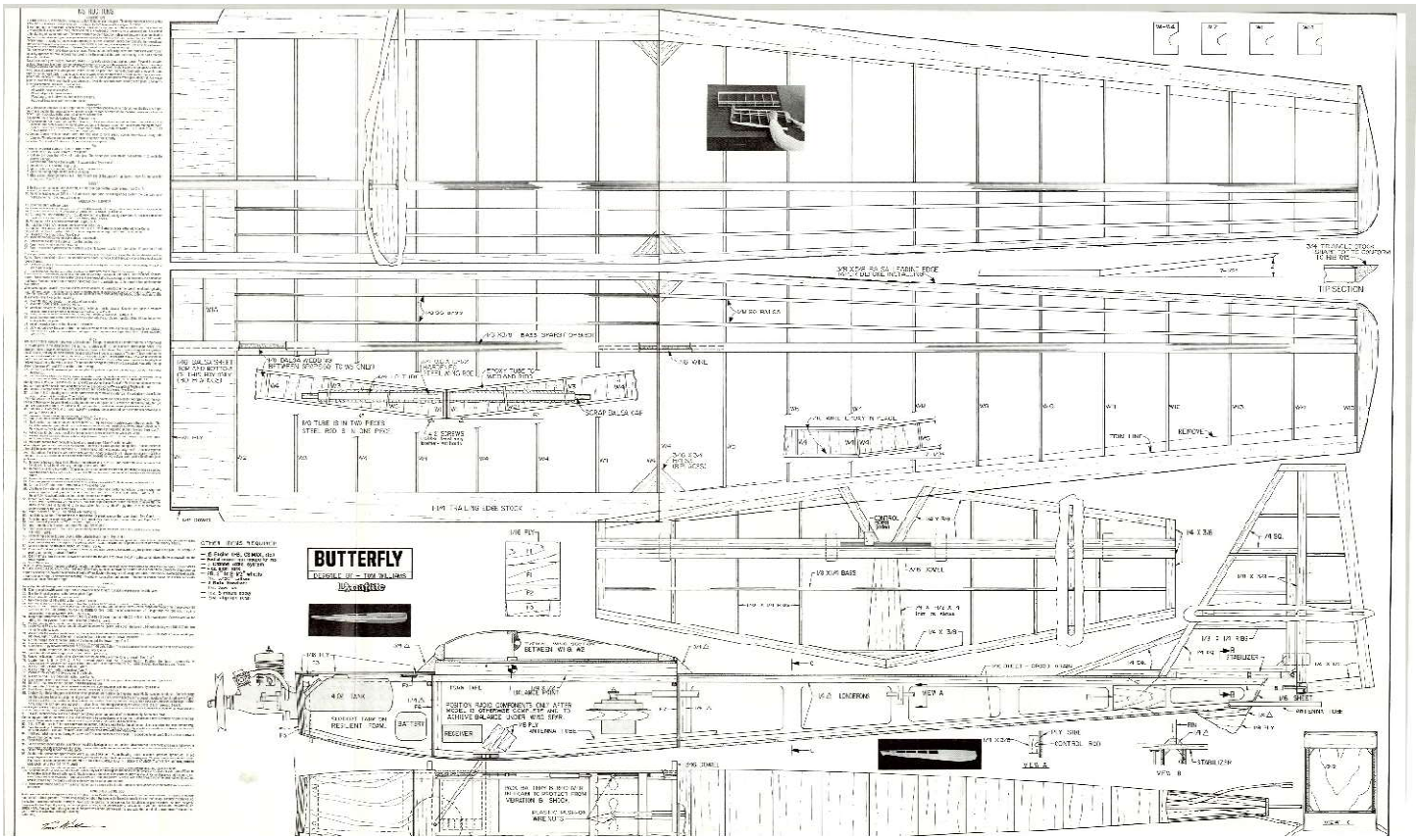
Double Trouble (My Own Model Design) Build Description

This build description is going to be different from others I've produced in the past. This scratch build was accomplished using paper and pencil hand drawn plans of a model that was my own design. When I first saw Virgin Galactic's White Knight Two and Spaceship Two back in 2008, I thought it would be interesting to see if these two aircraft could be built as RC models. As with the two Virgin Galactic aircraft, the mothership model would carry a smaller aircraft model to altitude and then be released to allow another member of our flying club to control its flight using a separate transmitter. I searched the web for any existing plans but came up with zero. So, I decided that I would come up with something myself. My White Knight Two model would be similar by having two fuselages, a very large wingspan, and a center wing section that would carry the smaller captive carry model.

Because of its very gentle handling characteristics, known flying qualities, and rather simple design, I decided to use the plans from my Dynaflight Butterfly kit (pictured below) as a starting point, and then made many additions and modifications from there. The largest difference was this would be a twin fuselage model using two 4-cycle engines for power, and a wingspan of approximately 152 inches overall. Not a small model. Having two fuselages there always was the potential that one of the two engines could quit in flight, resulting in a bad situation. To try and reduce the single engine out impacts, I extended the length of the Butterfly fuselage and increased the size of the rudders and vertical stabilizer/elevators to provide more lateral control authority. The two fuselages would be joined together by a three-foot center wing section that would also carry the drop model.



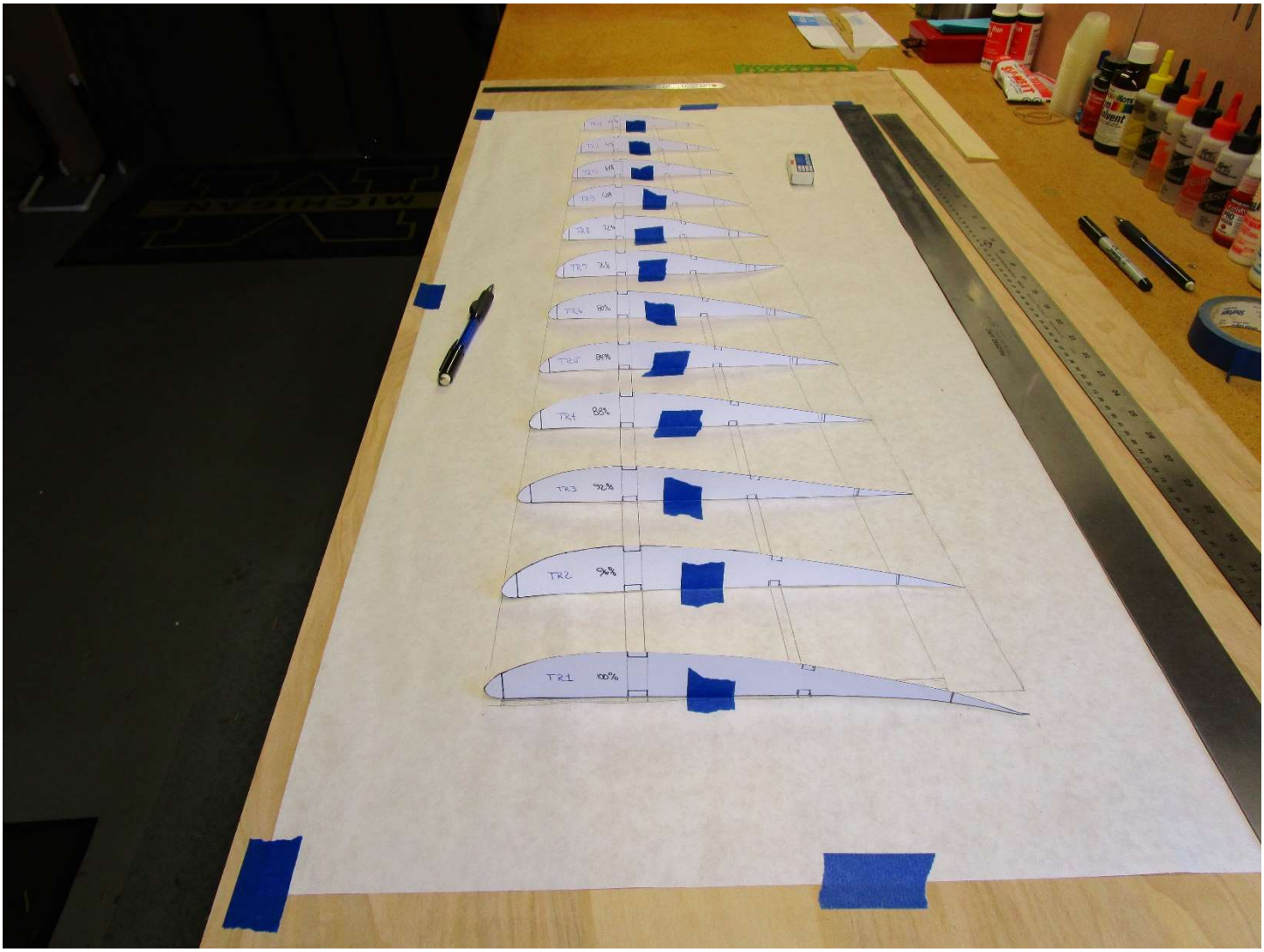
With my hand drawn plans, I don't have a pdf file that you can download. Sorry. Maybe someday I'll get the plans scanned into a pdf file, or maybe even try and work the plans up in a CAD program. Anyway, I'll go through my build so you can see the process and what resulted.

As with my other builds once I had the plans finished, I sat down and worked up a complete material and hardware list. The hardware list I have in an Excel spreadsheet is shown below.

Double Trouble Parts List										
Part	Size	CW	MWs	Tips	Fus & Conts	Total Qty.	Source	Item Number	Price Each	Total Price
Carbor Fiber Wing Tube	1/2" OD X 48"	1				1	CST	T515L4	$19.25	$19.25
Carbon Fiber Tube	1/8" OD X 48"	1				1	CST	T530L4	$8.95	$8.95
Robert Steel Pin Hinge Points (15)	1/8"			10	20	2	Tower Hobbies	LXET55	$5.79	$11.58
Dubro Control Horns Nylon T-Style (2)				1	2	3	Tower Hobbies	LXD935	$1.10	$3.30
Fourmost Bomb Release		1				1	Tower Hobbies	LXG870	$4.89	$4.89
Dubro Steering Arm & Connectors	5/32"				2	2	Tower Hobbies	LXD847	$2.87	$5.74
Dubro S6 Square Fuel Tanks (2)	6 oz.				1	1	Tower Hobbies	L5D71602	$9.54	$9.54
Great Planes Adjustable Engine Mount	.20-.48				1	1	Tower Hobbies	LXJ771	$5.49	$5.49
Great Planes Adjustable Engine Mount	.20-.48				1	1	on hand	n/a	$0.00	$0.00
Engine Mounting Bolts & Lock Nuts (4)	4-40 X 3/4"				2	2	Tower Hobbies	LXK050	$2.29	$4.58
Dubro Over-Ride Servo Saver					2	2	Tower Hobbies	LXD646	$2.26	$4.52
K&S Music Wire (7 each at 36" long)	5/32" diam.				2	1	Tower Hobbies	LXR937	$11.99	$11.99
Music Wire (6" long)	1/8" diam.				2	2	Lowes	n/a		$0.00
Tactic Servo Extension	6" long				3	3	Tower Hobbies	LXDGLU	$3.59	$10.77
Tactic Servo Extension	6" long	1				1	on hand	n/a	$0.00	$0.00
Tactic Servo Extension	12" long	1				1	on hand	n/a	$0.00	$0.00
Tactic Servo Extension	24" long			1		1	Tower Hobbies	LXDGMA	$4.49	$4.49
Tactic Servo Extension	24" long			1		1	on hand	n/a	$0.00	$0.00
Sullivan Push Cable w/Clevis	.056 X 36" long				1	1	Tower Hobbies	LXFU95	$6.99	$6.99
Sullivan Push Cable w/Clevis	.032 X 36" long				1	1	Tower Hobbies	LXFU94	$4.49	$4.49
Sullivan Semiflex Gold-N-Rod w/Clevies (2)	36" long				2	2	Tower Hobbies	LXFU92	$6.99	$13.98
Sullivan Single Threaded Rod (8)	2-56	1		2		1	Tower Hobbies	LXFV05	$4.29	$4.29
Top Flight MonoKote Neon Red	6'					1	Tower Hobbies	LXHW10	$21.99	$21.99
Top Flight MonoKote Transparent Red	6'					2	Tower Hobbies	LXHV48	$14.99	$29.98
Hobbico Latex Foam Rubber	1/4"				1	1	Tower Hobbies	LXL430	$3.99	$3.99
Great Planes Screw-Lock Connectors (2)					2	2	Tower Hobbies	LXK098	$2.49	$4.98
Great Planes Nylon Wing Bolts (4)	1/4" - 20	2				2	Tower Hobbies	LXK194	$1.49	$2.98
Great Planes Hooded Pushrod Exits (2)					2	2	Tower Hobbies	LXK061	$1.99	$3.98
Great Planes Pushrod Conn Nylon Fastlink (4)		1		2	4	2	Tower Hobbies	LXK096	$1.19	$2.38
Great Planes Bolt Set/Blind Nuts (4)	4-40 X 3/4"				2	2	Tower Hobbies	LXK044	$2.49	$4.98
Great Planes Threaded Ball Link Set (3)	2-56				1	1	Tower Hobbies	L5K09003	$5.43	$5.43
Wheels	3"				4	4	on hand	n/a	$0.00	$0.00
Great Planes Plated Wheel Collars	5/32"				6	6	on hand	n/a	$0.00	$0.00
Great Planes Landing Gear Straps Flat (4)	5/32"				2	2	Tower Hobbies	LXK163	$1.29	$2.58
Switch Harness w/Charge Port					2	2	on hand	n/a	$0.00	$0.00
Hitec Servo (for airlerons)	HS-225BB			2		2	Tower Hobbies	LXN664	$17.99	$35.98
Hitec Servo (for rudders & elevators)	HS-425BB				4	4	on hand	n/a	$0.00	$0.00
Hitec Servo (for bomb release)	HS-311	1				1	on hand	n/a	$0.00	$0.00
Hitec Servo (for throttles)	HS-81				2	2	on hand	n/a	$0.00	$0.00
O.S. 26 Surpass 4 Cycle Engine					2	2	on hand	n/a	$0.00	$0.00
Great Planes Fuel Tubing	3'				2	2	on hand	n/a	$0.00	$0.00
Hitex 72 Mhz Receiver (5 channel min.)	Channel 31				2	2	on hand	n/a	$0.00	$0.00
Receiver Battery (4.8 volt)	2000 mah				2	2	on hand	n/a	$0.00	$0.00
Wood Screws	2-56 X 1/4"	4		8	4	16	on hand	n/a	$0.00	$0.00
Wood Prop	10 X 6				2	2	Tower Hobbies	LXHY24	$2.49	$4.98

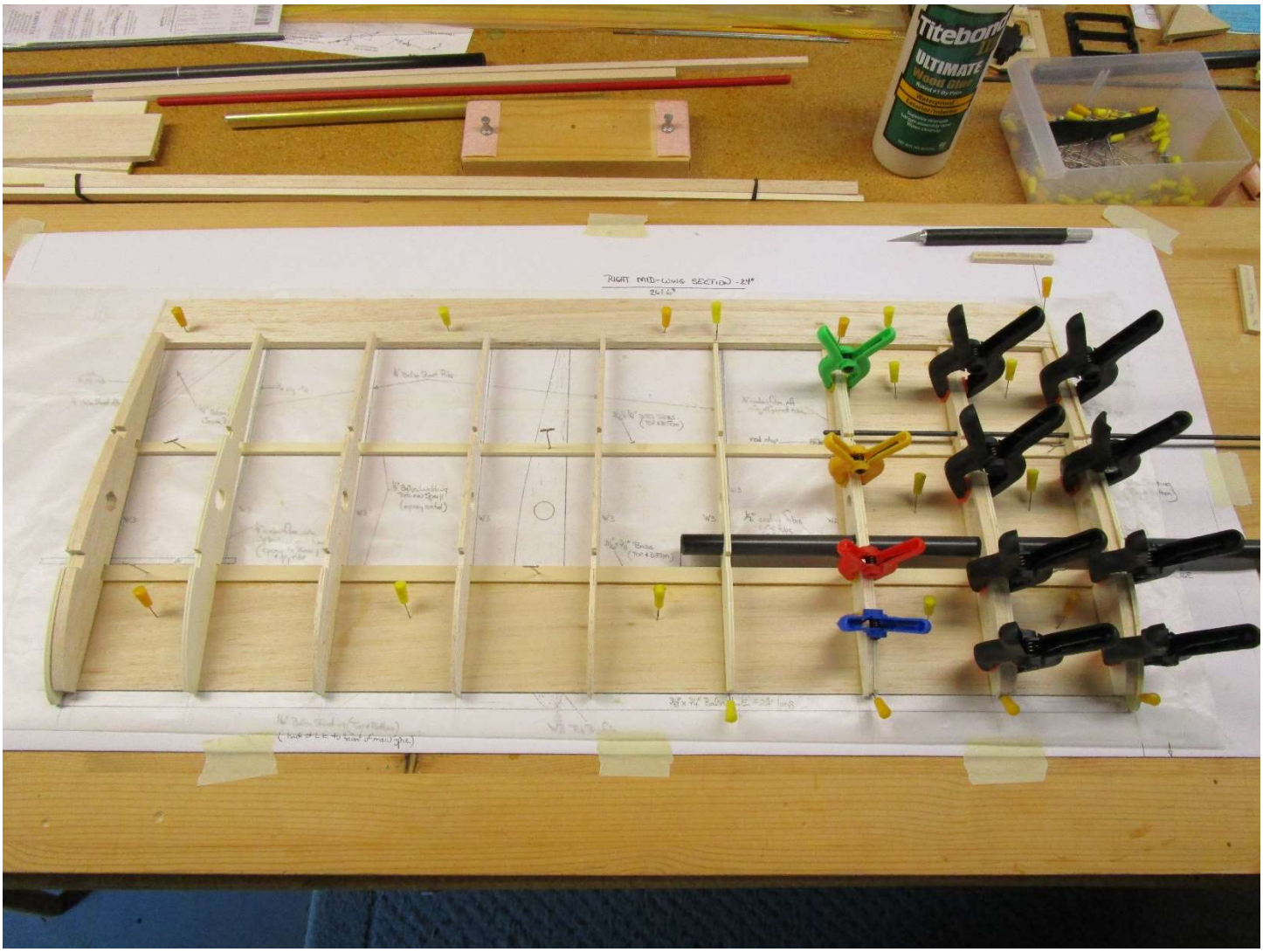
While waiting for my material order to be delivered, I started this build with laying out the various wing panels. The Double Trouble wing was broken down into five different panels; a center wing panel that joins the two fuselages, two mid-wing panels that attach to the center panel using carbon fiber tubes, and two outer wing panels with ailerons in each. The center panel and two mid-wing panels are all joined together without any dihedral, but the two outer panels are joined to the mid-wing panels with a dihedral of 3.5 degrees.

Because the Butterfly plans only provided a single rib profile for the center section, I had to come up with rib patterns for the double taper outer wing panels. I accomplished this using a percentage reduction from the main rib profile that would give me the required double taper for the outer wing panels. Pictured below are those profiles laid out along the outer wing panel plan.



Next, we start cutting out ribs, and there are a LOT of them. The picture below shows the buildup of the outer wing panel over the plan. Each of these panels are 34" long, have 13 ribs each, a 24" aileron, and a panel area of 274.4 sq. inches. This panel will be epoxied to the mid-wing panel and as visible on the plan in the picture has a 1/8" carbon fiber tube running thru the two inner ribs and extends into the mid-wing panel. There is an aileron servo bay between the 3rd and 4th ribs.

Seen here is the build of the right mid-wing panel. Each are 24” long, have 15 ribs each with a cord length of 11”, and a panel area of 261 sq. inches. As pictured, I used the 1/8” and 1/2” carbon fiber tubes to hold the inner ribs in place while the glue dries.

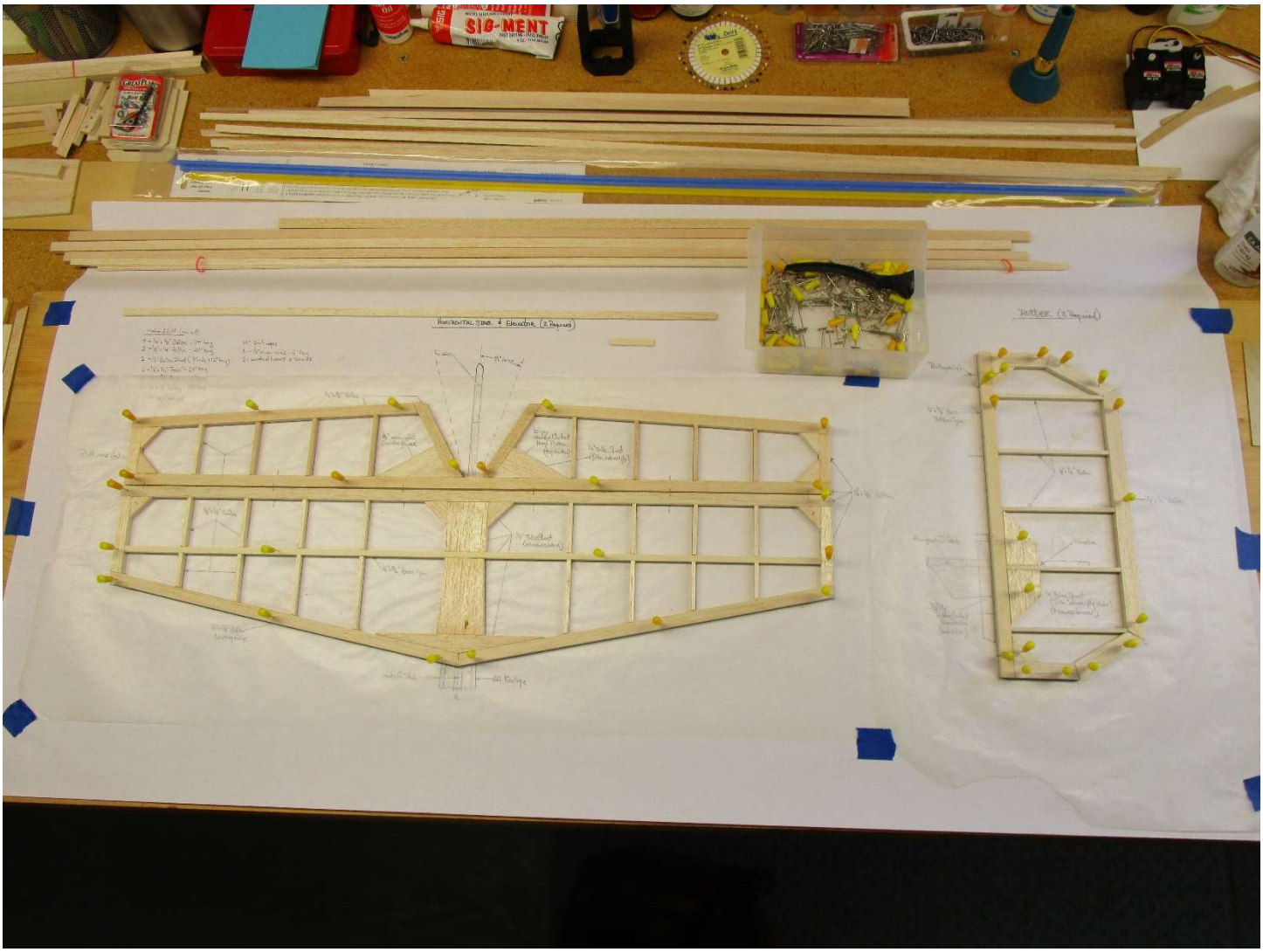


Now for the center wing panel which is pictured below. This panel is 36" long, has 21 ribs with a cord length of 11", and a panel area of 391.5 sq. inches. Here again, I used the 1/8" and 1/2" carbon fiber tubes to hold the outer ribs at each end in place while the glue dries. The payload release servo bay is located in the center of the panel.

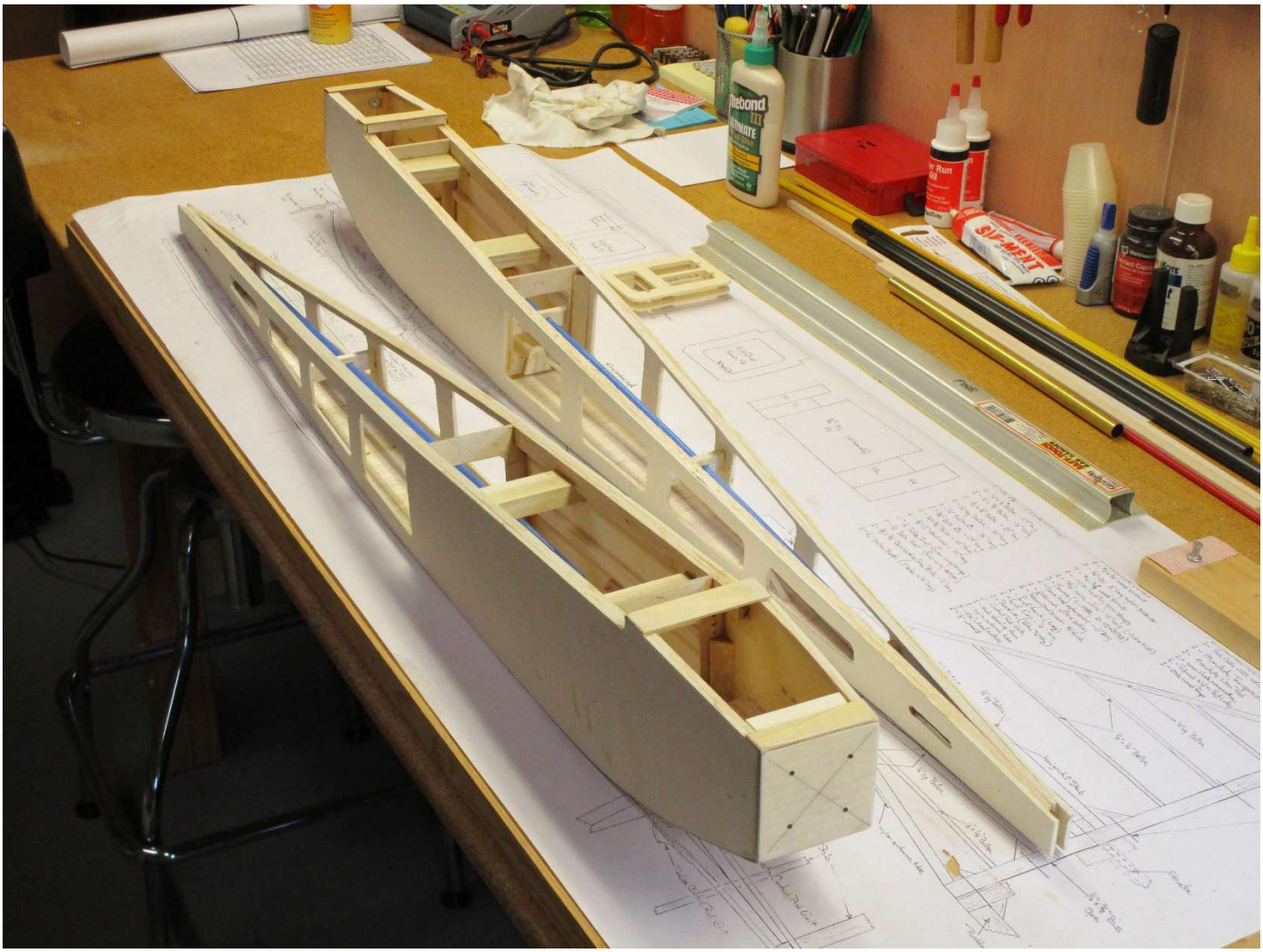
The first picture below shows the two mid-wing panels matted to the center wing panel with the carbon fiber tubes. To give you some idea of the size, that is sitting on top of an 8-foot table.

The second picture shows all the wing panels laid end to end. They then get sanded to shape and the outer and mid-wing panels are epoxied together.

Enough with wings for now. Let's move on to the tail feathers, of which there are two sets for this model. As seen below, these are basic balsa stick constructions built directly over the plan. The horizontal stab is 24" long, and the rudder is 11" high. Nothing fancy here. Once the glue dries, they get sanded to final shape using 220 grit sandpaper and then ready for covering.



How about some fuselages. Yes, two of them on this big baby. These are a simple 3" wide by 4" high box center bay with gradual fuselage taper to the aft tail. Again, nothing fancy or complicated. Each is 43" long, and the sides are cut from lite plywood to ensure a good strong structure. The front bay behind the firewall is for the receiver battery and the fuel tank. In the picture you can see the two servo trays laying on the plan. Each fuselage will get its own 72Mz receiver and battery pack. Also shown in the lower right corner of the picture is the vertical stabilizer which again is a simple balsa stick construction. The two blue tubes are control rod tubes that run from the center bay back to the tail. Make sure you install the engine mount blind nuts before epoxying the firewall to the fuselage sides. NOTE - I should have also drilled the fuel line holes and throttle control rod hole before the installation.



Well, it's time to see how all this is going to fit together. Pictured below is the mating of the two fuselages to the center wing panel. Each are attached using three 1/4"-20 plastic wing mounting screws. Each fuselage will get a steerable nose landing gear and one main landing gear installed.

The next two pictures show a complete fit check with the engines, landing gear, and aileron servos installed. I do this to determine the final location of the servo trays and receiver batteries to set a proper center of gravity.

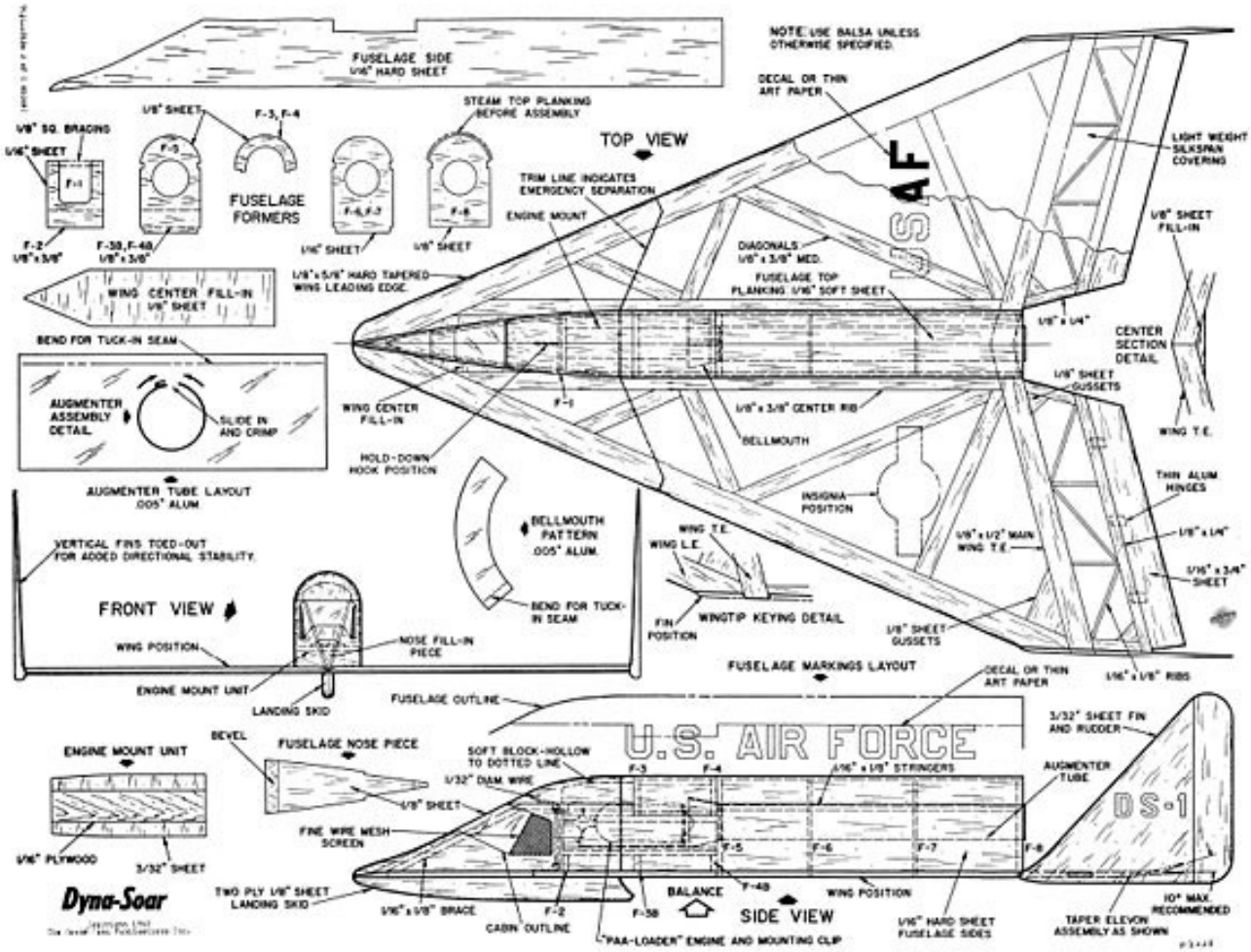
The two pictures below show the results of the build. I used transparent covering to help display all the effort put into this scratch build. That's an overall 152" of wingspan and 1,462 square inches of wing surface. She was a great-looking model. The second picture shows a Boeing X-20 mounted under the center wing panel.

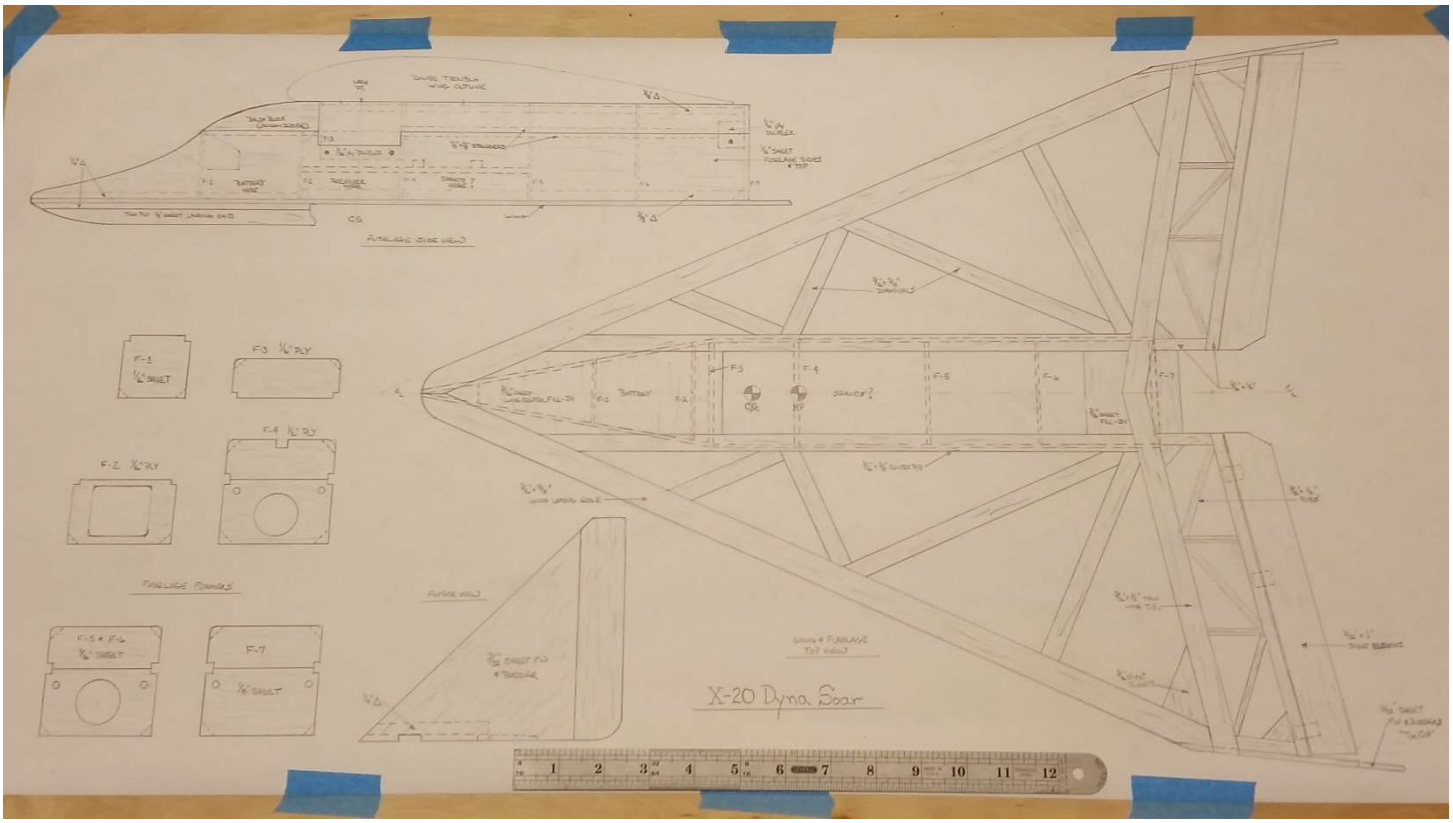
To give you some idea as to the size of the overall model, below you see me holding Double Trouble and the Boeing X-20 laying on the ground. She was difficult to fly at first. Initially using two O.S. Surpass .26 4-cycle engines the model was underpowered. I ended up changing them out for two O.S. .35 2-cycle engines, which helped greatly. Unfortunately, this also increased the stress on the 1/2" diameter carbon fiber tubes joint which failed on the right wing on my fifth flight. If you plan to attempt this build, I'd HIGHLY recommend using larger diameter carbon fiber tubes. The build description for the X-20 follows below.

Boeing X-20 Dyna-Soar Build Description

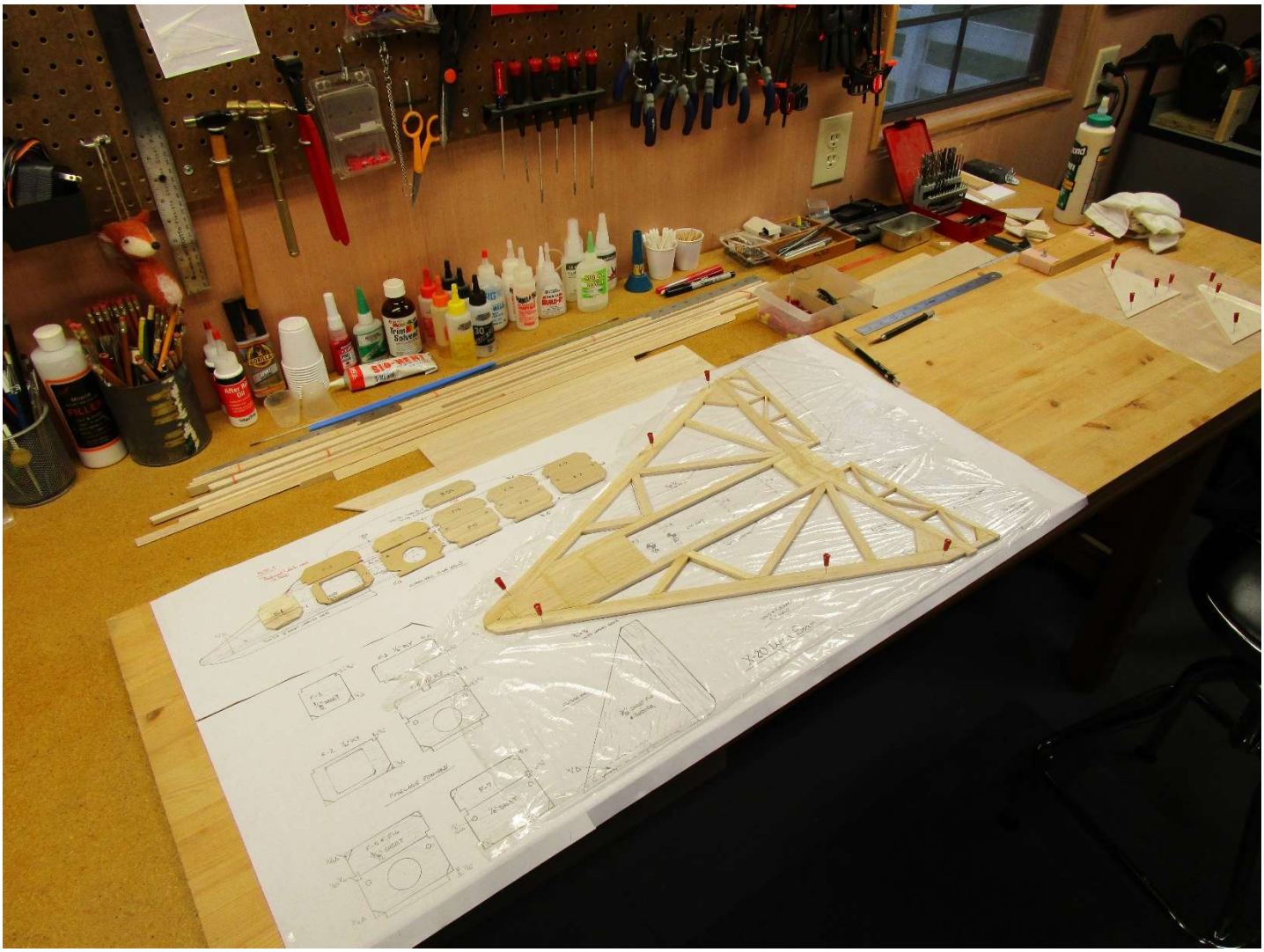
The Boeing X-20 Dyna-Soar ("Dynamic Soarer") was a United States Air Force (USAF) program to develop a spaceplane that could be used for a variety of military missions, including aerial reconnaissance, bombing, space rescue, satellite maintenance, and as a space interceptor to sabotage enemy satellites. The Dyna-Soar design contract was awarded to Boeing on Nov. 9, 1959, and on June 19, 1962, the Dyna-Soar was designated the X-20. The Dyna-Soar, designed to be a 35.5-foot (10.8-meter) piloted reusable space vehicle, had a sharply swept delta 20.4-foot-span (62-meter-span) wing. Unlike the later Space Shuttle, Dyna-Soar did not have wheels on its tricycle undercarriage, as rubber tires would have caught fire during re-entry. Rather, it used high temperature metal skids. The X-20's ultra-obscure status is owed to the fact that the thing never flew. Construction was never even finished. Aside from a partially constructed prototype, the X-20 has remained a figment of industrial imagination, a set of blueprints gathering dust.

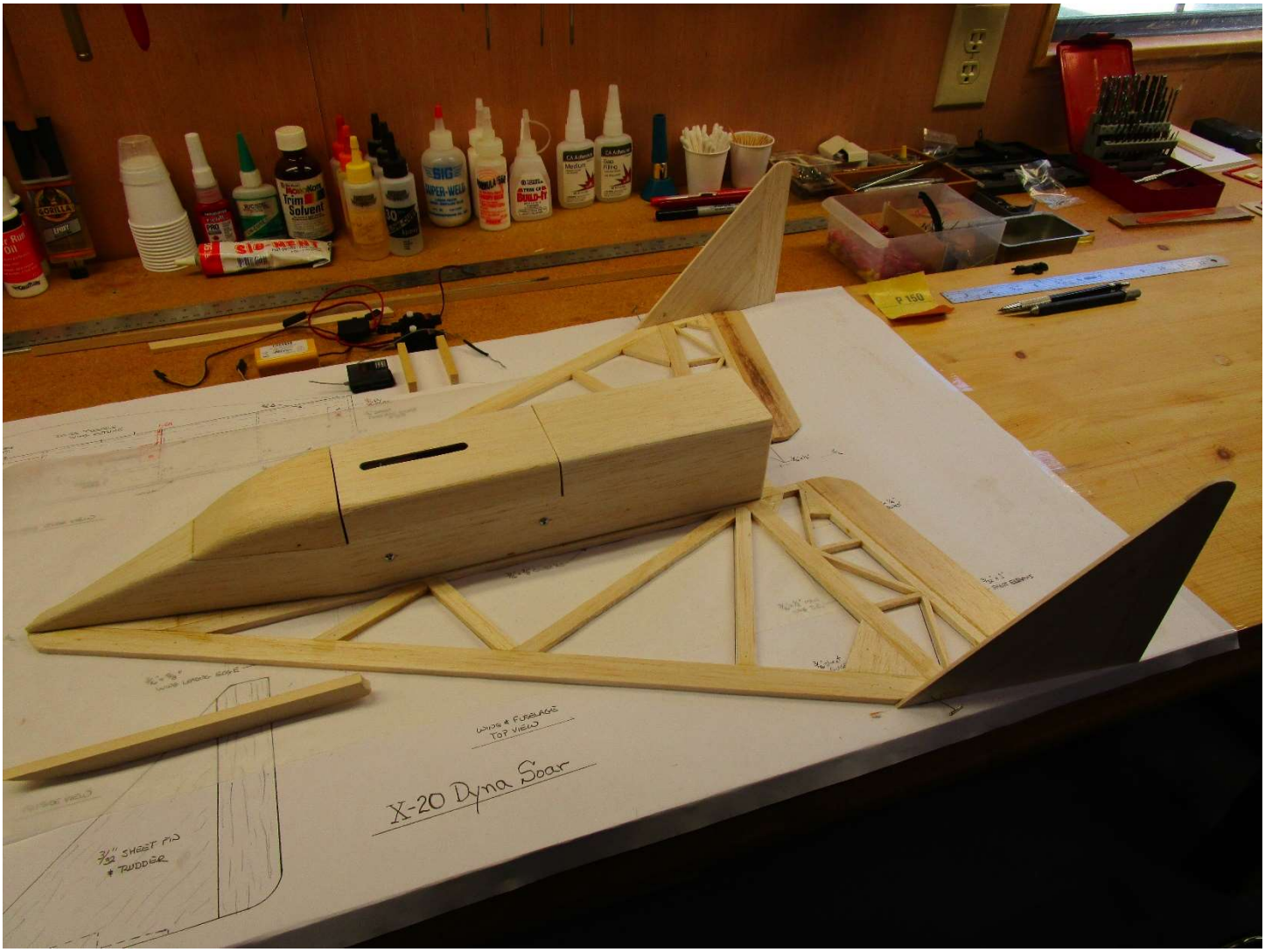
So now you know what the X-20 was. I did my web research and was able to find a plan on Outerzone for a Jetex powered free-flight version of the X-20 pictured below. Using this plan, I developed my plans shown below for a non-powered RC version of the X-20. This model would use a Hitec 72Mz receiver with two small servos to control the ruddervators. Access to the receiver, battery, and servos is through a hatch along the top of the X-20 fuselage. My X-20 would attach to the underside of the Double Trouble mothership center wing section using a servo-controlled release mechanism, which would be actuated using the "Gear" switch on the transmitter. You can see the outline of the Double Trouble wing profile at the top of my plans.


FUSELAGE SIDE
1/16" HARD SHEET
NOTE: USE BALSA UNLESS OTHERWISE SPECIFIED.
DECAL OR THIN ART PAPER
STEAM TOP PLANKING BEFORE ASSEMBLY
TOP VIEW
1/8" SQ. BRACING
1/16" SHEET
1/8" SHEET
F-3, F-4
FUSELAGE FORMERS
F-2 1/8" x 3/8"
F-38, F-48 1/8" x 3/8"
1/16" SHEET
1/8" SHEET
TRIM LINE INDICATES EMERGENCY SEPARATION
ENGINE MOUNT
LIGHT WEIGHT SILKSPAN COVERING
1/8" SHEET FILL-IN
DIAGONALS 1/8" x 3/8" MED.
FUSELAGE TOP PLANKING 1/16" SOFT SHEET
1/8" x 5/8" HARD TAPERED WING LEADING EDGE
WING CENTER FILL-IN 1/8" SHEET
BEND FOR TUCK-IN SEAM
AUGMENTER ASSEMBLY DETAIL
SLIDE IN AND CRIMP
AUGMENTER TUBE LAYOUT .005" ALUM
WING CENTER FILL-IN
HOLD-DOWN HOOK POSITION
1/8" x 1/4"
CENTER SECTION DETAIL
1/8" SHEET GUSSETS
1/8" x 3/8" CENTER RIB
BELLMOUTH
WING T.E.
THIN ALUM HINGES
INSIGNIA POSITION
1/8" x 1/2" MAIN WING T.E.
1/8" x 1/4"
1/16" x 3/4" SHEET
BELLMOUTH PATTERN .005" ALUM.
BEND FOR TUCK-IN SEAM
VERTICAL FINS TOED-OUT FOR ADDED DIRECTIONAL STABILITY.
FRONT VIEW
WING T.E.
WING L.E.
FIN POSITION
WINGTIP KEYING DETAIL
1/8" SHEET GUSSETS
1/16" x 1/8" RIBS
WING POSITION
NOSE FILL-IN PIECE
ENGINE MOUNT UNIT
LANDING SKID
FUSELAGE MARKINGS LAYOUT
DECAL OR THIN ART PAPER
FUSELAGE OUTLINE
U.S. AIR FORCE
3/32" SHEET FIN AND RUDDER
AUGMENTER TUBE
DS-1
ENGINE MOUNT UNIT
BEVEL
FUSELAGE NOSE PIECE
SOFT BLOCK-HOLLOW TO DOTTED LINE
1/32" DIAM. WIRE
1/16" x 1/8" STRINGERS
F-3
F-4
F-5
F-6
F-7
F-8
1/8" SHEET
FINE WIRE MESH SCREEN
1/16" PLYWOOD
3/32" SHEET
Dyna-Soar
TWO PLY 1/8" SHEET LANDING SKID
1/16" x 1/8" BRACE
F-2
CABIN OUTLINE
F-38
BALANCE
F-48
WING POSITION
SIDE VIEW
"PAA-LOADER" ENGINE AND MOUNTING CLIP
1/16" HARD SHEET FUSELAGE SIDES
TAPER ELEVON ASSEMBLY AS SHOWN
10° MAX. RECOMMENDED


X-20 Dyna Soar

This X-20 build is very simple and straight forward. Pictured below is the start of the scratch build directly over the plan. All the formers (F-1 through F-7) are cut from balsa sheets. Everything else is balsa sticks. AS you can see to the upper right of the picture, I used Titebond Ultimate III wood glue for this build.





Above is the X-20 near completion. Not on the bench behind the plane are the receiver, battery pack, switch assembly, and the two servos. The hatch is held in place by the small screws visible on the fuselage side. From here everything gets final sanding and shaping. Then on to the covering.

Shown above is the completed build. The control roads were unique given the position of the ruddervator control horns to the servo control rods exit from the fuselage, but they work as required.

As with the real Boeing X-20, this model never flew. My Double Trouble lost its right wing on the fifth flight when the carbon fiber tube broke at the center wing to mid-wing joint. Sorry to say, I never rebuilt Double Trouble.