo and behold, 12 psi just as nice as you please. Prior to installing the Holley Pump I had replaced all of it's screws with drilled head filister screws so I could safety wire everything. All other plugs and special screws were drilled for the same purpose. I also installed a Free Flow Check Valve around the pump since it does not have a built-in free flow by-pass valve. The price of \$105 plus the Free Flow Check Valve at \$12.50 sure beats hell out of a genuine aircraft fuel pump at approx. \$195. Sorry, Gentlemen, it won't do the job for a Fuel Injected Engine. From there on it was all downhill. Fuel Selector Valve on Main Tank, Master Switch On, Fuel Boost Pump On, 4 Shots of the Primer, Prop Clear! VAROOM. With the exception of an overly rich carb., all systems checked out just fine and as the famous Johnnie Bench says in his paint commercials, NO RUNS NO DRIPS NO ERRORS. Oh Yes, one more item of interest. I also installed a Free Flow Check Valve around the engine driven fuel pump.

NEW COMPRESSION STRUT FOR THE CABANE ASSEMBLY

After seeing the Pitts modification to the Cabane Struts a couple of years ago (The S2 and the newT model) plus later models of the Christen Eagle and hearing scattered reports of Skybolt problems with bending of the front attach plates of the upper wing, I decided at the inception of the Firebolt program to add a compression member in the cabane strut assembly. The problem lies in the plywood skins of the center section of the upper wing. They are not strong enough to withstand the high shear loads parallel to the Mean aerodynamic chord line. The rear legs of the cabane strut assembly are really quite flexible. They stand "free in the breeze" so to speak. Therefore, all of the bending occurs in the front attach plates. My good friend Herb Anderson at Pitts told me that on their "T" model where the diagonals are reversed, the bending showed up in the rear attach plates.

The "Fix" is really quite simple. Since the centerline of the Cabane Strut Bolt Bushings are below the thickest portion of the camber of the upper wing on the Skybolt and the Firebolt, we can achieve the optimum fix whereas Pitts and Christen have to go slightly off center to install a piece of streamlined tubing to serve the same purpose. The only other change that I have had to make is to weld the outlet flange in the wing tank slightly off center so we can screw in the Finger Strainer and Outlet Elbow, so they will clear the new Compression Member. If you will look on Page 8, Photo #3, you will see the new Compression Member installed in Buddy Moman's Firebolt. The drawing below shows how to accomplish the job, FIG. #1



The new Compression Strut also serves as the nut for the the Wing Attach Bolts. We do however, use a different bolt than previously. The new bolt is a AN6H-(drilled head)-32A and requires that it be safetied to the Cabane Bushings with .040 Stainless Steel Safety Wire.

A word of caution regarding the new Compression Member is advisable at this point in our article. UNDER NO CIRCUMSTANCES DO YOU WANT TO HAND MAKE AND OR TAP THIS PART. IT'S A JOB THAT MUST BE DONE IN A LATHE. It is suggested that you drill and tap the 5/8" o.d. by .156 wall tubing, 1" deep on each end.

One thing is for SURE, when the new Compression is installed, the complete Cabane Strut structure is as strong as a Battleship. I can't help but think that as a fringe benefit of all of the foregoing, we will see less tendency of Aileron Flutter because the wing will not be constantly working like a spring.

A further benefit is our ability to use this member during construction of the Cabane Strut assembly. I suggest that you tack weld everything in place and complete all of the required welding in the area of the Cabane Bushings including the re-inforcing straps. At this point in the construction process we ream the bushings and face them off to length so that we have the correct spacing of 20 3/4" between the inside ends of the bushings. Using AN960-616 Washers to take the place of the Spar Attach Plates, install the New Compression Member and snug up the bolts. Proceed with the rest of the Cabane Strut welding and then re-heat the welds to relieve the stresses. When all has cooled off, remove the bolts and see if you can remove the Compression Strut with just light finger pressure. If you can't, then replace the bolts and re-heat the Rear Cabane Legs with the "Smoke Wrench" ala Skybolt News dated APRIL 1977, Page 7, FIG.#5.

While we are talking of the added benefits of our new Compression Member it brings me to the next chapter.

ANGLE OF INCIDENCE FIXTURE - ALSO LEVELS THE AIRCRAFT FOR RIGGING AND FINAL ASSEMBLY

Being able to level the aircraft EXACTLY the same, time after time, after time, is a feat that is difficult to accomplish in welded steel tube type construction. Welding here and there constantly changes the structure. Most times it's a microscopic change but nevertheless, a change.

Our new Compression Member and the Angle of Incidence Board shown in FIG. #2 allows us to repeatedly level the aircraft with un-canny precision.

We cannot say too much about the Angle of Incidence of the wings. Everything that is a part of proper rigging, is relative to the angle of incidence of the wings. Stabilizer incidence, thrust line, you name it and it revolves around the incidence of the main lifting planes. The natural tendency of the Skybolt is to fly slightly, Tail Down. The amount of tail down attitude is a result of flying weight compared to the lift co-efficient of the wing and herein lies the pitfall of in-accurate angle of incidence. In any design, the design parameters lead to the establishment of the angle of wing incidence necessary to produce level flight based on the lift co-efficient and the projected aircraft weight. Bigger, Heavier engines won't make the tail come up in flight. Instead, just the opposite takes place. If we get too much incidence, we tend to lead towards over stability. I'm referring here to an aircraft which is designed for good aerobatic qualities. All of this may be dry reading, but it leads to the telephone calls that I get on the "Hotline" asking, "Whats wrong with my Skybolt. The dynamic balance tips of the elevator do not streamline with the leading edge of the stabilizer?" "I have increased the angle of incidence of the stabilizer but the problem persists." The answer! you're not going to materially correct the situation at the stabilizer. $\frac{1}{2}$ to $1\frac{1}{2}$ degrees positive incidence in the stabilizer is all we can tolerate without really fighting the wings and increasing drag while we watch the cruise speed go down. SO! YOU SAY. What am I going to do? The answer is simple. DO IT RIGHT THE FIRST TIME. Use the wing angle of incidence for all leveling and rigging.

When you built and installed the Cabane Struts it was necessary to use the longerons between Stations "0" and "24" to achieve longitudinal leveling. Lateral leveling was probably done across the top "0" Station Cross Member. You established $1\frac{1}{2}$ degrees in your Cabane Fixture and proceeded to weld away. I guarantee you, including yours truly, we didn't end up with exactly $1\frac{1}{2}$ degrees. Therefore, since this angle of incidence is so important, use the Angle of Incidence Fixture in FIG. #2 for all future longitudinal leveling.

When performing the initial rigging of both Upper and Lower Wings, we also use our new Fixture to set the wing incidence with extreme accuracy. Merely set the bottom edge of the the "Incidence Fixture" on the compression members of the

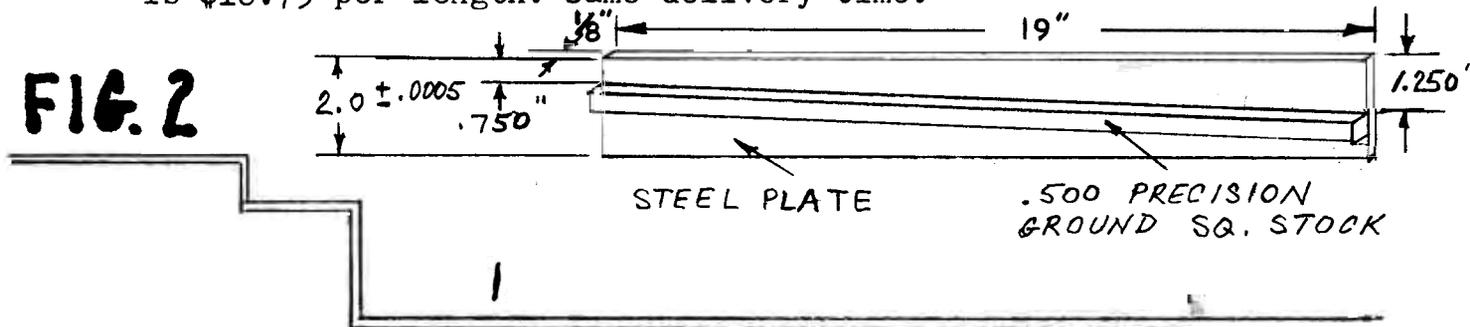
wings and adjust the wing so the level on our Fixture reads "Level". I suggest that you invest in a sensitive Machinists Level. It will reward you, well into the future. In closing this paragraph, I would advise you to go back in time and re-read the Jan. 1977 issue of the Skybolt News. On Pages #6 and #7 I wrote an article entitled, "Preparing the wings for accurate rigging".

Once again our "Draft Angle Chart" on Page 10 of the April 1978 issue of the Skybolt News has proven itself invaluable.

In constructing the "Angle Of Incidence Fixture", I urge you to take the Back Plate to a machine shop and have the edges ground on a surface grinder to produce parallel edges that are within "Plus Or Minus .0005 inches. The precision ground square stock does not need to be re-ground since it is already very accurate. The reason that we have to have a piece of 2"x 1/8" x 19" Flat Stock ground is because precision ground material necessary to make the back plate only comes in 18" lengths, or so I'm told.

While you are at the Machine Shop, have the machinist use his Vernier Height Gauge and mark the ends of the Back Plate with the 3/4" and 1 3/4" index marks. Better yet, have him rest one end of the Back Plate on a .750 Round Gauge Block and the other end on a .250 Gauge Block. Then using his Height Gauge. Scribe a fine line all the way across the face of the Back Plate. The 1/2" Sq. stock can now be positioned on the back plate, clamped, drilled and tapped.

If you have trouble locating a good precision level, I will be glad to get one for you. The price is \$44.00 each. Allow 10 days to 2 weeks for delivery. 1/2" Ground Sq. Stock x 18" is \$18.75 per length. Same delivery time.

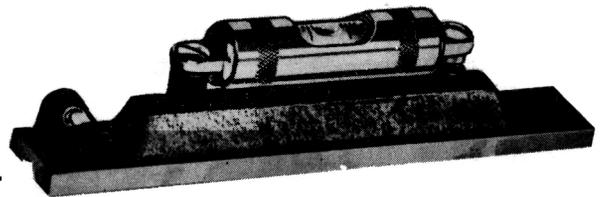


- * Made to strict Federal specifications.
- * Highly sensitive ground vial.
- * FINE GRADUATIONS.
- * SET IN CAD. PLATED BRASS TUBE, with knurled protecting cover.
- * Adjustable to maintain accuracy.
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SHIPPING WT. 2 LBS.

HI-PRECISION BENCH LEVEL

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F.O.B PHX.
ARIZ.



(6) LENGTH: 6" SENSITIVITY: 90 SEC.

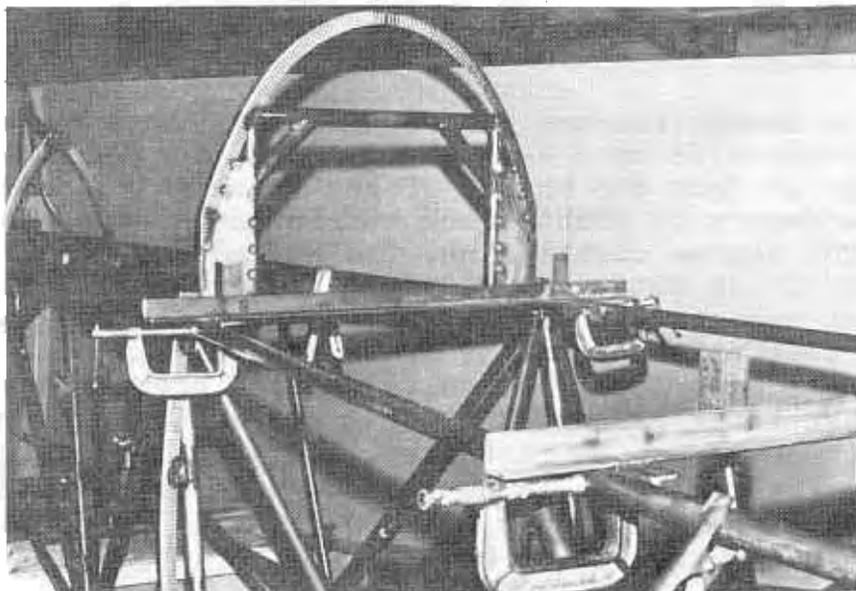
INSTALLING THE DUAL "FIREBOLT" CANOPY---PART 2

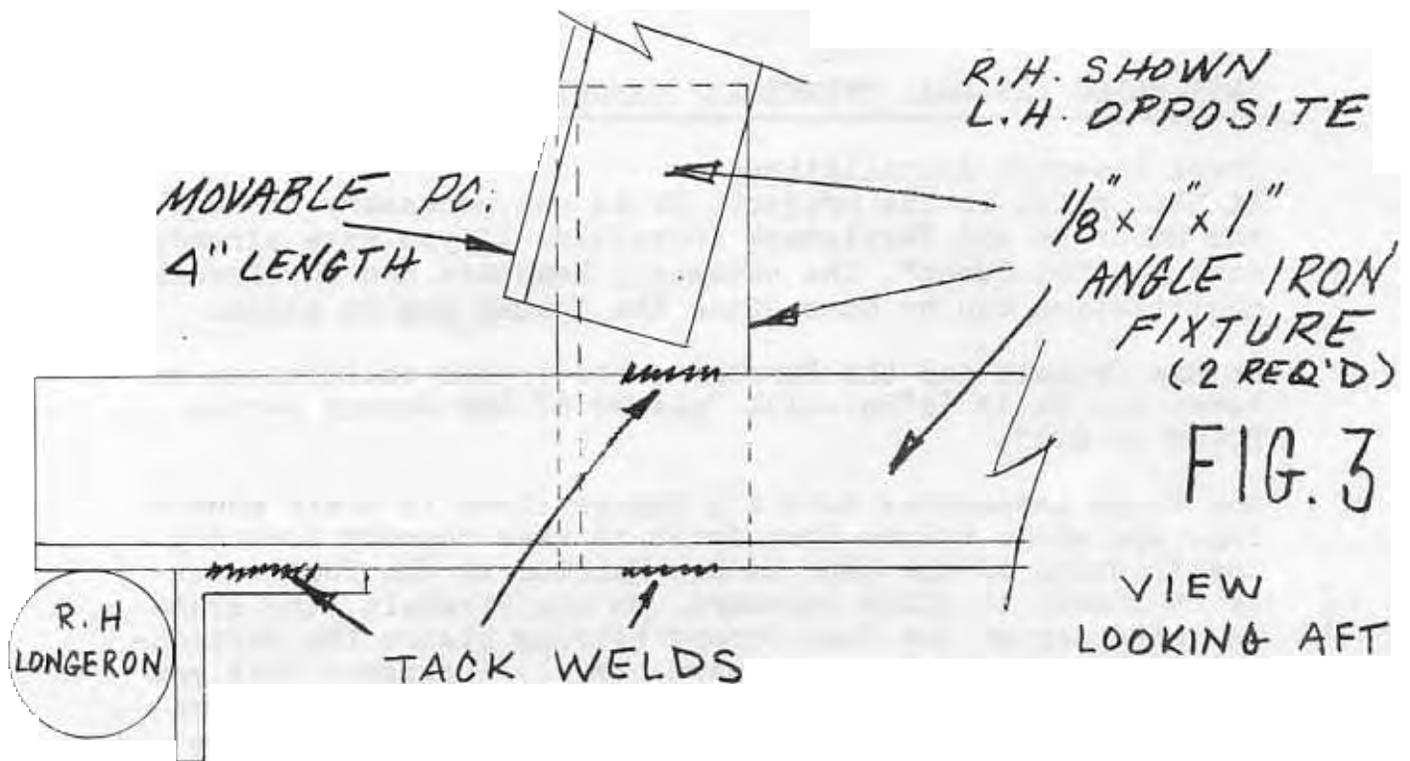
Track Assembly Installation:

At this point in the project, it is not necessary to have the Headrest and Turtledeck installed. If you have already done so, "No Sweat". The necessary Headrest and Turtledeck modification can be done after the Tracks are in place.

In the Skybolt and the Firebolt, the inside measurement between the Rails ($\frac{1}{2}$ "Sq.-4130 Tubing) of the Canopy Bubble Frame is $20\frac{1}{4}$ ".

The Track Assemblies have a $\frac{1}{2}$ degree slope in their mounting. The slope raises from front to rear thereby lowering the friction of the Rear Canopy Fairing at the Turtledeck as it starts to slide rearward. On the Firebolt, the slope is necessary so the Rear Canopy Fairing clears the Horizontal Stabilizer in it's rearward travel. I suggest that you make an Angle Iron Frame as shown in Photo #1 so that you can insure accuracy of the installation. You will notice that the uprights on the frame are at 90 degrees to the cross members of the frame. Missing in the photo are the angle pieces that I clamp to the uprights so that I can infinitely adjust the mounting of the tracks for the $\frac{1}{2}$ degree slope, maintain track parallellism as well as the 9 degree tilt of the tracks. In Fig. #3 we see the Angle Iron Frame with adjustable angle . Prior to the Track Installation, it is necessary to level the fuselage fore and aft. Here we can use our Angle of Incidence Fixture up against the bottom of the Cabane Strut Compression Member to get level flight attitude. Also level the fuselage laterally.





The radius of the Headrest Former shown in Photo #1 is 8". This is a Firebolt fuselage. On the Skybolt we use a 6" radius which I will call "Minimum" radius while 8" will be the "Maximum" radius.

After we have our "Angle Iron" Fixtures in place, the Track Assemblies can be located and installed. In FIG.#4 you will notice that the Track Supports or Stand-offs are made from 3/4" x 3/4" x .049 Square 4130 Tubing. The Flanged Brackets that weld to the Stand-offs are made from .063 - 4130 sheet stock. They are 3" long. The 90 degree flanges are 1/2" x 1 1/4".

The Track Assemblies are fastened to the Flanged Brackets of the Stand-offs by 2 each AN507-1032R8 Screws. The screws go in from the inside of the Track so consequently it is necessary to countersink the inside of the Track with a 100 degree countersink. The rear Stand-off Brackets have a AN315-3R Nut tack welded on the outside. This is necessary because of the limited room for the coaming skin at that point. When the Track Assembly is slid fully aft we will need a pair of holes drilled through the inner most track member at a point where the rear track mounting screws can be installed. To facilitate describing the Track Members as we proceed with our article, I will call the "Stationary Member #1, the "Outer Moving Member" #2 and the "Inner Moving" #3.

FIG.#5 is drawn twice the actual size for purposes of clarity. In this view it is interesting to note that the Coaming Attach Flange that is Pop-Riveted to Member #1, has a continually changing angle as you go aft from the windshield station. Photo #9 in Series #4 Vol. #6 Page 10 will give you another perspective of this part.

Of further note in FIG.#5 is the AN315-3R Nuts that are tack welded to the Aft Mounting Brackets

FIG.#6 gives us a side view perspective. Note that the Rear Instrument Panel extends below the fuselage cross-member. The height of this panel is $11\frac{1}{4}$ " overall. Height above the top edge of the longerons is 7" same as the Bulkhead Panel at Sta. 51.

Note also in FIG.#6 that the Rear Canopy Bow is mounted $6\frac{1}{2}$ degrees off vertical. The height of this Bow allows clearance of the Turtledeck by $\frac{1}{8}$ ". This clearance also applies to the Front Bow of the Canopy. Both Bows are welded to the $\frac{1}{2}$ " sq. Base Rail. To provide attachment for the Bubble, 22 ga. Cold Rolled full length flanges are Skip Welded to the Bows. The same applies to the Flange for the Windshield Bow.

Photo #2 shows the Canopy Frame mounted on a Wood Fixture. I advise you to do likewise while working with the Frame and or Bubble while off the airframe. The Wood Fixture is match drilled to receive $\frac{1}{4}$ " dia. pins inserted in the Base Rail Attach Bushings. Always take care when fabricating parts using this Fixture, that the Fixture is sitting on a level surface with no twist. Accuracy of construction of the total Canopy and it's systems is imperative if you expect to have a smooth working, "Quick Release" Bubble and Frame assembly after you are through.

Photo #3 is a good shot of the Track assemblies as mounted, as well as the Notch in the Turtledeck.

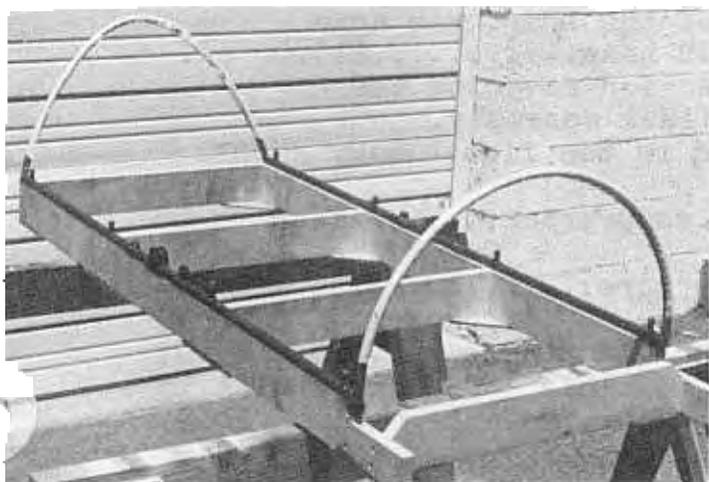


Fig #2

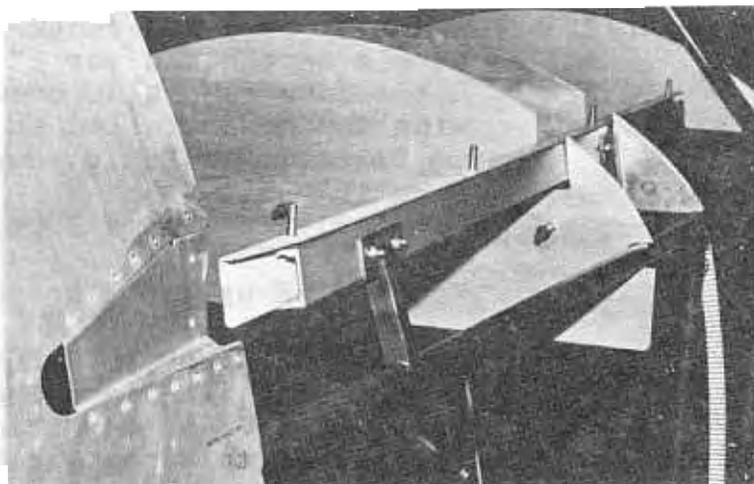


Fig #3

In next months issue we will continue with the Dual Canopy installation and cover the Cutting & Mounting of the Bubble.

Also coming in the next issue is a "self Aligning Trunion" for use with the Pitts type flying and landing wires plus "New Rudder Cable Tension Spring Mounting", "Inspection Covers at the Tail of the Fuselage" and more.

PARTS AND SUPPLIES FROM STARFIRE AVIATION, INC.

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3/4" "\$10.20 " " " "

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Mounts flat on the sidewall, 1" thick, allows all push-pull rods to be installed on the outside of the fuselage tubing.

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