Good Morning Dave,

While going through my collection of plans this afternoon, I ran across a set of hand drawn Cloudster plans shown below. A number of years ago Dick Huang ran me off a copy of his set that he had gotten from Jim Adams. Jim had apparently drew them up for 1/2A Texaco because the plans show an R/C version using a Cox .049 for power.

Shown below is the title block on these plans. The plan is dated 1938 so it would be an Antique and it is gas powered so it should qualify for the SAM Speed 400 electric event. However, before I scale these plans, I need some validation that this set of hand drawn plans would be legal for the Speed 400 electric event. Please respond.....................Tandy
1938

“CLOUDSTER” R/C GAS MODEL
DRAWN BY JIM ADAMS - DESIGN BY BOB OSUMI
Hi Gene,

After I received your last message, I went through my old timer plan collection again today and found a set of actual Cleveland Cloudster plans that I had overlooked yesterday. The plan’s title block is shown below as Plan Set No. GP-5004C, however, there is no date shown in the title block.

Looking over the plans, I discovered that they illustrate both wing dihedral on the left as well as wing polyhedral on the right as shown below. So I do not know if this plan set qualifies as an Antique or not, but it certainly is an Old Timer, which is all I need for the Speed 400 event.

I compared the Cleveland plan with the Jim Adams plan and the two check out OK, except for the nose section forward of the wing’s leading edge. The Cleveland plan shows an inverted Ohlsson 23 ignition engine for power. The distance from the wing’s leading edge to the rear face of the prop plane measures 4-1/4" as shown below.
For comparison, here we have the Jim Adams plan, which shows an upright Cox .049 engine for power. The front end has been modified and the firewall has been tilted for down thrust in the Cox engine. However, the distance from the wing’s leading edge to the rear face of the prop plane is the same as the Cleveland plan (4-1/4") as shown below. So the Jim Adams plan also has the same nose moment as the original Cleveland plan. This is as good as I can do to show that the Jim Adams Cloudster plans are valid. I hope this comparison provides the proof you are looking for, but is the plan a Antique as the Jim Adams plan indicated (1938) or is it an Old Timer?.................Tandy
David Harding

From: Tandy C. Walker [tandyw@flash.net]
Sent: Tuesday, October 27, 2009 11:29 AM
To: Undisclosed-Recipient; @@smtp105.sbc.mail.mud.yahoo.com
Subject: 1 Speed 400 Cloudster - New Model Selection

**Speed 400 Cloudster Project**

This first report intentionally contains the necessary documentation to justify the selection of the Jim Adams Cloudster plan for the SAM Speed 400 electric event.

After scaling the Baby Playboy plans and modifying the front end, fortunately Ned Nevels pointed out that it was against the Speed 400 rules to use the rubber version of the Baby Playboy plan. So I decided to discontinue the Baby Playboy project for my Speed 400 electric model.

I spent most of last week searching for another model suitable for the Speed 400 event. While going through my collection of plans, I ran across a set of hand drawn Cloudster plans shown below. A number of years ago Dick Huang ran me off a copy of the one he had gotten from Jim Adams, a long time experienced modeler and leader in the SAM movement. Jim had apparently drew these plans up for the SAM 1/2A Texaco event because the plans show an R/C version using a Cox .049 for power. Dick had very carefully calculated the plan’s wing area to be 352.16 sq. in. and wing span as 51.70 inches.
Shown below is the title block on these plans. If the 1938 date is accurate, the Cloudster should be an Antique and it is gas powered so it meets the SAM Speed 400 electric rules.

These Jim Adams plan was compared with a set of original Cleveland Cloudster plans whose title block is shown below.
the *Cleveland Cloudster* plan illustrates both wing dihedral and polyhedral as shown below. Since there is no date in the title block, I do not know for sure if the Cloudster plan qualifies as an Antique or not, but it certainly is an Old Timer, which is all I need for the Speed 400 event.

I compared the *Cleveland* plan with the *Jim Adams* plan and the two check out OK, except for the nose section forward of the wing's leading edge. The *Cleveland* plan shows an inverted Ohlsson 23 ignition engine for power. The distance from the wing's leading edge to the rear face of the prop plane measures 4-1/4" as shown below.
For comparison, the Jim Adams plan below shows an upright Cox .049 engine for power. The front end has been modified and the firewall has been tilted for down thrust in the Cox engine. However, the distance from the wing's leading edge to the rear face of the prop plane is the same as the Cleveland plan (4-1/4") as shown below. So the Jim Adams plan also has the same nose moment as the original Cleveland plan. After consulting with Gene Wallock, Dave Harding, Jack Hiner, and Jim O'Reilly several times, I have concluded that the Jim Adams plan qualifies for the Speed 400 event.
It was thought that the Speed 400 rules contained an 8 oz/sq.ft. wing loading requirement. However, during the Cloudster plan discussions, a surprise discovery was made that there is no wing loading requirement in the Speed 400 rules. As a result, I settled on a scaled down wing area of 300 sq. in. for the Cloudster. The scale factor applied to the plan is SQRT(300/352.16) = 0.923. Yesterday I had the plans scale down for a wing area of 300 sq. in. and I will build the Cloudster incorporating the polyhedral wing configuration.

So after all of these discussions, calculations, and comparisons, last evening I finally got started building something! :O< I laid up the Cloudster's first fuselage side using the scaled down plans as shown below. The longerons and forward vertical members are 3/16" square, however the aft fuselage vertical members are reduced to 1/8" X 3/16" to save weigh. Notice that I am building the fuselage with the down thrust built into the firewall as per the Jim Adams plan......................Tandy
Sue and I had a lot going on today. We had to have the exterminators out to spray and dust for ants of all things. All of this rain we have been getting here in north Texas really has the ant population stirred up. We have a house keeper right now while Sue is recovering from her injury and it was her day to clean the house. I took Sue to Arlington Memorial Hospital this afternoon for one of her physical therapy sessions. So I have not had a lot of time work on the Cloudster today, but I did manage to get the second side of the Cloudster fuselage laid up as shown below. The 3/16" sq. balsa seems a little large to me, but I selected pretty light wood (i.e., the two longerons together only weigh 5 grams) and the aft fuselage vertical members are reduced to 1/8" X 3/16" to also save weigh. If it turns out that the fuselage structure is too heavy when I get it framed up, I will go back and build another one out of 1/8" square.

One item I forgot to mention in my first report. My friend James Lollar up in Ada, Oklahoma likes cabin models and asked me to send him copies of my Cloudster plans, which I did. I think he is considering building the 300 sq. in. version for the Speed 400 electric event as well..................Tandy
David Harding

From: Tandy C. Walker [tandyw@flash.net]
Sent: Thursday, October 29, 2009 2:10 PM
To: Undisclosed-Recipient; ;@smtp104.sbc.mail.mud.yahoo.com
Subject: 3 Speed 400 Cloudster - Test for Changing Wood Size

On Tuesday I received a one line e-mail from Jack Hiner that said: "Tandy, 1/8 inch square spruce or hard balsa will work for longerons on a model this size......Jack

After I received his message, I picked out some 1/8" square hard balsa strips to make new Cloudster sides with. However, about 15 years ago Dick Huang and I went over to MAL's hobby shop in Irving, Texas and had Edcor Sea cut us a hundred 5/32" square balsa strips each and I still have a supply. A size comparison between 3/16", 5/32", and 1/8" square strips is shown below.

As it turns out the 1/8" square hard balsa strips weigh about the same as the 5/32" square medium balsa strips, but the 5/32" square strips have a little more mass to them. Several years ago I built up the cabin Playboy fuselage frame shown below out of a set of the 5/32" square medium balsa strips. This structure is about the size of the Cloudster and it weighs 21 grams or about 3/4 of an ounce.

After some discussion with Jack Hiner, collectively we decided that since the
Cloudster does not have a real long tail like the Baby Playboy and does have short nose, the 5/32 is better choice. Besides, the 5/32 square will give more joint gluing area.

So last evening I laid up the first Cloudster fuselage side using 5/32" square balsa strips as shown below.

In the picture below, the 3/16" square two sides are at the top of the picture and the 5/32" square side is at the bottom.

I weighed the 3/16" square side on the AccuLab scale and it weighed 7 grams as shown below.
Then I weighed the 5/32" square side and it weighed 6 grams as shown below.

I was very surprised to find that there was only one-gram weight savings by using the smaller 5/32" square balsa strips! I guess part of the reason there is so little difference is the reduction from 3/16" square down to 1/8" X 3/16" for the vertical members in the aft portion of the fuselage. Considering the framing of both sides and the cross member on top and bottom, 5/32" square balsa strips will save less than 4 grams all total.

12/9/2009
I have wasted some time and materials going through this exercise, but at least now I know. Therefore, I am going to proceed with the Cloudster construction using the two sides I have already built out of 3/16" square strips.............................Tandy
The Cloudster’s fuselage width is a constant 2-9/16" from the front cabin post back to the inclined upright just behind the wing’s trailing edge. Four 3/16" square cross members of equal length were cut and glued with aliphatic glue to the inside face of the right side at the proper joints as shown below. The glue was allowed to only tack dry for only about 1 minutes. It was still pliable enough to square up the cross members both longitudinally as well as vertical with a square. Once squared, these were allowed to dry for about an hour.

Next, aliphatic glue was applied to the ends of the four cross members and the left side was put down onto the ends of the four cross members. Here it gets a little tricky. Working pretty fast, the ends of the cross members were carefully aligned to left side joints and the excess glue wiped off with a wet Q-Tip. With the aliphatic glue just tacked, the two sides were squared up using a combination of squares and steel block squares. Two 1 X 2 boards were laid across the left side over the four cross members and a steel block square was placed on each to act as a press on the left side, which is also shown below. This jig set up was allowed to thoroughly dry for a little over three hours.
I want to call your attention to the little squeeze bottle seen in the picture above with yellow aliphatic glue in it. A modeler sent me two of these and asked me to try them. The bottle has a long slender spout on it and when the bottle squeezed, the glue come out in a small 1/6" stream or a 1/6" spherical blob. It makes controlling the glue application so easy and the white screw on cap that you see keeps the spout from clogging up. However, at the moment, I can not remember who sent them to me.

After the squares and steel block squares were removed, the remaining other four 3/16" square cross members of equal length were glued in place as shown below.
Once every thing was dry, the sides of the fuselage were pulled together at the rear and the tail post were temporarily clamped using hard balsa wedges on either side. Then two sets of 1/8" X 3/16" cross members were glued in place as shown below.

Once these are good and dry, the insides of the 3/16" tail posts will be beveled (trimmed and sanded) down to 3/32" so that when they are glued together their combined width will be 3/16". However, this will have to wait until tomorrow because I am stopping for today. I have to clean up and get ready to take my wife out to dinner this evening. :O) ..........................Tandy
The picture below shows the Speed 400 motor inside the 1/64" plywood motor mounting tube. You can see the two 2.6 mm threaded holes in the front of the motor case that can be used for mounting. The plan is to make a plywood disk that will slip inside this motor tube and be glued in flush with the edge of the tube. The motor will then slide in from the rear of the tube and be secured to the disk with the two mounting screws from the front.

Sue and I had a lot of stuff to do today along with her 10:30 a.m. therapy session, so I did not get started working on the motor mount until around 3:00 p.m. this afternoon. However, I did get the disk pattern laid out on a piece of 1/16" plywood. The center hole was cut out and the two holes for the 2.6 mm screws located and drilled. In addition one of the four ventilation openings was located and cut out as shown below. Working in the blind, this turns out to be a cut and fit iterative process. As you can see, I have made some progress, just not very fast! I hope to get the other three ventilation openings finished tomorrow and the disk cut out and fitted to the inside motor tube. The disk will then be glued in place in the motor tube............................Tandy
When I closed the Report No. 7 this afternoon, I said, "I hope to get the other three ventilation openings finished tomorrow." Well after dinner, I helped Sue get ready for bed and she decided to watch some TV. So off I went to the model room to work on the three ventilation openings. I worked for a couple of hours and finished the disk’s openings, but did not get the outside trimmed as shown below.

This picture shows the disk overlaid on the front of the Speed 400 motor..........Tandy
This morning, the perimeter of the disk was trimmed down and sanded to shape for a snug fit inside the front of the motor tube as shown below.

The finished disk was oriented so that the single hole lined up with the bottom seam in the motor tube as shown below and then slipped inside the front of the motor tube. The Speed 400 motor was inserted from the rear and pushed forward to contact the inside face of the disk. The motor was then rotated to align its openings with the openings in the disk and the two 2.6 mm mounting screws were screwed in. By pushing on the back of the motor, the disk was moved forward to within about a 1/16" from the front edge of the motor tube. At this point the disk was CA’d around its circumference. A rubber band was wound around the outside of the front edge of the motor tube to insure a good bond between the disk and motor tube as shown below.
Once dry, the rubber band and motor were removed from the tube in order to take this picture for you to see.

The rolled motor tube with the disk glued in the front makes this motor mount incredibly strong and it only weighs 2 grams as shown below. However, the 1/16" plywood back plate and four small gussets will probably add another 1 to 2 grams. But what the heck, I think a 4 gram motor mount represents a significant weight savings, even if it was time consuming to make.
Again, working in the blind, an iterative process of cut and fit was used to make the motor's brush ventilation slots on the side of the motor tube as shown below.

The motor mount with the Speed motor inside was placed on the Cloudster plan for a trial fit as shown below. The current unknown is how much length is going to be required to fit the 1-3/16" spinner/adapter on the motor's shaft so the rear face of the prop is in the proper place on the plan. If you look close at my notation below the motor tube, you will see there is a fair amount of adjustable length to accomplish this.
So at this point I have to stop work on the motor mount until I receive the 1-3/16" spinner/adapter from Hobby Lobby in about two weeks. Then I can trim up and finish the motor mount’s 1/16” plywood back plate and glue it in place. This back plate is what will bolt to firewall. I plan to add four small gussets in a cruciform configuration between the motor tube and the back plate for additional motor tube support. So I guess I will turn my efforts now to building on the stab and rudder.

Speaking of Hobby Lobby, I contacted Jay Burkhart (a electric modeler and Hobby Lobby technical consultant) this morning to assist me in getting yesterday’s order corrected for the right LiPo battery packs. I received the updated corrected confirmation from Hobby Lobby this afternoon.

Item Description: PL2 1350mAh 2S 7.4V  
Item Number:   TP13502SPL2  
Quantity Ordered:  2  

Thank you for your help and support in this matter Jay!.............................Tandy
David Harding

From: Tandy C. Walker [tandyw@flash.net]
Sent: Thursday, November 05, 2009 10:42 PM
To: Undisclosed-Recipient ;@smtp104.sbc.mail.mud.yahoo.com
Subject: 10 Speed 400 Cloudster - Stab Patterns

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**Speed 400 Cloudster Project**

The Jim Adams plan of the Cloudster does not show the stab ribs as does the Cleveland plan so I went to the copy center today and had a copy of the Cleveland plan made reduced by the 0.923 scale factor. This provided the stab rib patterns, which I cut out as shown below.

Since I had the reduced copy anyway, I also cut out the stab’s tip and trailing edge patterns (S1 through S4) as shown below. Then I realized that I goofed on parts S1 and S2 as they were not for R/C with the stab and elevator division. So I cut out as second set of S1 and S2 modified from the other side of the plan, which does show the R/C division. Not a lot of progress today I know, but some. The key to model building is to something every day......................Tandy
In my last report, I showed these Stab tip and trailing edge pattern that were cut out of the reduced Cleveland Cloudster plan.

Well, as it turned out there was a fair amount of modification required to fit the Jim Adams plan. I used the patterns and cut the parts oversize. Then after a considerable amount trim, sand and fit on each oversize part, I finally got them to fit the Jim Adams plan as shown below.
I took each of the four parts and traced them out on a quadrille sheet to make correct patterns as shown below. Tomorrow I will mail these patterns to James Lollar up in Ada, Oklahoma as he is also building a Cloudster for the Speed 400 event.

Then I made matching parts for the other side of the stab as shown below.
Tomorrow, I will cut out the stab ribs and start laying out the stab structure. However, tomorrow afternoon Sue and I are going to see the new Amelia Earhart movie so I may not get too much done..........................Tandy
David Harding

From: Tandy C. Walker [tandyw@flash.net]
Sent: Tuesday, November 10, 2009 11:20 PM
To: Undisclosed-Recipient: ;@smtp105.sbc.mail.mud.yahoo.com
Subject: 12 Speed 400 Cloudster - Construction of the Stab

**Speed 400 Cloudster Project**

As I reported previously, the Jim Adams plan of the Cloudster does not show the stab ribs as does the Cleveland plan so I went to the copy center and had a copy of the Cleveland plan made reduced by the 0.923 scale factor. This provided the stab rib patterns, which I cut out as shown below.

![Stab Rib Patterns](image)

However, these patterns leave a little bit to be desired in their fit. So I used them as a guide to cut out stab ribs that actually fit properly. I made the height of each rib's LE 3/16" so it would butt into the LE full height. I also made the height of each rib's TE 1/8" because the 3/16" TE pieces must be trimmed down to 1/8". The resulting 1/16" rib parts are shown below.
Then the ribs (E2, E3, E4, E5, and E6) were traced onto a sheet of quadrille paper to come up with the correct rib patterns as shown below.
The center section of the stab is being modified in order to make the stab removable from the fuselage. This is accomplished with two 1/32" plywood stab plates shown below. As you can see, two 1/8" plywood squares are glued to the stab plates and threaded with a 2-56 tap.
The lay up of the stab structure is shown below. Notice how the two stab 1/32" plywood plates are integrated into the center section on the bottom of the stab.

This is a close up of the stab center section and there are two things to observe: (1) the wedge doubler that reinforces the leading edge joint and (2) the two 3/32" ribs that form the 3/16" slot on the stab’s center line for the vertical tail’s removable fin. The top and bottom of the center section will be planked with 1/32" sheet balsa a little later..............Tandy
The fuselage's stab platform has two 1/32" plywood plates, which are shown below.

1/32" balsa sheet is laminated onto the upper side of these plywood plates as shown below. This is to provide stiffness to the 1/32" plywood and save a little weight.

A countersink recess is drilled into the 1/32" balsa lamination as shown below to receive the heads on the 2-56 cap screws that secures the fin in the stab slot.
from the bottom.

This then allows the two mounting plates to be screwed down flush on the bottom of the stab as shown below.

With the two mounting plates screwed to the bottom of the stab, the stab and fuselage were jigged up and the two mounting plates glued on the fuselage top longerons.
Once the glued dried, the screws were removed and the stab taken off, leaving the two mounting plates perfectly aligned and glued in place as shown below.

The stab platform was then finished out with 1/16" balsa sheet in between the two stab plates and forward of the front stab plate as shown below. The two countersink recesses and the four mounting holes were hardened with CA to prevent wear.
The fin was inserted into the stab slot and secured with the two 2-56 cap screws from the bottom of the stab. Then a trial fit was made by attaching the stab to the fuselage’s stab platform with the four 2-56 cap screws as shown below.

This is a good shot from the bottom showing the stab mounting plates screwed to the fuselage.
This final picture shows the removable fin and stab mounted to the fuselage via the stab platform.

Well, work will cease for the day now as the Cowboy game will be coming on soon. The repair of my prescription glasses will require a minimum of five days (all next week). However, I will try to build the elevators and rudder if I can find some cheap reading glasses that will permit me to see the work............................Tandy
The plans call for a 1/16" wire to connect the two halves of the elevator together as shown below.

I decided to make a continuous elevator spar to eliminate the 1/16" wire. To reinforce the spar at the center, a 1/32" plywood doubler was glued to the back side as shown below. Notice that 1/32" balsa strips 1/16" wide were added to either side of the plywood double. This will make sanding a radius on the back side of the spar easier.

The lay up of the Cloudster's elevator is shown below. Since small removable nylon hinges are going to be used, notice the 1/16" gap between the stab spar and elevator spar to account for the hinge. If you look at the spruce base for the elevator control horn, you will notice only one 2-56 hole drilled and tapped. During the installation of the elevator push rod, the alignment angle of the control horn
angle will be determined and then the second hole will be drilled and tapped in the spruce base.

The lay up of the Cloudster's rudder is shown below. Again notice that a 1/16" gap between the fin post and the rudder post has been left to account for the hinge thickness. Also notice in the picture the large balsa reinforcement insert in the lower part of the rudder that fits around the spruce base for the control horn. If you look close, you can see my sketch of the cut out for a carry through elevator spar..................Tandy
First order of business was to hinge the rudder as shown below. As you can see, three of the small Du-Bro nylon hinges were used, two up on the fin, and one down on the bottom of the rudder to attach to the fuselage's tail post. Back up pieces were glued to the inside of the spars where the hinge halves go through to reinforce the slot and isolate the interior of the surfaces from the hinge slot openings. Notice that the cut out for the elevator spar carry through is not large enough yet, but it will be finalized after the elevator is hinged. Notice the rudder's control horn is also installed.

This picture shows the rudder/stab mounted to the stab platform on the fuselage. The bottom of the rudder was intentionally left wide so it could be trimmed off to match the bottom of the fuselage.
If you remember in Report No. 16, only one 2-56 hole was drilled and tapped in the spruce base for the elevator control horn. In the picture below, the elevator has been taped to the stab and a temporary push rod/clevis connected to the control horn. Then the push rod was oriented to the angle it will exit the side of the fuselage. As you can see, this allows the control horn to be turned to the proper angle to line up with the push rod, which in turn locates the desired position of the second hole in the control horn base.
The picture below is an edge view of the elevator's main spar. This shows you the two hinge halves installed with the continuous wire pin running through the hinge loops. With a continuous wire pin, these small hinges allowed me to keep the gap down to less than 1/16". The 1/32" piano wire that I have measures 0.032" and it is slightly too tight to go through these hinge loops without a lot forcing. However, I found some 10" lengths of 0.031" piano wire that I got somewhere a long time ago that slips through these small hinge loops with ease.

This picture shows a bottom view of the hinged elevator to the stab. There are four hinges, two on a side as the plans call for. Two separate continuous wire pins are used for the right and left sides of the elevator to eliminate having to push one continuous hinge pin through four hinges down entire length of the stab. Again, back up pieces have been glued to the spars where the hinge halves go through to reinforce the slot and isolate the interior of the surfaces from the hinge slot openings. If you look close, you can see the elevator's control horn's second mounting hole has been drilled and tapped with the 2-56 cap screw now in place.
This afternoon, I will start carving and shaping the vertical and horizontal tail surfaces to form the rounded leading edges and tapered trailing edges, which will finish up the entire tail structure ready for covering.......................Tandy
This picture shows the Cloudster’s horizontal tail (stab and elevator) after the surfaces have been carved and shaped to form the rounded leading edges and tapered trailing edges. Due to concerns over the small gluing area of the elevator rib ends to the trailing edge, 1/16" gussets were added to one side of the ribs for additional support as shown below. This finishes up the horizontal tail structure, which is now ready for covering.

A weight check was done on the removable horizontal tail as shown below. You can see that the hinged horizontal tail structure weighs 16 grams (0.56 oz), without the control horn attached.
The picture below shows the Cloudster’s vertical tail (fin and rudder) after the surfaces have been carved and shaped to form the rounded leading edges and tapered trailing edges. A weight check was also done on the removable vertical tail and the hinged vertical tail structure weights 5 grams (0.18 oz), without the control horn attached. Also notice that 3/16" gussets were added to one side of three of the rudder ribs for additional support. This finishes up the vertical tail structure, which is now ready for covering.
This is a close up of the fin leading edge fairing that interfaces with the stabs leading edge.

This is a close up of the rudder’s cut out for the elevator’s continuous spar pass through. Notice that a radius has been provided around the rudder’s cut out opening to eliminate combination surface deflections such as full right rudder and full up elevator.

This side view close up of the tail assembly showing how the elevator’s continuous spar passes through
the rudder cut out.

This is another rear view close up of the tail assembly showing the elevator’s continuous spar passes through the rudder cut out. Notice that the bottom of the rudder has not been trimmed off even with the bottom of the fuselage yet. This will not be done until the fuselage’s bottom bulkheads and stringers are glued in place.

As you may recall from Report No. 5, the fuselage primary structure weighed 18 grams (0.63 oz).
After building on the stab mounting platform on the rear of the fuselage, the fuselage weight has increased up to 20 grams (0.71 oz) as shown below. Therefore, the stab mounting platform only resulted in a 2 gram increase.
The completed tail assembly was mounted to the fuselage with the four 2-56 cap screws and weighed as shown below. The weight has now increased to 46 grams (1.62 oz). Notice in the picture that this weight includes the two control horns and four 2-56 cap screws to secure the control horns to the control surfaces.

This past week I have been working using a pair of +2.75 reading glasses that I bought at Walgreens for under ten bucks at Jim Lollar’s recommendation. Since I broke my prescription glasses, I had to have something to provide close up vision with my single focus lens implants for distance. They took a little getting use to, but I am getting by pretty well. Hopefully my prescription glass repair will be ready Monday................Tandy
Sue and I spent a lot of this past weekend decorating our for Christmas. It is a little early, but we are flying down to Houston to spend Thanksgiving with Sue’s son (Rick and wife Andrea) and we wanted them up when we return on Saturday. With Sue still recovering from her broken shoulder, our neighbor Donald Thompson was kind enough to come over Saturday morning and help me with getting the 28 boxes of decorations down out of the attic (I handed the boxes down from the attic and Don stacked them on the garage floor for me). The picture below shows our decorated Christmas tree that we put up in front of the bay window in the "President’s Room" (the named given to this room by my dad before his passing).

I did find some time to work on the Cloudster’s landing gear Sunday afternoon. After careful review of both the Cleveland and Jim Adams Cloudster plans, I could not find a landing gear wire size called out nor a true view of the wire landing gear layout. So a little reconstruction work had to be done. 1/16" diameter piano wire
was selected for the landing gear. On the Jim Adams plans, the apex angle of the landing gear wire measures 75 degrees as shown below.

Also on the Jim Adams plans, the vertical distance from the top of the apex angle to landing gear axle measures 5" as shown below.

Given the 75 degree apex angle and the 5" vertical distance, a true view of the wire landing gear drawing can be laid out as shown below.
The landing gear was bent up out of 1/16" piano wire as shown below.

Then the cross brace was made out of 1/16" piano wire. It was positioned, wrapped with small brass wire, and soldered in place as shown below.
Did you ever look and look for something and then later discover it is right in front of you? Well, after I finished recreating the landing gear drawing, bending up the wire landing gear and cross brace, and soldering it in place, I discovered that the landing gear wire size and drawing was right there on the left wing drawing shown below----Well DUH! The plan call out is for 3/32" landing gear wire and the vertical height of the drawing was 4-3/4", which by the way disagrees with the 5" shown on the plan's fuselage drawing shown above.

Since there is very little difference in the landing gear drawings and the one I have already made is
lighter, I am going forward with it. I am going to look into making the landing gear removable without having to much of a weight penalty. However, this may not be possible, but that is the subject of a later report..............................Tandy
In yesterday’s Report 19, this picture of the wire landing gear with the cross brace soldered in place was presented. An error was made in that the cross brace bent ends were wire wrapped and soldered inside the wire landing gear as shown below.

Using a Dremel cut off wheel, the wire wrapping was cut down one side and then heated up and removed. A new cross brace was made and correctly wire wrapped in place on the wire landing gear as shown below.
This shows a picture from the front of the new wire wrapping after it had been soldered in place. You see, when the wire landing gear is laced to its 1/16" plywood mounting plate, the bottom edge of the plate butts down against the cross brace.
28 gauge brass wire was used to lace the wire landing gear to the 1/16" plywood mounting plate as shown below.

This shows an edge view of the landing gear laced to the plywood mounting plate and why I had to change the cross brace location.
This shows a trial fit of the landing gear’s plywood plate in the fuselage structure.................Tandy
David Harding

From: Tandy Walker [tandyw@flash.net]
Sent: Saturday, November 28, 2009 11:34 PM
To: Undisclosed-Recipient: ;@smtp108.sbc.mail.mud.yahoo.com
Subject: 21 Speed 400 Cloudster - Hobby Lobby First Order Arrival

**Speed 400 Cloudster Project**

I received my first order from Hobby Lobby on Tuesday before Thanksgiving. However, I did not get to open it until this evening. Shown in the picture below are: (1) four sets of red polarized connectors, (2) a JESI 12 Amp ESC, and (3) two motor mount wafers. I am not sure why all of the connectors are red. Seems like half of them should have been black? Also, I probably will not use the two motor mount wafers now that I have a motor mount built.

![Image of Hobby Lobby order contents](image)

Also shown in the picture below are: (1) two Pro Lite 1350 mAh 7.4 volt battery packs, (2) two 6 volt Speed 400 motors, and (3) 1-3/16" spinner/adapter. The only things I seem to be missing are the two props (coming in a second order) and black connectors, which I will have to order. I may order some different type connectors as I am not sure I even like these new ones!

12/9/2009
The picture below shows a trial fit of the 1-3/16" spinner/adapter mounted on the Speed 400 motor and placed on the Cloudster plans, which shows a good fit. ......................... Tandy
This afternoon and evening I completed the motor mount. This entailed measuring and cutting the 1/64" plywood motor tube to length, completing the rear mounting ring including trimming the ring’s outside and drilling the four 2-56 mounting holes, gluing the rear mounting ring to the motor tube, and adding three of the four side support gussets as shown below.

This is a close up view of the rear mounting ring from the back of the mount.
This picture shows the Speed 400 motor mounted in the motor tube with spinner/adapter attached and the assembly laid on the plans to check the location of the rear face of the spinner. Notice that the top of the rear mounting ring has to be trimmed down later to fit inside of the cowl contour and the fourth support gusset added at the top.....................Tandy.
The plan pattern for the Cloudster's firewall is shown below. The top and bottom portions are shown cut out for 1/8" planking to extend to the front face of the firewall. However, I prefer that the cowl butt up against an all plywood firewall so I filled in the cut outs as shown below.

The firewall was cut out of 3/32" plywood and bonded to the front face of the fuselage main frame as shown below. A wooden ruler was run through the two front side members of the fuselage frame and two heavy steel squares were placed on either side of the ruler to form a type of press while the aliphatic glue dried.
The picture below shows the finished firewall with lightening holes bonded to the front face of the fuselage main frame.
The picture below shows the hand made Speed 400 motor mount secured to the firewall with four 2-56 cap screws. Notice that the motor mount rear mounting ring will have to be trimmed down about an 1/8" across the top to permit the cowl to fit up to the firewall.
The Speed 400 motor, spinner/adapter, and tail assembly were attached to the fuselage main frame as shown below. The total weight at this point is 139 grams (4.9 oz).

A 1/16" piano wire was run through to the top longerons and adjusted to balance point as shown below for a CG status check. The balance point is 3/16" forward of the desired CG, which is a good indication the model can be balanced without ballast weight. .........................Tandy
In Report No. 20, the landing gear was laced to the 1/16" plywood mounting plate with small brass wire. As part of the Cloudster’s on-going weight-saving effort, three lightening holes were carefully located and made in the mounting plate as shown below before it was glued into the fuselage main frame. Instead of using epoxy to pot the wire lacing in place, two coats of CA was applied on both sides of the mounting plate, which is much lighter in weight than epoxy.

The edges of the landing gear’s 1/16" plywood mounting plate were coated with aliphatic glue and then clamped into place on the fuselage main frame with seven plastic clamps as shown below.
Once the glue was dry, the clamps were removed leaving a very clean looking landing gear installation as shown below.
This last picture shows the entire fuselage main frame with the landing gear installed.
The next task will be to install the rudder and elevator servos. They will be placed as far back in the cabin area as possible and still be able to get to the servo mounting screws from the top opening over the cabin..................Tandy
Looking in from the right side of the fuselage main frame, you can see the ends of two 1/16" X 1/4" plywood servo rail mounts secured in place with a sandwich structure.

Looking down from the top of the cabin, notice the 1/2" notch on the forward edge of the aft rail.
The small light weight Hitec HS-55 servos shown below were selected for use on the Cloudster. The servo rail mounts are placed to touch each end of the servo. Therefore, to remove the servo, they are slid over to the center where the notch is located, lifted up, and then tilted to get the servo out from between the rails. It is because the servo wire and connector prevents the servo from being lifted straight up out of the rails.
A very good friend of mine and outstanding model builder who won the SAM Championship several times, was Jim Reynolds of Universal City, Texas down by San Antonio. Jim, who is gone now, showed me how to make extremely light weight push rods, which I have used many time, using Sullivan's Gold-N-Cable #507 shown below. He told me to use the yellow sheath as the guide and substitute 1/32" piano wire as a push rod for the 1/32" stranded cable that comes with the set.

I came up with a neat little clip design to hold the 1/32" piano wire on the servo control arm that I will now describe using the picture below. A 90 degree bend is put on the end of the 1/32" (.032") wire to form a push rod post as shown on the bottom. The keeper, shown on top, is bent up out of .021" piano wire. Notice that the keeper has "V" bent on the end that fits up around the push rod post.
The keeper is attached to the push rod by wrapping the two together with soft 28 gauge brass wire as shown below.

Care must be taken in getting the keeper properly aligned so that the V on the end engages the push rod post. Then to complete the clip, the wire wrapping is carefully soldered in place as shown below.
The two push rods are clipped onto the two control arms of the installed servos as shown below. Notice that the V keeper is placed on the inside of the push rod post so it can not possibly come off.

This picture shows how the push rods cross as they go back down the fuselage main frame in order to keep the push rods as straight as possible. To complete the push rod installation, both yellow sheaths must be braced (stabilized) at least every three inches. On the Cloudster, a brace will be added at every other station in the fuselage main frame.
The 2-56 brass coupler for the Sullivan clevis comes much too long and heavy for this application. So as part of the Cloudster's on going weight saving effort, both ends of the coupler are removed using a Dremel cut off wheel. As you can see, the length and weight of the couple is cut in half as shown below. However, There are still enough threads on the short couple for two complete adjustment turns in either direction.

The picture below shows how the two push rods exit the aft end of the fuselage and attach to the
rudder and elevator control horns. You can see that by cross the push rods in the fuselage the push rods can remain essentially straight.

Before quitting for the day, the Speed 400 motor was mounted to the fuselage assembly which was weighted as shown below. The weight so far is now 175 grams (6.17 oz) and the model CG is still right where it should be..........................Tandy
David Harding

From: Tandy Walker [tandyw@flash.net]
Sent: Monday, December 07, 2009 8:03 PM
To: Undisclosed-Recipient; ;@smtp106.sbc.mail.mud.yahoo.com
Subject: 26 Speed 400 Cloudster - Stablizing the Push Rods

**Speed 400 Cloudster Project**

I have had little time to work on the Cloudster the last couple of days, however I did manage to get the rudder and elevator push rods stabilized and finished out today. In the front view of the fuselage below, you can see the three 1/16" X 3/16" balsa cross members holding the two push rods in position.

![Fuselage View](image)

This is a different perspective of the cross members in this view looking in from the right side. The yellow sheaths have been sanded on the outside to scuff the exterior surface to enhance their CA bonding to the cross members.
This picture shows the push rod exit at the rear of the fuselage where it emerges out of the 3/32" X 1-1/4" balsa filler sheet. The yellow sheath was extended out the back a little further than shown. 15 minute epoxy was then mixed up and the sheath was coated liberally on the outside and inside of the filler sheet with the epoxy. Then the sheath was both pulled back into filler sheet and rolled over and over at the same time to coat the inside of the exit joint. It is important that the push rod clevis be engaged in the control horn so that the yellow sheath angle is held in its proper position while the epoxy sets up.
This picture shows the epoxy coating from the inside of the filler sheet.

Once the epoxy was thoroughly cured, the epoxied yellow sheath was coarsely ground down with a Dremel barrel sanding drum, but not too close to the filler sheet. Final sanding was done by hand, leaving a neatly inlaid elliptical opening flush with outside of the filler sheet as shown below.
This picture shows the clean exit of the 1/32" push rod out of the fuselage’s side at just the right angle.

This completes the Cloudster’s push rod installation. The next task will be to develop all of wing’s rib and wing tip patterns in preparation for building the wing next.............................Tandy
A couple of years before Dick passed away, he had me get the "Airfoil 8" software program. Later, he gave me a cassette containing all of his empirical airfoil data of various models that he had developed and collected over the years. I loaded these data into the Airfoil 8 Program in the "Coordinates" option shown below. I had forgotten about this program because I had not used it for probably over ten years.

As I was preparing to develop the rib patterns for the Cloudster's wing, I noticed that the main rib R1 laid out in the bottom right corner of the Jim Adams plans as shown below. Rib stations in percent had been drawn on the R1 rib and I immediately recognized that it was Dick Huang's work from the hand printing. He obviously had measured and recorded the Cloudster rib airfoil coordinates. Could it be I already had the Cloudster's wing airfoil coordinates loaded in the Airfoil 8 Program?
So I opened up the Coordinates option and sure enough, there was the data file for the Cloudster wing airfoil. It is called "CLOUDSTR.NOR" along with many of the other Old Timer model airfoils as shown below.

I clicked on CLOUDSTR.NOR and put in a chord length of 6.9". The Cloudster airfoil was displayed as shown below. The display is a little grainy, but the print out is smooth.
The full size Cloudster’s airfoil was then printed out as shown below. I then made the R1 rib pattern by drawing in the LE, TE, and all of the spars. I checked the Cleveland Cloudster plans and the bottom of the 1/8" X 1/2" trailing edge lays flat on the plans as shown below.

So from this point on, it will be a simple matter to develop all of the Cloudster’s wing rib patterns..........................Tandy
I received an e-mail from Dave Harding last Friday with a very good method that he uses to account for wing rib finite trailing edge thickness when using an airfoil computer program. I feel it is worthwhile to pass his comments below along to you guys....................Tandy

----- Original Message -----
In preparation for producing the Cloudster wing ribs, the next step was to first cut out the 1/32" plywood R1 rib template shown below.

This included drilling the two alignment holes and carefully cutting out all of the spar notches and checking their fit with the actual spars selected as shown below.

As part of the Cloudster's on going weight saving effort, the sizes of the spars were reduced as follow:

- **Main Spars**: 3/32" X 1/4"
- **Rear Spar**: 3/32" X 3/16"
- **Turbulator Spars**: 1/16" X 3/16"
- **Leading edge**: 1/4" X 1/2" *(trimmed down later)*
- **Trailing Edge**: 1/8" X 1/2"

The sharpness of the plywood rib template is better seen from the back side as shown below.
Two 1/16" alignment dowel pins were cut to length. The plywood template was placed over a sheet of medium 1/16" balsa and a No. 44 drill bit was twisted by hand through the template's alignment holes into the balsa sheet below. The alignment dowel pins were inserted through the holes pinning the template to the balsa sheet as shown below. It is to be noted that the forward hole and dowel was done first and then aft hole and dowel done second.

The first balsa rib was then cut out, notched, and sanded to shape while on the template. Then the near perfect R1 rib was removed and placed below the template for you to see below.

Just to illustrate the accuracy consistency of this method, the second R1 rib was cut out, notched, and sanded to shape. It was then placed below the first R1 rib as shown below. I know some model builders make a complete stack of wing ribs at one time using a band saw. However, for me, maintaining this kind of accuracy in balsa can only be done one rib at a time using the template method.
This process will now be repeated over and over for a day or so until all of the Cloudster ribs have been made...........................Tandy
I know that many of you are seasoned modelers and build equally as well or better than I, so some of the material I report on seems rudimentary and too tutorial for most you. However, I had a response from a particular modeler indicating he was having trouble cutting accurate notches in his wing ribs and wanted to know how I do it. So I decided to make the answer to his question one of my Cloudster reports.

We all have specific tools for specific jobs that work best for each of us. Balsa can be a difficult wood to cut because it tends to crush along the cut if the blade you are using isn’t extremely sharp. Throughout my many years of modeling I found that there is only one brand single edge razor blade that has an exceptional edge sharpness that approaches surgical steel. It is the "GEM" single edge razor blade by Personna shown below. These blades are sometimes hard to find, but here in North Texas Walgreen’s drug stores do carry them and they are expensive at $5.15 for package of 10 blades. However, I never use any razor blade but the GEM when I am building models.

The collection of tools I use for cutting out notches in 1/16" balsa wing ribs are shown below as follows: (1) the knife is used for cutting out the bottom of notches because the razor blade will not work, (2) The GEM razor blade, (3) a small flat file with a thickness just under 1/16" (probably 3/64"), and (4) a 6" flat file with a
thickness just under 3/32".

Using one of the 1/16" X 3/16" notches as an example, the procedure is to first carefully cut down the template notch sides with the razor blade as shown below, cutting a little at a time on each side until you have reached the depth of the notch. Do not worry about the squareness of your cut at this point, in fact it is better to have the blade tilted slightly to the inside of the notch. Use the knife to cut across the bottom of the notch and get rid of the balsa material in the notch.

Now, using the small flat file, carefully square up the edge cuts of the notch a little at a time as shown below, which opens up the width of the notch. Do not try to reach the final width on the first filing. By the way, the 6" file is used to square up the edged of the 3/32" X 3/16" notch at the rear of the rib.
Using the 1/16" X 3/16" balsa spar stock, check the tightness of spar in the notch as shown below. Then go back with the file and widen the notch just slightly. This is an iterative process, but with a little practice, you can get the desired fit in a couple of tries.

Some of you will think this is simply too much work for just notching out a rib. However, we are all
modelers after all and building models is part of what we do and enjoy. So it takes a little extra time, the notch accuracy of the end result shown below is well worth the extra effort in my opinion.

I hope this information will be helpful, especially to the more inexperienced model builders that are having trouble. Of course you must realize that over time all modelers have developed their own way of doing everything. This is only one of many ways to notch ribs and probably not the best way..................Tandy
The Cloudster plans call for pre-gluing the wing tip pieces together into a unit so that the tip of the unit can be blocked up 1/4" [scaled to (.231'')] before gluing it to the leading and trailing edge. In the picture below, the three wing tip pieces are pinned down and glued together on the left wing tip plan as shown below.

The wing's leading edges, trailing edges, and all of the spars have selected. In addition, all of the wing pieces, except the three center section ribs, have been cut out. You can see in the picture below (1) the two 3/16" wing tip units, (2) eighteen of the 1/16" R1 ribs stacked together, and (3) two each of the 1/16" R4, R5, R6, and R7 tip ribs. The center section ribs will be cut out later after the complete right and left wing halves have been built. A review the method of wing attachment will be reviewed carefully before the center section of the wing is built.....................Tandy
Wing tip panels have always been a challenge. Getting the spars and tip ribs to transition and taper down out at the tip is difficult and mostly an art form. It is always kind of a guess as to how much to curve the top spar down or the bottom spar up out at the wing tip. However as shown below, the Jim Adams plans specify that the wing tip pieces glued together as a unit are to be shimmed up 1/4", which scales to (0.923 * 0.25) = 0.231".

Therefore, it was thought that the tip panel was going to be easy on the Cloudster wing. It turns out that this couldn't have been more wrong as shown below. When the wing tip pieces glued together as a unit are shimmed up, the unit does not mate (interface) properly with the trailing edge, so the question is what to do?
Referring back to the insert of the front view of polyhedral wing on the Cleveland Cloudster plans below, it can be clearly seen that the bottom surface of the wing tip panel remains straight and the top surface curves down to meet the bottom surface at the tip.

When the leading and trailing edges are pinned down on the plan in an attempt to accomplish this, the wing tip unit can not also be flat on the plan. You see due to the wing's undercamber, the bottom spar is elevated off the plan and will not tie into the tip unit properly. The solution to this problem can be addressed by looking at the R1 rib pattern below. First, the bottom spar is elevated 3/32" off the plan. By shimming the bottom of tip unit up 3/32" off of the plan at the tip, the bottom spar can be straight as well as flush with the tip unit at their intersection and the bottom surface of the wing tip panel will remain straight.

In the picture below, the leading and trailing edges have been pinned down and the first three R1 ribs have been glued in place, with root rib inclined at 96.85 degrees. The wing tip unit has been elevated 3/32" at the tip and glued in place. The 3/32" X 1/4" bottom spar has been
put in place with a 3/32" spacer put underneath such that the bottom spar is flush with the tip unit at their intersection.

From this point on, the remaining tip ribs will be glued in place and then the top 3/32" X 1/4" will be installed and bent down into place........................Tandy
In order to lay out the wing's right inner panel, the dihedral and polyhedral inclination jigs had to be made. From Report No. 33 it was determined that the polyhedral break angle was 13.701 degrees. It is my custom to put half of this angle (13.701/2 = 6.85 degrees) on the end of the wing's inner panel and half on the end of the wing's tip panel. Since this angle is beyond 90 degrees, the angle of the inclination jig is 90+6.85 = 96.85 degrees. This angle was laid out on paper with a protractor as shown below.

Then using a piece of 3/16" balsa, one edge of the polyhedral inclination jig was cut and sanded to the proper angle as shown below.
The 1/4" X 1/2" leading edge and the 1/8" X 1/2" trailing edge were pinned down on the right wing’s inner panel. Then five of the R1 ribs were glued in place 90 degrees to the plan. The jig was used to set the inclination of the temporary polyhedral rib on the end of the inner panel as shown below.

Again from Report No. 33, it was determined that the dihedral break angle was 6.76 degrees. Since this angle is small, the total angle was applied to the root of the wing’s inner panel. Using same piece of 3/16" balsa, the other edge of the inclination jig was cut and sanded to the proper angle (96.76 degrees) and used to set the inclination of the inner panel’s root rib as shown below.
The main 3/32" X 1/4" top spar was placed in the rib cut outs without gluing. Heavy steel abutments were placed up against end of the spar to hold it in place spanwise. Then a small steel block square was used to check and adjust each R1 rib to 90 degrees on the main spar. Only the five R1 ribs were tacked in place with a drop of medium CA. Then the two inclined end ribs were checked with the inclination jig and tacked in place with a drop of medium CA.

The wing’s inner panel was removed from the plan. It was placed upside down on the work table and the top spar was clamped in three places with Quick Clamps. This is a measure to insure that the inner panel remains straight while the bottom main spar is glued on. Only the five R1 ribs were tacked in place with a drop of medium CA.
The inner panel was placed back on the plan and the two end ribs were checked with the inclination jig before they were glued to the bottom spar as shown below.

After the rear bottom 3/32" X 3/16" spar and the three 1/16" X 3/32" turbulator spars were glued in place, all of the spars were trimmed off and the temporary polyhedral rib bar sanded smooth. Again, the inclination of the temporary polyhedral rib was checked using the jig as shown below. This was also done on the inner panel’s root rib. Notice also that 1/16" gussets have been added to the outboard side of the rib/trailing edge joints to strengthen the joint.
The picture below shows the wing's completed inner panel, except for the modification of the leading edge at the root.

The picture below shows how the leading edge curves in at the root to mate with the center section. The wing will be built with a false straight leading edge until the center section’s main spar carry through is completely assembled for accuracy purposes. Then this portion of the leading edge will be cut away and modified as per the plans below.
The wing’s right tip panel will be built next. However, tomorrow is Christmas Eve and all modeling has to stop as Sue and I are having many guests and activities both tomorrow as well as Christmas day, so I will not get started on the right wing’s tip panel until Saturday. So until then,....................

MERRY CHRISTMAS TO YOU ALL

Sue and Tandy
Speed 400 Cloudster Project

The validation for making a polyhedral wing instead of a dihedral wing on the Jim Adams Cloudster plans comes from the original Cleveland Cloudster plans shown below.

This report deals with the issue of developing the polyhedral wing geometry for the Jim Adams Cloudster plans using the Cleveland Cloudster plans. To begin, the measurements and calculations for the polyhedral wing shown on the original Cleveland Cloudster plans are as follows:

Note: **All calculations were performed in the attached Excel spread sheet.**

**Given:**
- Inner Panel Span (Li) = 12-3/4" (12.750") measured
- Tip Panel Span (Lt) = 12-7/8" (12.875") measured
- Inner Panel Vertical rise = 1-1/2" (1.50")
- Tip Panel Vertical rise = 4-1/2" (4.50")

1. Tip Span (Lt) to Semi-Span (b/2) Ratio = **0.5024**

2. Inner Panel Dihedral Angle (d) = \(\text{ArcSin}\left(\frac{1.5}{Li}\right)\) = **6.756** Deg

3. Angle (J) = \(\text{ArcSin}\left(\frac{4.5}{Lt}\right)\) = 20.458 Deg

4. Tip Panel Polyhedral Angle (c) = J - d = **13.701** Deg
Now with the above geometry and wing data, the measurements and calculations used to development of the Jim Adams Cloudster polyhedral wing are as follows:

**Notes:**
1. The wing center section will remain flat over fuselage for ease of wing attachment.
2. The wing’s inner and tip panel angles were made the same on the Jim Adams plans as on the Cloudster plans.

**Given:**
- Semi-span (b/2) = 23-15/16" (23.9375") measured
- 1/2 Center section Span (1/2 Lc/s) = 1.223" measured

**Calculated Above:**
- Tip Span (Lt) to Semi-Span (b/2) Ratio = 0.5024
- Inner Panel Dihedral Angle (d) = 6.756 Deg
- Tip Panel Polyhedral Angle (c) = 13.701 Deg

1. Tip Span (Lt) = 0.5024 X 23.9375 = 12.027" <<<<<<

2. Inner Panel Span (Li') = 23.938-1.223-12.027 = 10.688" <<<<<< (measurement checks at 10-11/16")

**Note:**
This will require changing the wing’s rib spacing to make equal rib spacing with a rib falling at the polyhedral break.

3. New Rib Spacing = Li'/6 = 1.7813" <<<<<<

4. Inner Panel Vertical Rise (Hi') = Li' X Sin d = 1.257" <<<<<<

5. Tip Panel Vertical Rise (Ht) = Lt X Sin c = 2.849" <<<<<<

12/21/2009
Based on the 1.78" rib spacing of Item No. 3 above, the new rib locations were drawn in on the Jim Adams wing plan as shown below.

**Inner Panel**

**Tip Panel**
The parts are available and the geometry has been calculated so that tomorrow the construction of the Jim Adams Cloudster polyhedral wing can begin..............................Tandy
The four remaining tip ribs were glued in place over the relatively hard 3/32" X 1/4" balsa bottom spar. A medium 3/32" X 1/4" balsa strip was chosen for the top spar because it has to curve down out at the tip. Actually, the top spar was beveled and glued to the tip unit first before it was bent to shape as shown below.

The wing’s inner was pinned down over the plans and wing’s tip panel was jigged up such that the tip was elevated off of the plan 2.85". A trial clamped fit was made without gluing to check the set up as shown below.
Notice the steel square with the plywood clamped to it at the right. This will be 2.85" jig brace placed under the wing tip when the two panels are glued together. A measurement check was made of the tip’s elevation with a metal scale as shown below.

In this close up, you can see that the bottom of the wing tip is elevated exactly 2.85".
In the picture below, the right wing’s inner and tip panels have been glued and clamped together with the 2.85” jig brace supporting the wing tip. This will be left to dry overnight. Then the two temporary polyhedral ribs will be removed so that the main spars can be braced and the polyhedral joint completed..............................Tandy
After the right wing’s glued and clamped inner and tip panel joint had dried overnight, the right wing was removed from the plan. Then with great care, the two temporary polyhedral ribs that had been clamped together were carefully cut into sections and removed as shown below. Notice that the portion of the two temporary polyhedral ribs between the upper and lower 3/32" X 1/4" main spars was left in place. This preserves the vertical spacing between the upper and lower spars.

In order to fabricate a plywood polyhedral brace that will fit between the two main spars, a template was drawn by pressing a trimmed sheet of 1/16" up against the forward face of the main spars and tracing an outline from the rear inside the two spars. The 1/16" balsa template was cut out as shown below.
The balsa template was then placed on a sheet of 1/16" plywood and the pattern traced onto the plywood. The plywood brace was cut out and sanded to fit in between the two main spars (things like this never fit properly without a little hand tweaking). As part of the Cloudster's on going weight saving effort, six 1/4" lightening holes were carefully located and made in the plywood brace as shown below before it was glued in between the two main spars.

The finished plywood brace was slipped into place between the two main spars. The 1/4" wide spars are much wider than the 1/16" brace. Since the main spars are 1/4" wide, the brace will be centered inside the spars when there is a 3/32" distance between the edges of the spars and the brace (i.e., 3/32 + 1/16 + 3/32 = 1/4). Therefore a piece of 3/32" balsa was used to center the brace before it was permanently glued in place as shown below.
Even though there is a large cross sectional gluing area on the 1/4" X 1/2" leading edge, a leading edge brace was made out of 1/64" plywood to add further support. The brace's edges were lined with balsa as shown below so they would sand smoothly when the balsa leading edge is carved and sanded to shape.

The leading edge brace was glued with aliphatic glue and clamped to the inside face of the leading edge as shown below.
Once dry, the clamps were removed, which is shown below. This brace adds considerable strength to the leading joint at the cost of very little weight.

Using the R1 plywood template made in Report No.29, a polyhedral rib was made from 3/32" sheet balsa. The polyhedral rib was made thicker for attaching the wing covering to. This rib was had a 1/16" strip cut from the center for the polyhedral brace as shown below.
The two segments of the polyhedral rib were glued into place and the trailing edge polyhedral joint was reinforced with two large 1/16" gussets (0.6" on a side) as shown below.

This shows the polyhedral rib glued in place from the top side.
Next the three 1/16" X 3/16" turbulator spars will be added to the wing's tip panel and the wing tip will be trimmed and sanded to final shape.

HAPPY NEW YEAR

..........Tandy.........
This morning I glued in the three 1/16" X 3/16" turbulator spars in the wing's right tip panel and then spent most of the rest of the day working on finishing out the wing tip. Filler blocks were cut from very soft 3/16" sheet balsa and glued in place on top of the wing tip pieces. These were carved, trimmed, and sanded to final shape as shown in the picture below.

This shows a close up of the wing tip leading edge.
This shows a close up of the wing tip trailing edge.

This picture shows the bottom of the finished wing tip.
The right half of the wing currently weighs 24 grams (0.85 oz) as shown below. However, this will come down some because close to 40% of the 1/4" X 1/2" leading edge will be removed when the leading edge is carved and sanded to final shape. So the complete wing structure, including the flat center section, should weigh no more than between 1.8 to 2.0 ounces.

The fuselage including the tail assembly, push rods, two servos, landing gear, motor with motor...
mount, and spinner weighs 175 grams (6.17 oz) as also shown below. So including the estimated wing structural weight of 2 oz, the current Cloudster weight is 8.17 oz, just barely over half the Speed 400 event minimum weight requirement of 16 oz. Wonder if this Cloudster can be brought in at or near the minimum weight of 16 oz. Any comments?

Now, next week the left half of the wing will have to be built. During this time, there will be no Cloudster reports posted because they would be redundant. The Cloudster reports will resume when construction on the wing’s center section begins and the two halves of wing are jointed to the center section.......................Tandy
Speed 400 Cloudster Project

Here are summary pictures of the construction of the left half of the wing.................Tandy

Jigging, Clamping, and Gluing left tip panel to left inner panel.

Block Filling the wing Tip with Soft Balsa.
1/16" Plywood Polyhedral Brace.

This shows a picture of the finished left half of the wing with the plywood brace glued in place.
This picture shows both the right and left halves of the finished wing. Each half weighed in identically at 23 grams (0.81 oz) for a total weight of 1.62 oz without the center section. It looks like the wing structure weight may come in at or near 2 oz.

Barring tomorrow unforeseen events, I will build the center section and join the wing halves.........Tandy
I forgot to change the number and title of the report I sent this morning. If you are saving the Cloudster reports, please replace it with this corrected one.

**Speed 400 Cloudster Project**

This morning I took the wing up off of the plans and carefully glued in the center section’s bottom main spar. This now has the two wing halves accurately and securely tied together so that remaining construction of the center section can continue. Today I will be working on making the plywood main spar carry through brace support, installing the recessed leading edge parts, and finalizing the design of the wing attachment to the fuselage. However, I did place the the wing on the fuselage and took the picture below so you can get a feel for how a Cloudster with a polyhedral wing looks..................Tandy
Now that the two wing halves are joined together, the remaining construction of the center section can continue. The first task was to remove a portion of the two temporary R1 ribs on either side of the center section as shown below.

In an earlier step, portions of the two temporary center section ribs between the upper and lower 3/32" X 1/4" main spars were left in place to preserves the vertical spacing between the upper and lower spars. In order to fabricate a plywood polyhedral support brace that will fit between the two main spars and bridge the center section, a template was drawn by pressing a trimmed sheet of 1/16" balsa up against the rear face of the main spars across the center section and tracing an outline from the front inside the two spars. The 1/16" balsa template was cut out as shown in the upper portion of the picture below. The balsa template was then placed on a sheet of 1/16" plywood and the pattern traced onto the plywood. The plywood support brace was cut out and sanded to fit in between the two main spars, which is shown in the lower portion of the picture below.
As part of the Cloudster’s on going weight saving effort, ten 1/4" lightening holes were carefully located and made in the plywood support brace as shown below before it was glued into the center section.

The finished plywood support brace was then slipped into place between the two main spars. The 1/4" wide spars are much wider than the 1/16" brace. Since the main spars are 1/4" wide, the brace will be centered inside the spars when there is a 3/32" distance between the edges of the spars and the brace (i.e., 3/32 + 1/16 + 3/32 = 1/4). Therefore a piece of 3/32" balsa was used to center the brace before it was permanently glued in place as shown below.
Work was stopped for today as the final design of the wing attachment to the fuselage has not yet been completed............................Tandy
Before starting work on recessing leading edge, it is instructive to measure and compare the "as built" overall vertical rise of each wing tip with the design value while the temporary leading edge is still in place. The wing's inner panel end R1 rib replacements were glued in place, including the portion all the way forward to the temporary leading edge as shown below. Notice that the three turbulator spars are extend to these end R1 ribs as well and the trailing edge dihedral joint was reinforced with two larger 1/16" gussets (0.6" on a side) as shown below.

The design value of the wing's vertical rise at the tip can be calculated from Report No. 33 as follows:

\[ \text{Design Vertical Rise} = \text{Hi'} + \text{Lt} \times \sin(J) \]
\[ \text{Design Vertical Rise} = 1.257 + 12.027 \times \sin(20.458) = 5.461" \]

Now to measure the vertical rise, the wing center section's leading and trailing edges were firmly weighted down to the work table with two square steel blocks as shown
below. Then a triangular scale also shown below was used to measure the wing tip vertical rise off of the work table.

The vertical rise measurement of the lower edge of the left wing tip off the work table, as viewed from the front leading edge, is 4-15/16" as seen below.

This however is not the true measurement because there is a 7/16" (0.438") blank section at the end of the scale as shown below. The true measurement is (4.938+0.438) = 5.376". Therefore, left wing tip rise is slightly under the design value by 5.376-5.461 = -0.085", which is only a 1.6% overall error.
The vertical rise measurement of the lower edge of the right wing tip off the work table, as viewed from the trailing leading edge, is 5" as seen below, which is 5+0.438 = 5.438". The right wing tip rise is slightly under the design value by 5.438-5.461 = -0.023", which is only a 0.4% overall error.

These errors are well within practical building tolerances for balsa. I am pleased and probably very lucky that these errors turned out to be so small.........................Tandy
Speed 400 Cloudster Project

The first step in creating the wing’s recessed leading edge is to make the center section’s portion of the leading edge out of 3/8" X 1/2" balsa stock. The forward portion of the 1/2" height is beveled down so that the front face is only 1/4" high. Next the forward portion of the two R1 center section ribs are trimmed down and then the leading edge is glued in place as shown below. To make sure the bottom face of the leading edge lies in the same plane as the center section's temporary leading and trailing edges, the wing center section’s temporary leading and permanent trailing edges were firmly weighted down to the work table with two square steel blocks as shown below.

This excerpt from the Jim Adams Cloudster plan details the wing center section showing the forward plywood plate that extends down below the bottom of the center section for the forward wing attachment to the fuselage.
The picture below shows the center section structure that was added forward of the main spar. It consist of three 1/16" balsa sub ribs and a 3/32" balsa back plate with a beveled top behind the leading edge to form the slot for the 1/16" plywood plate. Notice the rather sharp curvature of the ribs between the leading edge and the main spar.

To accommodate this curvature, a piece of 1/16" balsa sheet was wetted and taped around a 1-3/8" wooden dowel to pre-form the curvature as shown below.
Once dry, the tape was removed and the resulting preformed 1/16" sheet is shown in the picture below.

The pre-forming step makes it much easier then to glue the 1/16" balsa sheeting to the top of the forward center section structure as shown below.
Slightly curved 1/16" balsa sheeting was also glued to the bottom of the center section between the main spar and the 3/32" balsa back plate, leaving the 1/16" wide slot open.

The temporary leading edge and permanent trailing edge have served well as a jig to accurately position the center section’s permanent leading edge. In the picture below, you can see that all three lie along a straight line.

In the picture below, a piece of 1/16" plywood has been slipped into the slot for a test fit. After the wing is finished and covered, the finished wing attachment plywood plate will be glued in place.
Tomorrow the two curved portions of the recessed leading edge will be cut out and glued in place. Then the temporary leading can be removed leaving the sculptured recessed leading edge....................Tandy
The next step in completing the recessed leading edge is to make the two curved portions of the leading edge and glued them in place as shown below. This now has the center section recessed leading edge firmly tied into the temporary leading edge, which can now be removed. Notice that the inside curvature of these two pieces is finished, but a fair amount of trimming and sanding has yet to be done to shape the outside curvature of the recessed leading edge.

Using an X-Acto razor saw, the temporary leading edge was cut away and separated from the primary wing structure as shown below. It has served its purpose well to hold the wing structure true and accurate until the recessed leading edge could be built.
I have spent most of the day today carefully trimming, sanding, and shaping the difficult curved portions of the recessed leading edge. The top view of the recessed leading edge is shown below.

The bottom view of the recessed leading edge is shown below. A considerable amount of time was spent making the two curved pieces that form the recessed leading edge symmetrical. The curvature of the left side was finished first. Then a paper template was made and traced onto the bottom of the right side, which was most helpful in getting the
two curvatures the same.

This shows the finished recessed sculptured leading edge. Notice the three turbulator spar extensions and the way they tie into the center section's recessed leading edge. Also notice that top portion of the 3/8" X 1/2" leading edge has been partially trimmed down along the top, but there is still quite a bit of work before the leading edge is completely shaped.

Work has stopped for the day. The next step will be construct the center section's remaining structure and planking behind the main spar, which will also include the rear wing attachment.

However, this will not get done tomorrow. My grandson (Steve) is coming over tomorrow morning (before he returns to Texas A&M on Monday where he is a junior in computer science engineering) at 10:00 a.m. to do some “brain surgery” on my computer. :O< He is going to first save and then delete all files in the memory of the two partitioned disk drives. He
will then remove the partition between the two drives so that there will be only one large composite disk drive. Then he restore all of the software with the six recovery CD’s and reload all of my files. Thank goodness for smart computer savvy grandsons....................Tandy
**Speed 400 Cloudster Project**

Well, I am up and running again, even though I still have a few computer issues and settings to work out. The reformatting of my computer caused me to loose all of the group folders in the Outlook Express e-mail address book including the Speed 400 group. Therefore, I have had to develop a new Speed 400 e-mail address group folder from memory, which will not have some on the original list.

During all of this down time, I did get some work done on the Cloudster wing's center section. As part of the Cloudster's ongoing weight saving effort, a significant portion of the center section's top and bottom 1/16" balsa planking was eliminated to save weight as shown below. Also shown is the center rib of the five center section ribs.

Here you can see the five center section ribs glued in place between the main spar and the trailing edge. You can also see the 1/16" X 1/2" plywood plate attached to the center section's trailing edge with a 2-56 cap screw in the center for the rear attachment of the wing to the fuselage.
This picture shows the center section planking completed.

This is just a shot of the complete wing showing the planked center section.
The wing is attached to the fuselage at the front with a plywood hold down plate that slips onto two 3/16" dowels as shown on the plan excerpt below.

The wing's hold down plate was made from 1/16" plywood as shown below. Notice that eight 1/4" lightening holes were made to reduce weight as part of the Cloudster’s on going weight saving effort.

This shows the hold down plate inserted into its wing slot near the leading edge, but not yet
glued in place.

Since this completes the Cloudster’s wing structure, it was weighed and compared to the construction goal of 2 ounces. As shown below, the wing structure weighs 56 grams or 1.98 oz..........................Tandy
Speed CLoudster Project

In order to interface the wing's forward hold down plate with the fuselage, second 1/16" plywood plate was made and two 3/16" holes were drilled for the two dowels that slide into the hold down plate. As shown below, this was glued into the top of the fuselage primary structure. The two 3/16" dowels have been cut to length, shaped, and slipped into the holes, but not yet glued in. Notice the two dowels are rounded on the ends. As a side note, since there is no front adjustment to pull the wing down tight against the fuselage structure, a good close tolerance fit of much be achieved.

This picture shows the forward portion of the two dowels cut off at an angle as per the plans.
Here you can see the 2-56 cap screw threaded into a blind nut embedded in a strip of 1/16" plywood underneath the 1/8" balsa. If you look close, you can see that a piece of white ABS plastic tubing lines the hole to serve as a grommet to protect the edge of the hole around the balsa.

In order to protect the edges of the hole in the wing’s plywood rear attachment, a small amount of medium CA was carefully applied around the hole in the plywood, a small 2-56 washer was slipped through the top planking and placed down onto the plywood as shown below. A 2-56 cap screw was inserted and tightened down to hold the washer in place until the CA dried.
This is a view from underneath showing the two dowels engaged in the front hold down plate and the 2-56 cap screw threaded into the blind nut. Notice the curved gapped opening over the top longeron resulting from the wing’s undercamber.

A piece of 3/16" balsa was cut out and carefully sanded to shape as shown below to form the wing saddle that will fit into the opening and interface with the wing’s bottom planking.

This shows the wing saddle piece glued to the left top longeron under the wing.
At this point, a problem was realized! You see in order to remove the wing, it must be slid back 5/16" to disengage the hold down plate from the two dowel. However, the wing will ramp up as it starts to slide back along the wing saddle and the hold down plate will instantly bind on the two dowels! Fortunately, the two dowels had not been glued in place so they could still be removed. New shorter dowel were made with almost flat ends as shown below.

In this view under the wing, you can see that the new dowels only extend through the wing's hold down plate 1/16", which allows the hold down plate to cleanly disengage with only a slight aft movement in the wing while also rotating the wing trailing edge up slightly. Several trial wing attachments and removals proved this to be quite satisfactory.
This shows the current Cloudster's structure from a frontal view. Total weight at this stage of the construction is $(6.17 + 1.98) = 8.15$ ounces, just slightly over half of the 16 ounce minimum weight requirement for the Speed 400 event. The 6.17 ounce weight was presented in Report No. 25 and the 1.98 ounce weight was presented in Report No. 47.

This shows another view of the Cloudster's structure from the rear.
The wing and tail assembly should be covered next so that the location of the rather heavy Li-Po battery can be determined that will balance the model. However, I still have to decide what the color scheme will be and what covering material to use, which I will probably have to be ordered. In the mean time, the tail skid can be made and installed and the fuselage’s bottom bulkheads can be cut out. I also need to get a set of the lightest 2-1/8" wheels I can find. There are some of these curved spoked spider looking wheels for electric models that weigh almost nothing, but they look simply terrible in my opinion. I may have to resort to making some light balsa wheels myself like the one shown below that I made for the little rubber powered Cub I built. Do you know of some light weight 2" to 2-1/8" wheels?.................Tandy
Some time was spent with Jerry Kestner here today while he resolved most of the remaining issues on my computer that have cropped up since he did the restoration and reformatting of the hard drive. There was not too much progress on the Cloudster today except for the tail skid installation and some initial concept work on how to go about building the cowl. However, I will go on and post the work on the tail skid.

The tube for securing the 1/32" wire tail skid was cut from a piece of 1/16" aluminum tubing with a 1/32" I.D. This tube was installed in the rear of the fuselage structure using two 1/16" plywood retainers, which were glued into the structure as shown below. The plywood retainer at the bottom of the picture also has a small second piece of 1/16" plywood glued on the bottom to prevent the aluminum tube from going all of the way through. The aluminum tube itself was cleaned with Acetone and CA’d to the two plywood retainers. The aluminum tube was left protruding out the bottom about a 1/4". Once the bottom bulkheads and stringers have been installed, this tube will be cut off flush with the stringer line. A piece of 1/32" piano was bent on the lower end to form the tail skid and inserted into the aluminum tube as shown below. However, it will not be epoxied inside the tube until the fuselage has been finished and covered.
David Harding

From: Tandy C. Walker [tandyw@flash.net]
Sent: Wednesday, January 27, 2010 5:08 PM
To: Undisclosed-Recipient; @smtp103.sbc.mail.mud.yahoo.com
Subject: 50 Speed 400 Cloudster - Construction the Cloudster's Cowl Frame

**Speed 400 Cloudster Project**

The Jim Adams plan has a sculptured cowl that fairs into the back of a spinner as shown below.

![Diagram of the cowl frame](image1.png)

After several concept considerations for constructing a cowl, an approach finallyimmerged. Four 1/16" holes were carefully hand drilled into the firewall as shown below.

![Image of the cowl frame with holes](image2.png)
Four 7/16" lengths of 1/16" piano wire were cut and inserted into the holes in the firewall. The length of these cowl alignment pins allow the pins to protrude out of the front face of the firewall 3/16" to engage the rear face of the cowl sides.

Next, a 3" wide sheet of 3/16" medium soft balsa sheet was cut to length for the cowl side shown below. A 3/16" wide strip was cut from 1/64" plywood, which is also shown below.
The strip of plywood was glued to the rear edge of the 3/16" balsa sheet. This protects the balsa edges from getting all dented up. The two holes were marked to align with the cowl pins and then drilled 3/8" deep. An aluminum tube with 1/16" I.D. was cut to length and inserted into the hole as shown below.

A trial fit was performed to check the alignment of the pins with the holes as shown below. Thank goodness, they did fit!

The aluminum tubes were removed and then permanently CA's in place as shown below.

A strip of 1/16" plywood was drilled out for the Speed 400 motor shaft. This plywood
strip was forced down against the front of the cowl sides and held down with a 3/32" wheel collar as shown below. Even though the fuselage sides taper in at the front, the cowl sides were positioned perpendicular to the firewall and CA's to the plywood strip. In addition, a second balsa strip was added on the front of the cowl sides to jig the cowl sides straight. Notice that a balsa brace was also added between the cowl sides on the bottom back near the firewall to further hold the cowl sides straight.

Once dry, the wheel collar was taken off and the cowl frame was removed from the fuselage as shown below.
The cowl frame was turned over and this picture taken to show the four lined holes to receive the four cowl alignment pins. The reason the cowl sides are kept parallel is that any and all balsa rectangular blocks can be easily glued to the inside faces of the cowl sides.
Before the cowl sides are blocked in on top and bottom with balsa and the cowl carved to shape, a method for cowl retention must first be designed. However, that will be the subject of tomorrow’s report. Work has stopped for the evening as the President’s State of the Union speech is coming on at 8:00 p.m. and will last until 10:00 p.m. and Sue and I want to watch it in its entirety..........................Tandy
Speed 400 Cloudster Project

Three mistakes were made on the first cowl frame in Report No. 50: (1) the 7/16" cowl alignment pins shown below were too long, (2) the 3/8" aluminum tube liners for the cowl pins went into the cowl sides too far, (3) the cowl sides were made perpendicular to the firewall instead of parallel to the fuselage sides. Once the cowl was blocked in and carving and trimming of the sides started, the ends of the four embedded aluminum tube liners would quickly be exposed because they extend out too far and are too close to outside surface of the cowl.

To correct this problem, first the cowl alignment pins were shortened to 1/8" as shown below. After all, these pins only need to be long enough to engage the back face of the cowl sides.
This is where the approach to the cowl frame changes. A 1/2" length of balsa was cut off the end of a 2" X 2" soft balsa block. The front and rear cross grain face were sanded smooth. Then a hole was cut out in the block as shown below and sanded so as to slip snugly over the front end of the cylindrical motor mount. Notice the end grain of this cowl nose block.

Then two new cowl sides were made using the procedure in Report No. 50, except the rear faces of the sides were beveled so that the cowl sides were parallel with the fuselage sides instead of being perpendicular to the firewall. The vertical side edges of the cowl nose block were carefully trimmed and sanded so that the cowl sides that are parallel with the fuselage sides were also tangent to nose block. Once this was done, the nose block was slipped over the motor tube, the new cowl sides were pushed onto their
respective alignment pins, and the two cowl sides were glued to the nose block with aliphatic glue as shown below. This approach insures an almost perfect alignment fit of the cowl to the firewall.

A temporary balsa brace was also added between the cowl sides on the bottom back near the firewall to hold the cowl side spacing until the this can be blocked in with balsa.

Once this is allowed to thoroughly dry, then balsa will be blocked in between the cowl sides on top and bottom. Oh yes, a method for attaching the cowl has been thought out, but this will be presented and discussed in a later report.....................Tandy
The first soft balsa fill in block to be added between the two cowl sides was on top as shown below.

Next two tapered soft balsa blocks were added to the insides of the two cowl sides as shown below. Notice inside carving and relief shaping of the top block.
Last night when I checked the location of the rear face of the spinner, pushed all of the way onto the motor shaft, I found that the forward face of the cowl falls short by an 1/8" @#$%! So I cut off an 1/8" (plus a little for sanding) cross grain wafer to glue to the front of cowl frame in order to properly mat with the spinner.

This picture shows the 1/8" cross grain balsa wafer glued to the front of the cowl from the side.
This picture shows the wafer from the front. The penciled circle was drawn around the base of the spinner when it put in place.

Some crud and rough shape carving on the cowl’s top front is shown below. Notice that the bottom of the cowl has not been blocked in yet. A central cowl retention screw arrangement has to developed first before blocking it in.
Carving, sanding, and shaping of the cowl can not be continued until the bottom bulkheads and stringers have been added as well as the curved planking on the top of the fuselage right behind the firewall. This is necessary to fair the lines of the cowl into the lines of the fuselage to form the seamless transition. So for the time being, any further work on shaping the cowl will be discontinued, except for developing the central cowl retention screw arrangement.......................Tandy
Revision A
See the narrative above the third picture below.

Speed 400 Cloudster Project

In developing a method for attaching the cowl to the firewall, the simplest approach was taken using a single 4-40 "screw assembly", which will be explained later. For the assembly to be effective, it has to be located so as to apply equal pressure on each of the four cowl alignment pins. The exact center location is defined by the intersection of the two diagonals between the four pins as shown below. However, the threaded hole had to be moved down about a 1/4" so as not to interfere with motor mount.
A small plywood square an 1/8" thick was glued to the back of the firewall to provide additional threads for the cowl screw as shown below. Holes were drilled in the firewall and back plate separately with a No. 43 bit. The shank of the bit was inserted into the firewall and used to align the 1/8" plywood square on the back while the glue dried. Then 4-40 threads were cut through both pieces at the same time.
The center of a piece of 3/16" (this wrong, it should be 1/4") wooden dowel was drilled out for a 4-40 screw to slide through. This was glued to a piece 1/16" plywood and the two in combination were glued to the forward inside face of cowl nose block as shown below. This plywood plate serves as a strong back for the screw to pull against.
As part of the Cloudster's on going weight saving effort, a 4-40 screw assembly referred to above was used for the cowl attachment instead of a long heavier 4-40 metal Allen head screw. The principal element of this assembly is a 1" length of white ABS plastic tubing threaded inside each end with 4-40 threads as shown below.

The complete 4-40 screw assembly, which is shown below, is composed of a short 4-40 metal screw, a 1" length of threaded ABS plastic tube, and longer 4-40 Allen head nylon screw. The total weight is something less than one gram because on the AccuLab scale, it reads zero.

The 4-40 metal screw is screwed in from the back side of the firewall as shown below.
The 1" length of threaded ABS plastic tubing is screwed finger tight onto the threads of the metal screw protruding out the front of the firewall as shown below.

This is a view from underneath the unfinished cowl. It shows how the cowl is secured to the firewall by inserting the 4-40 Allen head nylon screw through the cowl retention screw guide (the drilled out dowel), screwed into the open end of the threaded ABS plastic tube, and then tightened down, which pulls the cowl down snug onto the front face of the firewall.
I am most pleased with the way this method for attaching the cowl to the firewall worked out. Now the bottom of the cowl has to be blocked in with a large opening left in the front to provide motor cooling air. However, as was said before, carving, sanding, and shaping of the cowl can not be continued until the bottom bulkheads and stringers have been added as well as the curved planking on the top of the fuselage right behind the firewall. This is necessary to fair the lines of the cowl into the lines of the fuselage to form the seamless transition..........................Tandy
In developing a method for attaching the cowl to the firewall, the simplest approach was taken using a single 4-40 "screw assembly", which will be explained later. For the assembly to be effective, it has to be located so as to apply equal pressure on each of the four cowl alignment pins. The exact center location is defined by the intersection of the two diagonals between the four pins as shown below. However, the threaded hole had to be moved down about a 1/4" so as not to interfere with motor mount.
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The center of a piece of 3/16" wooden dowel was drilled out for a 4-40 screw to slide through. This was glued to a piece 1/16" plywood and the two in combination were glued to the forward inside face of cowl nose block as shown below. This plywood plate serves as a strong back for the screw to pull against.
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David Harding

From: Tandy C. Walker [tandyw@flash.net]
Sent: Thursday, February 04, 2010 6:28 AM
To: Undisclosed-Recipient: ;@smtp106.sbc.mail.mud.yahoo.com
Subject: 54 Speed 400 Cloudster - Cowl Retention Modification

**Speed 400 Cloudster Project**

In the previous Report No. 53, a 4-40 metal screw was screwed in from the back side of the firewall to secure the threaded ABS plastic tube to the front of the firewall as shown below. It is difficult to anticipate some potential problems and a concern arose that once the fuselage was completed there would be no way to access this screw, should the need arise.

To resolve this problem, a 4-40 Allen head nylon screw was screwed into the firewall end of the threaded ABS plastic tube as tight as it would go just short of twisting it off. Then the screw was cut off leaving a 5/16" length of nylon threads as shown on the left below.
Now the ABS plastic tube with its length of nylon screw can be threaded into the firewall from the front as shown below thus eliminating the requirement to access the firewall from the back side.

The picture below shows the cowl neatly attached to the firewall with the newly revised 4-40 screw assembly. This is not only a more user friendly design, but also eliminates the metal screw and saves a little weight to boot.................Tandy
The work today focused on constructing the turtle deck right behind the firewall. The first step was to cut out and sand the two bulkheads from 1/16" medium hard balsa as shown below. No, those are not lightening holes in the top bulkhead!

As you can see in the picture below, the two hole are openings for the two top blind nut on the firewall that permit the balsa bulkhead to be glued to the back of the firewall.
Soft balsa 3/32” X 3/16 strips were cut in graduated lengths, tapered, beveled along the sides, and individually glued to the two bulkheads to form the turtle deck surface as shown below.

This is a view of the completed strip planking on the turtle deck looking down from the
top before it was trimmed and sanded.

The aft edge of the strip planking was trimmed off around the cockpit area and the turtle deck’s outer surface was then carefully sanded flush with the top of the arched contour of the firewall. With good tight strip joints, the surface of the sanded turtle deck appears to be sheeted a continue piece of 3/32” sheet balsa as shown below. I am most pleased with the appearance of the turtle deck.............................Tandy
To obtain a light stiff battery box, the top and bottom of the box was made by laminating 1/32" sheet balsa with 1/16" sheet balsa. Since these were bonded with aliphatic glue, they had to be clamped down tightly while the glue dried as shown below.

Here you can see the edges of the box’s laminated top and bottom.

This shows the battery box assembled with 1/16" balsa vertical grain sides.
This picture shows the Li-Po battery slipped the battery into the box with foam to snug it up. The length of the box is 1.82" as shown.

A trial fit of the battery box inside the fuselage structure is shown below.
The length of the battery box is constrained so that the battery can be removed for charging from the bottom bay directly below and behind the battery box as shown below. This bay will be fitted with a removable hatch cover.

The Electronic Speed Control (ESC) will be mounted on a shelf above the battery box. Therefore it was necessary to go in under the planked turtle deck and make the opening shown below for the ESC wires to go through to the Speed 400 motor. This was a little difficult, but doable.
The shelf for the ESC was constructed of 1/32" plywood with two 3/16" square balsa runners as shown below. The shelf was 1" wide and 1-11/16" long.

The top of the shelf was given two coats of clear dope with a light sanding in between coats. Then the hook side of Velcro was attached as shown below.
The shelf was then glued into the fuselage structure as shown below.

This shows the shelf from the bottom with the two runners....................Tandy
The JESI 12 Amp Electronic Speed Control (ESC) comes with a switch already installed on the unit. I guess it serves as a safety "kill switch" to completely disable the ESC. The ESC switch mount is made out of 1/16" plywood with 1/8" balsa glued to the inside as shown below. A rectangular opening was made in the 1/16" plywood for the switch slide to go through and two holes were drilled for the small mounting screws also shown below.

This picture shows the switch mount integrated into the right side of the fuselage structure. I was going to put it on the left side, but ended up putting it on the right instead. This was because James Lollar said he was going to put his switch on the right side and when I checked all of my other models, sure enough their switches were on the right side also.
Here the ESC switch is shown from the outside screwed to its mount. Notice the switch is well above the battery box so it does not interfere installing and removing the flight battery. The first three open bays of the fuselage sides will be inlaid with 1/16" balsa.

This picture shows the wire routing from the ESC unit to mounted switch.
I received some very good instructions from Jay Burkart (an experienced electric flier) today on how to use connectors to hook the two ESC yellow wires to the back of the Speed 400 motor, which I will share with you later when the connectors are installed..................................Tandy
David Harding

From: Tandy C. Walker [tandyw@flash.net]
Sent: Tuesday, February 09, 2010 6:51 PM
To: Undisclosed-Recipient: ;@smtp102.sbc.mail.mud.yahoo.com
Subject: 58 Speed 400 Cloudster - Fuselage Side Inlay and Receiver Mount

**Speed 400 Cloudster Project**

I only got to work on the Cloudster off and on today between morning and afternoon scheduled medical appointments. Before I begin this report, I want to pass along a response from Jay Burkart correcting a statement I made in yesterday’s Report No. 57.

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Tandy, a word to the wise to share with all of your buddies on electric. The switch on a ESC (speed controller) is NOT an On and Off switch. It is an ARMING Switch. When you plug the battery into a ESC it is hot and working, but the switch keeps the signal from the receiver from getting to the ESC to hange the throttle setting. So that means that the ESC is drawing power from the battery even though it seems like nothing is happening. Which in turn means that it is draining the battery a little and if you forget to unhook the battery even though the switch is in the off position it can easily drain the battery FLAT. So that will absolutely ruin a Lipo battery. When you are done flying always unplug the battery or learn the hard and expensive way. I know because I forget at times and have to buy another Lipo........

Jay
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OK, to inlay the fuselage side structure, 1/16" medium balsa sheet was used. The right side of the fuselage inlay is shown below. However, 3/32" sheet balsa was used on the combing on the aft window at the rear. There is still more considerable work to do on the windows.

The left side of the fuselage inlay is shown below. Notice the hole in the inlay.
This is a close up of the hole in the first bay of the fuselage structure. Its purpose is to help promote additional air ventilation and circulation for cooling the Speed 400 electric motor. Tandy
David Harding

From: Tandy C. Walker [tandyw@flash.net]
Sent: Wednesday, February 10, 2010 2:48 PM
To: Undisclosed-Recipient: ;@smtp101.sbc.mail.mud.yahoo.com
Subject: 59 Speed 400 Cloudster - Removable Battery Box Design and Window Fillets

Speed IV Cloudster Project

It was intended that the battery box made in Report No. 56 was to be glued into the fuselage structure. However, this will require a hatch in the bottom of the fuselage to get the Li-Po battery out for charging. As you well know, constructing and installing a hatch is a significant undertaking and should be avoided if at all possible. To address this issue, a design to make the battery box removable was developed so that the battery in its box can be installed and removed through the top opening in the fuselage under the wing.

The first task was to provide an attachment hard point on the battery box itself. A small rectangle was cut out of 1/8" plywood. A hole was drilled in the center and a 2-56 blind nut was embedded in the plywood. Another hole was cut out in the center of the bottom of the battery box for the head of the 2-56 blind nut to fit down into so that the plywood rectangle would fit down flush on the bottom of the battery box when it was glued in place as shown below. Notice the slightly rounded forward edges on the forward face of the box to assist in aligning the box up against the firewall.

The second task was to provide adequately strong attachment structure in the bottom of the
A hole was drilled in the center of a wide cross member and a length of ABS tubing was CA’d in the hole. This cross member was indexed in the fuselage structure with the battery box in its desired location and then the cross member was glued in place as shown below. Notice the two triangular gussets securely tying the cross member to the bottom longerons for additional strength.

This picture shows the battery box attached to the fuselage with a long 2-56 screw inside the ABS tube.

The ABS tube was intentionally left long so that after the fuselage’s bottom bulkheads and stringers are in place, the screw can be inserted from outside the fuselage as shown below. The tube will be trimmed and sanded flush with the bottom of the finished fuselage structure. Some
battery/battery box trial installations and removals in the presents of all of the ESC wiring will have to conducted to make sure of the functionality of this design before the requirement for a hatch is abandoned. The functionality has to include both the installation and removal as well as connecting the battery to the ESC.

Additional work was also done to complete the window openings by adding 3/32" fillets in the corners and sanding them to shape as shown on the right side of the fuselage below.
This picture shows the window openings on the left side of the fuselage. The sides of the fuselage have yet to be sanded to produce a smooth and integrated inlay surface, which is the "proof of the pudding" as they say...............................Tandy
In order to have a removable receiver mount, one needs a plate that attaches to the bottom of the receiver with Velcro and screws to the fuselage frame. As part of the Cloudster’s on going weight saving effort, the receiver plate is constructed primarily of 3/32" balsa with two 3/32" plywood cross strips embedded in the balsa. These cross strips are drilled and threaded in the center for 2-56 screws as shown below.

This plate was clear doped twice with sanding in between coats so that the hook side of the Velcro would stick securely. The picture below shows the hook side of the Velcro applied to the receiver plate.
The attachment for the receiver plate was made out of 1/32" sheet balsa. Three strips of 3/32" X 3/16" balsa was glued to the top of the 1/32" sheet balsa as shown below so as to form a U-shaped guide for the receiver plate. The receiver plate slides into the U-shaped guide, which aligns the holes for attachment from outside the fuselage.

Two small balsa blocks were drilled and pieces of ABS tubing was CA’d in the holes. These two blocks were glued in place on the bottom of the 1/32" balsa sheet as shown below.
Then the 1/32" balsa sheet assembly was glued into the bottom of the fuselage frame as shown below. The ABS tubes were intentionally left long so that after the fuselage’s bottom stringers are in place, the two screws can be inserted from outside the fuselage as shown below. The tubes will be trimmed and sanded flush with the bottom of the finished fuselage structure.

This final picture shows the receiver plate installed in the fuselage. You can see the hook side of the Velcro that the receiver will attach to in the picture below............................Tandy
In the picture below, you can see that the forward bottom strip planking has been complete and the ten bottom bulkheads have been cut out, sanded and glued to the bottom cross members of the fuselage.

This is close up of the forward bottom strip planking before it was sanded to shape. Notice the white ABS plastic tube embedded in the planking for the 2-56 screw to secure the battery box inside the fuselage.
The bottom block on the cowl was glued in place as shown below.
A week or so ago I saw a posting on the SAMTalk_Forum where Karl Gies recommended the Stanley break off blade knife for carving props, which looked like just what I needed to carve this cowl with. Karl said to extend the blade several inches without breaking off any pieces and use it like a long blade pocket knife. So I went to Home Depot and found the Stanley knife for $1.71. However, the term "Personna" on a SNAPOFFBLADE knife called "SmartEDGE" caught my eye. If you remember, the exceptionally sharp single edge GEM razor blades I use for cutting balsa also uses the same term "Personna" as shown below.
I hesitated because of the cost, but I went ahead and also bought the "SmartEDGE" knife at $4.98. Both the Stanley and SmartEDGE knifes are shown in the picture below. Even though the SmartEDGE knife is three times the cost of the Stanley, I found it was at least four times sharper than the Stanley! It slices balsa like butter just like the GEM blade does.
The cowl was easily carved, trimmed and sanded to shape thanks to the new *SmartEDGE* knife *(thanks for the tip Karl)*. Here are a few pictures of the Cloudster's cowl.

Side View
Front View

(I still have to ovalize the inlet opening in the front yet to increase the inlet area and reduce weight.)
Rear View

(I still have to remove some excess balsa from inside the cowl yet which will reduce the weight maybe another 30%.)

The cowl as it is now only weighs 7 grams or 1/4 of an ounce, but every little bit of weight that can be removed helps.
This picture shows the precise fit of the cowl to the Cloudster fuselage over the Speed 400 motor and mount.

Top View

Bottom View
This last picture shows how the clean lines of the cowl streamlines the front of the fuselage and mates with the spinner.

The next effort will be to wire up the Speed 400 motor to the ESC to the Li-Po battery with connectors. Then perform some trial installations and removal of the Li-Po battery though the opening under the wing to see the hatch in the bottom of the fuselage can eliminated or not. This has to be done before the stringers are added to the bottom of the fuselage bulkheads..................Tandy
I was not happy with the cowl-spinner interface fit. In the picture below, you can see that the base radius of the aluminum spinner flange is smaller than the radius of the front face of the cowl by at least 1/16".

In order to correct this mismatch in the cowl-spinner interface, the radius of the front face of the cowl has to be reduced by 1/16". However, as you can see in the picture below, this is not possible because there is only a 1/16" left on the front face of the cowl opening. Notice that the motor mount stops an 1/8" short of the front face.
So another 1/8" cross grain wafer was cut off of the 2" block as shown below.

This wafer was then cut and trimmed into a circular plug to fit inside of the front face of the cowl opening an 1/8" and glued in place as shown below.
Next, the inner portion of the plug was cut out so as to leave a 3/16" toroidal ring inside the cowl opening as shown below.
The ring was carefully sanded flush with the front face of the cowl and a piece of 1/64" plywood was glued onto the front surface. The picture below shows the large steel square block used as a weight to press the 1/64" plywood onto the front face of the cowl while the glue dried.

A hole was cut out of the plywood to match the hole in the toroidal ring as shown below.
The aluminum spinner flange was slipped onto the motor shaft and used to mark the outer trim diameter on the 1/64" plywood as shown below.
This picture just shows the outer circle that was marked in the plywood.
The cowl and 1/64" plywood was then trimmed and sanded down to the marked circle as shown below. Now the cowl has a hard plywood surface on the front to protect it from damage.

In the four pictures below, you will see the close fit that the aluminum spinner flange makes with the front face of the cowl.

**Side View**

**Right Side Quarter View**
Right Bottom Quarter View
(Notice the enlarged inlet opening)

Top View
I am now pleased with the fit and functionality of the cowl and I will move on to wiring up the electrical power train using connectors...............................Tandy
The Cloudster fuselage aft of the cabin area seems a little weak in torsion, even for an electric model. This is probably due to the lightweight 3/16" square balsa used in the structure. To stiffen the structure up a bit, 1/16" X 3/16" balsa diagonals were added in two of central bays as shown below.

This is a close up of the diagonal configuration used. Even though diagonals were only added to two bays, they stiffened up the structure considerably without adding much weight.
I received extra long 2-56 cap crews from Micro Fastener as shown below to secure the battery box and receiver mount to the fuselage frame.

This shows the 1" long 2-56 cap screw that goes through the white ABS tubing in the bottom planking used secure the battery box, which can be seen in the lower right portion of the picture below.
This is just a close up of the cap screw.

I also received the four transparent colors of Microlite covering yesterday that I ordered from Tower Hobbies.
I still have to develop a color scheme to be used for the Cloudster covering. James Lollar indicated that I should use a varied color pattern because these Speed 400 models get pretty hard to see at the end of the 90 second motor run..........................Tandy
Most of the afternoon today was spent wiring up the Electronic Speed Control (ESC) to Speed 400 motor using the polarized connectors recommended by Jay Burkart. The close proximity of the motor to the ESC dictated a close tolerance hook up with very little wire involved. As per Jay’s recommendation, the male connector was soldered directly to the (+) motor terminal and the female connector was soldered directly to the (-) motor terminal as shown below. Notice that the connectors are angled up about 35 degrees to the axis of the motor in order to line up with the connectors coming from the ESC.

This picture shows how short the ESC wires had to be cut. The male and female connectors are soldered to the ends of the wire as shown below.
Red heat shrink tubing completely covers the ESC (+) female connector to prevent it from coming in contact with the male (-) connector when they are not connected to the motor as shown below. Notice how little wire is used.

For installation, the ESC is first connected to the motor. Then the ESC is inserted through the hole in the firewall from the front and back through the hole in the bulkhead under the turtle deck planking. Once through, the ESC is secured to the Velcro pad shown below. Of course it is virtually impossible
to get the ESC in the proper position on the Velcro pad because it keeps sticking to the Velcro pad as soon as it touches it.

Therefore, to solve this problem, a Velcro separator cover was made as shown below. The cover consists of a 1/64" plywood plate with two 1/8" X 3/16" spruce runners glued to the edges as shown below.

The Velcro cover is dropped into place over the Velcro pad and is held there by the two runners on each side as shown below.
In the picture below, the ESC has been connected to the motor, inserted through the hole in the firewall from the front, and back through the hole in the bulkhead under the turtle deck planking. Notice that the fussy side of the Velcro on the ESC is kept separate from the hook side on the pad by the Velcro cover and can be placed in proper position.

Once the ESC is in proper position, the ESC is simply raised up and Velcro cover is slipped out, allowing the Velcro fussy side to mate with hook side as shown below.
With a slight downward pressure on the ESC, it is firmly secured to the Velcro pad as shown below.

So now we have the motor and ESC wiring and installation worked out. Tomorrow will be spent wiring up the LI-Po battery to the ESC using the polarized connectors and determining if the battery can be installed and connected to the ESC from the cabin opening under the wing without having to have a hatch opening in the bottom of the fuselage......................Tandy
I began the day by soldering the polarized connectors to the red and black wires on the Li-Po battery and the corresponding red and black wires on the ESC as shown below. The battery in its box was successfully installed in the fuselage through the opening in the top of the cabin and the battery connected to the ESC a total of three times. Based on this exercise, it was concluded that a hatch opening on the bottom of the fuselage is not necessary.

The next task was to install the antenna guides for the two FASST receiver antennae. I want to restate Futaba's three antenna requirements to "maximize" the 2.4 GHz receiver's reception performance. They are as follows:

1. The two antennae are to be 90 degrees to each other.
2. The locations of the two antennae are to be as far apart as practical in the model's fuselage.
3. The two antennae are to lie in different planes.

I used the standard Sullivan Gold-N-Rod for the antenna guides, which is yellow in color. It has a large enough hole in the center to accommodate the FASST antenna diameter and can be bent to hold its shape.
Here is a great tip for bending Sullivan Gold-N-Rod that was developed on the previous Sailplane project.

Gently heat the Gold-N-Rod with a heat gun and begin to bend it into the shape you want. Holding the shape you want and while it is still warm, dip the bend in cold water and this will instantly set the angle of the bend. If you miss the angle a little, reheat the bend and it will start to release or unbend. Again, hold in the angle you want and while it is still warm and dip it in cold water. This will again setting the angle of the bend that you want.

The configuration I chose to satisfy the above three requirements is shown in the pictures below. After the tubes were bent to shape, balsa brackets were glued to the fuselage structure, and the tubes inserted into the brackets. After some adjustment and alignment of the tubes, they were CA’d in place.

Left Side View

Left Side View from the Bottom.
This now completes both the electric power train and radio installations. The next task for tomorrow is to glue the three stringers to the fuselage’s bottom bulkheads shown below and plank in around the two ABS tubes through which the receiver is mounted.......................................................... Tandy
David Harding

From: Tandy C. Walker [tandyw@flash.net]
Sent: Saturday, February 20, 2010 7:56 PM
To: Undisclosed-Recipient: ;@smtp102.sbc.mail.mud.yahoo.com
Subject: 66 Speed 400 Cloudster - Completing Fuselage Bottom Structure

Speed 400 Cloudster Project

I have stayed pretty focused all day today on trying to finish the bulkhead/stringer structure on the bottom of the fuselage. I have always had problems fairing in a group of stringers at the back end of the fuselage and making them look right. To avoid this issue, I put in a solid balsa block at the rear to serve as a tail cone which can be more easily trimmed to shape than a bunch stringers! So before the 1/16" X 3/16" center bottom stringer was glued on, a .063" inclined hole was drilled in a triangular soft balsa block for the tail skid tube to slip through and the block was glued in place as shown below. Then the center stringer was glued in the bulkhead notches, which now butts up against the front of this tail cone.

Also an extra No. 3 bulkhead was glued on the back of the bulkhead supporting the bottom forward strip planking as shown below. This provides the location and support of the three 1/16" X 3/16" stringers that butt up against the back of the forward planking.
Since the two pieces of white ABS tubing for securing the receiver mount are on the centerline of the fuselage as shown below, the center stringer had to be pieced in between and on either side of the two tubes.

A surface has to be provided around these tubes in order to have an area to attach the bottom covering to. A No. 12 drill bit (.189") was used to drill a hole in a piece of 3/16" balsa sheet. The balsa was trimmed and sanded around the hole to form a .594" diameter flat disk shown below.
This disk was then split with the grain and a 1/16" wide piece removed from the center.

Each half of the disk was then glued in on either side of the stringer around the front tube as shown below.
This was also done around the second tube as shown below. These two disks will be contoured to the shape of the bottom of the fuselage and serve as areas to attach the covering material to.

All three of the bottom were glued in place and the two disks and tail cone were contoured to the shape as the picture below shows.

This is close up of the tail cone.
This is a close up of the stringer fillets that were added at the stringer attach point on the forward planking.

In the picture below, you can see that the bottom bulkhead/stringer structure has added considerable depth to the fuselage giving it a more attractive profile. I still have to add the fuselage block in front of the wing leading edge up above the cabin and then do all of the finish sanding on the fuselage before it is ready for covering.
There is one final decision I have to make on the bottom bulkhead/stringer structure. The oval shaped bulkheads are an extension of the oval shape of the bottom forward planking. However, the covering will stretch tight in a straight line across each stringer and cause the edges of the oval bulkheads to stick out under the covering. The oval bulkheads need to be sanded down to form either a straight line between stringers or recessed concave between stringers so as not to touch the covering at all. I am favoring the recess concave approach, but would appreciate any comments or recommendations?........................Tandy
This morning Sue and I went to early church and then out for breakfast afterward. Shortly after noon, we drove over to Pantego to see the new house our neighbors on the north just bought. They will be moving over there on Tuesday and Wednesday. So this afternoon there was time to finish the fuselage’s top forward cabin stop that interfaces with the wing’s notched leading edge, but I did not get to recessing the bulkheads between the stringers on the bottom of the fuselage.

The back side of the 1/4" x 3/8" balsa stop was lined with 1/64" plywood and then glued to the front of the wing saddle. This balsa stop was then carefully trimmed and sanded to shape with the appropriate slope for the wing screen attachment. The wind screen pattern was cut out of the plans and used to determine the right slope of the stop. This was an iterative process of trimming the stop, checking the fit with the pattern, and then trimming some more as shown below.

The finished cabin stop is shown in the picture below. Notice the 1/64" plywood liner on the back side of the cabin stop that the wing’s notched leading edge butts up against.
This picture shows the wing's notched leading edge in proximity of the cabin stop.

With the wing assembled to the fuselage in the picture below, you can see the nice fit of the cabin stop with the wings notched leading edge. ......................... Tandy
Dave Harding

From: Tandy C. Walker [tandyw@flash.net]
Sent: Monday, February 22, 2010 10:18 AM
To: Undisclosed-Recipient;@smtp107.sbc.mail.mud.yahoo.com
Subject: 68 Speed 400 Cloudster - Recessing the edges of the Fuselage's bottom Bulkheads

**Speed 400 Cloudster Project**

As was stated earlier, the oval shaped bulkheads shown below are an extension of the oval shape of the bottom forward planking. The covering will stretch tight in a straight line across each stringer and cause the edges of the oval bulkheads to stick out under the covering. The oval bulkheads need to be sanded down to form either a straight line between stringers or recessed concave between stringers so as not to touch the covering material at all.

I decided in favor of the recess concave approach, so I took this task on the first thing this morning. It took me approximately two hours to carefully trim and sand concave recesses on all 32 of the bulkhead edges between the stringers as shown below..................Tandy
The main wheels for the Cloudster arrived in the mail today from Tower Hobbies. They are 2" diameter GWS Light Foam Wheels and cost $2.50 a pair. The wheel has a light foam tire around a spoked plastic hub and is advertised to weigh 3.2 grams. The pair of wheels I received today weigh 7 grams as shown below.

The holes in the plastic hubs are .082", which is too large for the cloudster's 1/16" piano wire landing gear (.063"). So the hubs were drilled for a .063" ID aluminum tube to serve as an axle bearing as shown below. The bearing tube length was 1/4".
This picture shows a close up of the wheels mounted on the landing gear.

This shows the wheels in the present of the fuselage and I think they look quite nice.
On the rubber powered J-3 Cub I made a tail wheel out of balsa with an aluminum tube axle bearing as shown below. I think that I will do the same thing for the Cloudster as I do not like the looks of the tail skid................Tandy
Speed 400 Cloudster Project

When I made and hinged the rudder back in Report No. 18, you probably do not remember that I left the bottom of the rudder structure extending below the bottom of the fuselage structure as shown below. This was done so that later the rudder could be faired into the bottom line of the fuselage after the bulkhead/stringer structure was added.

After the bulkhead/stringer structure was added to the bottom of the fuselage, the rudder was faired in as shown below.

To perform a preliminary weight and balance, the entire model was assembled
including the Speed 400 motor, cowl, prop, spinner, ESC Li-Po battery, 2.4 GHz receiver, both servos, push rods, and wheels. This is everything except the covering, trim, and decals. The assembled model was hung from the ceiling in the model room and the two pictures were taken for you to see.

Right Front View

Right View
Next the complete model was weighed on the AccuLab scales. The total weight was 389 grams as shown below. This is 13.72 ounces, which is 2.28 ounces under the SAM Speed 400 minimum weight of 16.00 ounces. Hopefully the model covering will weigh no more than 2.28 ounces.
The model set up for checking the balance is shown below. Two one-gallon Randolph clear dope cans were placed on either side of the fuselage. A piece of 3/8" brass tubing was slid through the front window under the wing saddle and used to balance the model on.

The balance point was marked as shown below.

This balance point lies 0.62" ahead of the front edge of the window frame as shown on the steel ruler below.
The balance point was then determined to be 0.68" ahead of the desired CG as shown on the plan below. The majority of the covering material will be behind this balance point and the covering material weight will move the balance in the direction of the desired CG. Just how close is unknown at this time. However, the results of this interim weight and balance check looks very promising to me.

I will stop work on the Cloudster in the morning as it is time to start doing our annual taxes. :O< "BARF." While I am not looking forward to doing the taxes, the break from the Clouster project will be good for me to get away for awhile. Then when I come back, I will be fresh to start the covering process....................Tandy
My cold is still with me, but I am beginning to feel a some better so I decided to do a little work on the Cloudster. I may need the ability to shift the large Li-Po battery back slightly to trim the balance point. To do this, first a vertical grain 1/16" balsa back was put in the open battery box as shown below.

Next, two hooks were bent up out of extra long straight pins to shape and CA’d to the battery box’s top and bottom as shown below. These hooks have a half-loop on one end for a rubber band to hook into and Z-Bend on the other to hook through the balsa as can be seen below.
This allows the battery to be secured in its box with a single No. 10 rubber band as shown below. Now the battery can be moved aft in the box by placing a balsa filler or spacer in the box before the battery is secured.

In the picture below, you can see the battery and box installed in the bottom of the fuselage.
I hang the fuselages of all of my models on the wall of the model room as shown below. Notice the Class B Airborn fuselage on the extreme right.

In this close up, you can see how the Airborn is hung on the wall. During construction, I insert a piece of white ABS plastic tubing through the fuselage's structure at the rear.
and sand it down flush with the fuselage’s sides before covering. This permits the model to be hung on the wall with loop of waxed cord that runs from the hook on the wall, down through the insert, and then back up to hook as shown below.

As you can see in the picture below, an ABS plastic insert has been installed through the two large gussets between the lower longeron and tail post. This will permit the Cloudster fuselage to be hung on the wall in a similar manner.

The wire tail skid inserted in the aluminum tube in the picture above was made out 0.035" piano wire, but I could never locate any more 0.035" piano to wire to make a landing gear
for the tail wheel. Since 0.032" piano wire was loose inside the aluminum tube, particularly in torsion, I conducted a test using 0.032" piano wire and a separate length of aluminum tubing. A slight zig-zag was bent in the .032" wire and the wire inserted into the aluminum tube. The wire fit pretty tightly, but could be rotated very easily. Then I placed a drop of thin CA on the wire and it instantly wicked down in between the wire and the tube. I rotated the wire around several times and then let wire/tube combination set for about an hour. The tube was then placed in the table vise shown below and I proceeded to twist the wire. It was rock solid! In fact, I twisted the aluminum tube off in the vise without the wire ever rotating relative to the tube. This proves that the 0.032" could be used to make the landing gear for the tail wheel.

A tail wheel landing gear was bent up out of 0.032" piano wire for an aluminum hub 3/4" tail wheel. Again a slight zig-zag was put into the portion of the wire that slides up into the aluminum tube. A trial fit of the tail wheel is shown below, but the wire will not be CA’ed in place until after the fuselage is covered. By the way, the weight of the tail wheel assembly is less than 2 grams.
Hopefully tomorrow I will feel good enough to finally start on our income taxes...............Tandy
Once the stab and elevator surfaces were covered with UltraCote Lite transparent red, the covering over the hinge slots were cut and the hinge halves were inserted into their slots. The hinge wires were reinserted and the hinges were completely realigned. Then the hinge wires were removed in order to permanently bond the hinge halves in their individual slots as shown below. I use thin drops of Jett CA to wick down in between the hinge tongue and the balsa slot in several places as shown below, which takes a pretty steady hand and lots of time. Much care has to be taken because if the CA ever wicks into the hinge loops you are deep trouble. For years I have blunted the tip of a straight pin with a file. A drop of CA is applied to the blunted end of the straight pin and used to apply the CA to the hinge. This takes a lot of practice and you waste a lot of thin CA trying to get the drop to stay on the end straight pin, but it can be done, given enough time and patience.

As I reported back in my Sailplane construction series, my friend James Lollar from Ada, Oklahoma, clued me in on how to accomplish this task almost effortlessly. For years he has used a sowing needle with the tip of the eye cut off as shown below. When he puts a drop of thin CA on the needle, the drop will always catch and stay in the fork due to surface tension. Then he can easily touch the fork to the desired spots on the hinge and the CA goes right into where he wants it. I completed bonding in all eight hinge halves on the stab and elevator in less than twenty minutes this morning. Now why had I never thought of this simple approach in all my years of modeling?

Thanks James for the great tip!
The 0.031" hinge piano wires were cut to their final length. A loop was cut off of an extra nylon hinge, positioned on the hinge wire, and CA’s in place to serve as a stop for the hinge wire as shown below.

This is a picture of the right half of the horizontal tail with the elevator deflected down so you can see the continuous hinge wire installed.
This is a close up showing the hinge wire stop up against the outside of the hinge itself.

During final assembly, there will a "keeper" on the other end of the hinge wire like the one shown below on the stab/elevator combination of my Playboy Junior. The keeper is also made of a loop on extra nylon hinge. First thin CA is wicked into the loop. Holding the tongue of the hinge, the inside of the hinge loop is reamed out with a No. 69 drill bit (0.0292") so that a rather snug fit is achieved with the 0.031" hinge wire. Then the loop is cut off of the nylon hinge.
Now here comes the tricky part. To get the keeper onto the the end of the hinge wire, another wire with a little "L" bent on the end is inserted part way through the keeper. Using the wire with the L on ther end, the keeper is positioned at the end of the hinge wire, which is then pushed into the open side of the keeper. The back edge of a No. 11 X-acto blade is placed against the edge of the keeper and the keeper is pushed all the way onto the hinge wire. Now the stop is up against the outside hinge and the keeper is up against the inside hinge as shown above.

This completes the Cloudster's horizontal tail. The next task for this afternoon will be to start covering the wing..........Tandy
This afternoon I started covering the bottom of the Cloudster's wing as shown below.

I managed to finish covering the bottom of the wing with five separate pieces of UltraCote transparent red as shown below.
This picture shows the uncovered top of the wing, which I will finish up tomorrow. I am also going to have to get some graphics made for the AMA number as well as a 1937 Cloudster call out that I understand is required for the Speed 400 models.................Tandy

............Tandy
I finally completed covering the top of the Cloudster wing as shown below. I had some significant difficulty covering around the notched leading edge on top of the wing, ending up with puckers and over shrinking the covering in that area. I finally had to cut out the top right wing bay next to the center section and patch it. So I covered the top left wing bay next to the center section by itself and then the rest of the top left inner panel with a separate piece. I am really not happy with it, but is the best I could do.......................Tandy
As I was starting to clear dope the fuselage in preparation for the first covering with Polyspan Lite, I realizes I really needed vents in the aft part of the fuselage for air circulation to dissipate internal battery and ESC heat. The ideal place for these vents is in the 1/16" sheeting under the leading edge of the stab. A hole pattern was drawn on the sheeting as shown below.

The hole was cut out and sanded to shape on both sides of the fuselage as shown below.
Before any clear doping, the bare fuselage structure weighed in at 64 grams (2.26 oz) as shown below.

Oh yes, I almost forgot about securing the hinge pin in the rudder's bottom hinge shown below.
The approach used required drilling a 0.0292" hole in the end of a 1/16" wooden dowel that is 3/16" long. The dowel is then embedded and glued in the base of the rudder's structure as shown below. Notice also the recessed groove to the right of the dowel for the hinge wire to fit down into.

The 0.031" bottom hinge wire has "U" bent on the end as shown below that plugs into the hole in dowel with a force fit. This is sufficient to secure the hinge pin.
I have put three coats of 50/50 clear nitrate dope on the fuselage, cowl, fin, and rudder with sanding between the first two coats. Since it is late in the day, I will start the first covering of Polyspan Lite tomorrow............................Tandy
Well, yesterday afternoon and today I finally got the Cloudster’s fuselage and vertical tail covered with Polyspan lite. The picture below shows the fuselage covered with Polyspan lite and two coats of 50/50 clear nitrate dope. Of course the four side windows will get cut out later after the second covering of silk.

This is kind of a neat shot with no flash of the covered fuselage with the light shining through the covering.
The bare fuselage structure weighed 64 grams as reported in Report No. 79. The Cloudster's fuselage with three coats of 50/50 clear dope on the structure, covered with Polyspan lite, and two coats of 50/50 clear dope on the covering now weighs 69 grams as shown below. So it has only gained a total of 5 grams or (0.18 oz).

![Image of scales showing 69 grams.

The fin and rudder (vertical tail) also have three coats of 50/50 clear dope on their structure, covered with Polyspan lite, and two coats of 50/50 clear dope on the covering as shown below.
Because of the cowl’s complex shape, Polyspan Lite was not used. Instead a single piece of white silk was used. Silk is an amazing material to cover with. As shown in the picture below, there is only one seam in the first covering of silk. There will be a matching seam on the other side when the second covering of silk is applied.
The several coats of clear dope on these covered components will be allowed to thoroughly dry overnight before they are sanded with 600 grit paper and the final coat of clear dope put on them. Then the second and final covering of silk will be applied...............................Tandy
Dave Harding

From: Tandy C. Walker [tandyw@flash.net]
Sent: Tuesday, March 16, 2010 5:37 PM
To: Undisclosed-Recipient: ;@smtp103.sbc.mail.mud.yahoo.com
Subject: 81 Speed 400 Cloudster - Fuselage White Silk Covering

I still have a supply of "Model Covering Company" white silk that I chose for the Cloudster's second covering. In the picture below, a piece of the white silk has been cut to cover the right side with.

I spent yesterday and most of today covering the Cloudster's fuselage, cowl, and vertical tail with a second covering of white silk. The picture below shows these components covered with silk and one coat of 50/50 clear nitrate dope. Again, the four side windows will get cut out later after the second covering of silk has had all of its coats of clear dope.
This shot shows the silk covering on the bottom of the fuselage. The light and dark colors of balsa used to make up the cowl are going to show through the silk as you can see below.

This picture also shows the bottom of the fuselage. You can see how the nicely the silk flows over the stringer fillets that were added at the stringer attach point on the forward planking as well as how the scolloped bulkheads that do not contact the bottom coverings.
The bare fuselage structure weighed 64 grams as reported in Report No. 79. The Cloudster’s fuselage with three coats of 50/50 clear dope on the structure, covered with Polyspan lite, and three coats of 50/50 clear dope on the covering weighed 69 grams as reported in Report No. 80. With the second covering of silk and one coat of 50/50 clear dope the weight is now 74 grams. So the silk and one coat of clear dope has only added another 5 grams or (0.18 oz). The two coverings and a total of seven coats of dope weigh a total of 10 grams or a little over a third of an ounce (0.35 oz).
Tomorrow I will mix up 40% dope with 60% thinner and a small amount of retarder for penetration and start applying multiple coats of dope to these components to build up a finish on the silk.........................Tandy
After six additional coats of 40/60 clear dope was put on the fuselage, cowl, and vertical tail, the fuselage weight alone has grown to 78 grams (2.75 oz) as shown below.

At this point, I decided to completely assemble the Cloudster as shown below in order to do a weight and balance check before finishing with all of the trim and graphics and installing the windows and windscreen.
The assembled Cloudster including the tail wheel was placed on the AccuLab scales as shown below.
The total weight was 429 grams as shown below, which is only 15.13 ounces. The model balance check showed the balance point about a 3/16" forward of the desired CG location shown on the plans.

The Cloudster's continuous weight saving effort eliminating a few grams here and a few grams there really paid off. However, now I am 0.87 ounces short of meeting the 16 ounce minimum weight for the Speed 400 SAM event. I just hate to have to add dead weight to a light model. However, based on these results I am going to have to in order to be legal. So tomorrow I will disassemble the model and air brush one thin coat of clear satin Klass Kote on the fuselage, cowl, and vertical tail after all of the trim and graphics have been applied. That should put the balance point right on the desired CG. I probably will still have to add a little ballast to bring the model up to the 16 ounce minimum weight requirement.

By the way, I thought you might like to see how the tail went together on the back of the fuselage as shown below............Tandy
This report is going to be somewhat tutorial, even elementary, but for documentation purposes I wanted to go through the step by step process of painting trim on silk and describing the materials that work best for me. In the picture below is a special masking tape made by Pactra that many the model car guys use and you can get it in 1/16", 1/8", and 1/4" widths. This is absolutely the best masking tape for painting trim strips and patterns on silk covering. However, it is a little pricey, but one 20' roll will go a long way.

The trim application that I will be describing here is on the Cloudster's fin. My favorite "Swept-V" pattern is carefully masked off on the left side of the fin in the presents of the rudder using the Pactra 1/4" wide masking tape as shown below. This is also repeated on the right side of the fin.
Some of 3-M's low tack blue masking tape is put over the outside part of the Pactra tape to prevent accidentally getting paint on the silk outside the 1/4" Pactra tape. Then two thin coats of clear nitrate dope were brushed on the area to be painted (with drying in between) to seal the edges of the tape as shown below.

I have had great success using the water base Tamiya acrylic paint for painting on trim. The picture below shows the jar of Glossy Red that will be used.

Testors make camel hair brushes especially for applying this type of paint, but again they are also a little pricey. The one used in this application is the Model Master No. 8851C 3/8" camel hair brush shown below.
A thin coat of Tamiya Red paint was brushed on the masked off pattern, which was followed almost immediately a second thin coat as shown below.

The outside blue tape was removed within about ten minutes as shown below.
After about twenty minutes, the Pactra masking tape was removed, leaving the Swept-V pattern in Red as shown below. As most of you already know, the Pactra tape removal was done by carefully pulling it back over itself at a 45 degree angle to leave a clean sharp painted edge.

The look of this Red Swept-V pattern on the fin is best viewed in the presence of the rudder so you get
the perspective of the pattern on the complete vertical tail as shown below.

This procedure was also used to paint the tapered Red trim strip on both sides of the fuselage. Placement of the fuselage’s trim strip was dictated by three self imposed constraints:

1. Strip should be simple and taper down the full length of the fuselage.
2. Strip should not be painted on covering over vent holes that are to be cut out. *(prevents removing segments of the stripe)*
3. Strip should not extend forward beyond the plane of the firewall. *(just to keep the trim simple)*

These three constraints resulted in a Red strip on the side of the fuselage that starts a 1/4" wide at the front and tapers down to a 1/16" at the rear as shown below. This Red strip is clean and simple. Notice that removal of the covering over the two fore and aft ventilation holes will not remove or disturb any part of the Red strip. I think the Red strip will look even better when the covering over the fuselage’s two side windows is removed....................Tandy
We got up this morning to almost an inch of snow, a temperature of 30 degrees which seemed like 22 degrees with the 25 mph wind blowing. By the way, this our first day of spring here in north Texas. Brrrrrr! After going to Church, Sue and I went to breakfast and then returned home.

Since the Cloudster is 0.87 ounces short of meeting the 16 ounce minimum weight for the Speed 400 event, I decided to give the doped silk a coat of clear satin Klass Kote to achieve that ultra smooth finish. I spent this afternoon coming up with paint fixtures in preparation for air brushing one thin coat of clear satin Klass Kote on the fuselage, cowl, and vertical tail. To support the fuselage, a painting mandral composed of a 5/8" wooden dowel with a piece of 1/8" plywood on the end that was screwed to the firewall as shown below. The cowl was screwed to the end of a 3/4" wooden dowel to support it. Both the fin and rudder were suspended on 1/16" wooden dowels with a combination of 2-56 threaded rod and hinge halves that were fixed to the ends as shown below. These fixtures provide places to hold while each component is air brushed. The temperature is supposed to be back up into the 70's by Tuesday, so my plan is to do the air brushing sometime Tuesday afternoon, depending on temperature.
On a different note, I saw a picture of Albert Pardue’s outstanding Eugene III competition rubber model on SAMTalk_Forum yesterday, which is shown below. I noticed that this models has a beautifully installed windshield.

Thinking ahead on the Cloudster, I called Albert yesterday and had an informative phone conversation with him on windshield material *(windscreen to some)* and the adheisve to bond them on with. I want to pass along what he recommended.
Albert gets his windshield material (kind of like Mylar, but called something different) at the Hobby Lobby Arts and Craft store. It comes in three thickness'. He said the thinnest material was too flimsy for windshield and recommended one of the other two thickness'. He uses a glue product called "Welbond-More Than Great Glue". He gets it at Lowes or Home Depot hardware stores. He says it dries clear and works very well.

I called our local Hobby Lobby Arts and Craft store a little while ago, but they are not open on Sundays so I will get out tomorrow and see if I can pick up the windshield material and glue.......................Tandy
I spent some time considering what simple graphics would look best on the Cloudster wing. The first trim that was put on the wing was to hide the four covering seams. Where the transparent Red UltraCote Lite overlaps on these seams, the color is darker. So it required 1/4" white striping tape to adequately conceal these four overlapping seams as shown below.

When Joe Elgin designed the Cloudster back in 1940, he came up with a dual purpose label that he put on the plans. The label had the name "Cleveland Cloudster" encompassed by a cloud representation, but also served as a label for the modeler to put his name and address as shown below.

Using Joe’s cloud theme and the Speed 400 requirement to show the models name and the design year, I came up with a similar label only more circular as shown below.
I had two different people make up this label for me. Albert Pardure produced the label on his computer using an ink jet printer, which had to be oversprayed with Krylon to set the print. Denny Melancon, owner of Cajun Graphics, produced the same identical label as well as my AMA number on vinyl. In the end, I used Denny’s vinyl graphics on the wing as shown below.

This is a close up of the actual vinyl Cleveland Cloudster label on the left side of the wing.

Looking ahead, I have everything ready to airbrush the clear satin Klass Kote on the Cloudster’s fuselage, cowl, fin, and rudder when the temperature gets up into the 70’s, which will be sometime tomorrow.
afternoon.............................Tandy
At the end of Report No. 82 I said: "However, now I am 0.87 ounces short of meeting the 16 ounce minimum weight for the Speed 400 SAM event. So I will disassemble the model and air brush one thin coat of clear satin Klass Kote on the fuselage, cowl, and vertical tail". The clear satin Klass Kote provides an incredibly smooth matte finish to doped silk and since it is an epoxy, it will add some needed distributed weight. Even then, I probably will still have to add a little ballast weight to bring the model up to the 16 ounce minimum weight requirement.

Before applying the Klass Kote, the fuselage, cowl, fin, and rudder were weighed in together at 95 grams (3.35 oz). This provides a reference weight used to determine just how much additional weight the single coat of Klass Kote adds.

For those of you who have never used Klass Kote epoxy paint, the picture below shows what I use and how I use it. The Klass Kote cans, from right to left, are Reducer #500, Part-A Clear #40, and Part-B Satin Catalyst $463. In the foreground on the right is a prepared mix of 1/2 oz Clear and 1/2 oz Satin Catalyst and the jar on the left is a quantity of Reducer. The instructions tell you to mix equal parts of Clear and Catalyst and then let it set for 30 to 40 minutes so that the clear and the catalyst have time to react to each other. Then add in the Reducer. I add 100% reducer to the mix (1 oz) to reduce the viscosity for air
brushing with Paasche’s H-5 air tip.

This picture was taken in the garage and shows everything ready to begin. The 2 ounce mix in the jar is attached to the air brush. The other smaller jar is Reducer that will be sprayed through the air brush for cleaning after the Klass Kote has been applied.

This is a dumb looking picture of me I know, but I wanted to include it for your information. You are looking at a North Safety (Model No. 3001) mask that I always wear when spraying any kind of epoxy. It
has multi-stage filters, including the all important charcoal stage, to help filter out and prevent inhaling the atomized Klass Kote epoxy particles that get suspended in the air.

In less than ten minutes, the entire air brushing procedure was complete! The fuselage, cowl, fin, and rudder were brought into the model room and placed on the work table as shown below for curing overnight. Tomorrow, I will reweigh the fuselage, cowl, fin, and rudder together and report on the weight added by the single coat of Klass Kote.

Now it is time for the unfun part of disassembling the air brush and cleaning up all of the air brush equipment........................................Tandy
Before applying Klass Kote yesterday, the silk and dope covered fuselage, cowl, fin, and rudder were weighed in together at 95 grams (3.35 oz) as shown below. This provides a reference weight to determine how much additional weight Klass Kote will add to the covering.

A two ounce Klass Kote mix consisting of 1/2 oz Clear Epoxy, 1/2 oz Satin Catalyst, and 1 oz of Reducer was used to air brush one thin coat on the fuselage, cowl, fin, and rudder. It is noteworthy to point out that only about half of the mix was actually used in this application. After the Klass Kote had time to cured overnight, this morning the paint fixtures were removed and the fuselage, cowl, fin, and rudder were again weighed together as shown below. The weight with the Klass Kote is 99 grams (3.49 oz). The good news is that the application of one coat of Klass Kote only increased the weight by (99-95) = 4 grams (0.14 oz), not nearly as much as one would think for an epoxy paint. The bad news is that this is well short of the 0.87 oz I needed to meet the 16 ounce minimum weight for the SAM Speed 400 event. So just as I suspected, I am going to have to add roughly 3/4 of an ounce of ballast weight to meet the minimum.
There is one attribute of Klass Kote I want you to be aware of. In the picture below, you can see the Klass Kote’s incredibly smooth matte finish left on the fuselage’s doped silk covering. There is absolutely no evidence that there is any Klass Kote present. In addition, the finish is completely fuel proof, although that is not a requirement in this electric power application.
Over the next day or so, I will remove the covering from the window areas and vent holes and install the side windows and the windshield. Then I will assemble the model once again and do the final weight and balance. Looks like I am finally getting near the end of this project.......................... Tandy
The .032" tail skid wire was removed from the aluminum tube at the aft end of the fuselage. In Report No. 72, the tail wheel landing gear was bent up out of 0.032" piano wire for an aluminum hub 3/4" tail wheel. A slight zig-zag was put into the portion of the wire that slides up into the aluminum tube to make it fit snugly. The tail wheel wire was coated with thin CA and pushed down into the aluminum tube, being careful to make sure the tail wheel was straight with the center line of the fuselage as shown below. Additional thin CA was wicked down in between the wire and the tube using the sowing needle with the tip of the eye cut off as the applicator.

The fin and rudder hinge halves were also CA’d in place as you can see in the picture above. The procedure for doing this involves cutting the Polyspan/silk doped covering over the hinge slots and inserting the hinge halves into their slots. The fin was attached to stab and the stab was attached to the fuselage. The upper hinge wire was inserted in the two upper hinges and lower hinge wire was inserted into the lower hinge between the bottom of the rudder and the rear of the fuselage. The rudder was moved back and forth several time to realign the hinge halves with each other. Then the hinge wires were removed in order to permanently bond the hinge halves in their individual slots with CA as shown above.
The Cloudster’s "Lost" label was installed on the top of the fuselage just behind where the wing’s trailing edge will be as shown below.

The Great Planes ballast lead weights I ordered from Tower Hobbies arrived in today’s mail. The six ounce package comes in 12 individual 1/4 oz segments shown below with self sticking tape on the bottom. It looks like I am going to have to use three segments plus a part of one of the segments to get the Cloudster up to 16 ounces.

The four window openings were cut out on my Cloudster fuselage after lunch today, which is shown below. After a careful rim sanding, the openings are quite crisp and sharp!
From the right side, you can see that I also cut out the ECS switch opening and holes on the other side as well in the picture below. However, I had to cut into the red trim strip after all, which I was trying to avoid, but it could not be helped. Notice that I have not cut out the fore and air ventilation holes on the sides yet.

I cut the scaled down plan patterns for the windows and the windshield as shown below. They fit pretty closely, but some tailoring is required to get an acceptable fit to the fuselage framework.
The windshield pattern was traced onto a sheet of quadrille paper to preserve the original pattern. Then after some pattern fitting and splicing, a very good fit was achieved as shown below.

This picture shows a close up of the tailored windshield pattern taped in place for trial fit.
I saw the picture below of Albert Pardue’s "Eugene III" rubber model with that beautiful windshield installation.

So I contacted Albert and he told me that he uses a material called DURA-LAR by Grafix for his windshields. It is very similar to mylar, but different. It comes in a 9" X 12" pad of 25 sheets as shown below. It is made in three thicknesses: .003", .004", and .005". You can get it at your local Hobby Lobby Arts and Craft store and it cost $12.99 a pad, which is really only a little over fifty cents a sheet. As you can see, I bought the .005" thickness.
Albert uses Weldbond glue to install his windshields with. He said to try either Lowes or Home Depot, but neither one had the Weldbond glue. I finally found mine at one of our large privately owned hardware store here in Arlington for $2.99 a bottle.

Never having used either one of these products, I made a window mock-up this afternoon to use as a test
case for bonding DURA-LAR on with the new Weldbond glue as Albert recommended. As you can see in the picture below, the Weldbond glue dried completely clear and really has the DURA-LAR stuck down tight. I outlined the piece of DURA-LAR so you could see where it stops, otherwise, you couldn’t tell.

I think these products are going to work well for me. Thank you Albert for sharing products with me. This evening, before I quit working, I taped the tailored windshield pattern down on a sheet of the DURA-LAR as shown below.

Tomorrow, I plan to cut out the DURA-LAR and tackle the installation of the windshield......................Tandy
I want to review a problem I had before I ever got started on the windshield. When I was using the Weldbond glue on the test case yesterday, I noticed that it was somewhat thick and difficult to spread. So I called Albert Pardue in Alabama this morning to discuss two things with him. First I wanted to know how thick his Weldbond Glue was. Well, he said it was not thick at all and referred to it as "creamy" in viscosity. While I was talking with Albert, I also asked him how he glued his windshields on. He said he puts the glue along the top and two side edges, but NONE along the bottom edge. He pulls the windshield down tight with blue masking tape and then let the Weldbond glue dry thoroughly. Then he used 1/8" black striping tape around the bottom to seal it. He said one could also apply the Weldbond glue sparingly along the bottom seam with a tooth pick, but you have to be very careful.

I went to the hardware store and bought a new bottle of Weldbond glue. The store clerk let me unscrew the top and check it out before I bought it. Sure enough, it had that creamy consistency that Albert described to me this morning. So I did in fact have a bottle that had gone bad.

The first step was to cut the windshield out of a sheet of the .005" DURA-LAR with the pattern taped on it and do a trial fit on the fuselage frame. I really like the 3M transparent tape (sometimes called Magic Mending Tape) for taping the DURA-LAR down with. As you might expect, the windshield cut out didn't fit too well, even though I thought the tailored pattern did. You really have to be patient trying to fit windshields because the material is "springy" and it is hard to get a good fit on all edges. As a matter of fact, it wasn't until the third windshield cut out that I got the fit to be acceptable.

The picture below shows a side view of the trial fit of the third windshield cut out held in place with four small pieces of tape. The trick was to get the windshield material at the right angle so it would lay down flat against the upper wing stop.
This shows a second view of the trial fit more from the front to show the nice smooth contact of the windshield's lower edge around the fuselage turtle deck.
This shows the third view of the trial fit more from the top. The DURA-LAR’s .005" thickness is just right for this type of windshield.
Finally the Weldbond glue was carefully applied to the top and both side edges and the windshield cut out was put in place, taping the right edge down first with two small pieces of tape. The windshield was wrapped around the frame and the left edge was pulled down tight and taped in place with two small pieces of tape. Using my thumb and finger, I squeezed the material against the frame to spread out the glue under the windshield and wiped off the excess with a damp rag. Then I came back and taped both of the side edges down tight against the vertical frames with a long piece of tape as shown below. Unfortunately, I did get a little of Weldbond glue onto the windshield inside, but hopefully it will dry clear enough to not be too noticeable. Albert’s advice to not put glue on the windshield’s lower edge, at least during the initial installation, kept me from getting into trouble.

Now I will let the windshield completely dry overnight before even attempting to remove the tape. I will be thinking about what to do with the unglued lower edge of the windshield. I may try to carefully put glue along the intersection of the windshield and the fuselage’s turtle deck, but I am not sure yet. If it turned out too bad, the seam can always be covered up with thin black striping tape as Albert suggested. In fact, I secured the bottom edge of my rubber powered J-3 Cub’s windshield that way, only using 1/16" yellow striping tape as shown below. The tape has stayed down for a couple of years now. I would appreciate any feed back or critique you might have concerning my approach to this windshield installation........................Tandy

3/26/2010
Last year, a fellow modeler (Van Wilson) sent me two identical glue applicators to try out. I filled one of them with aliphatic glue and have been using it with great success for some time. The small pointed opening of applicator’s tip lets you put just right amount of glue where you want it. So today I filled the second applicator with the Weldbond glue as shown below in preparation for the Cloudster’s side window installation.

I found the best way to glue the DURA-LAR windows in place was to put a small bead of the Weldbond glue around the window opening as shown below. However, the first time I tried to glue the side window on, I really messed it up. When I pressed the DURA-LAR down onto the glue bead, it oozed out onto the window inside %$#@*. However, I was able remove the window and easily clean all of the glue off of the fuselage frame with a damp rag. I took the DURA-LAR cut out to the sink and also cleaned all of the glue off of it with warm water. On my next attempt, I applied the small bead of glue just as before, but this time I smeared the bead of glue out into a thin film with my finger. Working relatively quickly, I cleaned my fingers off with water and then put the DURA-LAR in place over the window opening. I went around the edges of the DURA-LAR and pressed it down.
onto to the smeared glue film with my finger. Then I went around the edges of the DURA-LAR with a damp rag and cleaned off all of the excess glue (this Weldbond glue cleans up really well with water).

The fuselage was laid on its side on the work table and a piece of foam was placed over the fresh glued DURA-LAR window. A smooth Maple board was placed on top of the foam and three steel building blocks were placed on the Maple board for weight. This provided the necessary pressure around the window to hold it down while the glue thoroughly dried.
The picture below shows the end result of all of my windshield and window efforts, with which I am most pleased. You cannot see it in this picture, but the forward edge of the side window’s DURA-LAR butts up nicely against the back edge of the windshield’s DURA-LAR on the fuselage’s vertical frame. In summary, this particular part of modeling has always been a big problem for me. However, thanks to Albert Pardue’s advice and recommendations, I think I have products and a procedure that I can do a respectable job with from now on. Hopefully, this discussions will be useful to some of you.
I still have to decide how to seal the bottom edge of the windshield, but not today as I want to think about it for a while. If you recall, Albert Pardue appears to have completely outlined his windshield and maybe the windows also of his Eugene III with thin black striping tape as shown below. I might do the same or I might just go around the bottom edge of the windshield only with a piece of thin white striping tape and not do the complete outline. What do you think?.............................Tandy
There are at least two approaches to seal the bottom edge of the Cloudster's windshield. These include (1) applying sparing amounts of either Weldbond or epoxy with a tooth pick along the seam or (2) trying to put thin striping tape around and over the seam. Yesterday afternoon I did a test case of trying to apply Weldbond with a tooth pick on a sample and that did not work out for me at all so I didn’t even try the epoxy.

Next I tried putting 1/16" wide white striping tape around and over the windshield seam, stopping it at the corners where the side windows begin. The color of the white striping tape did not look very good and the 1/16" width was so narrow that I could not accurately control the amount of tape on the windshield and the amount on the fuselage's turtle deck for a good seal.

I did not have any 3/32" wide tape in white tape, but I did have some in both black and red. I put a strip of the 3/32" black striping tape around and over the windshield seam, stopping it at the corners as before. With the wider tape, I was able to control the amount of tape on the windshield and the amount on the fuselage's turtle deck and secure a good seal. However, the black did not look all that good either and I did not like the tape's abrupt termination at the corners.

I noticed that the color of the 3/32" red striping tape pretty much matched the color of the red Tamiya painted strip on the fuselage. It was then I got the idea to used the red 3/32" striping tape around and over the windshield seam, but instead of stopping it at the corners, take it on back along the bottom edge of the side windows and stop it midway on the upright behind the cabin. This way the thinner tape stripe will compliment the fuselage's side trim. The collection of the five pictures below show the red striping tape seal on the bottom edge of the Cloudster's windshield from different aspect angles:

Right side View
Top view showing the accurate control the amount of tape on the windshield and the amount on the fuselage’s turtle deck. The bottom edge of the windshield is well sealed.
Left Frontal View Close Up

Left View of the Entire Fuselage
Well, what do you think of this approach of sealing the bottom edge of the windshield? .................. Tandy
This morning I had a few final details to finish up before performing the final weight and balance on the Cloudster. The first task involved gluing the wing's forward plywood hold down plate into the slot in the wing as shown below.

The rudder and elevator .032" piano wire push rods were inserted through the yellow sheath guides and threaded brass couplers were soldered onto the ends of the wires as shown below.
The model was completely assembled and placed on the AccuLab scales as shown below. The gross weight of the model was 437 grams (15.41 oz) as shown below. The balance point was still just slightly forward of the CG.
The minimum weight requirement for the SAM Speed 400 event is 16 ounces, which is 453.60 grams. Therefore, a ballast weight of 454 - 437 = 17 grams must be added to the Cloudster. A retainer for the ballast weight shown below was made using a 3/32" plywood plate and a 2-56 cap screw and washer. This was designed to fit under the two 1/16" plywood servo rails and utilizes a stop against the forward rail and a center spacer.

Three 1/4 oz segments of the Great Planes ballast lead weights were trimmed and drilled so that the weight including the plywood retainer, screw, and washer was 17 grams as shown below.

The ballast weight assembly was carefully positioned on the two servo rails between the two servos and screwed down tight as shown below. The weight’s aft position put the balance point right on the desired CG.
For confirmation, the finished model, including the ballast weight, was again weighed on the AccuLab scales as shown below. The Cloudster weighs exactly 454 grams (16.01 oz) and is perfectly balanced.
I took the final six pictures of the finished Cloudster for you to see below.

Right Side View

Left Top View

Right Frontal View
As this construction project draws to a close tonight, this is the 92nd and final Cloudster's construction report. I began this Speed 400 project on October 27, 2009, over five months ago and completed it this evening. I truly hope you have enjoyed my efforts on this project as much as I have sharing them with you. There will be one more follow up report later on in the spring after the weather gets good to present the results of the Cloudster's flight testing. So for now, good night and goodbye............................Tandy
Sue and I went to Veteran’s Park again this morning to test the 30% reduction in elevator control and get some in-flight pictures. We arrived around 7:30 a.m., clear, calm, and about 59 degrees. I assembled the Cloudster and took it to the edge of the park on the concrete walkway to check the RPM out in the open as shown below. At full throttle it tach ed 12,800 RPM. Yesterday I tried to check the RPM in model room and only got 6,500 RPM so it must have been the lights in the model room interfering with the tach.

We walked out to the center of the park’s field to launch. I made one last check of the controls before I launched as shown below.
Sue caught the Cloudster a moment or so after launch as shown below.

For some reason I was having problems trimming the model as it was climbing out, but it did get quite high at the end of one minute. However, after I cut the motor I still couldn’t seem to get
it under control and it was getting higher and further away. I sensed that I was beginning to
loose the Cloudster as its image had grown very small now due to range. So I added throttle to
try to start coming back to the field. However, the power only aggravated the model’s
gyrations. Finally it just disappeared out of sight in the morning’s clear blue sky somewhere over
Arlington.

I have no explanation for what went wrong this morning. I only know that the Cloudster is gone, unless
someone happens to find it and calls me. Otherwise, this is last picture we will ever see of the
Cloudster on its way up................................Tandy
On May 3, 2010, I had a fly away on the third test flight of my new 300 sq. in. electric Cloudster.

On May 11, 2010, the lost Cloudster was found in the back yard of an Arlington home eight days later after two rain storms.

It had suffered rather extensive damage.
I decided to jump back in and build another 300 sq. in. Cloudster for the Speed 400 event! It was too good of a flyer for me not to have one for this year’s SAM Champs, if it could be built quickly. I concluded that I could build a second one in a much shorter time using what components I could salvage and my own construction reports as a guide.

The right wing panel was missing and the center section was badly damaged, but the main plywood spar brace was in tact.

A completely new right wing panel was built.
The new wing panel was integrated into the salvaged wing structure.

A complete wing structure emerged.
The wing structure was covered with transparent red UltraCote Lite.

The color scheme and trim were duplicated and the exact same Cajun graphics were applied to the wing.

When the vertical tail covering was cleaned off, it was discovered that the tip of the fin had received a moderate blow to the top edge, leaving the silk covering on one side of the tip wood a little wrinkled. Distilled water was injected into the crushed balsa through the covering with the syringe and a little heat was applied to the area, which expanded the damp balsa underneath and tightened up the silk covering.
The elevator control surface has been subjected to exposure and over stressing, which had significantly wrinkled the covering.

It was necessary to remove all of the covering from both the elevator and stab so each joint could be inspected and reglued as necessary. Discolored wood from water damage was bleached out with household bleach.

The elevator and stab were recovered with transparent red UltraCote Lite.
The fuselage was so damaged that it was not salvageable so a new one had to be built. To add a little weight and reduce ballast, I used heavier 3/16" balsa strips in the fuselage's primary structure.

To save time an aluminum motor mount was used.
The main landing gear was salvaged with a little straightening and rust removal.

Because of all of the water damage, two new servos along with new receiver, ESC, battery, and motor were purchased.
2.4 GHz antenna guides and push rods were installed.

Balsa blocks were glued together to form the blank for the new cowl.
The new cowl was carved and sanded to final shape.

The fuselage and cowl were double covered with white silk over Polyspan Lite and given seven coats of clear nitrate dope.
The fuselage’s red stripe was painted on both sides.

The fuselage and cowl were given one thin air brushed coat of clear satin Klass Kote.

The covering was cut out to form the four side window openings.
The windshield and side windows of 0.005" clear Dura-Lar were installed.

Red striping tape was used to seal the bottom of the windshield as well as trim the side windows.
This second Cloudster was finished this morning, 64 days after the decision to build a new one.

The Cloudster’s balance point is at 48.7% as per the Jim Adam’s plan and the total weight is 16.05 ounces................Tandy
Good Morning Trevor,
At 75 years of age, I am not one to give up or get discouraged easily. The Speed 400 event is one that interests me very much. I think the Cleveland Cloudster with the polyhedral wing is going to be strong competitor in this event. The recovered Cloudster is pretty well trashed out, but there are some tail components that are use-able. Since I still have time before the 2010 SAM Champs in September, I have started construction on a second Cloudster. I am not writing detailed construction reports on this rebuild because it would be redundant with the first series, but I will share a few pictures with you on where I am at the present time.
The vertical tail covering was water stained and I cleaned that all off with a glass cleaner and soft rag. I discovered that the tip of the fin had received a moderate blow to the top edge as shown below, which left the silk covering on one side of the tip wood a little wrinkled. I injected distilled water into the crushed balsa through the covering with the syringe that has a "hair" size needle also shown below. Then I applied a little heat to the area, which expanded the damp balsa underneath and tightened up the silk covering. This completely repaired the damaged tip so you can not tell it was ever damaged!
So you see Trevor, there will be a new second Cloudster in not the too distant future.

Tandy
Instructions and Cautions for your Speed 400 Propulsion System.

For New To Electrics ~ Special Instructions/Cautions

1. Always turn on your transmitter before plugging-in the battery
2. Always make sure the throttle is closed
3. The first time you try the system do so without the propeller.
4. On every landing make SURE you close the throttle*
5. On a crash landing ALWAYS CLOSE the throttle*
6. After every flight always unplug the battery**

* If you stall the motor by catching the propeller on the ground, the system will "see" very high current ~ high enough to melt something; ESC or Motor

** LiPoly batteries MUST NOT be discharged below about 3 volts per cell. For the two-cell battery this is 6 volts. If you leave it plugged in to the ESC it will drain to below this voltage and ruin the battery even if the transmitter is not turned on.

About Electric Motors and their Limits

Most motors we use in model airplanes have permanent magnets and copper wire wound armatures. The brushed motors use carbon brushes rubbing on a commutator to switch the voltage to alternating electromagnets. The brushless motors accomplish the same switching by electronic means.

However, all such motors have limits and as we are seeking the most power for the weight of the motor we push them towards these limits. There are three limits that concern us with the Speed 400 (Mabuchi) motor*. They are;

1. Temperature in the copper windings (the bare copper is insulated with a varnish like substance)
2. Temperature in the permanent magnet; beyond a certain temperature the magnetic properties are permanently diminished.
3. Speed of the armature; windings can separate due to centrifugal force.

So long as we use a two-cell battery we don't worry about #3. But the first two are a real concern.

The temperature is dependent on the internal losses in the motor, cooling and run time. The losses are a function of the operating current, which in turn depends on the propeller used. For the Speed 400 SAM competitions I use the GWS DD 6x3 prop. It pulls about 8 amps and will take an aerodynamically clean 16 ounce model almost out of sight in the three minute run. If properly cooled the motor will survive just fine. Some use a bigger prop such as the APC 6 x 4 or even larger; do so at your own risk. But know that the magnet damage is not apparent until you fly and find the performance is way down.
I always include cooling in my Speed 400 airplanes. I usually mount the motor to a forward bulkhead where I cut cooling holes to match the front face of the motor. I have included a pattern for you to do the same if you mount your motor this way. In addition to these cooling holes I also arrange for the motor compartment to have cooling air via a small intake and exhaust. It is also a good idea to have some cooling flow over the ESC too.

*Note on Limits; High quality motors use high temperature insulation on the armature wires, neodymium or other rare materials in the magnets to increase the critical “Currie Point” temperature and armatures are nowadays wound with Kevlar thread to vastly increase the limiting armature speed.

System description

Note; in this bench test setup you see my Astro Servo Simulator in place of the radio receiver


Turnigy TGY-20A/33300 20A BRUSHED ESC
Turnigy nano-tech 950mah 2S 25~50C Lipo Pack

Prop adaptor 2.3 mm shaft, and GWS DD 6x3 prop and JST Male connector and wire pigtail ~ many vendors
Motor mounting screws ~ 2.3 mm x 8 mm Search eBay as these are used in several model helicopters.

ESC instructions

Included.
Battery charging

You MUST use a LiPo battery charger, and it is wise to hold the battery in a paint can, ammo box, cement block or other fire proof container while charging. This is probably over the top, but even the 1% problems can grow to be disasters. It is not necessary to balance charge the battery every time but check it once in a while.

If you damage the battery in a crash etc. discard it. Read the web to discover how.

Your ESC will shut down the motor, but enable continued flight control when you have used up the juice to the 6 volt level. With the provided 950 mAh battery this will be about five minutes of full throttle running.

If you need more batteries make sure they are TWO cell ~ 7.4 volts nominal. If you can’t solder then look for batteries with a JST connector that matches the one on the battery I have sent you.

Installation

For models I design I find it simplest to mount the motor to the front former as shown here on my TU-ANT-25. The motor is fixed by two 2.3 mm screws. Make sure the screws are not bottoming on the motor as this will be into the windings. Test the length and use washers to ensure there is clearance.
If you are converting a 1/2 A Cox powered airplane you can buy mounts that will attach your Speed 400 to the Cox bulkhead. The prettiest of these mounts is made by Loren Kramer especially for this purpose. Here is one of his mounts used by Tandy Walker on one of his models. You can reach Loren at;

Loren Kramer; 707-763-9170

Another approach is to clamp the motor to longitudinal mount rails, like you might have used to attach a beam mounted glow motor. Here again heat is your enemy so aluminum clamps are recommended. You could buy them or simply make your own from aluminum flashing, a very useful material available inexpensively from Home Depot and other such stores.

Our friends in SAM 8 have a whole web page devoted to mounting Speed 400 motors although some of them involve gearboxes which are not allowed in this event. http://the-great-sam8.com/s400info.html

**Operation**

**Be sure to test your installation for the first time without the propeller!**

First hand launch should be with partial power. If you have insufficient downthrust you may climb into a loop with full power.

On landing watch the prop position. These GWS props are quite delicate and if the prop is up-and-down give the throttle a little bump until the prop blades are horizontal. Remember to shut the throttle landing.

If you do land with the prop vertical check the root of it after the flight. If a blade is somewhat swept back look at the root and see if there is any damage. If there is discard the prop. You don't want it to fail when turning fast; these guys will turn 15k.

Have FUN.

Oh, if you do fly in the Speed 400 event in a SAM meet let me know and I will send you $10 (one time only!)  

Dave