My Balsa & Glass Workshop

Andy Clancy's Bee Liner Build Description

Updated as of 17 January 2025

Designed by the father of the Lazy Bee, Andy Clancy, the Bee Liner is a multi-motor version of the classic sport flyer with a bit of 1930s retro added in for good measure. A quote from Andy Clancy - "Let me introduce you to The Bee Liner, a plane whose finest trick is just sitting stationary, taking a break. It is reclining in the air.

You can do this stunt easily. The Bee Liner is kept so supremely airborne because it has four propellers blowing their air over its wing. Fly it along at a slow pace under power and then suddenly cut the throttle. This will cause a sudden stall. As long as those props are spinning, the air is flowing, the wing is lifting… and the Bee Liner is flying in place. The plane is creating its own breeze to fly on. Then, if you are the dramatic type, stop the props. That lift provided by the propwash ceases instantly, so the plane falls. The onlookers gasp. (Be warned! If you performed this maneuver too close to the ground, you will end up with a new airplane "kit"!).

Flying this plane is fun and exciting. It's a Bee, after all! The Lazy Bee series of planes was meant to be particularly versatile in the sense that they could be docile for beginners, yet capable of providing challenging stunt-flying to an expert pilot. The Bee Liner is no exception. Stalls with the Bee Liner are predictable and gentle with an immediate recovery. Response to stick and throttle is quick and powerful. If you take your hands off the controls, the Bee Liner will quickly go to straight and level from any "nightmare" attitude. Performing any maneuver requires only a small space and little time. Flying at its slowest takes a little experimenting with technique.

It's even fun to watch. Its wide chord wing and the chubby fuselage make it easy for the eyes to follow it when it's far up and away. The nice synchronous hum of the four motors and props are amplified by the drum-like wing. You know: Oversized control surfaces, hands-off stability, extremely low minimum flying speed, and easy aerobatics."

Bee Liner Model Specifications:

Type: Multi-Motor Sport Flier

Wingspans: 51"

Wing Chord: 10"

Total Wing Area: 448 sq. in.

Wing Location: Low Wing

Wing Dihedral: 2.25" at wingtips

Stabilizer Span: 18.6"

Total Stab Area: 100 sq. in.

Rudder Height: 6.5”

Rudder Area: 21 sq. in.

Fuselage Length: 32.25”

Fuselage Width: 3.45”

Rec. No. of Channels: 4 – Throttle, Elevator, Rudder, and Ailerons.

Weight: 28 oz. - 46.5 oz. depending on power system selected.

Wing loading: 9 - 15 oz./sq. ft.

Glow engines: N/A.

Electric Powered: Output of 100 watts per brushless motor; 20A brushless ESCs; 3-cell LiPo pack sized up to 3,300 mah.

Figure 1 - Andy Clancy's Bee Liner

Image Source: https://www.modelairplanenews.com/online-bonus-preview-andy-clancys-bee-liner/

Clancy's Bee Liner is designed to fly with four brushless motors as small as 80 watts (.049-.051 Glow Engine Power). The electric-powered Bee Liner typically will have a total flying weight of around 28 - 46.5 oz. ready to fly, depending on your power system selection. It is recommended you use motors with a power output of 100-150 watts each. The Bee Liner tends to be tail heavy with brushless motors. You might want to use oversize motors to help balance the plane even though you do not need the extra power. Larger motors can be detuned by throttling them down, or by using a smaller prop than specified for the motor, or by not using the maximum number of cells. The best battery size to use is a 3-cell LiPo pack up to 3,300 mah. ***Be sure to decide on the power plant and other options before you glue the first piece!***

After a lot of web searching for Bee Liner plans and information, I was finally able to find a Bee Liner article that has several good build images, which I plan to use to aid my build. You can find this article @: https://www.modelairplanenews.com/online-bonus-preview-andy-clancys-bee-liner/.

The Bee Liner plans, and Andy’s Bee Liner Construction Article in the November 2017 issue of Model Airplane News can be obtained by contacting Andy @: https://www.andyclancydesigns.com/, or andyclancydesigns@gmail.com. You will **NOT** find Bee Liner plans on any of the “Free Plans” websites.

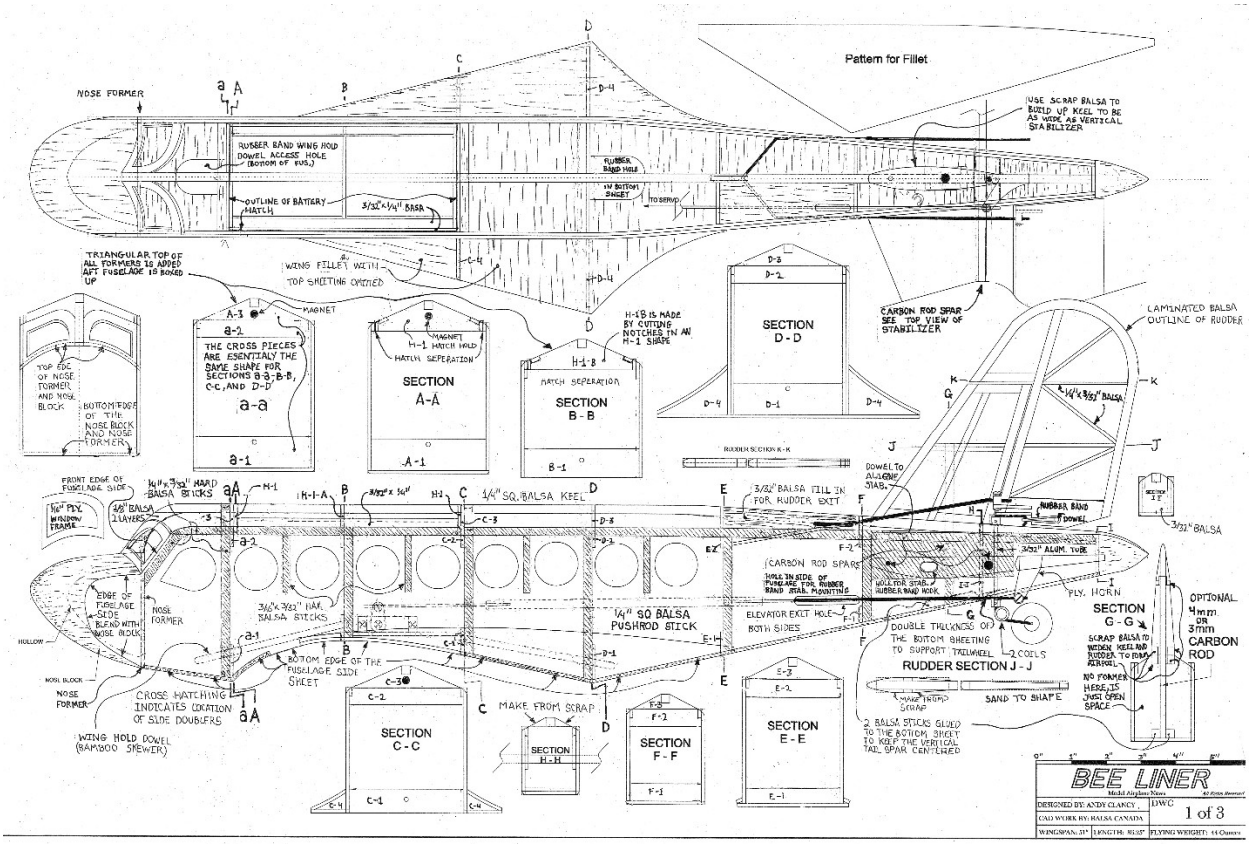


Figure 2 - Bee Liner Fuselage Drawing

Images Source: Extract from the Andy Clancy Aviation Bee Liner Plans.

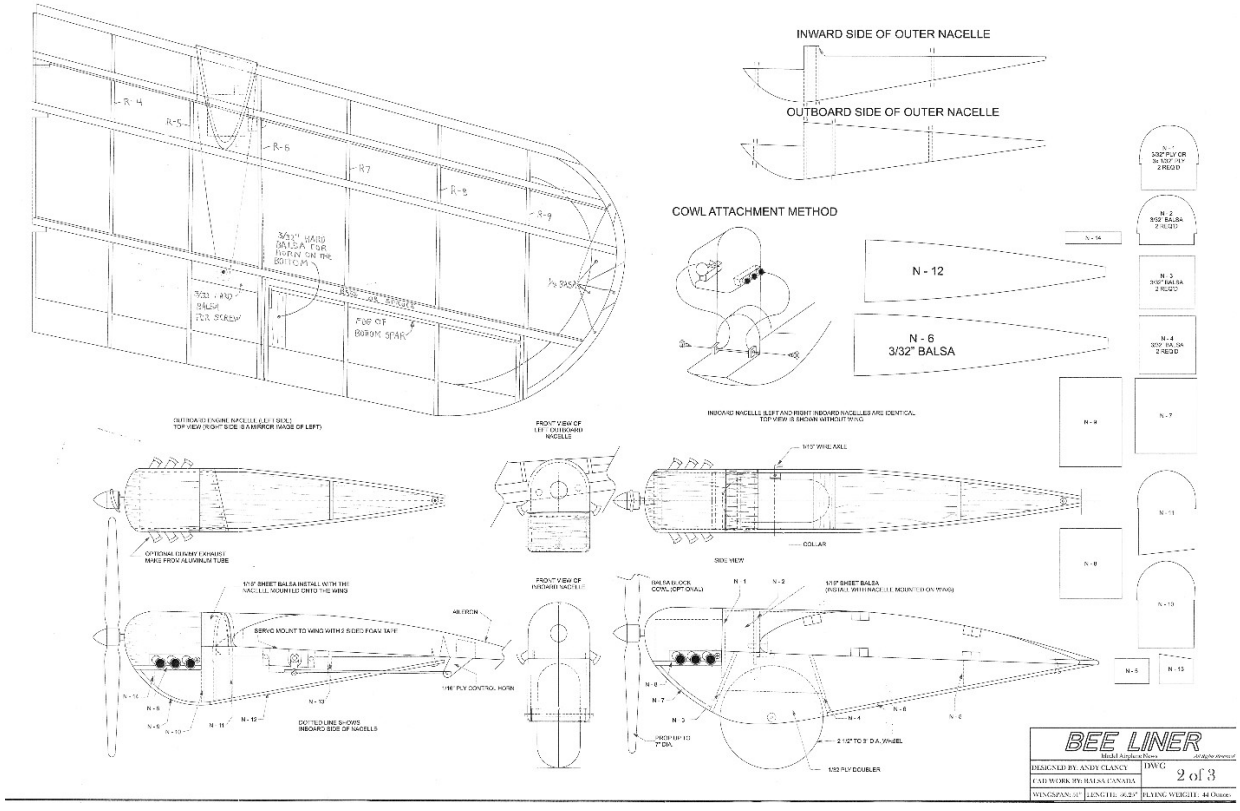


Figure 3 - Bee Liner Motor Nacelles Drawing

This scratch build will be ***my first four-motor RC model build***, so I am really excited about what new things I will learn along the way. Using the Andy Clancy Bee Liner plans, I determine what materials I will need to make my scratch build. Once I have a complete wood and material list, any balsa sticks and sheets, basswood sticks, and plywood needed are ordered from Balsa USA (https://balsausa.com/). The four Hitec HS-81 16.6g Nylon Gear Analog Micro Servos, Spektrum AR620 6-Channel RC Sport Receiver, Gold-in-Rod control rod set, main landing gear wheels, steerable tail wheel assembly, and all other required hardware can easily be located on the web or purchased from your local hobby shop. *Based on excellent recommendations from Lucien Miller, President & CEO of Innov8tive Designs, Inc.,* to power this little beauty I plan to use a BadAss Power System that puts out a total of approximately 320 watts, which is equivalent to a single 0.15 two-cycle glow engine. Yes, I am building yet another electric powered model. I know that is hard to believe. This BadAss Power System is comprised of the following components: 4 - BadAss 2305-1050Kv Brushless Motors; 4 - BadAss Rebel V2 Lite Series Brushless 20A ESCs; 1 - BadAss 45C 3,300mah 3S LiPo Battery; 2 – APC 7x6E Propellers (Normal Rotation); 2 - APC 7x6E Pusher Propellers (Reverse Rotation); and 4 - M5 x 0.8mm Thread Spinner Nuts. You can purchase the system and other components needed for the wiring harnesses (see Figure 4 below) from "Innov8tive Designs" at https://innov8tivedesigns.com/.

For an RC model of this size, the BadAss BA-2305-1050 motors work well using a 3-cell LiPo battery with 7-inch props. The motors weigh 1.44 ounces each and add in the weight of the prop adapter and cross mount they come in at 1.9 ounces each, so a set of four would be 7.6 ounces. The little BadAss Rebel Lite 20-amp ESC's weigh 0.46 ounces each, so a set of four would be 1.84 ounces. The BadAss 45C 3,300mah 3S LiPo battery weighs 11.5 ounces, so the total for the battery, four motors and four ESC's is right at 21 ounces. The covered airframe with servos should come in around 24 ounces, so the estimated weight of the complete Bee Liner model should be around 45 ounces. This is at the top end of the weight range, but still very flyable with 14 oz./sq. ft. wing loading.

With APC 7x6-E props, the following are the full throttle performance numbers for four motors:
Volts – 11.1
Amps – 28.6
Watts – 320
RPM – 9,166
Thrust – 57 ounces
Speed – 52 MPH

With the Bee Liner at 2.8 pounds, this results in a power loading of 114 watts per pound with a thrust to weight ratio of 1.27 to 1. This should provide very good short field takeoff power and the ability to climb straight up if wanted. Throttled back to 50% throttle, *which is where I will spend most of my time in the air*, the power system will only pull a total of around 8-9 amps, which should get me 15 minute flights from the 3-cell 3,300 LiPo battery with reserve left over.

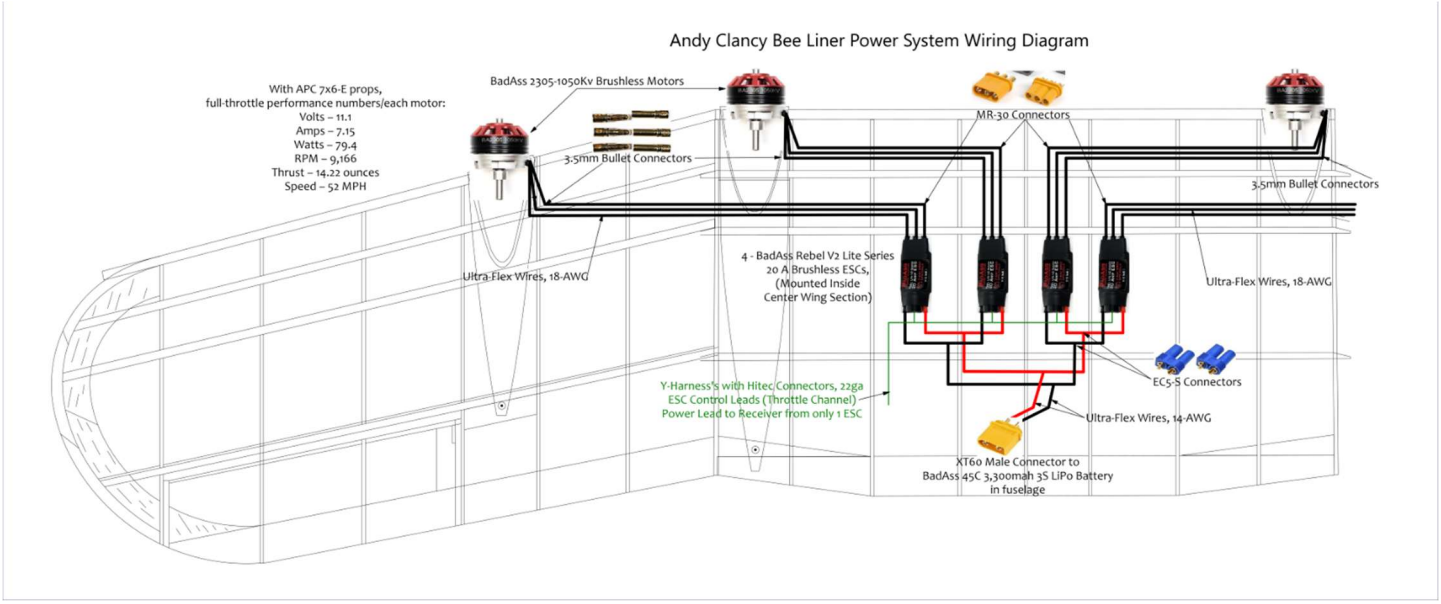


Figure 4 - Bee Liner Power System Wiring Diagram

The "Bee Liner Materials and Hardware List" below contains all the materials and hardware required to build my Bee Liner. I will update this list as I proceed through the build.

Bee Liner Materials and Hardware List

Amount	Description	Use
Balsa		
4	1/16" x 3 x 36" balsa sheet	wing sheeting
2	3/32" x 6" x 36" balsa sheets	fuselage sides
3	3/32" x 4" x 36" balsa sheet	fuselage parts and sheeting
10	3/32" x 3" x 36" balsa sheets	wing ribs
18	1/16"x 1/4" x 36" balsa sticks	laminated stabilizers outline
2	3/32" x 3/16" x 36" balsa sticks	fusalage doublers
12	3/32" x 1/4" x 36" balsa sticks	fuselage and stabs
3	1/8" sq. x 36" balsa sticks	fuselage
17	3/16" sq. balsa sticks	outer wing sections spars
6	1/4" sq. x 36" balsa sticks	fusealge and stabs.
4	2" x 2" x 2 ½" soft balsa blocks	motor nacelle cowl blocks
1	2 5/16" x 2 ½" x 3 ¼"soft balsa block	fuselage nose block
1	1" x 1 ½" x 1 ½" soft balsa block	fuselage tail block
1	3/8" x 36" triangular balsa stock	motor nacelles firewall backup brace, fuselage bracing
Basswood		
3	3/16" sq. x 36" basswood sticks	wing center section spars
1	1/8" x 1/4" x 36" basswood stick	wing center section rear top spar
Plywood		
1	1/64" 3-ply model aircraft grade birch plywood	strengthen rudder/elevator control horn mounting areas
1	1/32" 3-ply model aircraft grade birch plywood	various wing, fuselage, and motor nacelle parts
1	1/16" 3-ply model aircraft grade birch plywood	wing ESCs hatch cover
1	3/32" 5-ply model aircraft grade birch plywood	wing, firewall
1	1/4" 5-ply model aircraft grade birch plywood	wing mounting plates
1	3/8" 7-ply model aircraft grade birch plywood	wing mounting bolt block
Other Wood		
1	1/8" x 12" Hardwood Dowl	horizontal stab & motor nacelles mounting pins
Flight Control System		
1	Spektrum AR620 6-Channel RC Sport Receiver	2.4GHz DSMX receiver
4	Hitch HS-81 16.6g Nylon Gear Analog Micro Servo	rudder, elevator, and aileron servos
1	Safety Clip Servo Y-Harness with JR/Hitec Connectors, 22ga 12 inch	aileron servo leads
2	**TBD**" Servo Lead Extension	aileron servo leads
Electric Power System		
4	BadAss 2305-1050Kv Brushless Motors	
4	BadAss Rebel V2 Lite Series Brushless ESCs, 20A	
1	BadAss 45C 3,300mah 3S LiPo Battery	
2	APC 7x6E Propellers (Normal Rotation)	
2	APC 7x6E Pusher Propellers (Reverse Rotation)	
4	M5 x 0.8mm Thread Spinner Nuts	
1	XT60 Connector, Male	Wing Wiring Harness to LiPo Battery Connector
1	MR30 Connector Set, 4 Male	ESCs to Wing Wiring Harness Connectors

1	MR30 Connector Set, 4 Female	ESCs to Wing Wiring Harness Connectors
1	EC5-S Connector Set, 2 Male & 2 Female	ESCs to LiPo Battery Wiring Harness
1	Ultra-Flex Wire, 14-AWG Black, 3-Feet	ESCs to LiPo Battery Wiring Harness
1	Ultra-Flex Wire, 14-AWG Red, 3-Feet	ESCs to LiPo Battery Wiring Harness
2	Ultra-Flex Wire, 18-AWG Black, 10-Feet	ESCs to Brushless Motors Wiring Harnesss
1	Safety Clip Servo Y-Harness with JR/Hitec Connectors, 22ga 12 inch - ESC Control Lead (Throttle Channel) Extension Leads	
2	Safety Clip Servo Y-Harness with JR/Hitec Connectors, 22ga 6 inch - ESC Control Lead (Throttle Channel) Extension Leads	
2	LiPo Battery Straps, Small	

Miscellaneous Items

2	3" diameter & less than 1-1/2" wide ***light weight*** wheels - MLG wheels	
1	3/32" x 12" music wire	MLG axles
4	Du-Bro # 138 3/32" Wheel Collars	MLG axles
1	1/16" x 6" music wire	tailwheel wire
2	Du-Bro # 596 1/16" Wheel Collars	tailwheel assembly
1	Du-Bro # 125TW 1.25" Tailwheel	fuselage tailwheel
1	3/32" O.D. x 6" Tubing	tailwheel assembly
1	1/4" O.D. x 24" Aluminum Tubing	motor nacelle dummy exhaust pipes (air cooling vents)
2	Carbon tubes 1/4" diameter 24" long	horizontal & vertical stabilizers spars
1	Du-Bro # 142 1/4"-20 Nylon Wing Bolts (set of 4)	wing mounting bolts
1	Du-Bro #**TBD** Socket Head Bolts With Lock Nuts	motor cross brace to firewall mounting
12	Du-Bro #116 Standard Nylon Hinges	rudder, elevator, and aileron hinges
2	Du-Bro #237 T-style Nylon Control Horns (2 each)	rudder, elevator, and aileron rigging
2	Du-Bro #600 2-56 Spring Steel Kwik-Link Clevises	rudder, elevator, and aileron rigging
2	Du-Bro #855 E/Z Links	aileron rigging
7	12" 2-56 control rods, threaded one end	rudder, elevator, and aileron rigging
8	2-56 nuts	rudder, elevator, and aileron rigging
4	Small round magnets	battery hatch
1	Self adhesive velcro	battery mount & ESCs mounting
8	Servo mounting screws	attach motor nacelle cowls
1 roll	Double sided foam tape	attach control surface servos
1	**TBD**" x **TBD**" Clear Plastic Sheet	fuselage windows
3 rolls	Ultracoat covering	
1 bottle	Titebond Ultimate III wood glue	
1 set	15-minute epoxy	

Building the Modified Wing

So, with all that said, let us get started with our Bee Liner multi-motor RC model scratch build. The first thing I do with all my builds is to print out the plans on my Canon printer using the "poster" settings for a full-size plan. Then I take all those pages and put them together to get all three full-size plan sheets for the Bee Liner. You can also have your plans printed out at any Staples or FedEx Stores, which will run you approximately $30.

Builders Notes – 1) The Bee Liner plan sheets contain templates for all the various pieces that will need to be cut out, so you may want to crop those areas from the plan sheet using your favorite PDF editor and then use a thicker stock paper (80#) when printing versus standard printer paper. 2) I want to modify the wing to use a bolt-on mount versus the rubber bands shown on the plan. I also need to build an ESCs bay in the wing center section with a hatch on the wing upper surface. So, I make the required changes to the wing structure on the Bee Liner wing plan sheet. You can do this by drawing directly on the plans with pencil and ruler, or you can take the wing PDF plan sheet (sheet 3 of 3) and generate an SGV (Scalable Vector Graphics) file which can then be modified using your favorite CAD program. I will use the latter method with my "Back To The Drawing Board" 2-CAD program (https://drawingboardapp.com/). You can see these changes in Figures 5 and 6 below.

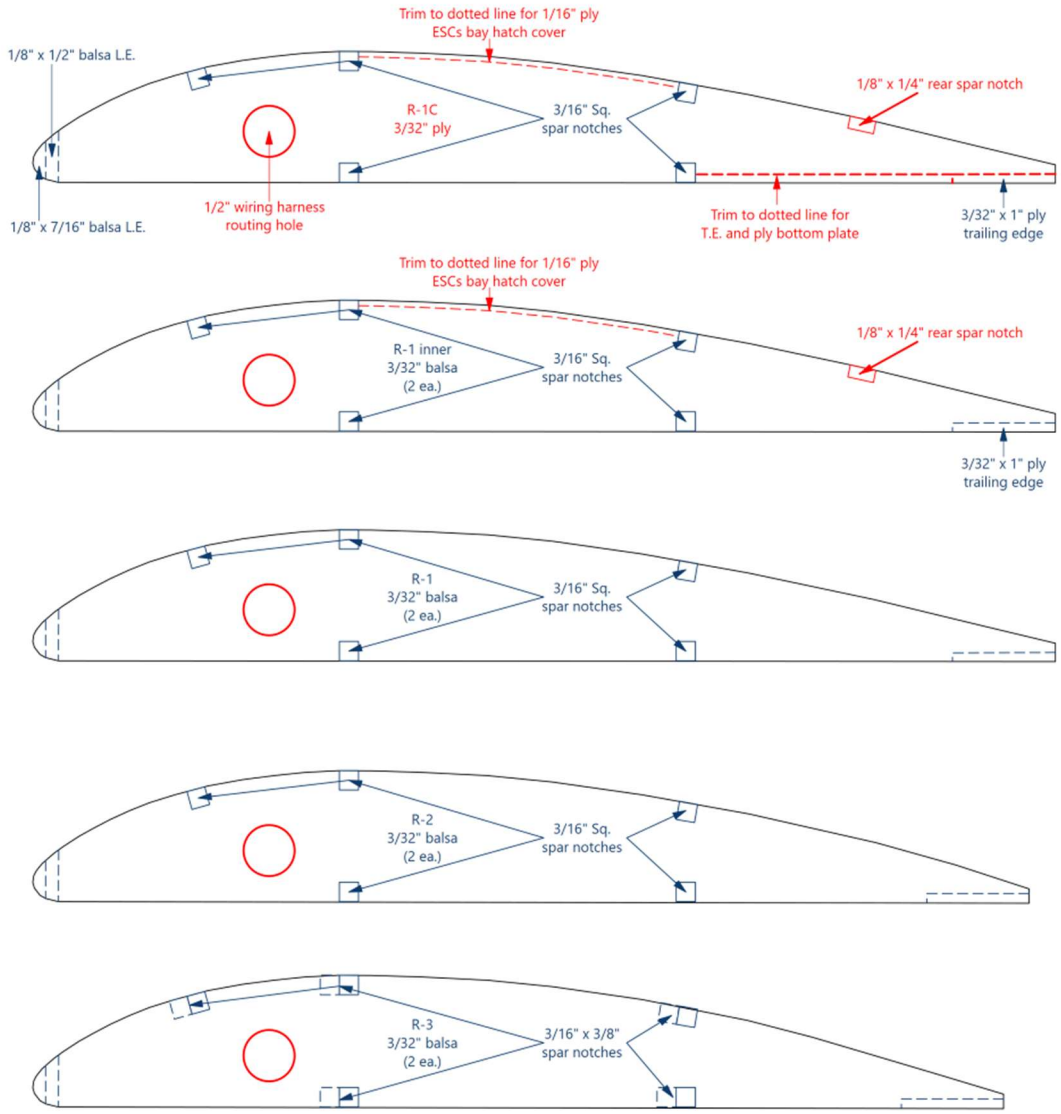


Figure 5 - Modified Bee Liner Wing Rib Profiles

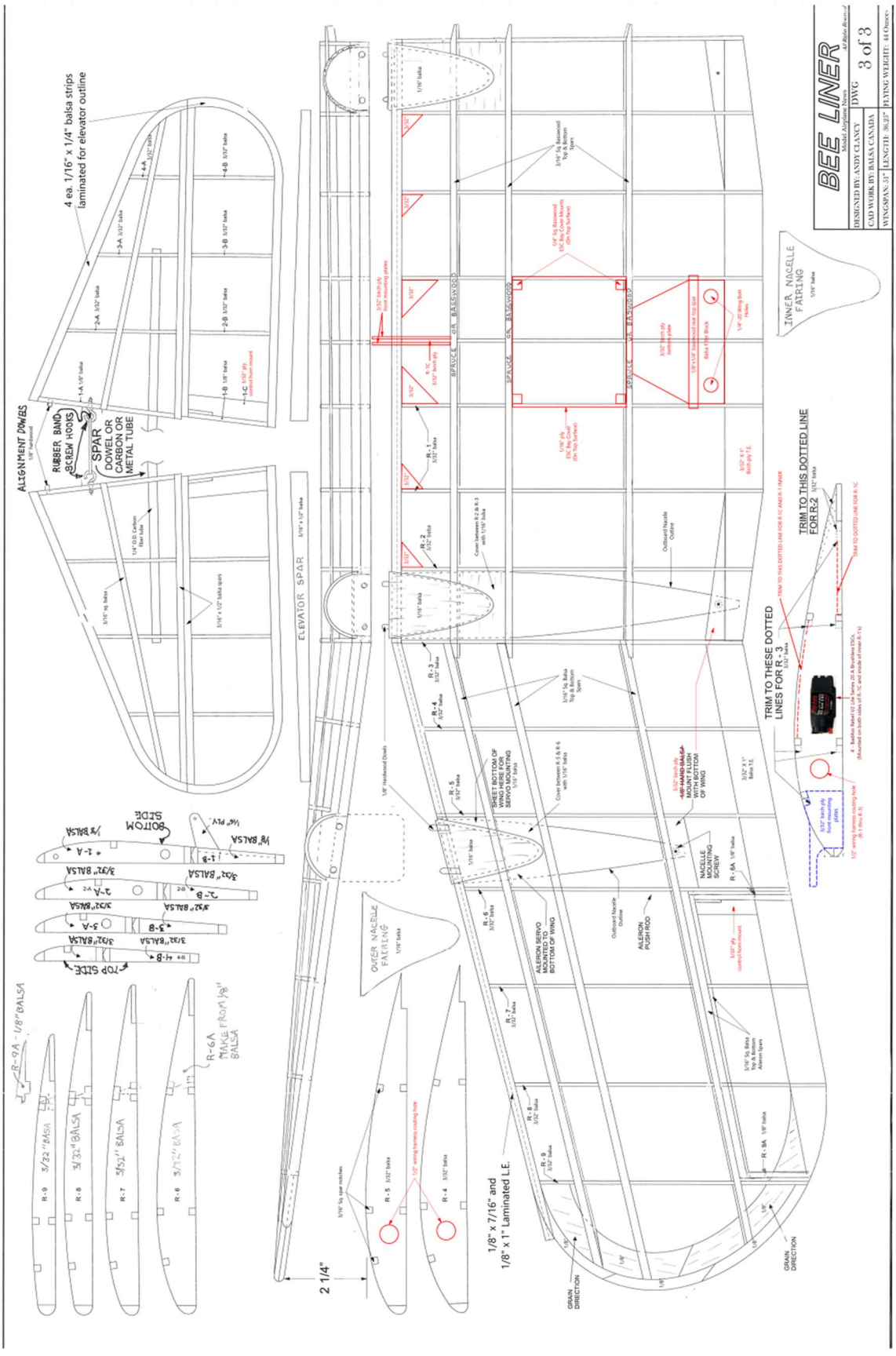
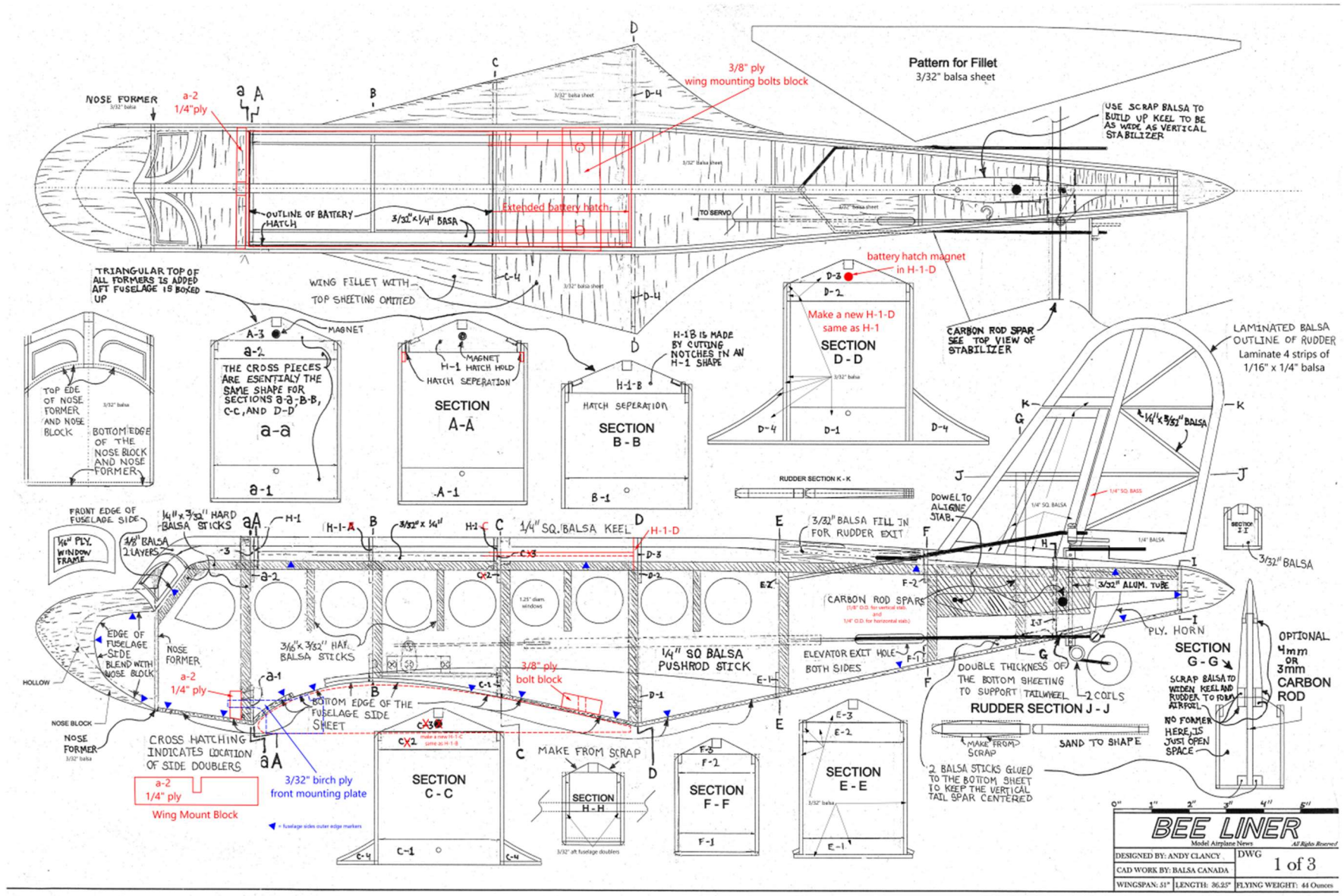


Figure 6 - Modified Bee Liner Wing Drawing

Each of the three wing panels are built separately, flat over the plan, starting with the two outer wing panels. The ailerons are built as integral parts of the outer wing panels and cut-away only after the completed wing has been sanded to shape. Shim up the trailing edge of each wing tip 3/16" at R-9 to build in a little wash-out. The lower spars **in the outer panels** are not installed until after all three panels have been built and joined together.

Building the Modified Fuselage

The modifications for a bolt-on wing also drive some changes to the Bee Liner fuselage structure. Additionally, by placing the ESCs in the center wing section and routing the power harness up through the top of the wing to connect to the LiPo battery in the fuselage, I need to move the elevator and rudder servos further aft in the fuselage. This requires that I make the fuselage battery hatch longer so I can access the servos. Using the same method as I used on the wing plan, the required fuselage modifications were made to the fuselage plan (sheet 1 of 3). You can see the changes in Figure **TBD** below.


Pattern for Fillet
3/32" balsa sheet
NOSE FORMER
a-2
1/4"ply
3/8" ply
wing mounting bolts block
USE SCRAP BALSA TO BUILD UP KEEL TO BE AS WIDE AS VERTICAL STABILIZER
OUTLINE OF BATTERY HATCH
3/32"x1/4" BASA
Extended battery hatch
TO SERVO
battery hatch magnet in H-1-D
TRIANGULAR TOP OF ALL FORMERS IS ADDED AFT FUSELAGE IS BOXED UP
WING FILLET WITH TOP SHEETING OMITTED
Make a new H-1-D same as H-1
SECTION D - D
CARBON ROD SPAR SEE TOP VIEW OF STABILIZER
LAMINATED BALSA OUTLINE OF RUDDER
Laminate 4 strips of 1/16" x 1/4" balsa
TOP EDE OF NOSE FORMER AND NOSE BLOCK
BOTTOM EDGE OF THE NOSE BLOCK AND NOSE FORMER
MAGNET
THE CROSS PIECES ARE ESENTIALY THE SAME SHAPE FOR SECTIONS a-a-B-B, C-C, AND D-D
a-a
a-1
MAGNET
H-1 HATCH HOLD
HATCH SEPERATION
SECTION A-A
A-1
H-1-B IS MADE BY CUTING NOTCHES IN AN H-1 SHAPE
HATCH SEPERATION
SECTION B - B
B-1
RUDDER SECTION K - K
FRONT EDGE OF FUSELAGE SIDE
1/16" PLY. WINDOW FRAME
1/8" BALSA 2 LAYERS
1/4" x 3/32" HARD BALSA STICKS
H-1
H-1-A
3/32" x 1/4"
H-1-C
1/4" SQ. BALSA KEEL
H-1-D
3/32" BALSA FILL IN FOR RUDDER EXIT
DOWEL TO ALIGNE STAB.
1/4" SQ. BASS
1/4" BALSA
3/32" BALSA
3/32" ALUM. TUBE
PLY. HORN
CARBON ROD SPARS
ELEVATOR EXIT HOLE BOTH SIDES
1/4" SQ BALSA PUSHROD STICK
3/16" x 3/32" HARD BALSA STICKS
3/8" ply bolt block
EDGE OF FUSELAGE SIDE BLEND WITH NOSE BLOCK
NOSE FORMER
a-2
1/4" ply
HOLLOW
NOSE BLOCK
NOSE FORMER
BOTTOM EDGE OF THE FUSELAGE SIDE SHEET
CROSS HATCHING INDICATES LOCATION OF SIDE DOUBLERS
a-2
1/4" ply
Wing Mount Block
3/32" birch ply front mounting plate
SECTION C - C
C-1
MAKE FROM SCRAP
SECTION H - H
SECTION F - F
F-1
SECTION E - E
E-1
DOUBLE THICKNESS OF THE BOTTOM SHEETING TO SUPPORT TAILWHEEL
2 COILS
RUDDER SECTION J - J
MAKE FROM SCRAP
SAND TO SHAPE
2 BALSA STICKS GLUED TO THE BOTTOM SHEET TO KEEP THE VERTICAL TAIL SPAR CENTERED
SECTION G - G
SCRAP BALSA TO WIDEN KEEL AND RUDDER TO FORM AIRFOIL
NO FORMER HERE, IS JUST OPEN SPACE
OPTIONAL 4mm OR 3mm CARBON ROD
BEE LINER
Model Airplane News
All Rights Reserved
DESIGNED BY: ANDY CLANCY
CAD WORK BY: BALSA CANADA
DWG
1 of 3
WINGSPAN: 51"
LENGTH: 36.25"
FLYING WEIGHT: 44 Ounces

Don’t forget, all the images in this build description are available for you to view in greater detail and larger size on my website @: https://balsaandglass.com/Balsa_Photos.html#Bee_Liner.