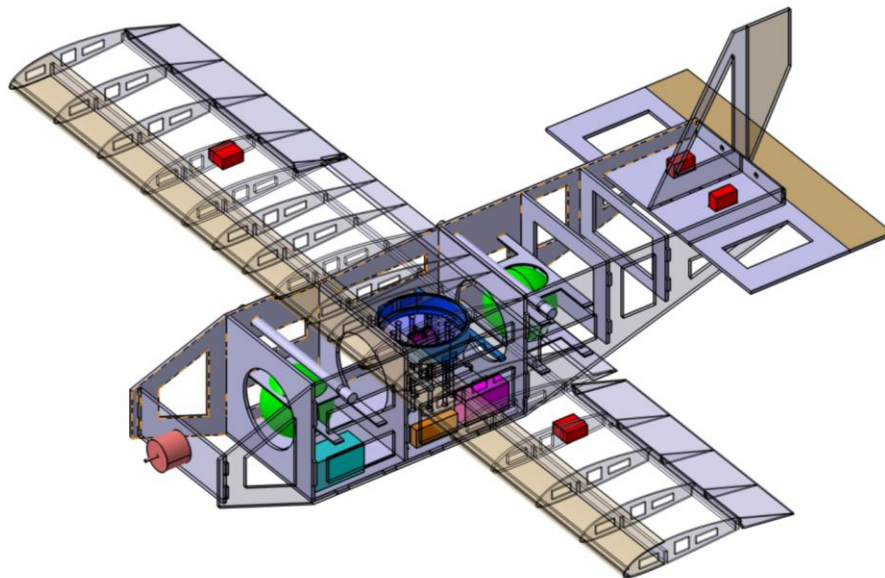




The WSU AE / Boeing
BRONZE PROPELLER COMPETITION
2018

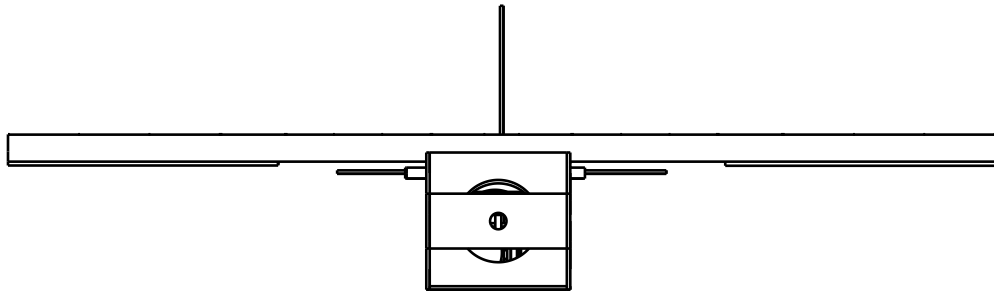


Detailed Design Report (DDR)

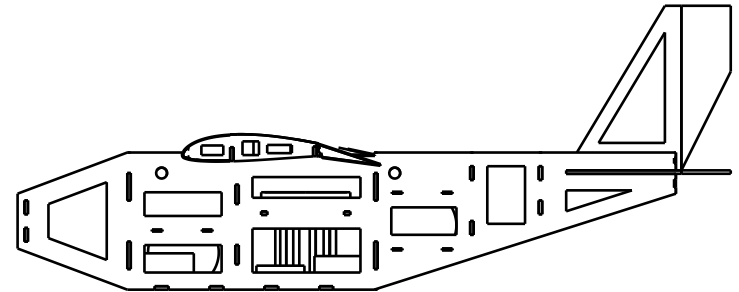
Team Tri Spectra

Team Members:

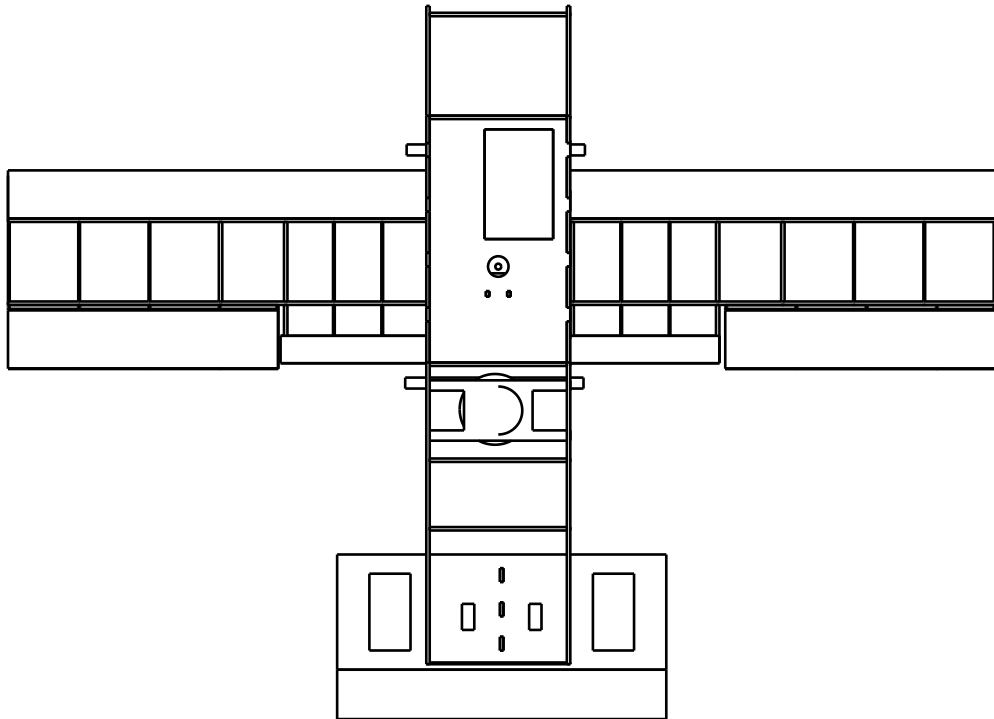
1. Abdullah Sifat
2. Patrick Dinh
3. Anwar S. Jihan



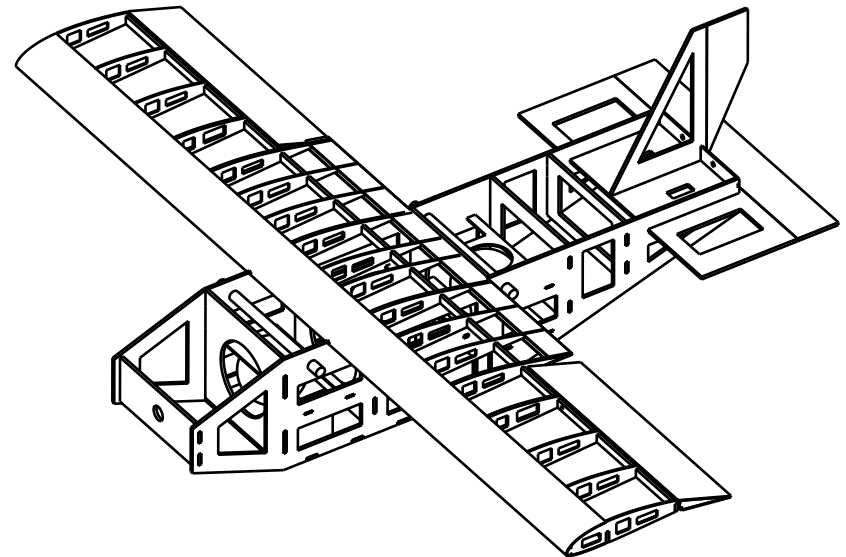
Front view
Scale: 1:7



Left view
Scale: 1:7



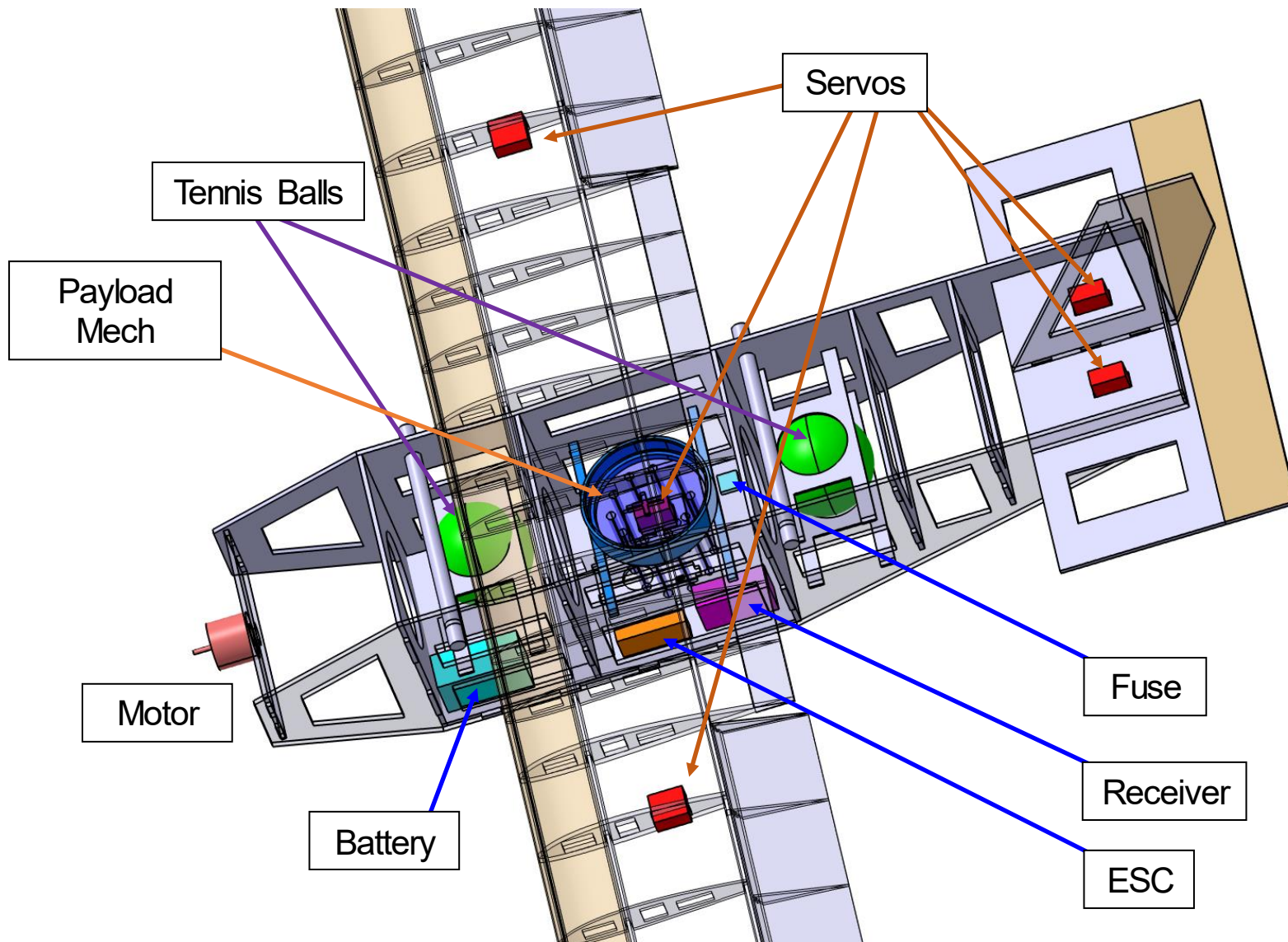
Top view
Scale: 1:7

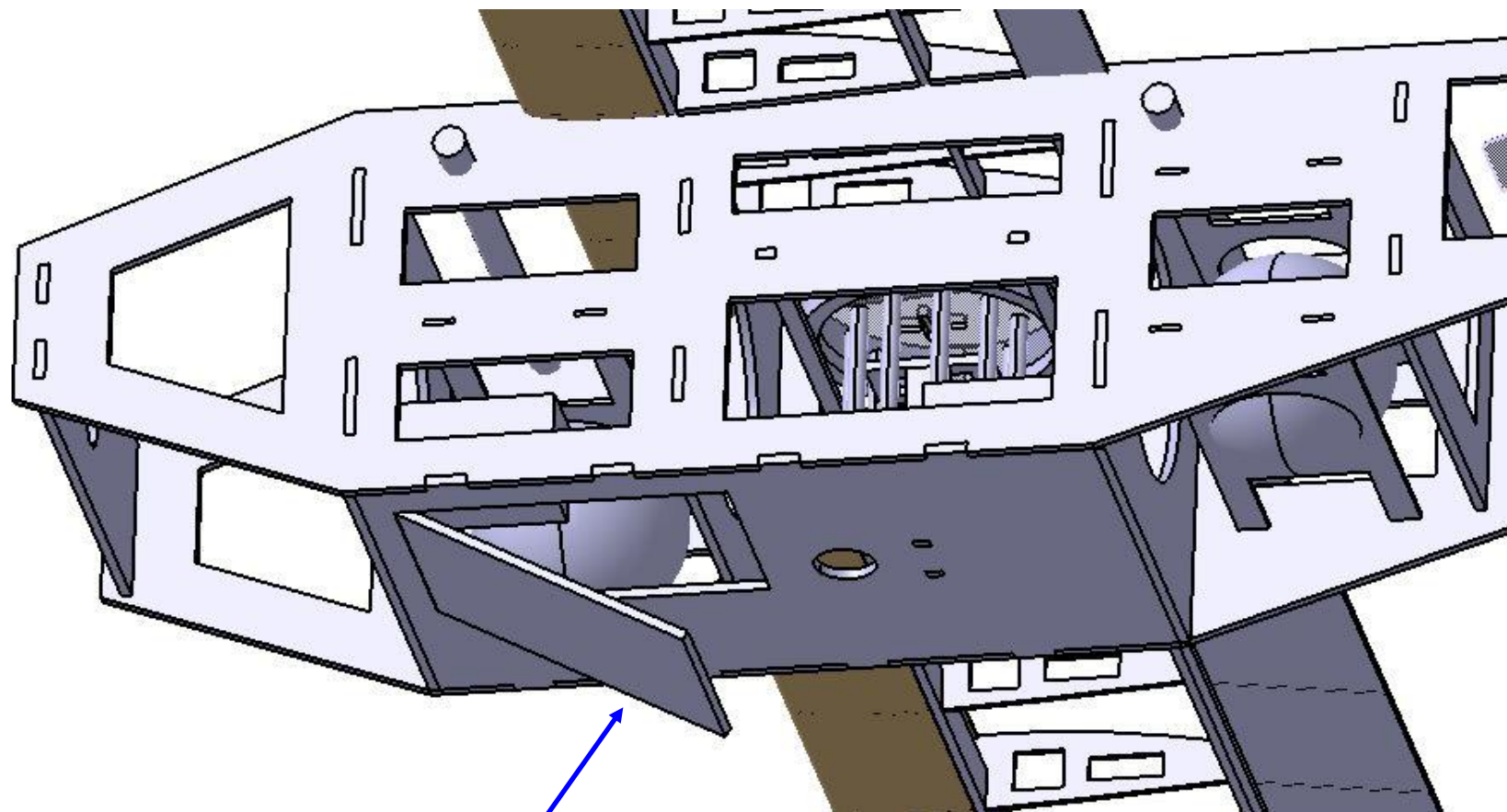


Isometric view
Scale: 1:7

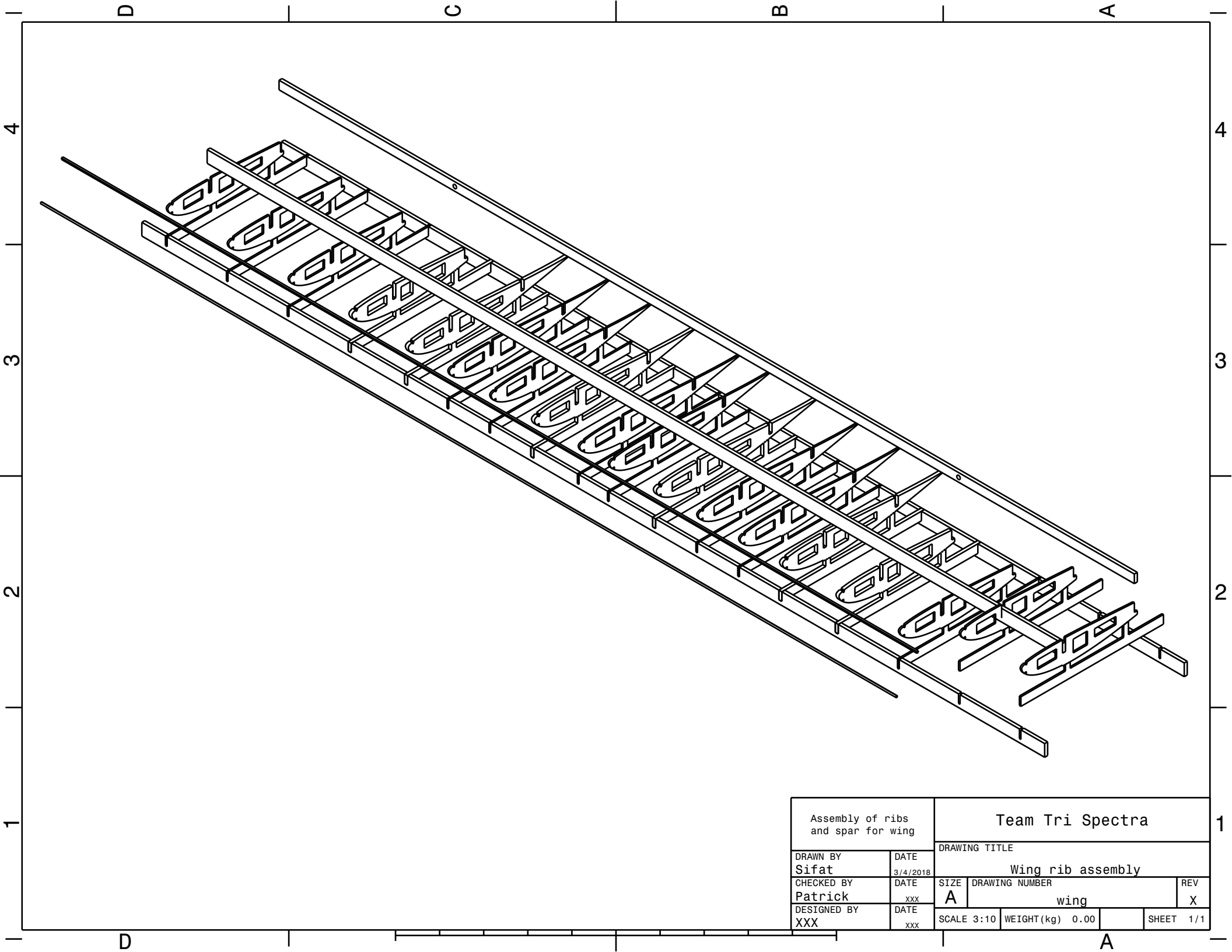
3-view and isometric view of the airplane		Team Tri Spectra			
DRAWN BY Patrick		DATE 3/3/2018		DRAWING TITLE 3 view and iso	
CHECKED BY Sifat		DATE xxx		SIZE A	DRAWING NUMBER xxx
DESIGNED BY XXX		DATE xxx		SCALE 1:7	WEIGHT(kg) xxx
				SHEET 1/1	REV X

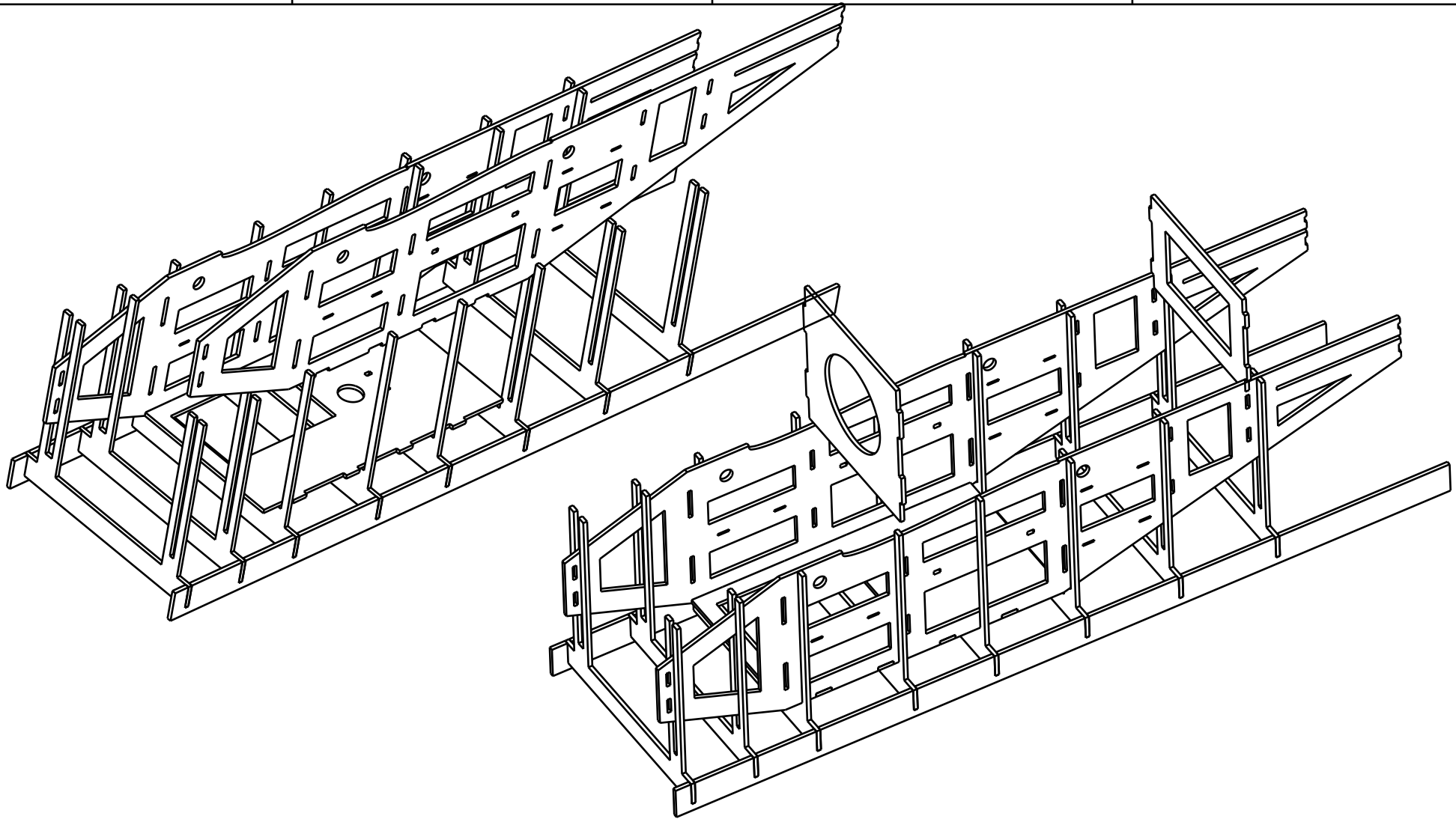
Layout drawing



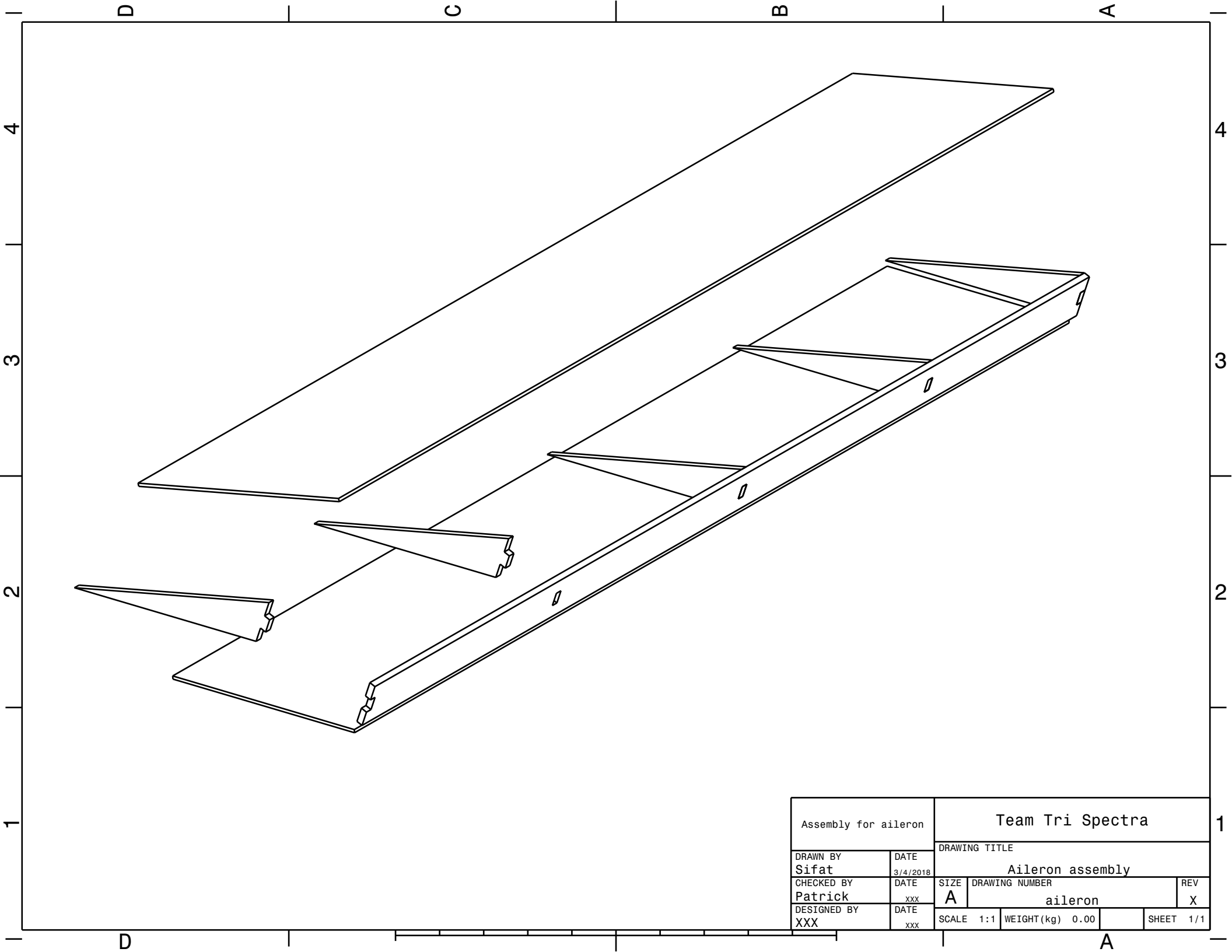


Access door

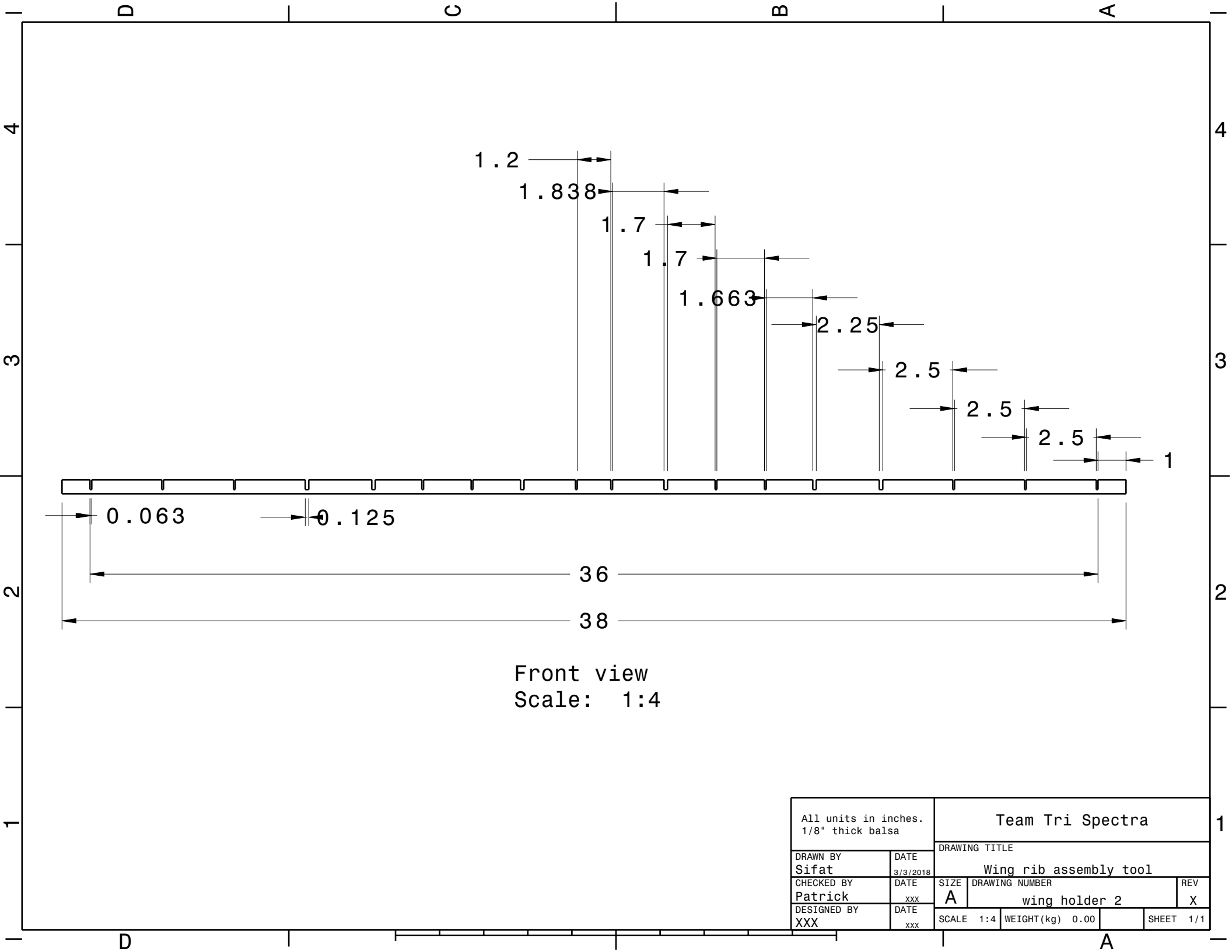


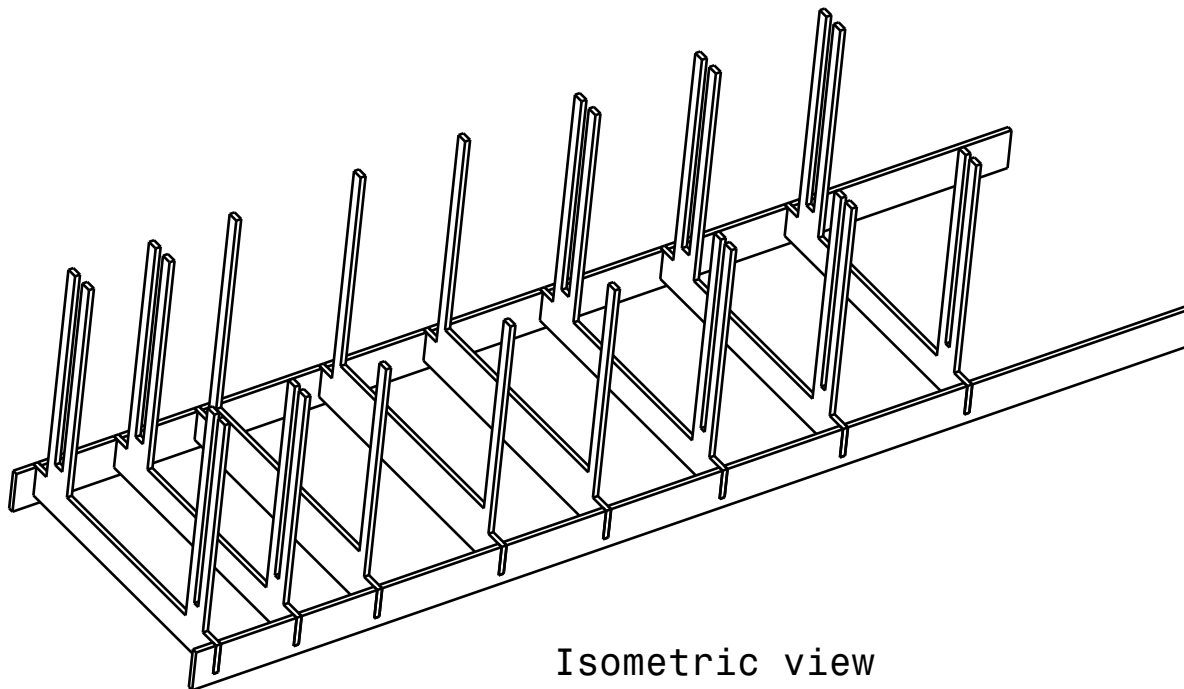
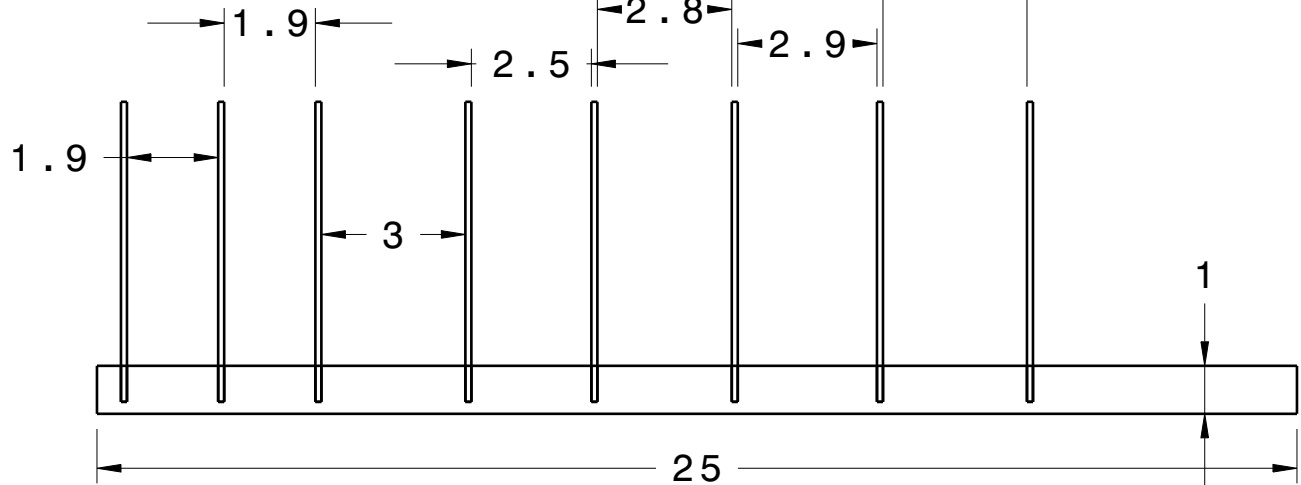
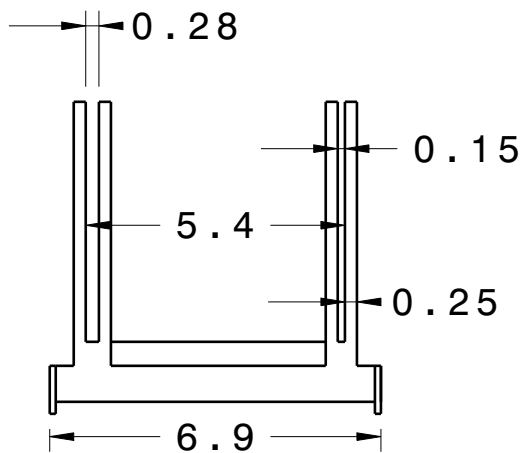


Fuselage components being inserted into the tool.		Team Tri Spectra			
DRAWN BY Sifat		DRAWING TITLE Fuselage assembly process			
CHECKED BY Patrick	DATE xxx	SIZE A	DRAWING NUMBER Product1		REV X
DESIGNED BY XXX	DATE xxx	SCALE 1:4	WEIGHT(kg) 0.00	SHEET 1/1	

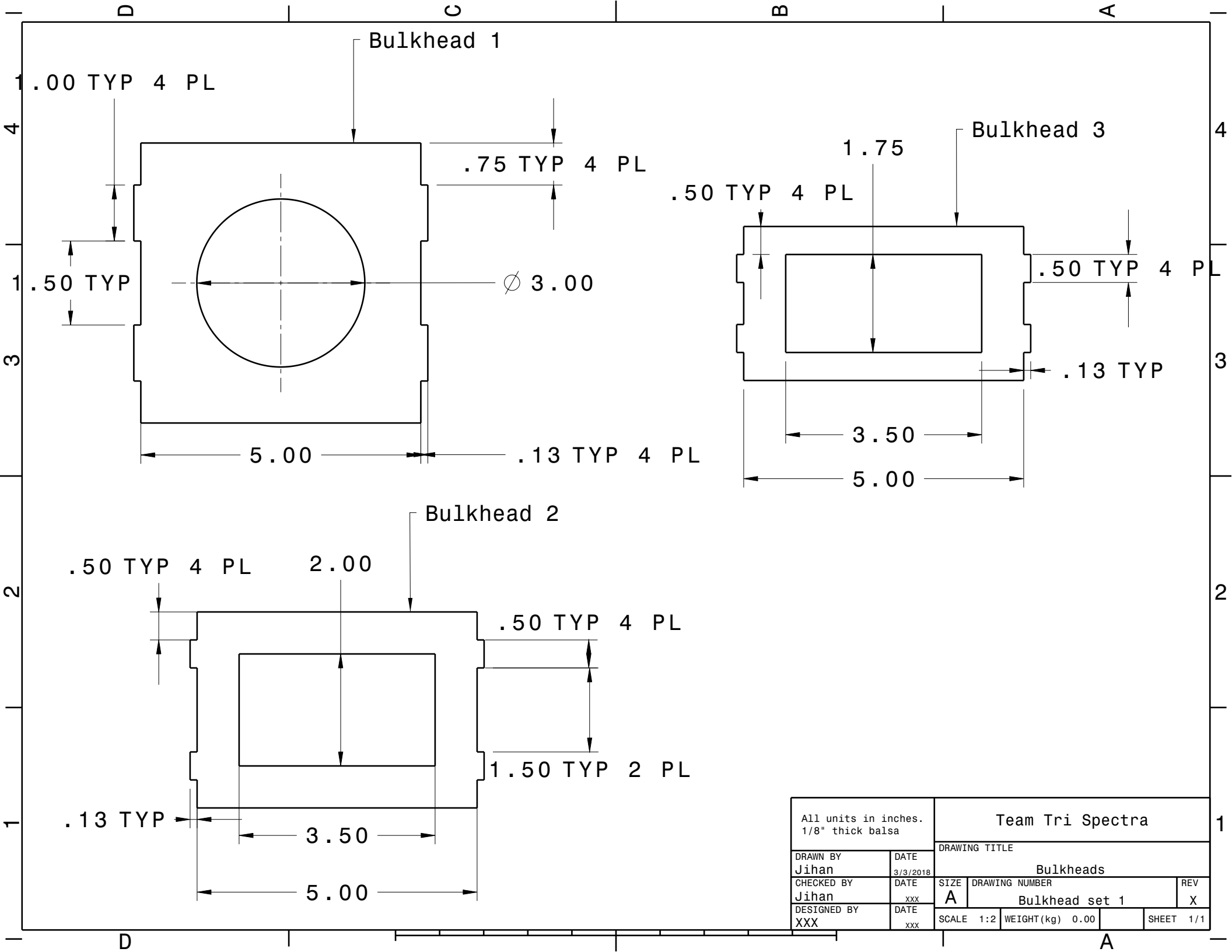


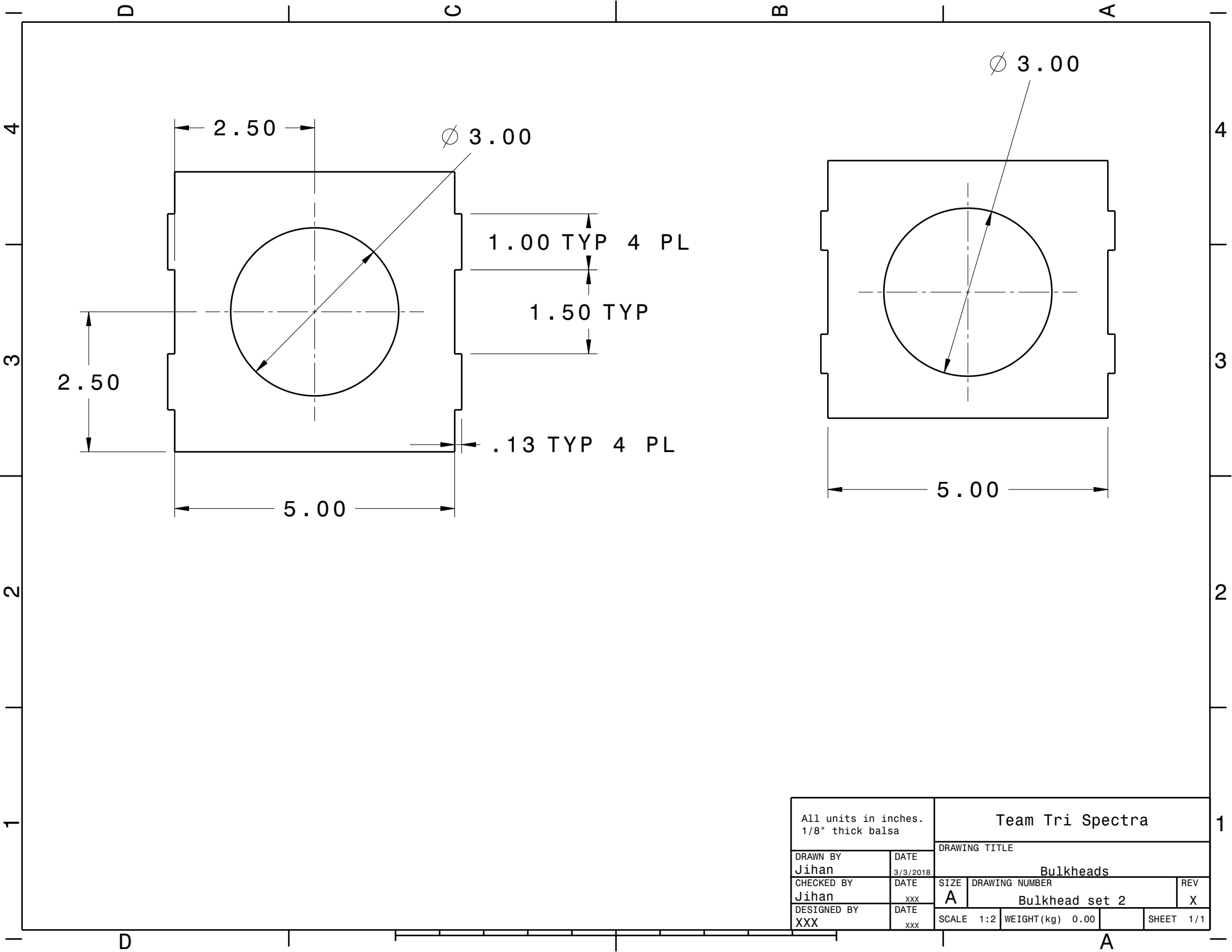
Assembly for aileron		Team Tri Spectra			
DRAWN BY Sifat		DATE 3/4/2018		DRAWING TITLE Aileron assembly	
CHECKED BY Patrick		DATE xxx		SIZE A	DRAWING NUMBER aileron
DESIGNED BY XXX		DATE xxx		SCALE 1:1	WEIGHT(kg) 0.00
				SHEET 1/1	REV X



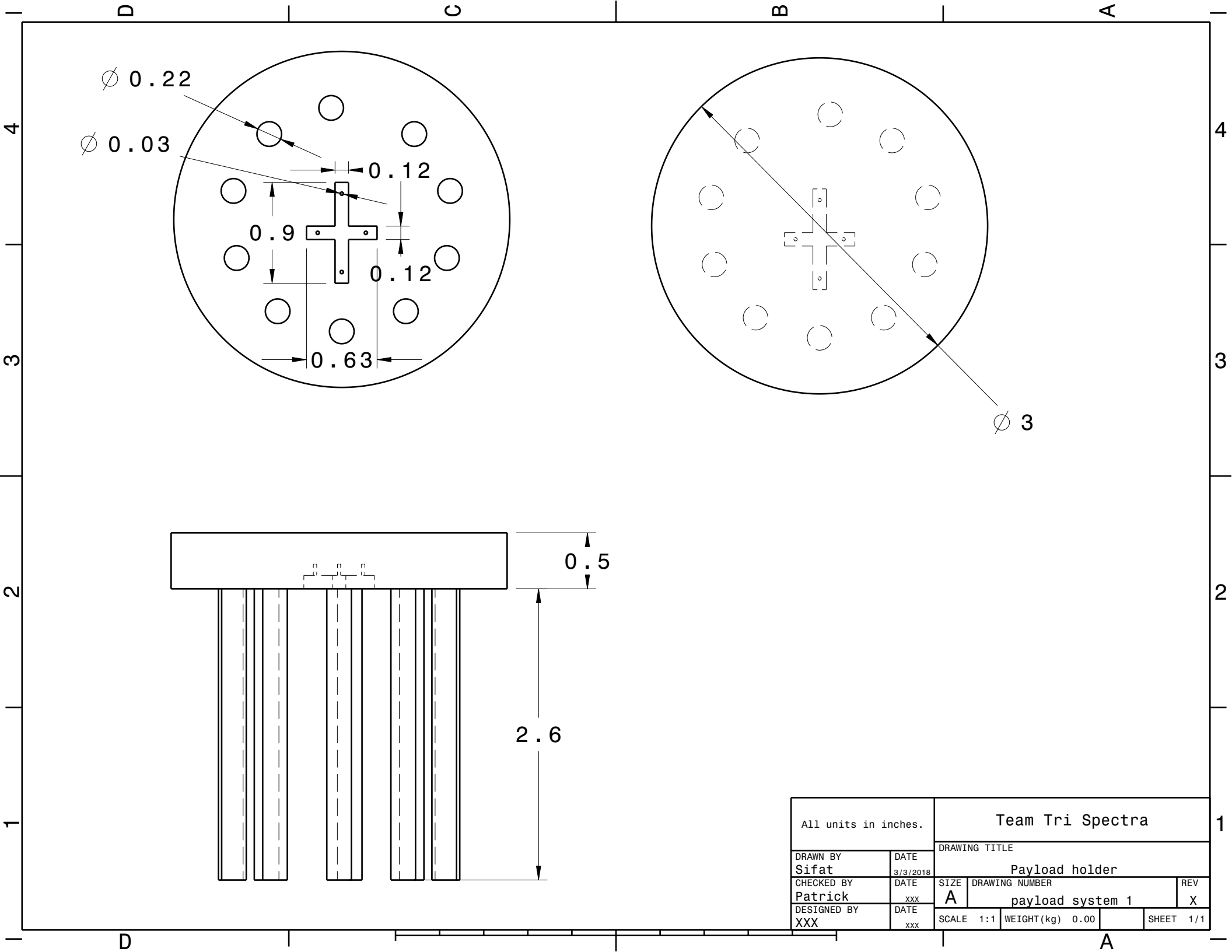


All units in inches.		Team Tri Spectra			
DRAWN BY Sifat		DRAWING TITLE Fuselage tooling			
CHECKED BY Patrick		DATE 3/3/2018	SIZE A		REV X
DESIGNED BY XXX		DATE xxx	SCALE 1:4		WEIGHT(kg) 0.00
			SHEET 1/1		

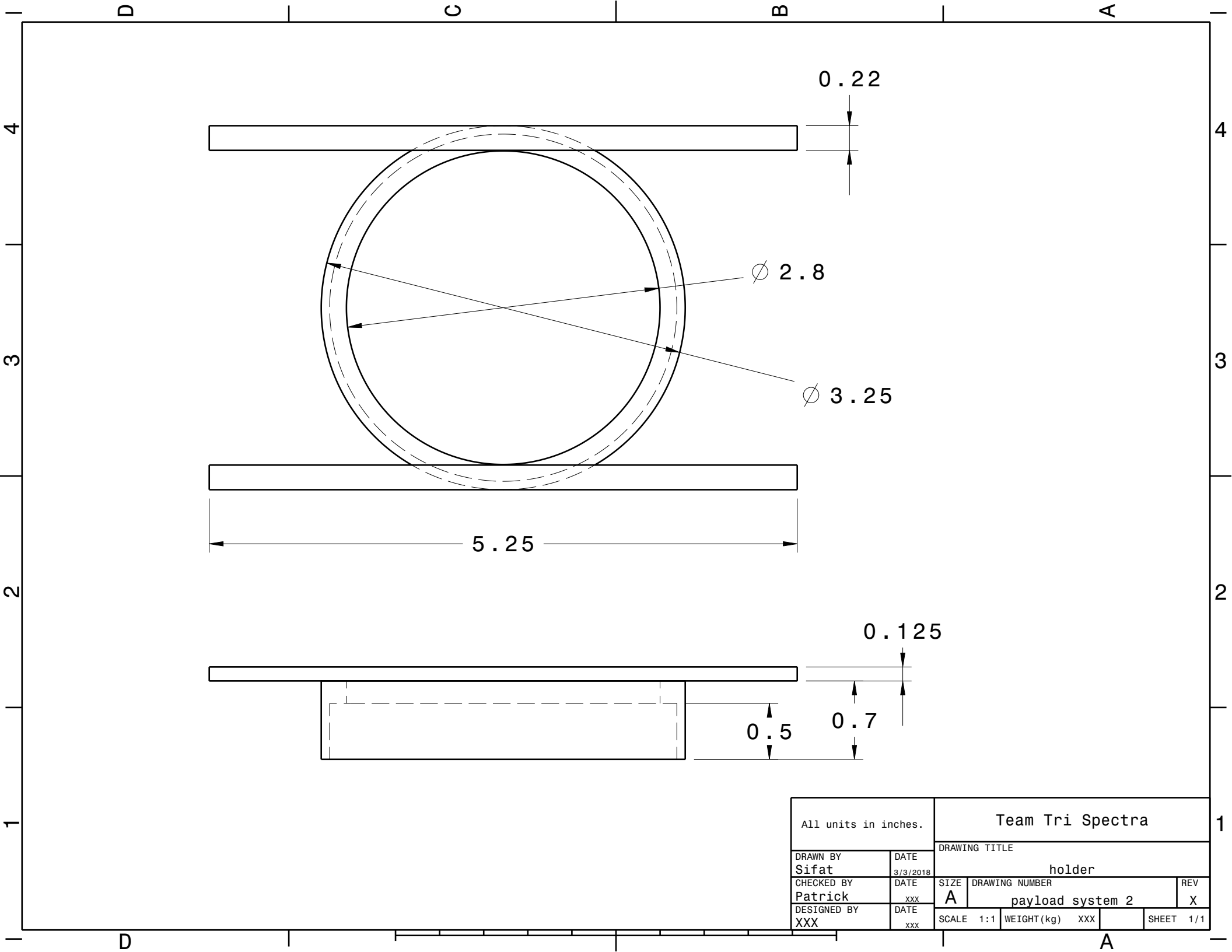


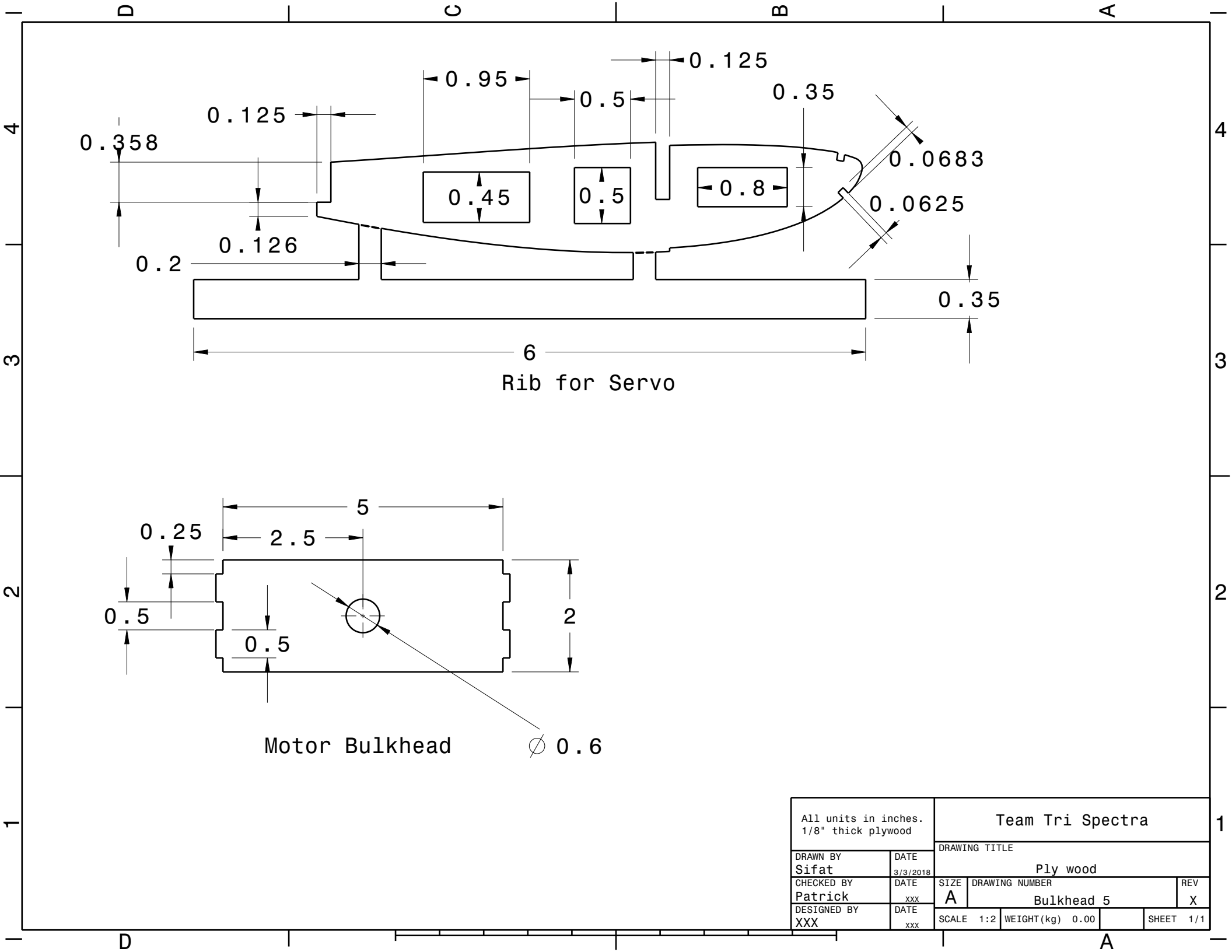


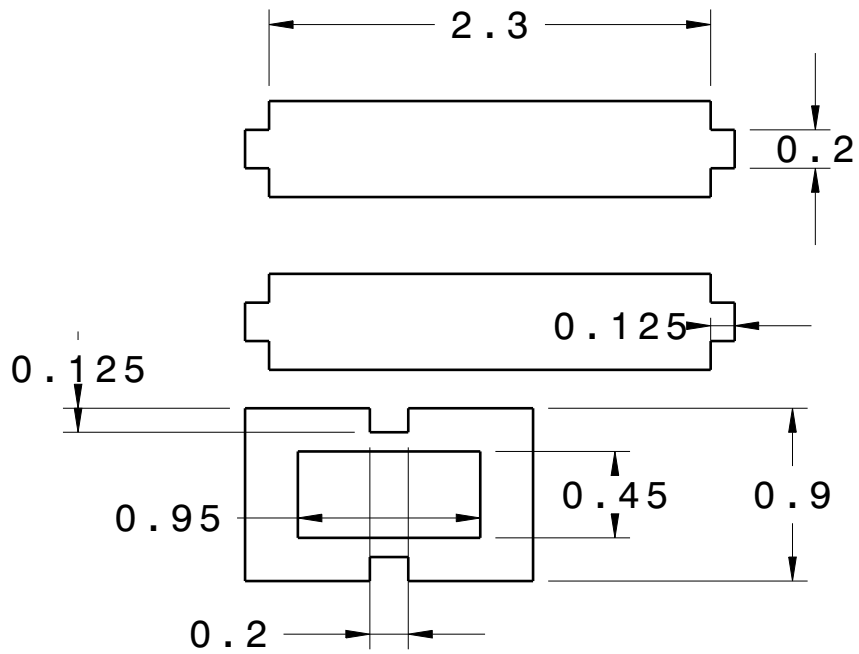
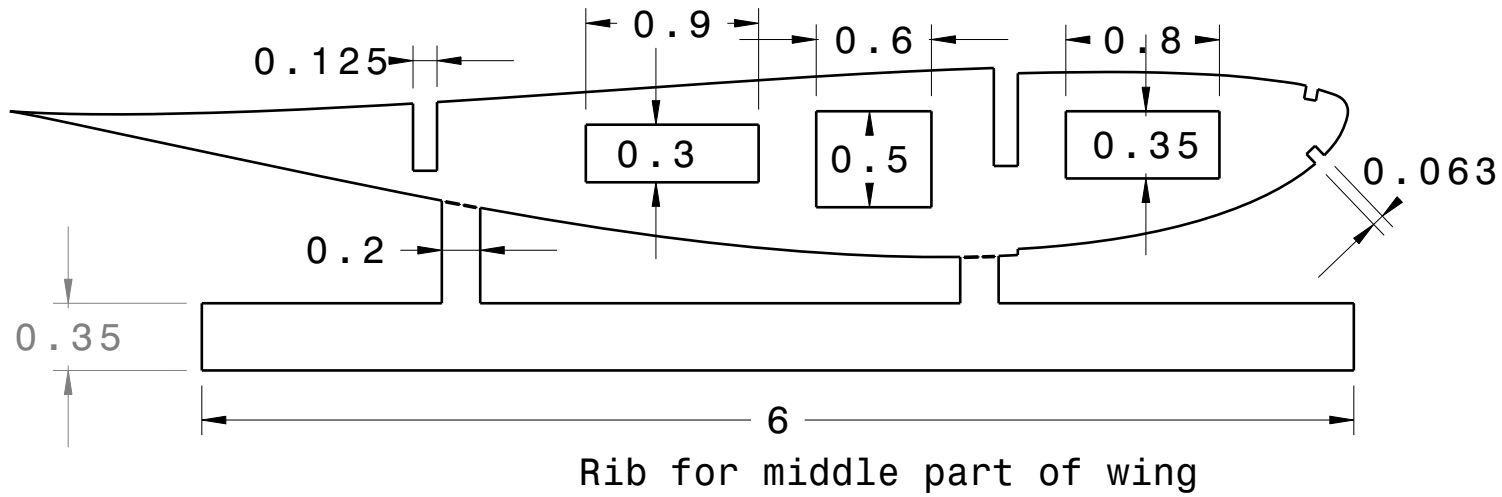
All units in inches. 1/8" thick balsa		Team Tri Spectra			
DRAWN BY Jihan		DATE 3/3/2018		DRAWING TITLE Bulkheads	
CHECKED BY Jihan		DATE xxx		SIZE A	DRAWING NUMBER Bulkhead set 2
DESIGNED BY XXX		DATE xxx		SCALE 1:2	WEIGHT(kg) 0.00
				SHEET 1/1	REV X



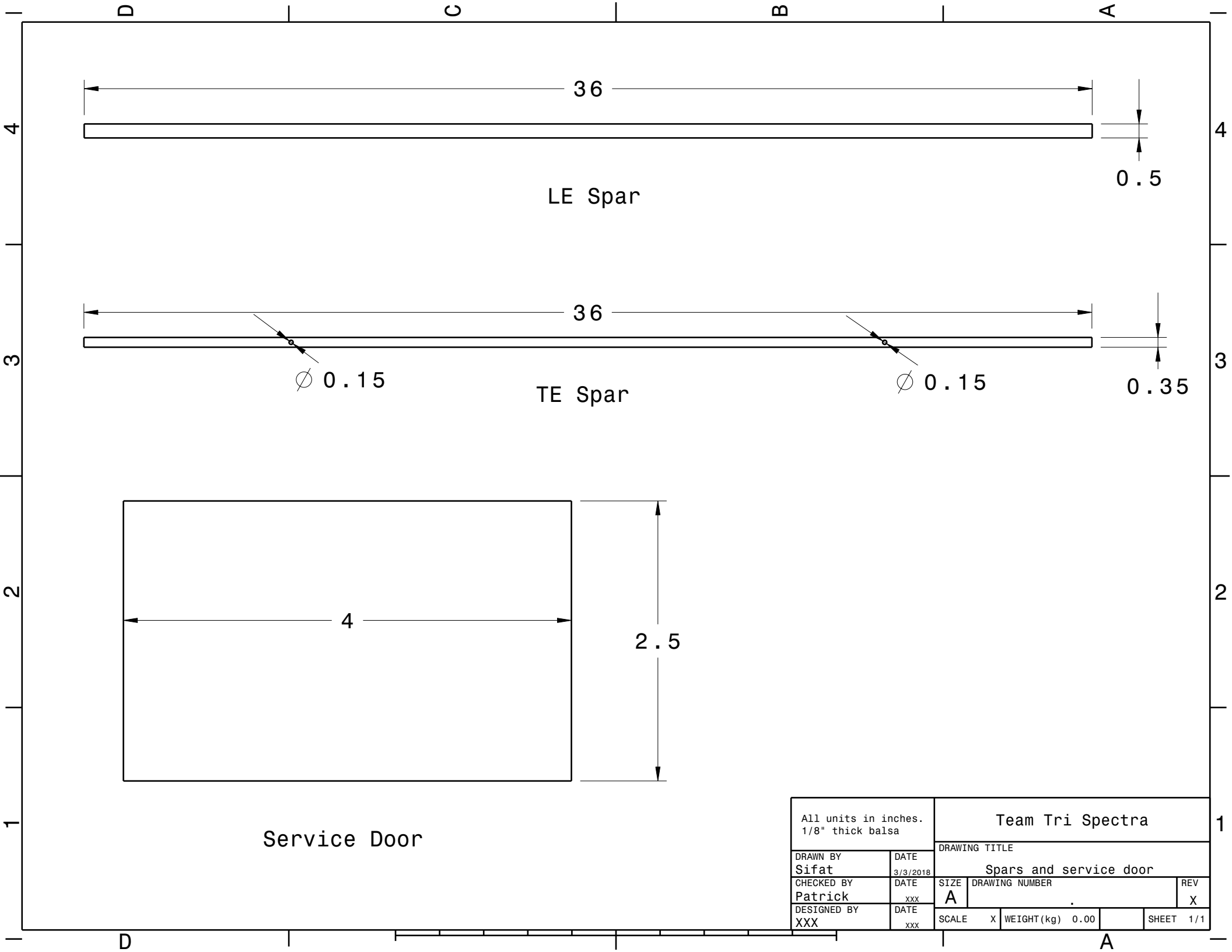
All units in inches.		Team Tri Spectra			
DRAWN BY		DRAWING TITLE			
Sifat		Payload holder			
CHECKED BY		DATE	SIZE	DRAWING NUMBER	REV
Patrick		xxx	A	payload system 1	X
DESIGNED BY		DATE	SCALE	WEIGHT (kg)	SHEET
XXX		xxx	1:1	0.00	1/1

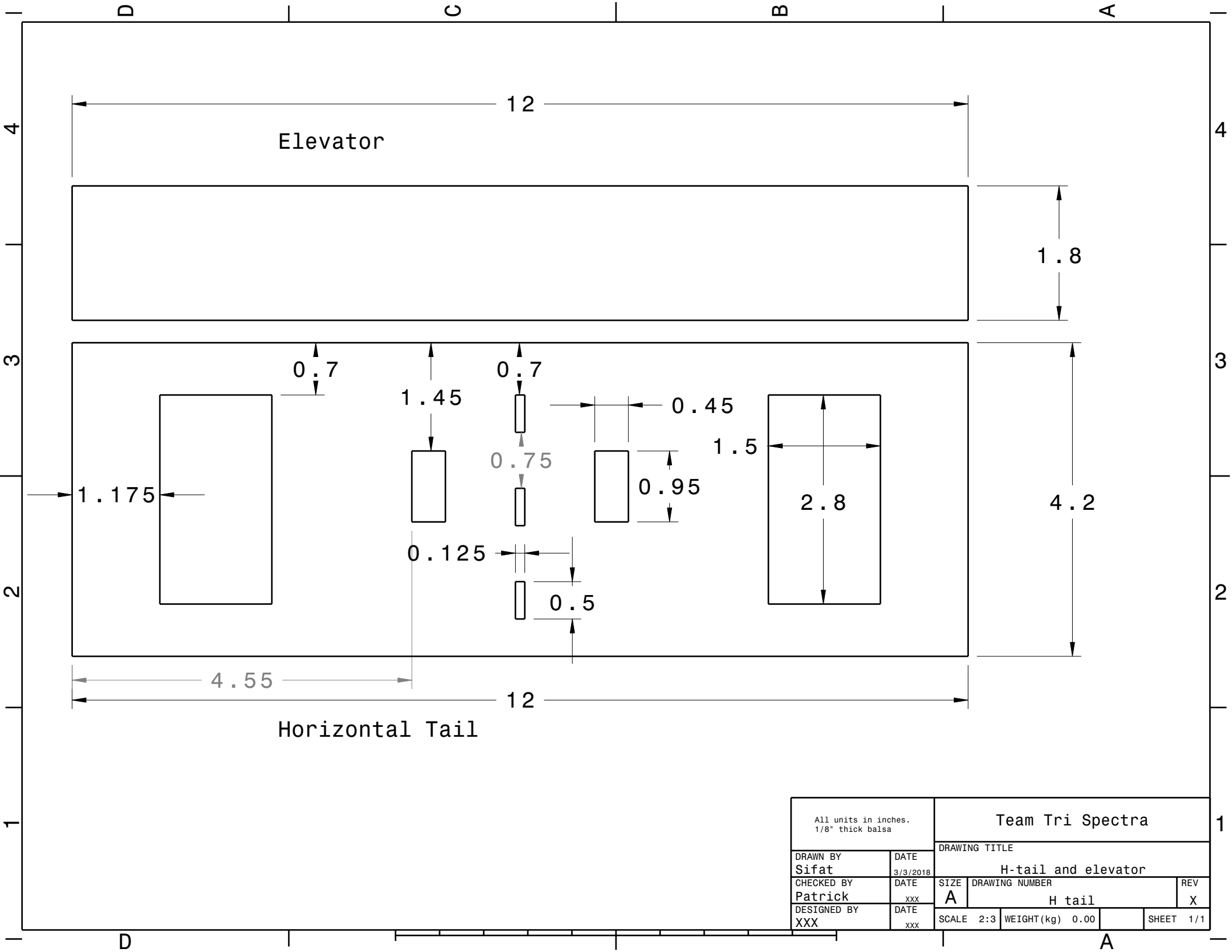




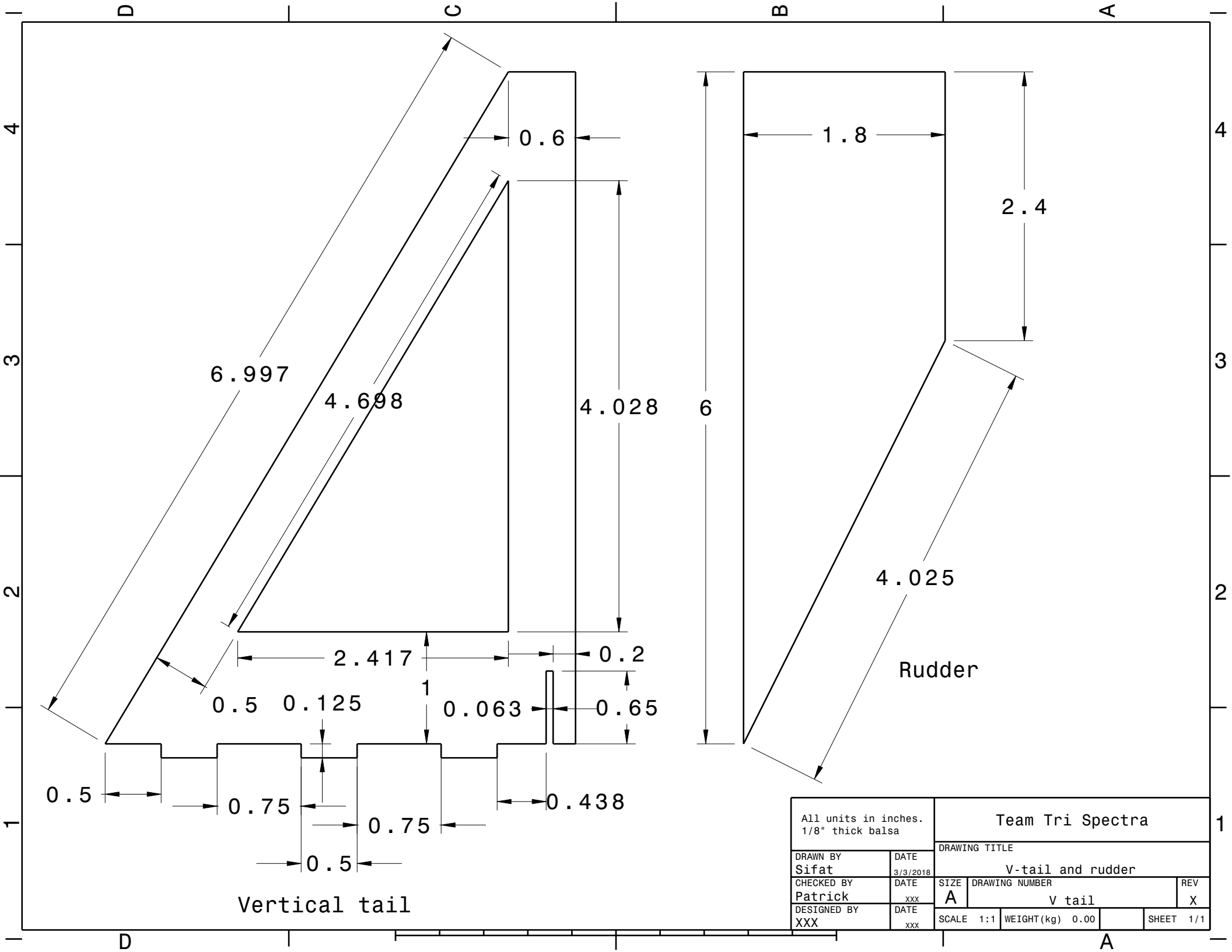


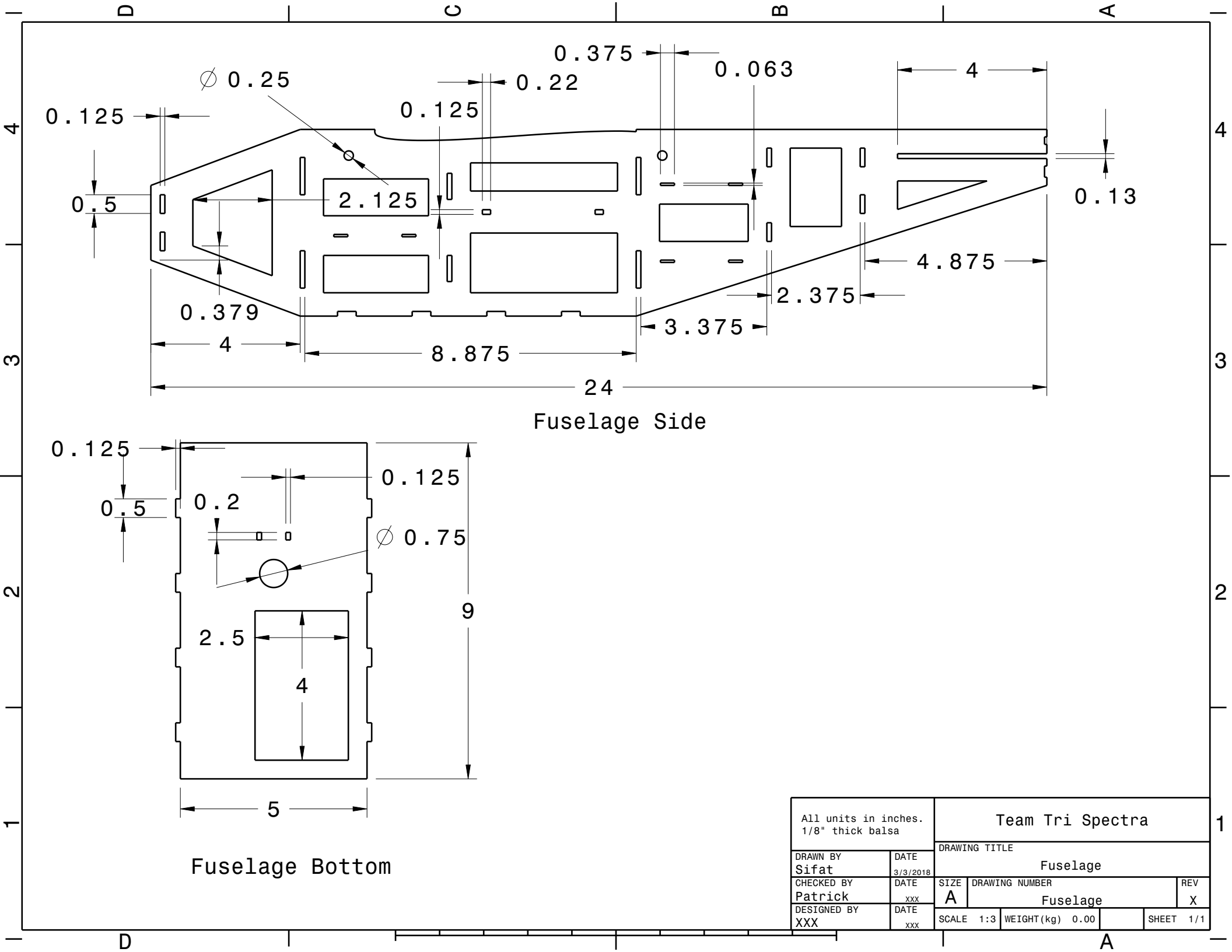
All units in inches. 1/8" thick balsa		Team Tri Spectra			
DRAWN BY Sifat	DATE 3/3/2018	DRAWING TITLE			
CHECKED BY Patrick	DATE xxx	SIZE A	DRAWING NUMBER .		REV X
DESIGNED BY XXX	DATE xxx	SCALE 1:1	WEIGHT(kg) 0.00	SHEET 1/1	



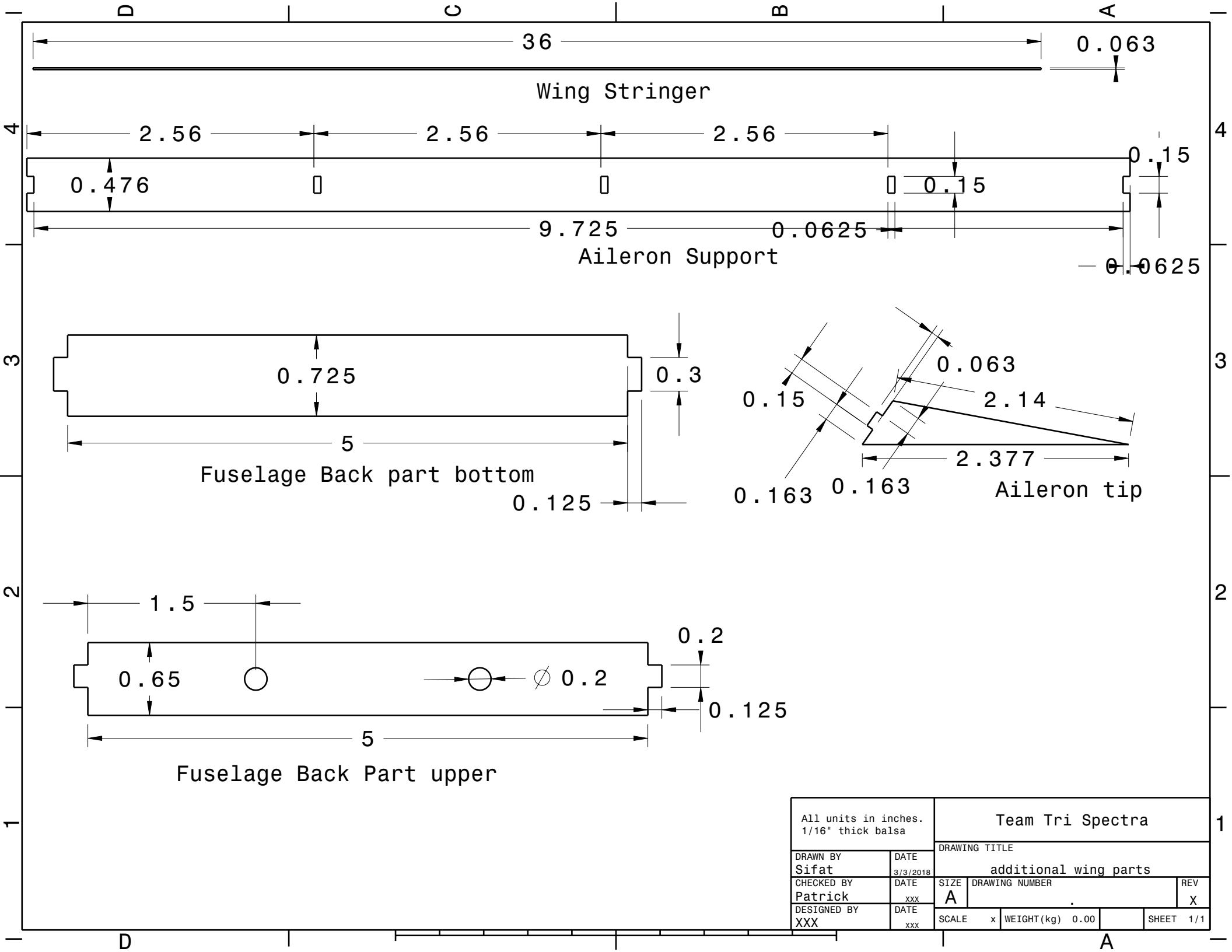


All units in inches. 1/8" thick balsa		Team Tri Spectra			
DRAWN BY Sifat		DATE 3/3/2018		DRAWING TITLE H-tail and elevator	
CHECKED BY Patrick		DATE xxx		SIZE A	DRAWING NUMBER H tail
DESIGNED BY XXX		DATE xxx		SCALE 2:3	WEIGHT(kg) 0.00
				SHEET 1/1	REV X

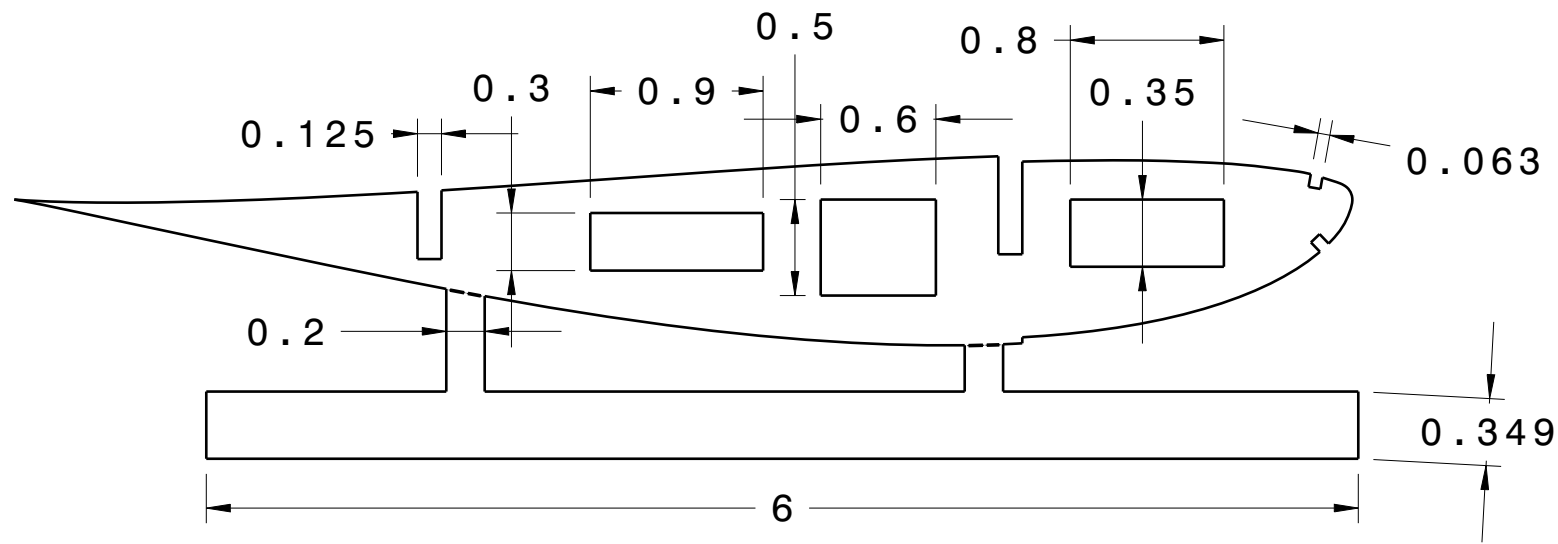




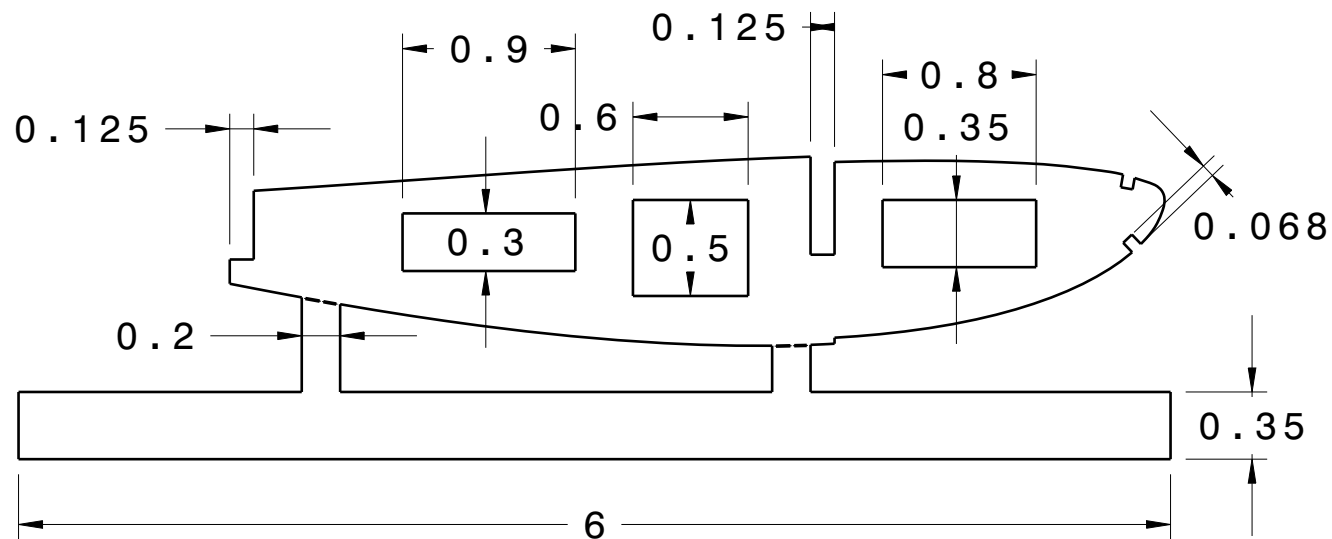
All units in inches. 1/8" thick balsa		Team Tri Spectra			
DRAWN BY Sifat		DATE 3/3/2018		DRAWING TITLE Fuselage	
CHECKED BY Patrick		DATE xxx		SIZE A	DRAWING NUMBER Fuselage
DESIGNED BY XXX		DATE xxx		SCALE 1:3	WEIGHT(kg) 0.00
				SHEET 1/1	



All units in inches. 1/16" thick balsa		Team Tri Spectra				
DRAWN BY Sifat		DATE 3/3/2018	DRAWING TITLE additional wing parts			
CHECKED BY Patrick		DATE xxx	SIZE A	DRAWING NUMBER .		REV X
DESIGNED BY XXX		DATE xxx	SCALE x	WEIGHT (kg) 0.00		SHEET 1/1

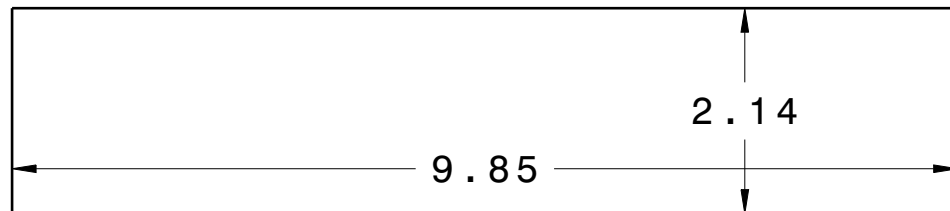


Rib with tool Middle

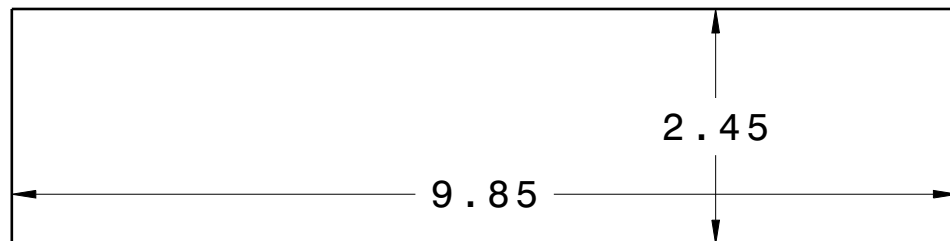


Rib with tool Aileron

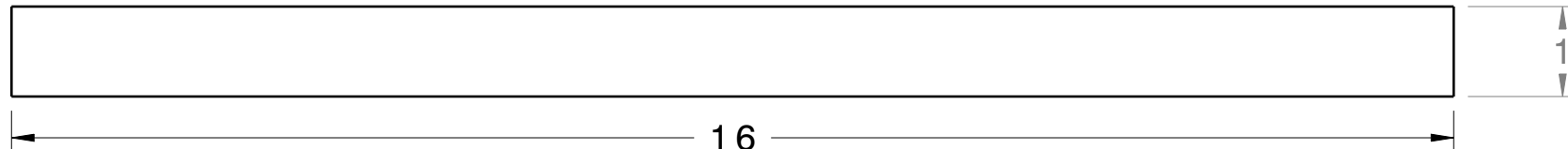
All units in inches. 1/16" thick balsa		Team Tri Spectra			
DRAWN BY Sifat	DATE 3/3/2018	DRAWING TITLE ribs			
CHECKED BY Patrick	DATE xxx	SIZE A	DRAWING NUMBER 1-16 ribs		REV X
DESIGNED BY XXX	DATE xxx	SCALE 1:1	WEIGHT(kg) 0.00	SHEET 1/1	



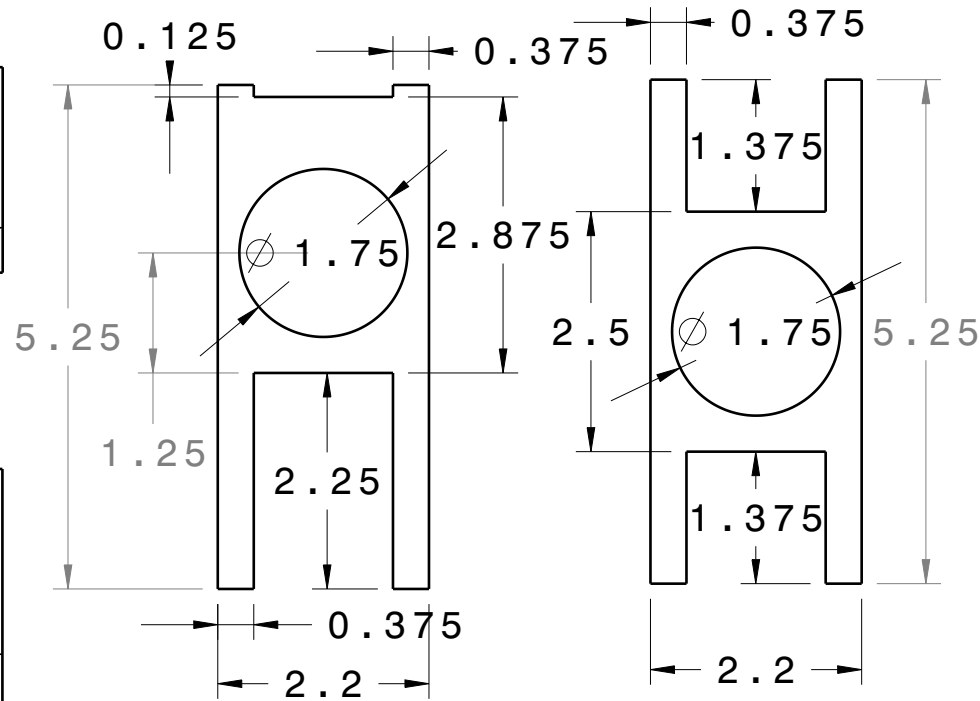
Aileron Skin 1



Aileron Skin 2



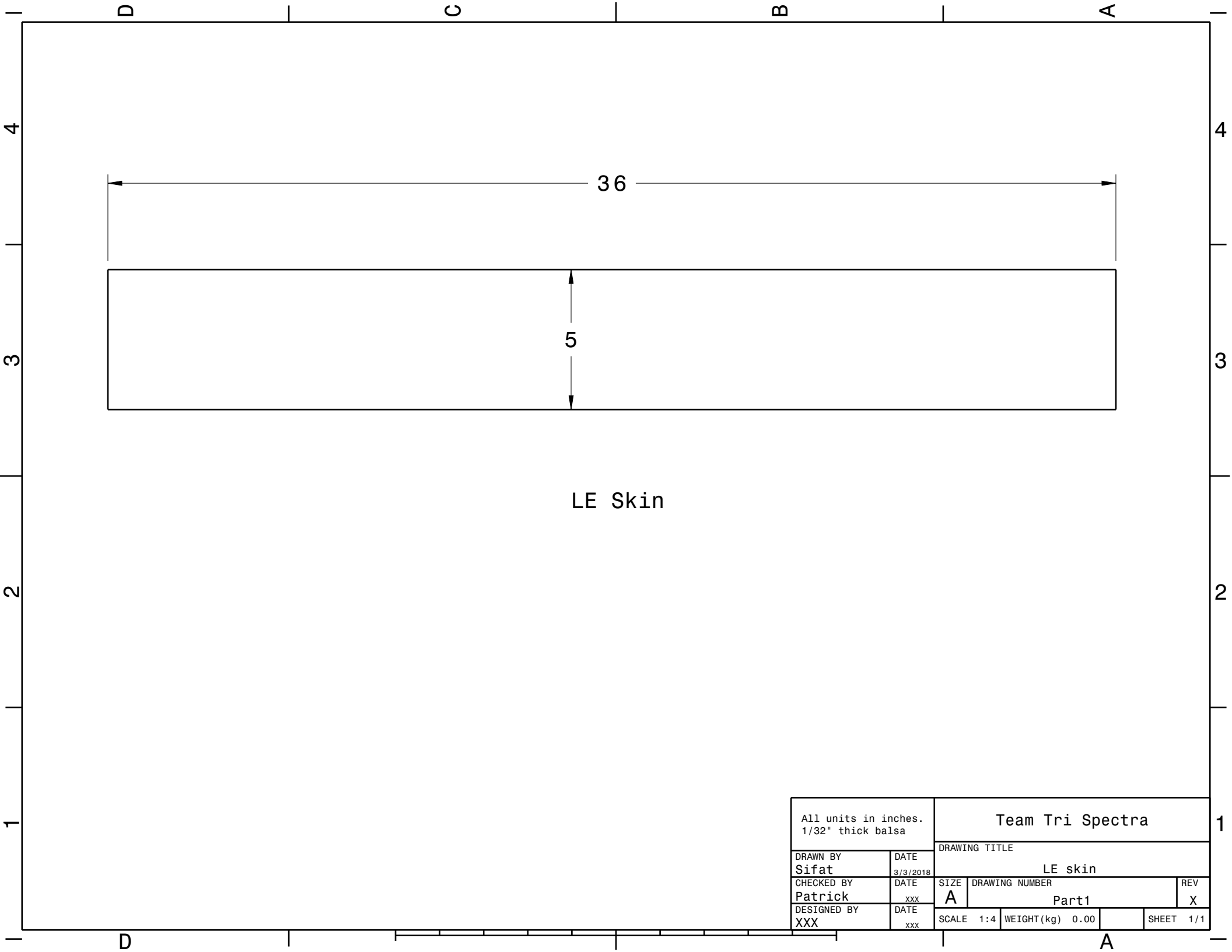
Wing TE Top & Bottom



Ball Holder 1

Ball Holder 2

All units in inches. 1/32" thick balsa		Team Tri Spectra			
DRAWN BY Sifat	DATE 3/3/2018	DRAWING TITLE Thin parts			
CHECKED BY Patrick	DATE xxx	SIZE A	DRAWING NUMBER 1-32 thick		REV X
DESIGNED BY XXX	DATE xxx	SCALE 1:2	WEIGHT(kg) 0.00		SHEET 1/1



Construction Instructions:

1. Wing Assembly

i. Ribs & Spar Assembly

- Install the wing tooling as per diagram.
- Insert the ribs which has tools attached to it according to the arrangement shown in the diagram.
- Insert the Leading edge and trailing edge spars and secure them with adhesive.
- Insert the stringers and secure them with adhesive.
- Attach skins and ailerons.
- Break away the ribs from the tools.

ii. Leading edge Skin making

- Soak the leading-edge skin part (1/32" balsa sheet) in Windex.
- Wrap the soaked LE skin on the male part of the pink foam tool.
- Carefully insert it into the female part of the pink foam tool.
- Place weight on both sides to maintain pressure.
- Leave it to dry.

iii. Aileron Assembly

- Insert the aileron tips into the support bar.
- Secure them with adhesive.
- Place the top and bottom skin and secure them with adhesive.
- Leave it to dry.

iv. Attach Aileron to Wing

- Attach one part of nylon hinge to the support bar of the aileron.
- Carefully align the aileron with the wing and mark the stop to attach control hinges.
- Attach control hinge on the marked position.
- Attach the other part of the nylon hinge to the trailing edge of the wing.

v. Attach Skins to the wing

- Once the leading-edge skin dries, take it out of the tool and carefully align it onto the leading edge of the wing.
- Attach the skin to the wing with adhesive.
- Attach the top and bottom trailing edge skins on the middle part of the wing with adhesive.

2. Fuselage Assembly

- Set up tooling for fuselage as per diagram.
- Insert bottom part into the tooling first.
- Insert side panels and bulkheads into the tooling.
- Push one of the side panel towards the other to attach all the bulkheads together.
- Secure all the parts with adhesive.
- Insert tennis ball and attach ball holders into place.

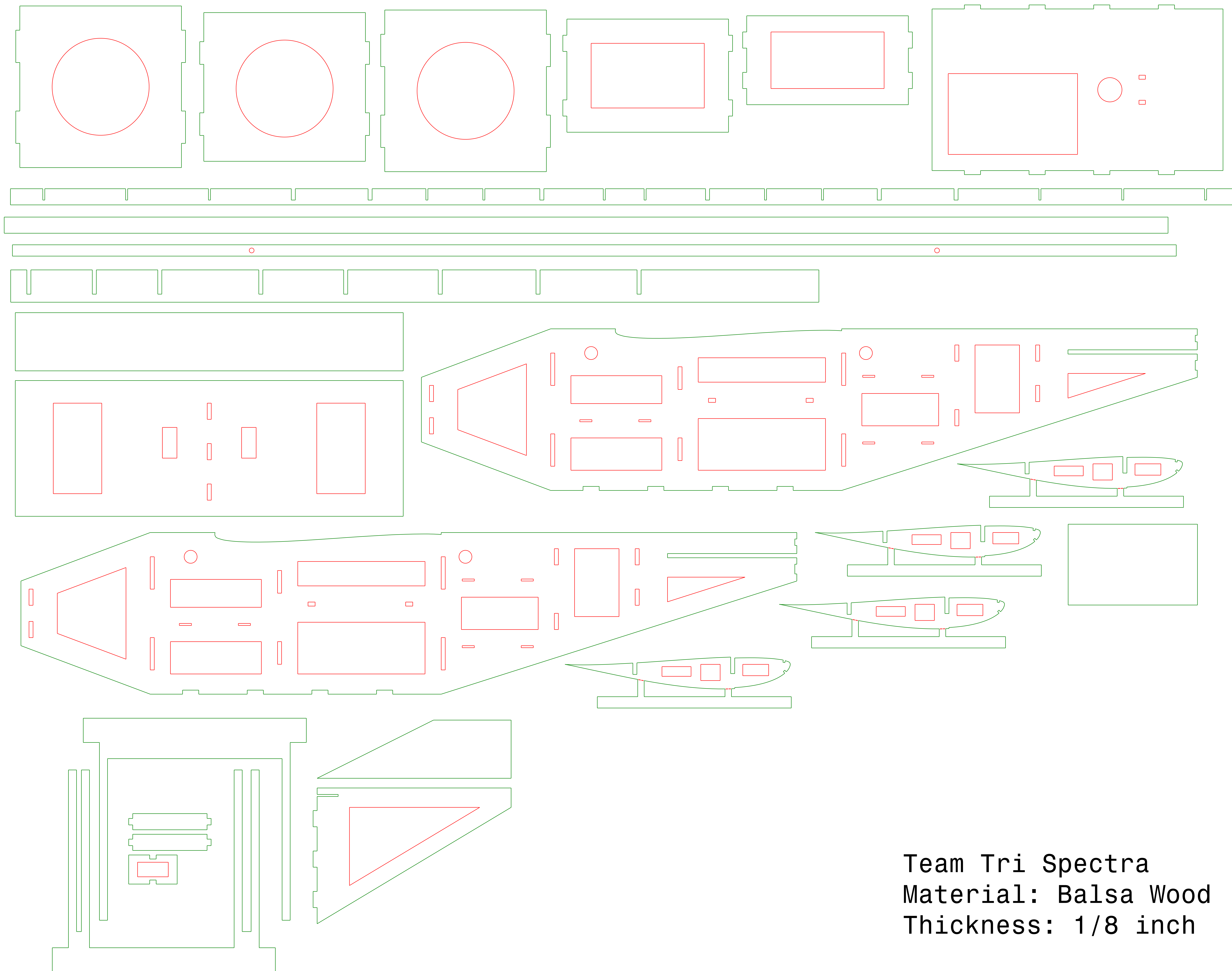
- Secure the assembled fuselage with rubber bands.
- Let the adhesive dry.
- Remove fuselage from the tooling.

3. Tail Assembly

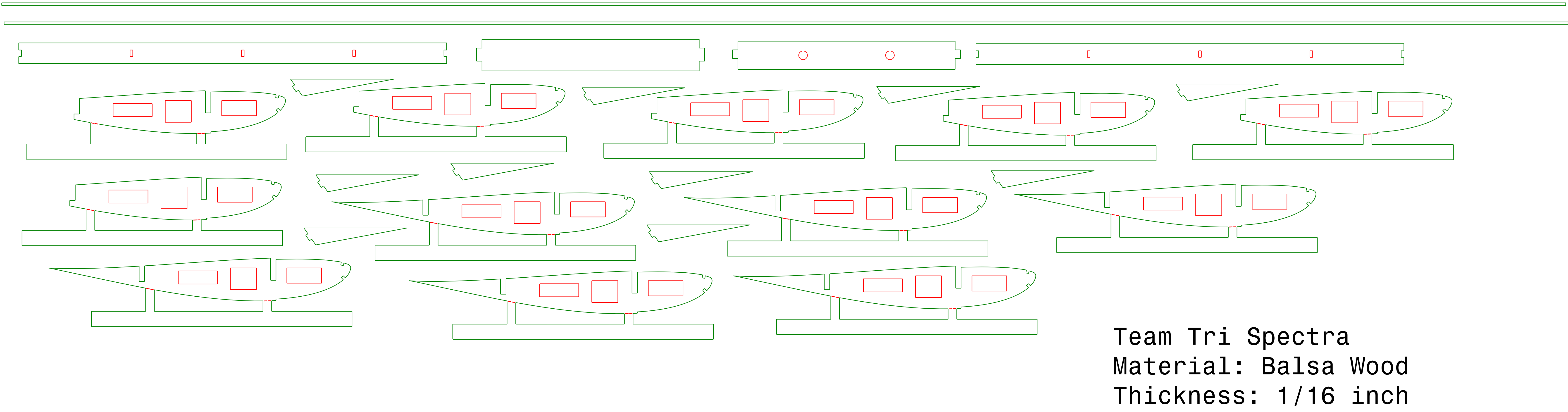
- Insert the horizontal tail into the slot made in the fuselage.
- Position the horizontal tail maintaining symmetry.
- Secure it with adhesive.
- Insert the Vertical tail into the slots on the horizontal tail.
- Secure it with adhesive.
- Attach servo horns onto the Rudder and Elevator
- Attach first part of Nylon hinges onto the Rudder and Elevator using adhesive.
- Attach the other part of Nylon hinges onto the respective tails using adhesive.

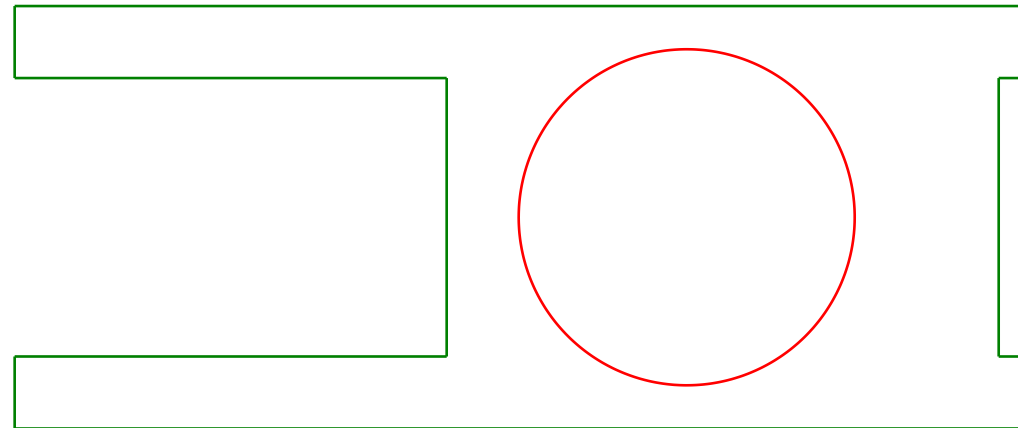
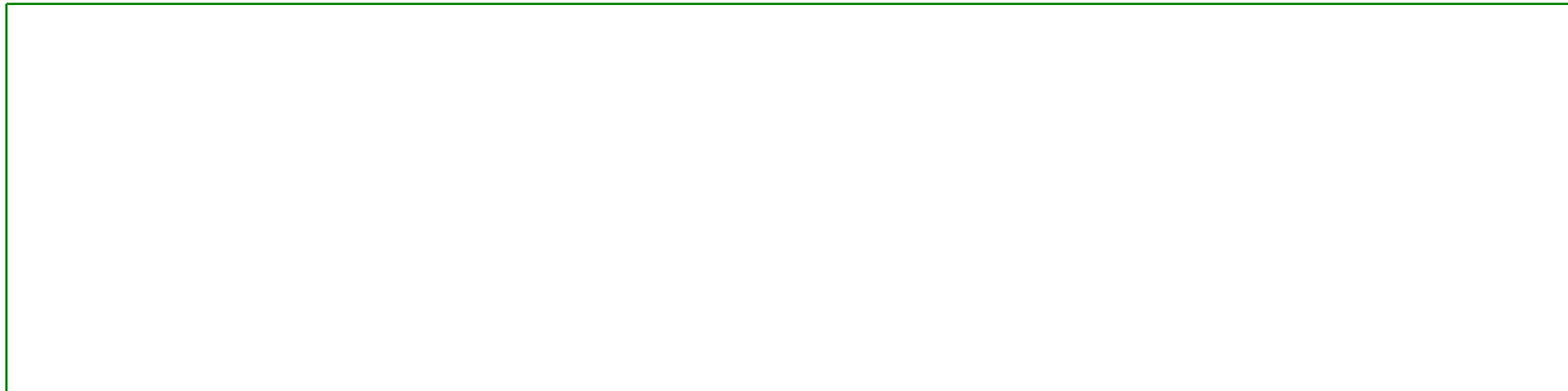
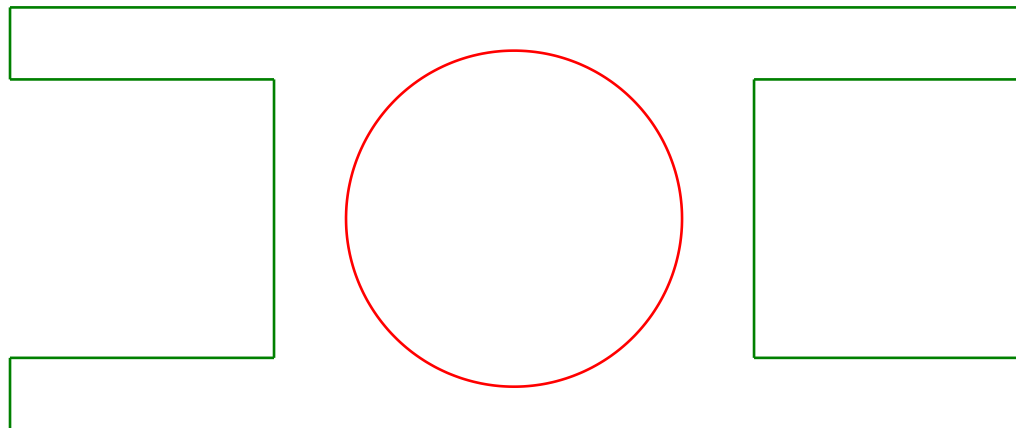
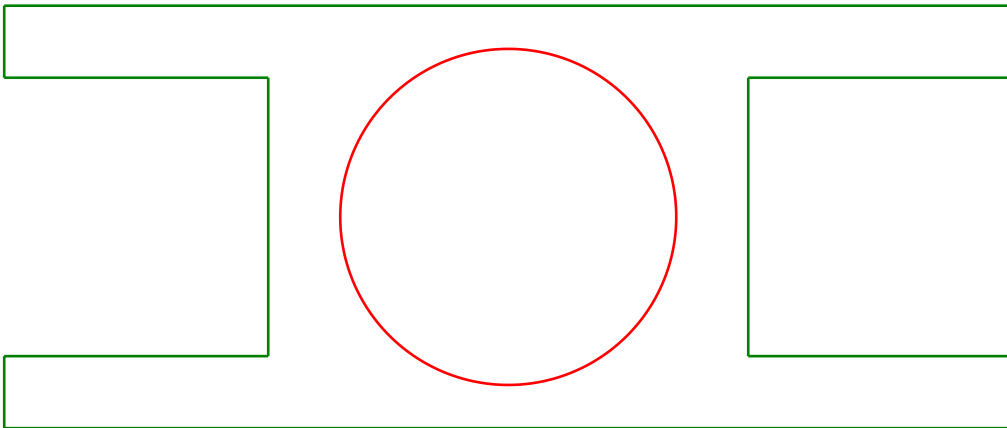
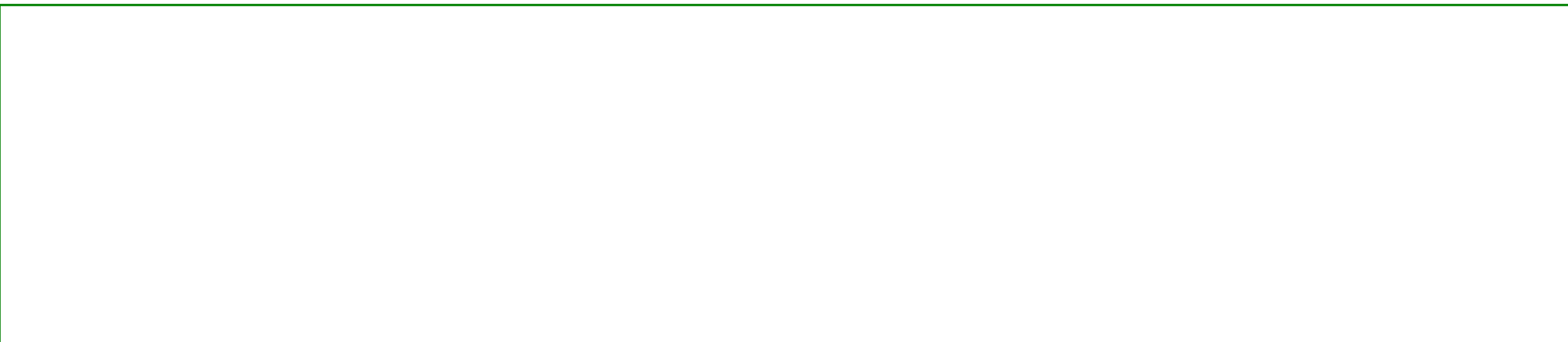
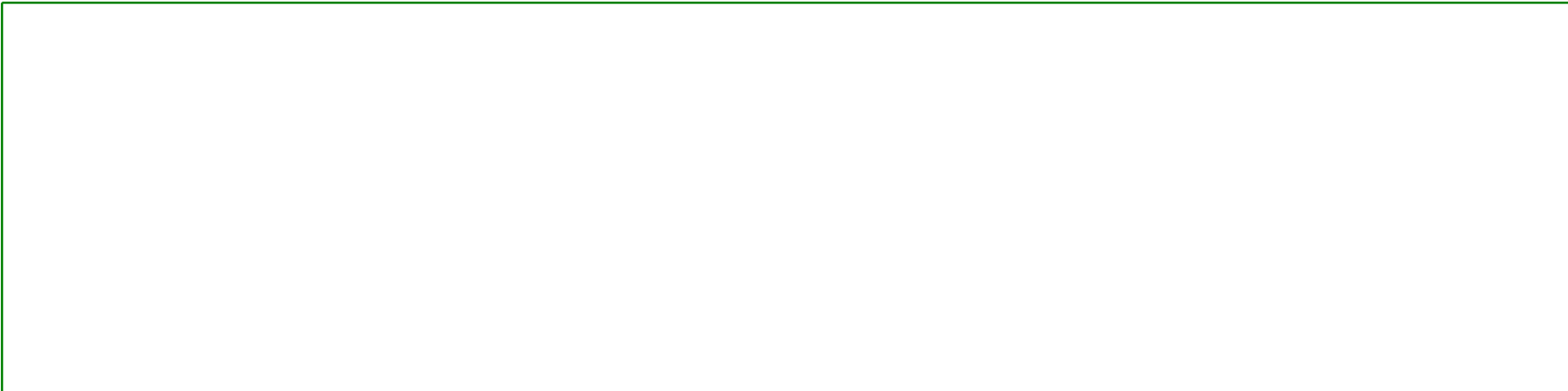
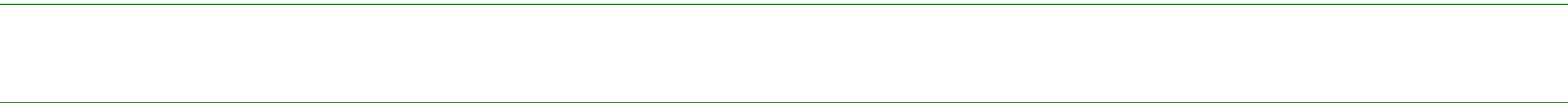
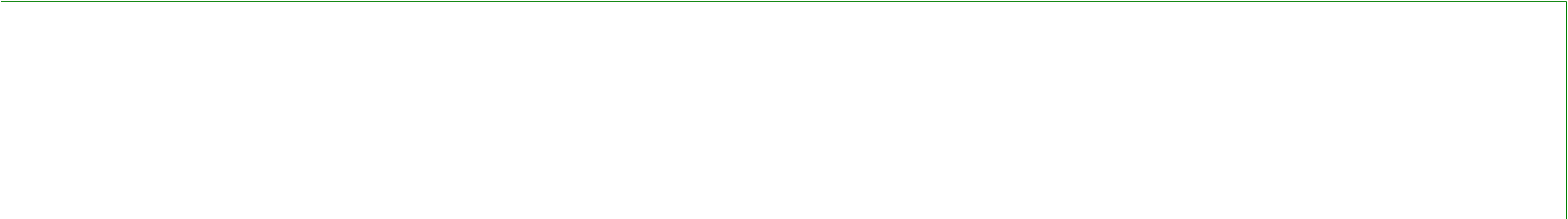
4. Propulsion System & Electrical Assembly

- The front panel of the fuselage needs to be drilled before fuselage assembly.
- Using the motor mount mark the holes onto the front panel and drill it.
- Mount the motor on the motor mound using 5 mm screws.
- Attach the motor on the front panel of the fuselage using 5 mm screws.
- Mount the propeller on the motor.
- Attach each servo (total of 5) on the specific places (See layout drawing) using screws.
- Run servo rods through the holes made on the spar of the wing and back panel of fuselage.
- Attach the control rods to servos and control hinges.
- Connect all the electrical components.

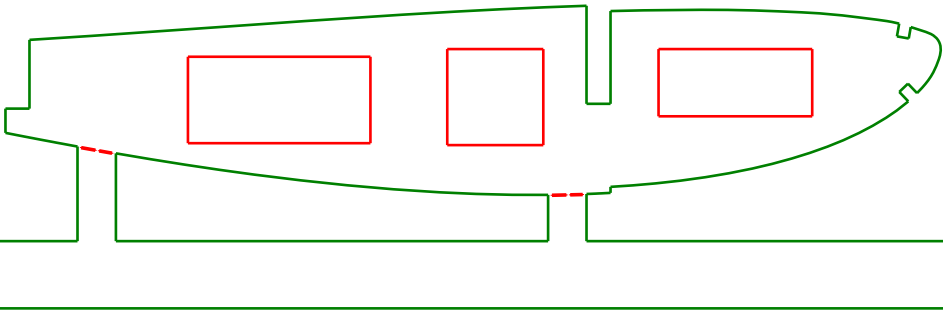
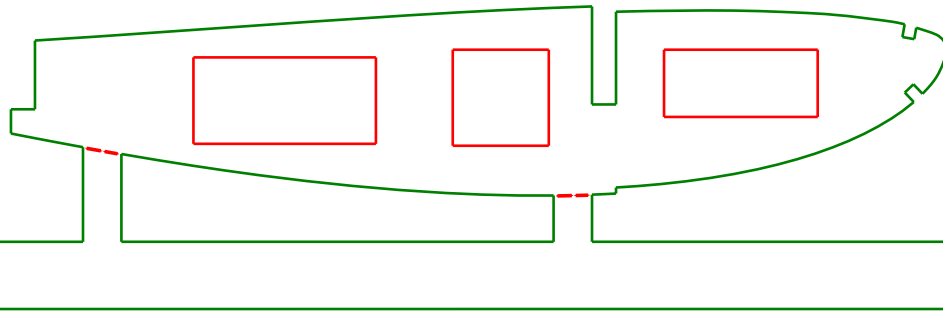
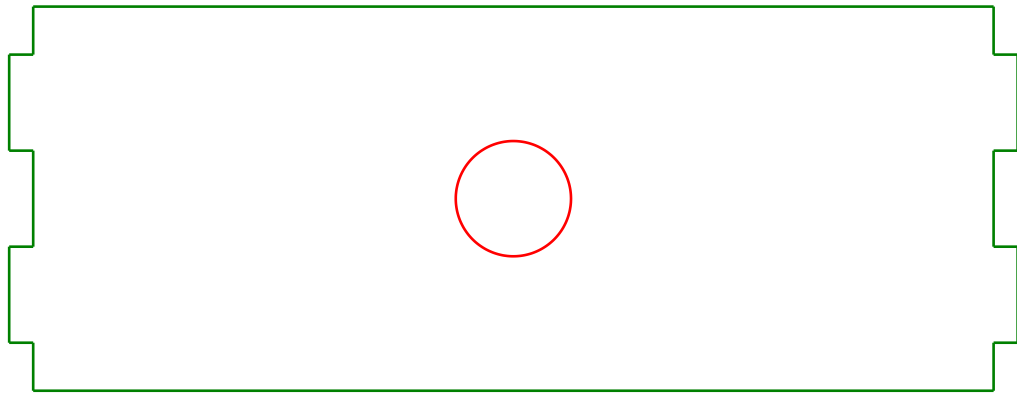


Team Tri Spectra
Material: Balsa Wood
Thickness: 1/8 inch





Team Tri Spectra
Material: Balsa Wood
Thickness: 1/32

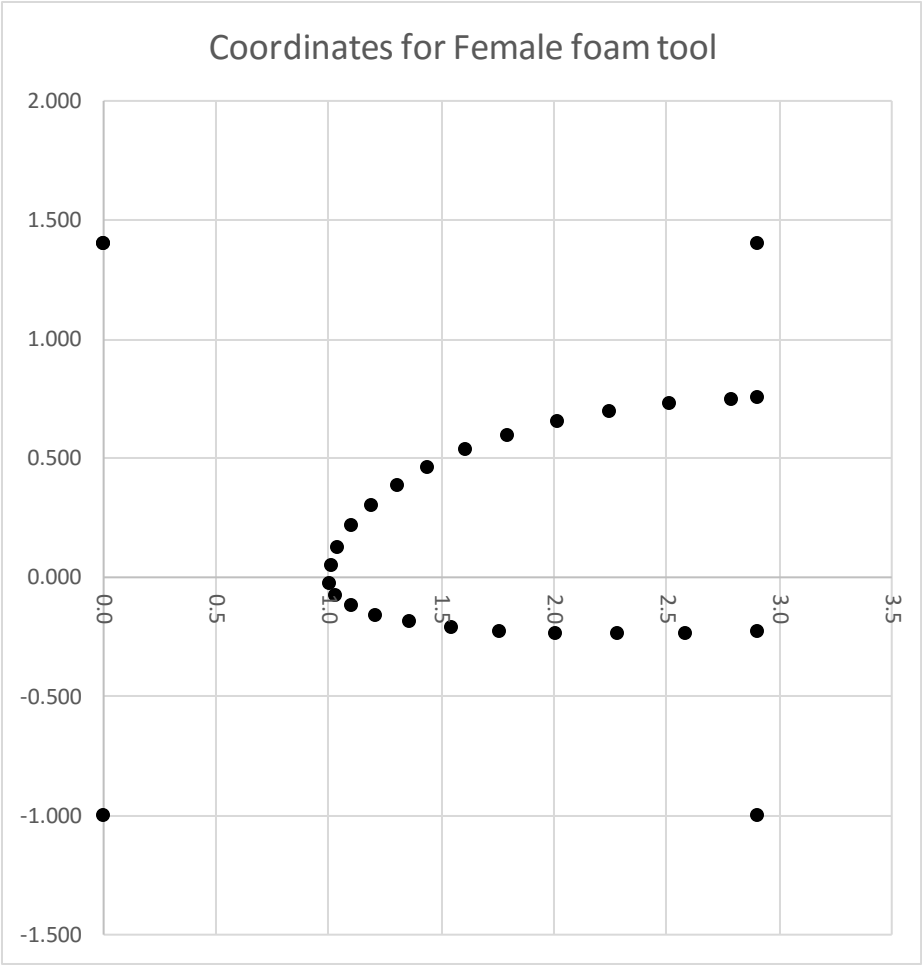


Team Tri Spectra
Material: Ply Wood
Thickness: 1/8

Female foam tool

X	Y
0.000	1.400
2.900	1.400
2.900	0.755
2.785	0.751
2.506	0.730
2.248	0.698
2.010	0.654
1.795	0.599
1.605	0.535
1.439	0.463
1.299	0.384
1.186	0.301
1.099	0.216
1.039	0.131
1.007	0.050
1.002	-0.023
1.030	-0.078
1.099	-0.119
1.209	-0.154
1.357	-0.184
1.540	-0.206
1.756	-0.223
2.003	-0.232
2.279	-0.236
2.580	-0.233
2.904	-0.224
2.903	-1.000
0.000	-1.000
0.000	1.400

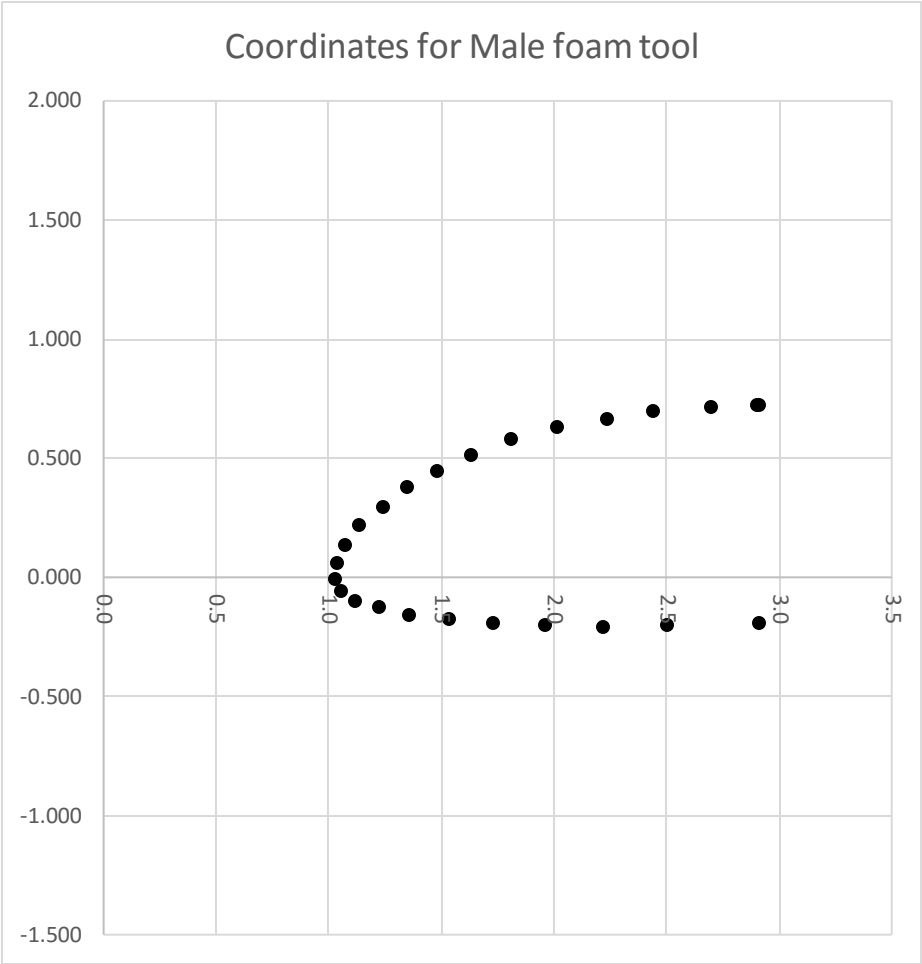
<UPPER LEFT



Male foam tool

X	Y
2.904	0.723
2.696	0.718
2.435	0.699
2.233	0.669
2.011	0.628
1.810	0.577
1.631	0.517
1.476	0.449
1.346	0.376
1.239	0.298
1.138	0.218
1.073	0.139
1.036	0.063
1.027	-0.005
1.054	-0.057
1.118	-0.095
1.222	-0.128
1.360	-0.156
1.531	-0.177
1.733	-0.192
1.964	-0.201
2.222	-0.204
2.504	-0.202
2.907	-0.194
2.907	0.723

<UPPER RIGHT



Team Tri Spectra
Aircraft Inventory & Costs

Item (equipment, materials, parts, laser cutting, etc.)	Unit Cost	Quantity	Total Cost	Vendor (name, http, WSU, etc.)	Stock #
Great Plane Electrify LiPo 3S 11.1V 850mAh 25C Star Battery	\$20.00	1	\$20.00	https://www.towerhobbies.com/cgi-bin/wti0001p?&I=LXCFZK	LXCFZK
Great Planes RimFire GPMG4560 Motor	\$50.00	1	\$50.00	https://www.towerhobbies.com/cgi-bin/wti0001p?&I=LXLWT6&P=7	LXLWT6
APC Thin Electric 9x6 Propeller	\$2.59	1	\$2.59	https://www.towerhobbies.com/cgi-bin/wti0001p?&I=LXZK94&P=ML	LXZK94
TALON 25 AMP ESC, 6S / 25V WITH 8 AMP BEC	\$33.96	1	\$33.96	http://www.castlecreations.com/en/talon-1/talon-25-esc-010-0128-00	010-0128-00
Futaba S3114 Servo	\$14.99	5	\$74.95	https://www.towerhobbies.com/cgi-bin/wti0001p?&I=LXNVC6&P=ML	LXNVC6
RX-FrSky G-RX8 Receiver	\$40.00	1	\$40.00	https://www.frsky-rc.com/new-frsky-g-rx8-receiver-integrate-with-variometer-sensor/	
Great Plane Rimfire Motor Mount 28mm	\$4.00	1	\$4.00	https://www.towerhobbies.com/cgi-bin/wti0001p?&I=LXLXV2&P=M	LXLXV2
Great Planes E-Spinner 1.5"	\$8.00	1	\$8.00	https://www.towerhobbies.com/cgi-bin/wti0001p?&I=LXRAZ1&P=0	LXRAZ1
1/8 Balsa Sheet (12x48)	\$36.41	2	\$72.82	http://www.nationalbalsa.com/balsa_sheet_p/181248sh.htm	
1/16 Balsa Sheet (12x48)	\$30.35	1	\$30.35	http://www.nationalbalsa.com/product_p/1161248bs.htm	
1/16 Balsa Stick (1/16x36)	\$0.32	2	\$0.64	http://www.nationalbalsa.com/balsa_sticks_p/11611636.htm	
1/8 Lite Ply Wood (6x24)	\$3.42	1	\$3.42	http://www.nationalbalsa.com/lite_ply_p/18624lp.htm	
1/32 Balsa Sheet (12x48)	\$30.35	2	\$60.70	http://www.nationalbalsa.com/balsa_wood_p/1321248sh.htm	
1/4 Round Birch Dowel	\$0.60	1	\$0.60	http://www.nationalbalsa.com/dowels_p/1436do.htm	
Coverite 21st Century Microlite Transparent Blue	\$13.99	1	\$13.99	https://www.towerhobbies.com/cgi-bin/wti0001p?&I=LXGDW2&P=M	LXGDW2
Coverite 21st Century Microlite Black	\$13.99	1	\$13.99	https://www.towerhobbies.com/cgi-bin/wti0001p?&I=LXGDV6&P=M	LXGDV6
Durbo Nylon Hinges Standard	\$5.99	1	\$5.99	https://www.towerhobbies.com/cgi-bin/wti0001p?&I=LXD941&P=SM	LXD941
Durbo Micro2 Control Horns	\$1.50	4	\$6.00	https://www.towerhobbies.com/cgi-bin/wti0001p?&I=LXJGT5&P=ML#resources	LXJGT5
Futaba Servo Extension 9" J	\$5.99	1	\$5.99	https://www.towerhobbies.com/cgi-bin/wti0001p?&I=LXH446&P=SM	LXH446
Durbo Hatch Latch	\$3.79	2	\$7.58	https://www.towerhobbies.com/cgi-bin/wti0001p?&I=LXMRK5&P=7	LXMRK5
Tactic Servo Extension 24" Futaba J	\$4.99	4	\$19.96	https://www.towerhobbies.com/cgi-bin/wti0001p?&I=LXDGLY&P=M	LXDGLY
Tactic Switch Harness w/Charge Plug Futaba J	\$7.99	1	\$7.99	https://www.towerhobbies.com/cgi-bin/wti0040p?&I=TACM2001	LXZTE2
Sullivan Flex Pushrod w/Gold-N-Clevis 48"	\$6.99	1	\$6.99	https://www.towerhobbies.com/cgi-bin/wti0001p?&I=LXFU91&P=SM	LXFU91
K&S Music Wire .047x36"	\$10.99	1	\$10.99	https://www.towerhobbies.com/cgi-bin/wti0001p?&I=LXWU98&P=ML	LXWU98
Great Planes Bullet Adapter 3.5mm Male/2mm Female	\$5.99	1	\$5.99	https://www.towerhobbies.com/cgi-bin/wti0095p?FVPROFIL=&FVSEARCH=lxpce8	LXPCE8
Zip Tie	\$4.56	1	\$4.56	https://www.homedepot.com	295780
Rubber Bands	\$3.99	1	\$3.99	https://www.towerhobbies.com/cgi-bin/wti0095p?FVPROFIL=&FVSEARCH=lxl434	LXL434
Velcro	\$1.27	1	\$1.27	https://www.walmart.com	5283073
30-Minute Epoxy	\$14.89	1	\$14.89	https://www.towerhobbies.com/cgi-bin/wti0095p?FVPROFIL=&FVSEARCH=lx026	LXC026
5-Minute Epoxy	\$19.89	1	\$19.89	https://www.towerhobbies.com/cgi-bin/wti0095p?FVPROFIL=&FVSEARCH=lx024	LXC024
Thin CA Glue	\$6.99	1	\$6.99	https://www.towerhobbies.com/cgi-bin/wti0001p?&I=LXK283&P=ML	LXK283
TOTAL AIRCRAFT COST			\$559.08		

1/8 Balsa Wood	Componets	Quantity
	Bulkhead 2	1
	Bulkhead 3	1
	Bulkhead 4	1
	Bulkhead 5	1
	Bulkhead 6	1
	Fuselage Side	2
	Fuselage Bottom	1
	Door	1
	Payload Servo Support Stand	2
	Payload Servo Support top	1
	Rib	4
	LE Spar	1
	TE Spar	1
	Verticle Tail	1
	Horizntal Tail	1
	Rudder	1
	Elevator	1
	Toolings	12

1/8 Lite Ply	Componets	Quantity
	Bulkhead 1	1
	Rib servo	2

1/16 Balsa Wood	Componets	Quantity
	Back Panel 1	1
	Back Panel 2	1
	Rib	6
	Rib without TE	6
	Stringer	2
	Aileron Support	2
	Aileron Tip	10

1/32 Balsa Wood	Componets	Quantity
	Aileron Skin top	2
	Aileron Skin Bottom	2
	Ball Holder 1	2
	Ball Holder 2	1
	LE Skin	1
	TE Skin	2

3D Printing	Componets	Quantity
	Payload System Holder	1
	Payload System	1
1/4 Round Birch Dowel	Dowel to hold wing	2