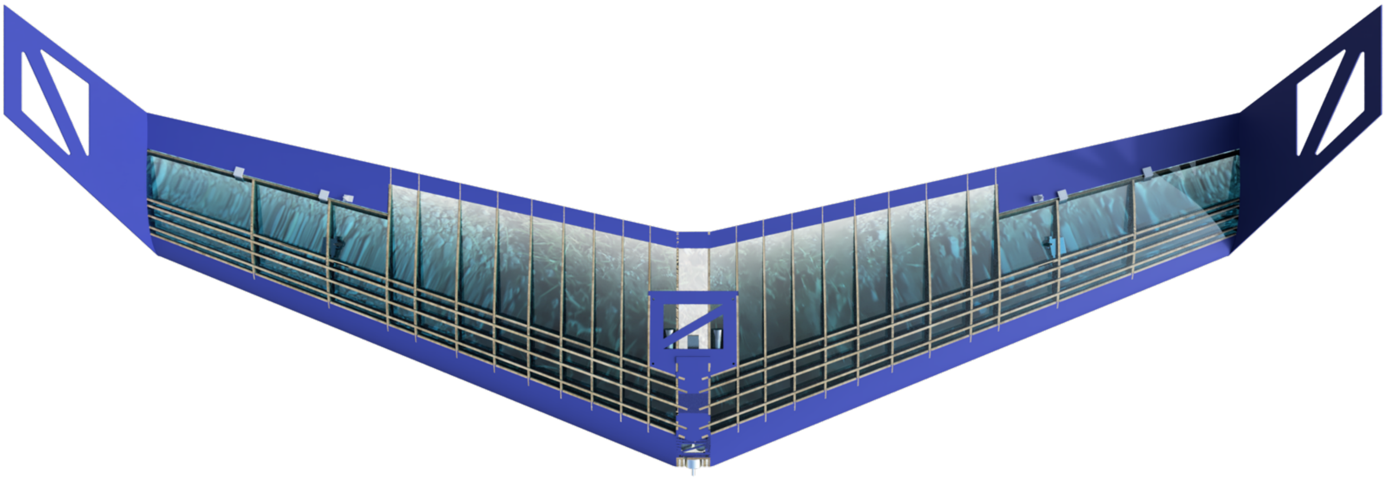
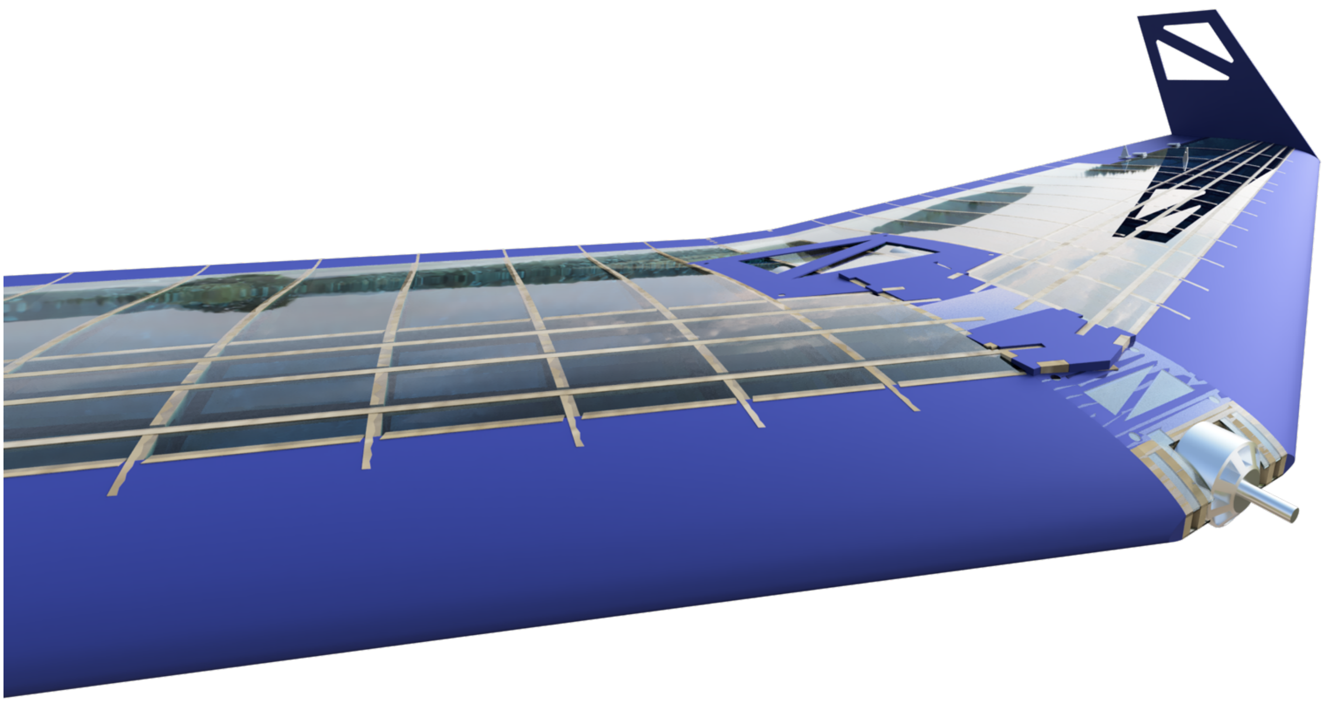
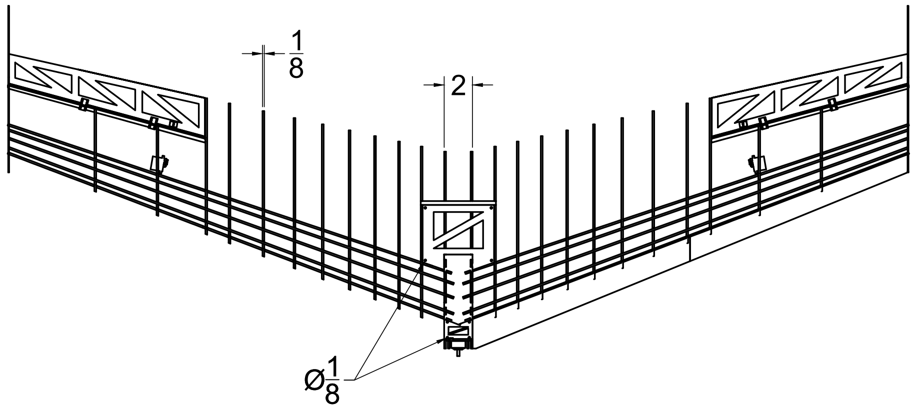
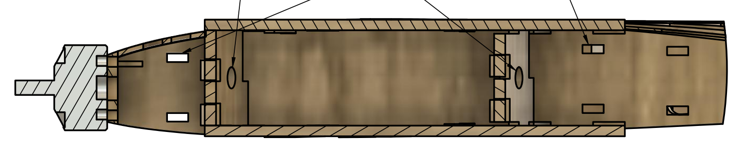
# Team 8
# AE 628
# Detail Design Report
# April 4, 2021

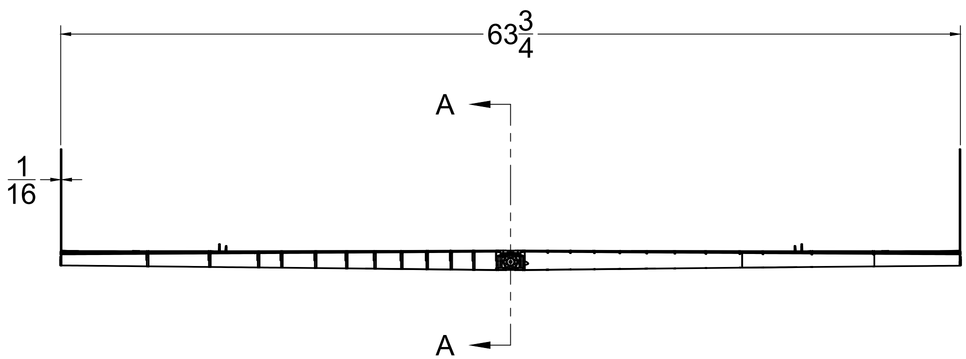


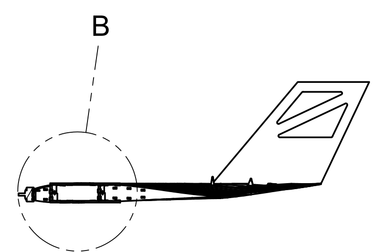





DETAIL B
SCALE 1:1



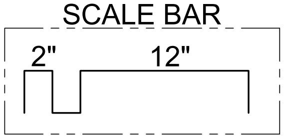

SECTION A-A
SCALE 1:6

ALL DIMENSIONS IN INCHES UNLESS OTHERWISE NOTED

NOT ALL DIMENSIONS SHOWN, REFER TO REFERENCE SCALE AT BOTTOM LEFT

COVERLITE SKIN NOT SHOWN

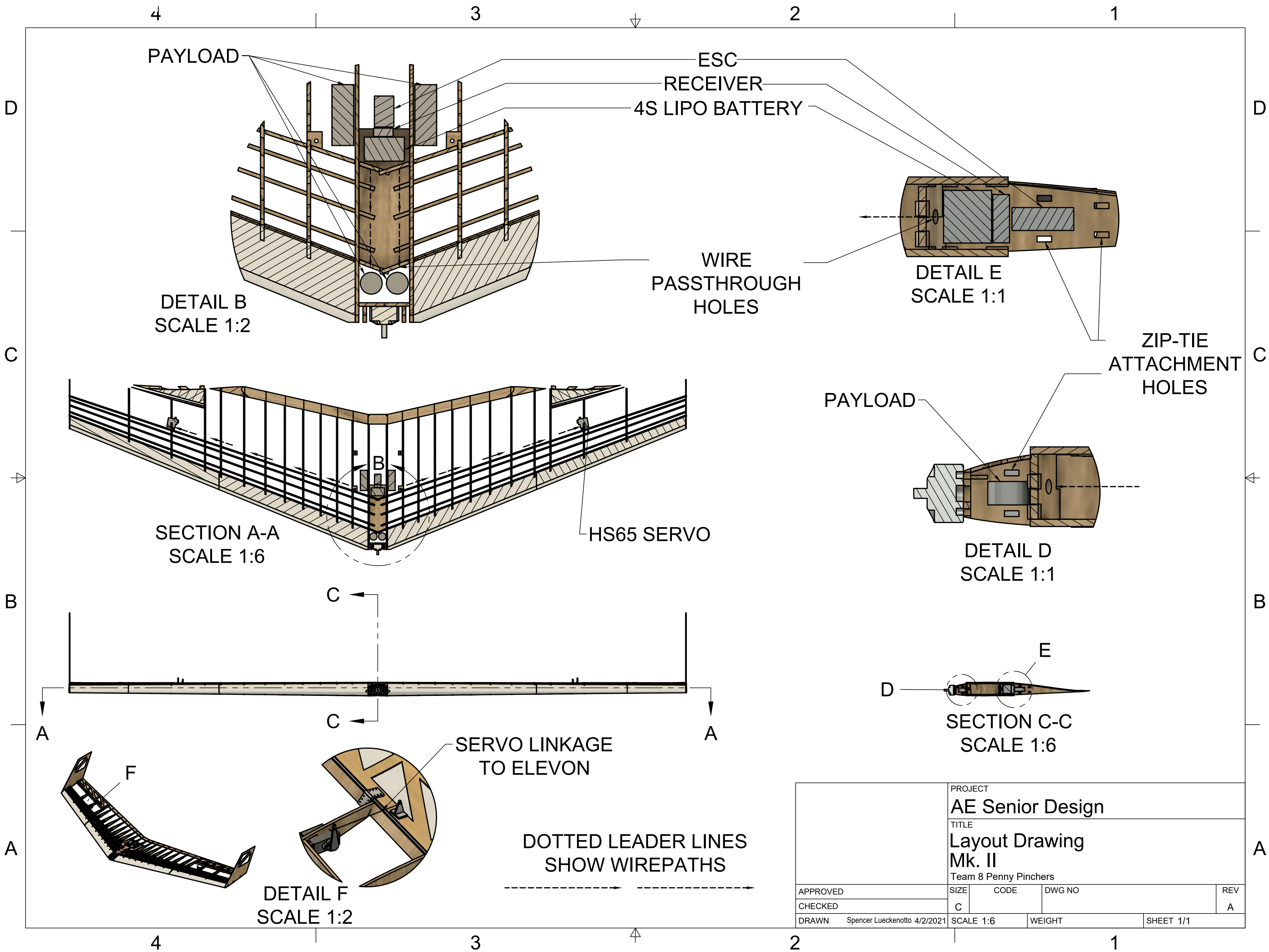
SCALE BAR

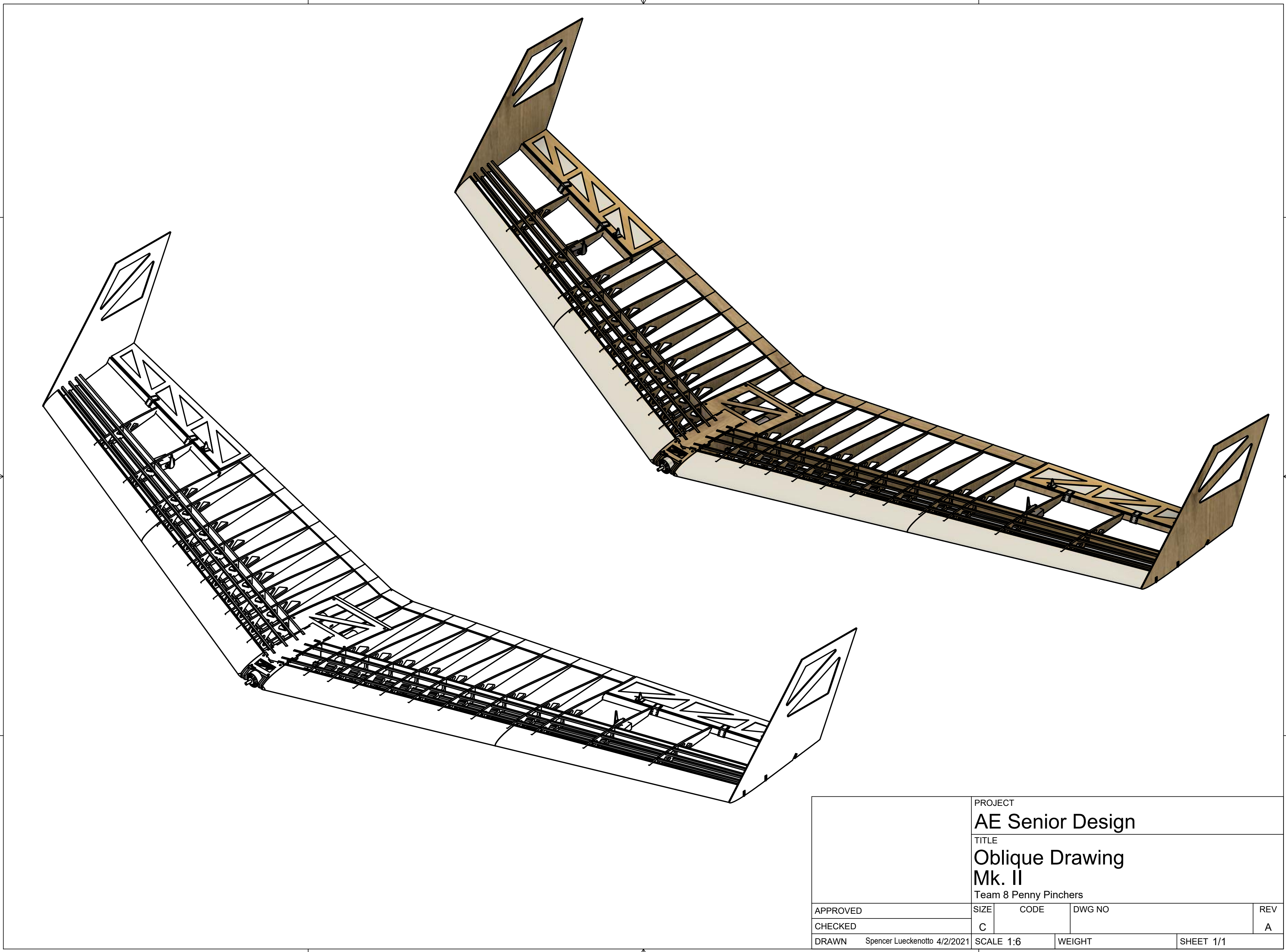



PROJECT
AE Senior Design

TITLE
Three View
Mk. II
Team 8 Penny Pinchers

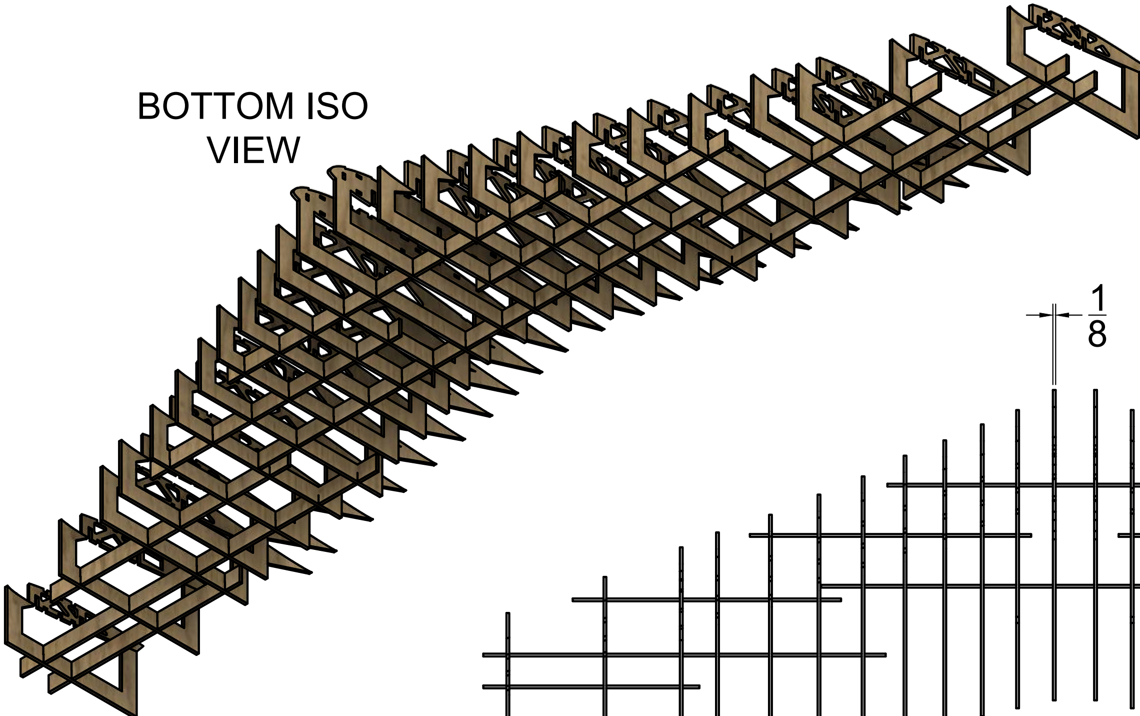
| | | | | | |
|---|---|---|---|---|---|
| APPROVED | | SIZE | CODE | DWG NO | REV |
| CHECKED | | C | | | A |
| DRAWN | Spencer Lueckenotto 4/2/2021 | SCALE 1:6 | WEIGHT | | SHEET 1/1 |

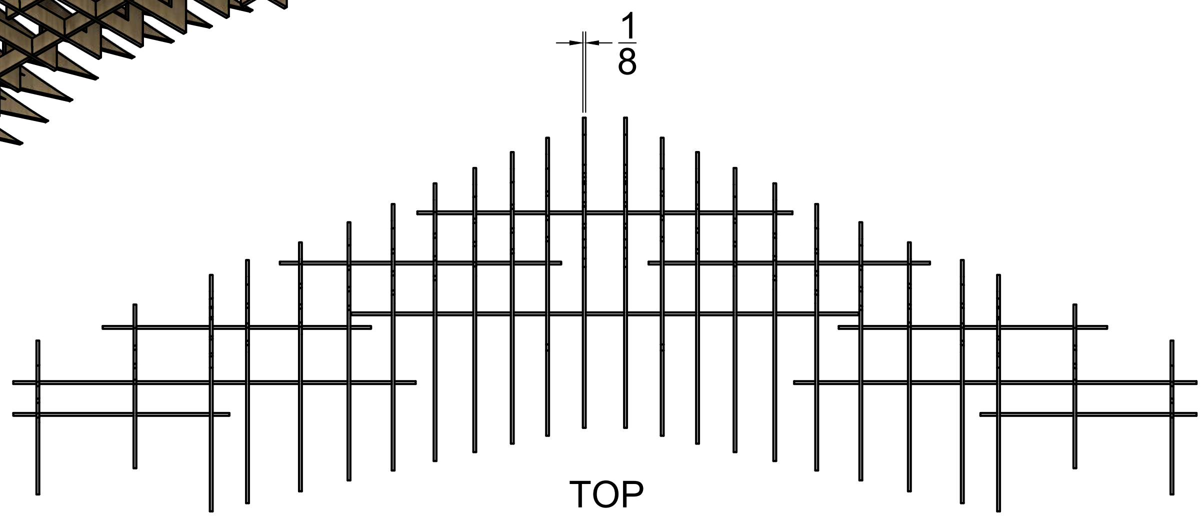

PAYLOAD
ESC
RECEIVER
4S LIPO BATTERY
WIRE PASSTHROUGH HOLES
DETAIL B SCALE 1:2
DETAIL E SCALE 1:1
ZIP-TIE ATTACHMENT HOLES
PAYLOAD
DETAIL D SCALE 1:1
B
SECTION A-A SCALE 1:6
HS65 SERVO
C
C
A
A
D
E
SECTION C-C SCALE 1:6
F
SERVO LINKAGE TO ELEVON
DETAIL F SCALE 1:2
DOTTED LEADER LINES SHOW WIREPATHS
PROJECT
AE Senior Design
TITLE
Layout Drawing Mk. II
Team 8 Penny Pinchers
APPROVED
CHECKED
DRAWN Spencer Lueckenotto 4/2/2021
SIZE C
CODE
DWG NO
REV A
SCALE 1:6
WEIGHT
SHEET 1/1




| | | | | |
|---|---|---|---|---|
| | PROJECT AE Senior Design | | | |
| | TITLE Oblique Drawing Mk. II Team 8 Penny Pinchers | | | |
| APPROVED | SIZE C | CODE | DWG NO | REV A |
| CHECKED | | | | |
| DRAWN Spencer Lueckenotto 4/2/2021 | SCALE 1:6 | WEIGHT | SHEET 1/1 | |

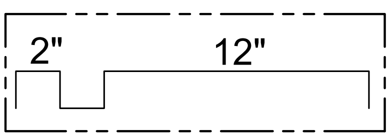
BOTTOM ISO VIEW






TOP

SCALE BAR

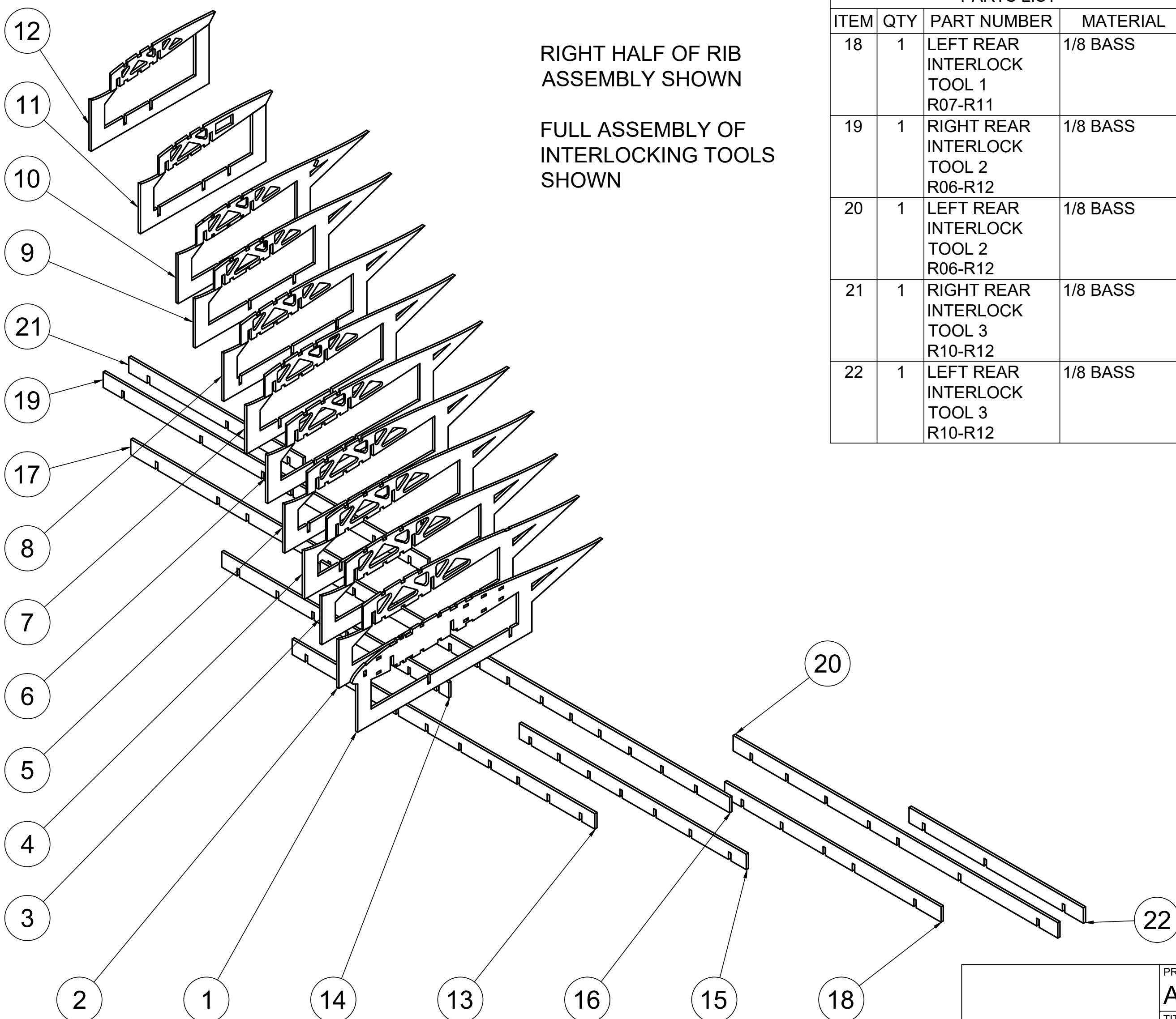



| | |
|---|---|
| | PROJECT<br>AE Senior Design |
| | TITLE<br>Tooling Drawing<br>Mk. II<br>Team 8 Penny Pinchers |
| APPROVED | SIZE B · CODE · DWG NO · REV A |
| CHECKED | |
| DRAWN Spencer Lueckenotto 4/2/2021 | SCALE 1:7 · WEIGHT · SHEET 1/1 |

## Exploded Tooling Assembly Drawing

RIGHT HALF OF RIB ASSEMBLY SHOWN

FULL ASSEMBLY OF INTERLOCKING TOOLS SHOWN




PARTS LIST

| ITEM | QTY | PART NUMBER | MATERIAL |
|---|---|---|---|
| 1 | 1 | RIB01 | 1/8 BALSA |
| 2 | 1 | RIB02 | 1/8 BALSA |
| 3 | 1 | RIB03 | 1/8 BALSA |
| 4 | 1 | RIB04 | 1/8 BALSA |
| 5 | 1 | RIB05 | 1/8 BALSA |
| 6 | 1 | RIB06 | 1/8 BALSA |
| 7 | 1 | RIB07 | 1/8 BALSA |
| 8 | 1 | RIB08 | 1/8 BALSA |
| 9 | 1 | RIB09 | 1/8 BALSA |
| 10 | 1 | RIB10 | 1/8 BALSA |
| 11 | 1 | RIB11 | 1/8 BALSA |
| 12 | 1 | RIB12 | 1/8 BALSA |
| 13 | 1 | FRONT INTERLOCK TOOL R01-R05 | 1/8 BASS |
| 14 | 1 | RIGHT FRONT OUTER INTERLOCK TOOL R02-R08 | 1/8 BASS |
| 15 | 1 | LEFT FRONT OUTER INTERLOCK TOOL R02-R08 | 1/8 BASS |
| 16 | 1 | MID INTERLOCK TOOL R01-R06 | 1/8 BASS |
| 17 | 1 | RIGHT REAR INTERLOCK TOOL 1 R07-R11 | 1/8 BASS |
| 18 | 1 | LEFT REAR INTERLOCK TOOL 1 R07-R11 | 1/8 BASS |
| 19 | 1 | RIGHT REAR INTERLOCK TOOL 2 R06-R12 | 1/8 BASS |
| 20 | 1 | LEFT REAR INTERLOCK TOOL 2 R06-R12 | 1/8 BASS |
| 21 | 1 | RIGHT REAR INTERLOCK TOOL 3 R10-R12 | 1/8 BASS |
| 22 | 1 | LEFT REAR INTERLOCK TOOL 3 R10-R12 | 1/8 BASS |

PROJECT
AE Senior Design

TITLE
Rib and Tooling ONLY
Mk. II

Team 8 Penny Pinchers

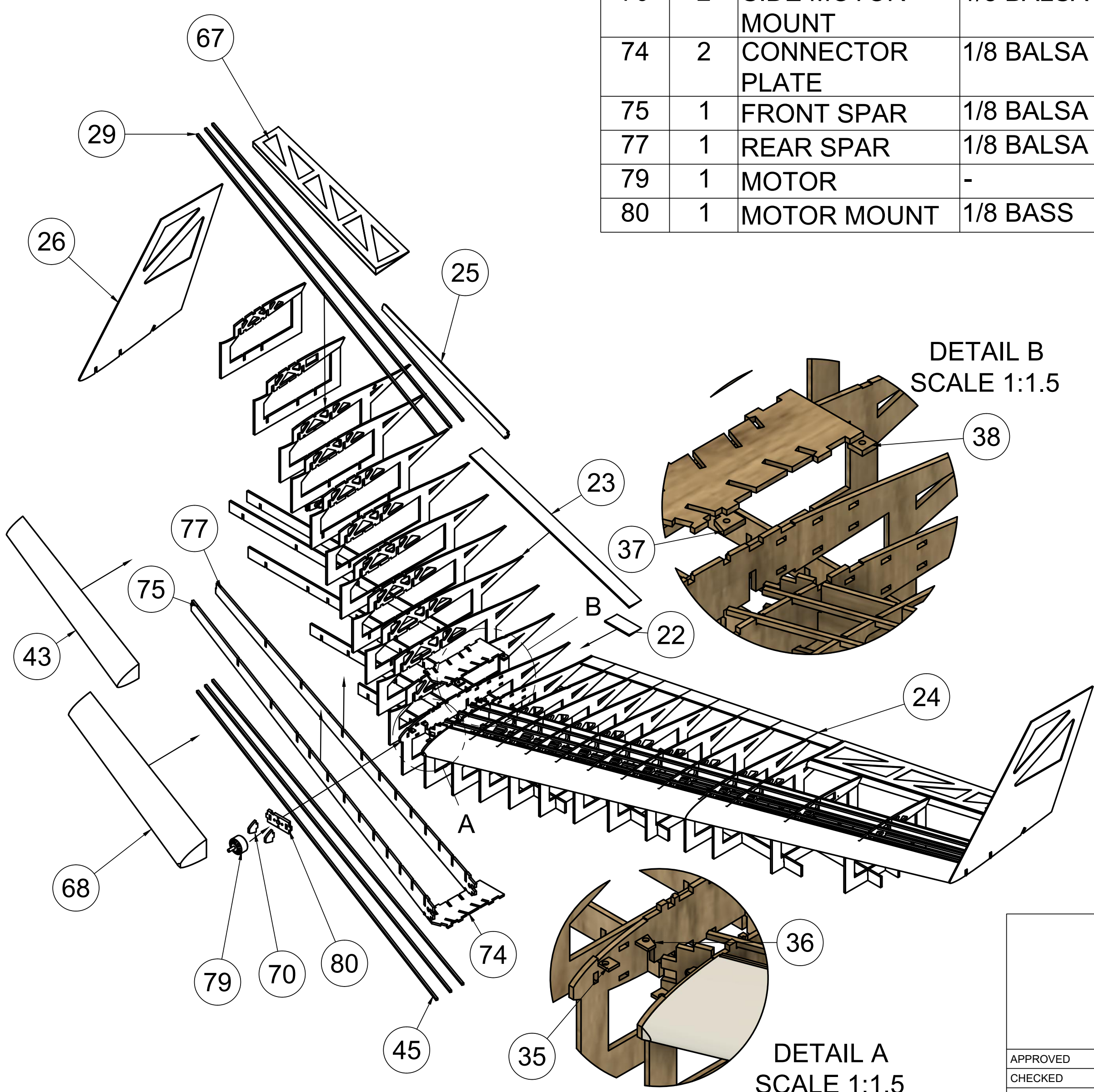
| | | | | |
|---|---|---|---|---|
| APPROVED | SIZE C | CODE | DWG NO 1 | REV A |
| CHECKED | | | | |
| DRAWN Spencer Lueckenotto 3/30/2021 | SCALE 1:3 | | WEIGHT | SHEET 1/1 |

PARTS LIST

| ITEM | QTY | PART NUMBER | MATERIAL |
|---|---|---|---|
| 70 | 2 | SIDE MOTOR MOUNT | 1/8 BALSA |
| 74 | 2 | CONNECTOR PLATE | 1/8 BALSA |
| 75 | 1 | FRONT SPAR | 1/8 BALSA |
| 77 | 1 | REAR SPAR | 1/8 BALSA |
| 79 | 1 | MOTOR | - |
| 80 | 1 | MOTOR MOUNT | 1/8 BASS |

PARTS LIST

| ITEM | QTY | PART NUMBER | MATERIAL |
|---|---|---|---|
| 22 | 1 | CENTER TE SKIN | 1/32 BALSA |
| 23 | 1 | RIGHT TE SKIN | 1/32 BALSA |
| 24 | - | LEFT WING ASSEMBLY | - |
| 25 | 1 | RIGHT ELEVON FALSE SPAR | 1/8 BALSA |
| 26 | 1 | RIGHT WINGLET | 1/16 BALSA |
| 29 | 3 | TOP STRINGERS | 1/8 BALSA |
| 35 | 2 | FWD FRONT PINHOLE (PH) | 1/8 BALSA |
| 36 | 2 | FWD REAR PH | 1/8 BALSA |
| 37 | 2 | AFT FRONT PH | 1/8 BALSA |
| 38 | 2 | AFT REAR PH | 1/8 BASS |
| 43 | 1 | RE 2 | EPS FOAM |
| 45 | 3 | BOTTOM STRINGERS | 1/8 BALSA |
| 67 | 1 | RIGHT ELEVON ASSEMBLY | - |
| 68 | 1 | RE 1 | EPS FOAM |




VEHICLE PART COUNT:
**75**

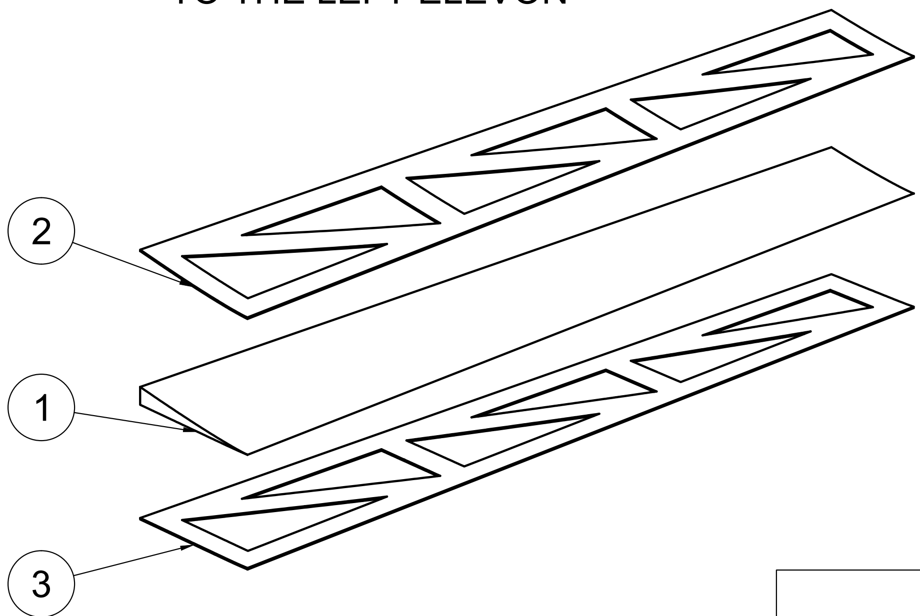
TOOLING PART COUNT:
**12**

| | |
|---|---|
| PROJECT | AE Senior Design |
| TITLE | Assembly Master Mk. II |
| | Team 8 Penny Pinchers |
| APPROVED | |
| CHECKED | |
| DRAWN | Spencer Lueckenotto 3/31/2021 |
| SIZE | C |
| CODE | |
| DWG NO | |
| REV | B |
| SCALE | 1:4 |
| WEIGHT | |
| SHEET | 1/1 |

RIGHT ELEVON
ASSEMBLY SHOWN

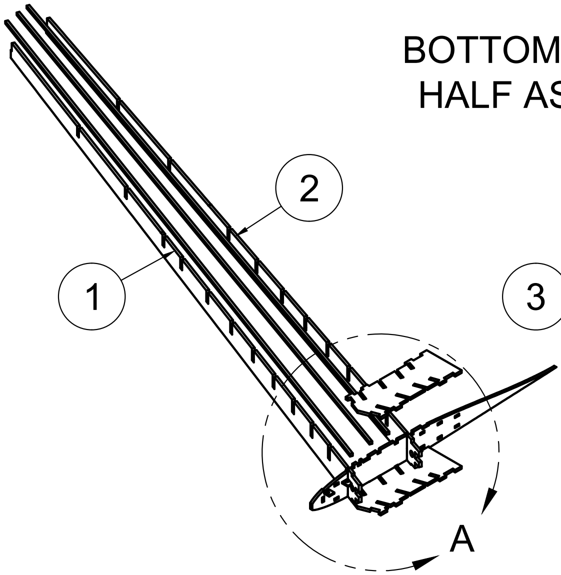
THIS ASSEMBLY
DRAWING ALSO APPLIES
TO THE LEFT ELEVON

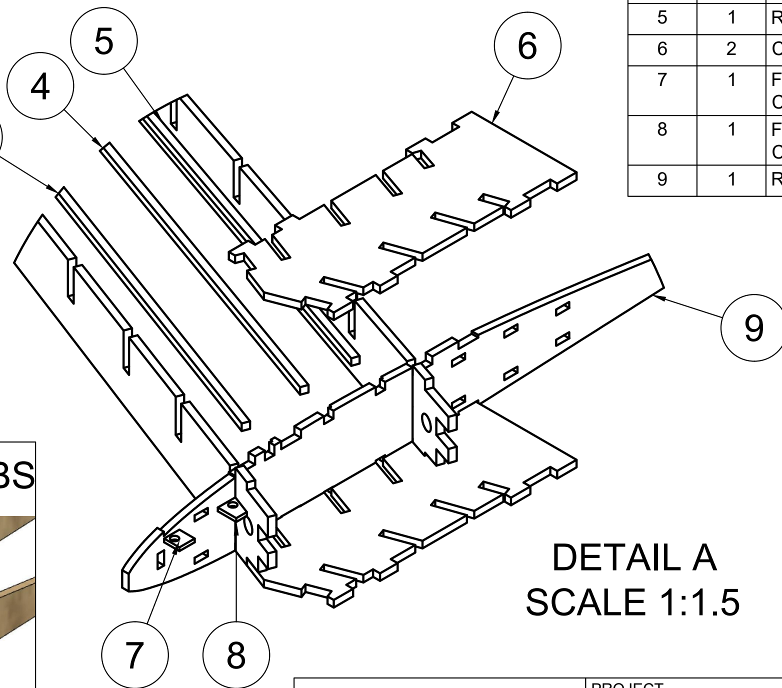
| PARTS LIST | | | |
|---|---|---|---|
| ITEM | QTY | PART NUMBER | MATERIAL |
| 1 | 1 | RIGHT ELEVON FOAM CORE | EPS FOAM |
| 2 | 1 | RIGHT ELEVON UPPER SKIN | 1/32 BALSA |
| 3 | 1 | RIGHT ELEVON LOWER SKIN | 1/32 BALSA |




| | | | | |
|---|---|---|---|---|
| | PROJECT: AE Senior Design | | | |
| | TITLE: Elevon Assembly Mk. II<br>Team 8 Penny Pinchers | | | |
| APPROVED | SIZE: B | CODE | DWG NO | REV: A |
| CHECKED | | | | |
| DRAWN Spencer Lueckenotto 3/31/2021 | SCALE 1:2 | WEIGHT | SHEET 1/1 | |

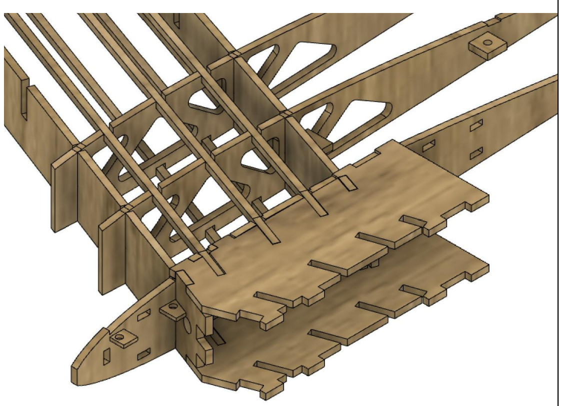
BOTTOM STRINGERS AND LEFT HALF ASSEMBLY NOT SHOWN




DETAIL A
SCALE 1:1.5

FULLY ASSEMBLED WITH RIBS



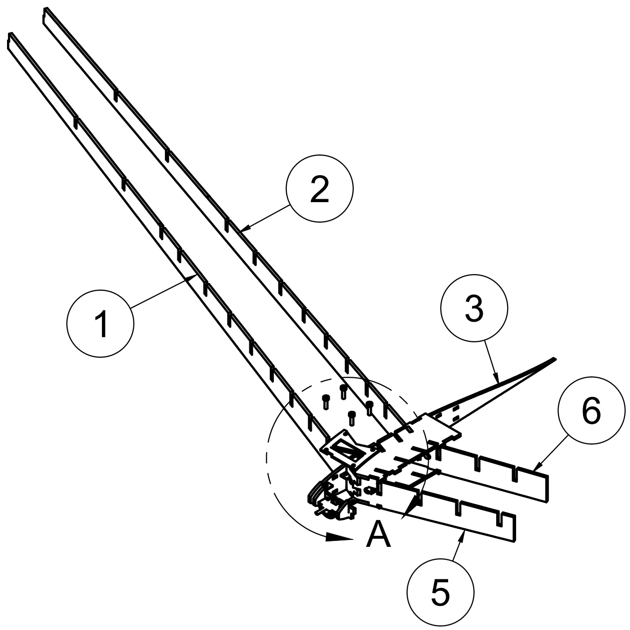
| PARTS LIST | | | |
|---|---|---|---|
| ITEM | QTY | PART NUMBER | MATERIAL |
| 1 | 1 | RIGHT FRONT SPAR | 1/8 BALSA |
| 2 | 1 | RIGHT REAR SPAR | 1/8 BALSA |
| 3 | 1 | RH 20% TOP | 1/8 BALSA |
| 4 | 1 | RH 28% TOP | 1/8 BALSA |
| 5 | 1 | RH 35% TOP | 1/8 BALSA |
| 6 | 2 | CONNECTOR PLATE | 1/8 BALSA |
| 7 | 1 | FWD FRONT RIGHT CORNER SOCKET | 1/8 BALSA |
| 8 | 1 | FWD REAR RIGHT CORNER SOCKET | 1/8 BALSA |
| 9 | 1 | RIB01 | 1/8 BALSA |

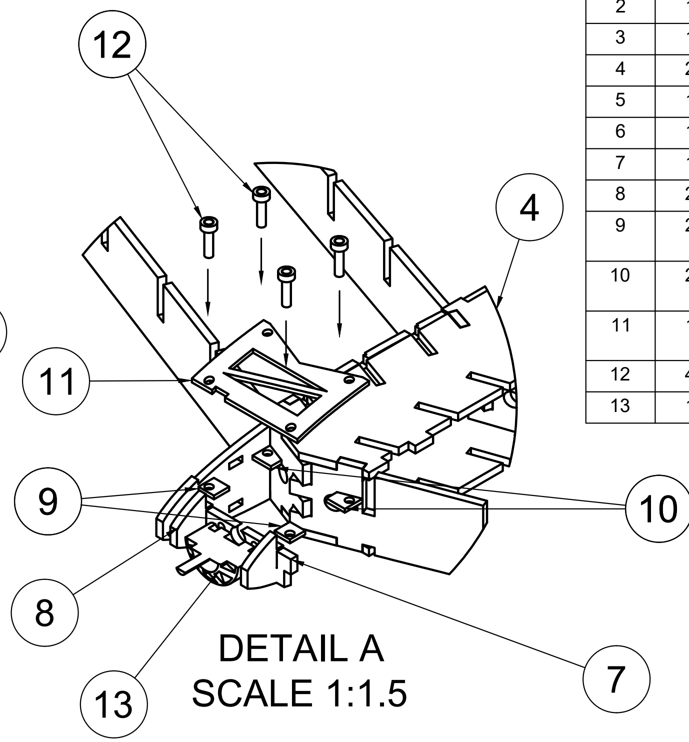
PROJECT
AE Senior Design

TITLE
Right Half Wingbox Assembly Mk. II

Team 8 Penny Pinchers

| | | | | |
|---|---|---|---|---|
| APPROVED | SIZE B | CODE | DWG NO | REV B |
| CHECKED | | | | |
| DRAWN Spencer Lueckenotto 4/1/2021 | SCALE 1:4.5 | WEIGHT | SHEET 1/1 | |

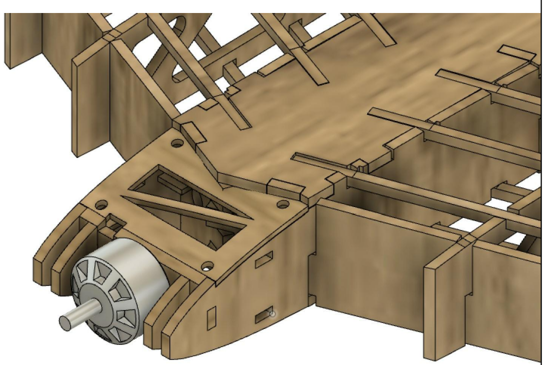


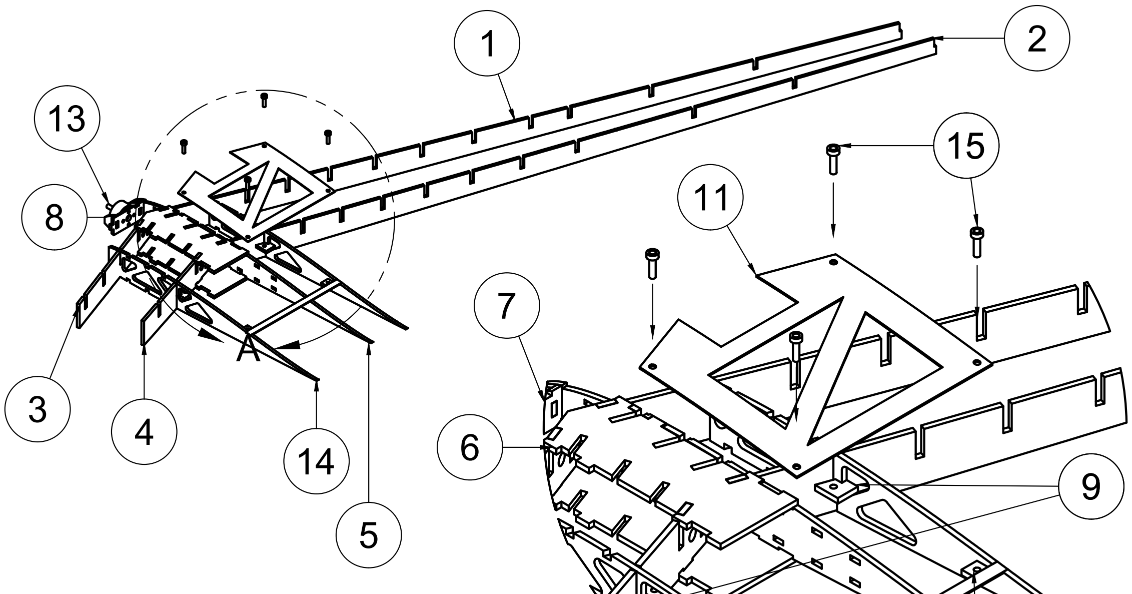

DETAIL A
SCALE 1:1.5

| PARTS LIST | | | |
|---|---|---|---|
| ITEM | QTY | PART NUMBER | MATERIAL |
| 1 | 1 | RIGHT FRONT SPAR | 1/8 BALSA |
| 2 | 1 | RIGHT REAR SPAR | 1/8 BALSA |
| 3 | 1 | RIB01 | 1/8 BALSA |
| 4 | 2 | CONNECTOR PLATE | 1/8 BALSA |
| 5 | 1 | LEFT FRONT SPAR | 1/8 BALSA |
| 6 | 1 | LEFT REAR SPAR | 1/8 BALSA |
| 7 | 1 | MOTOR MOUNT | 1/8 BASS |
| 8 | 2 | MOTOR SIDE PLATE | 1/8 BALSA |
| 9 | 2 | FWD FRONT CORNER SOCKET | 1/8 BALSA |
| 10 | 2 | FWD REAR CORNER SOCKET | 1/8 BALSA |
| 11 | 1 | FRONT PAYLOAD PANEL | 1/16 BALSA |
| 12 | 4 | HATCH BOLT | NYLON |
| 13 | 1 | MOTOR | ALUMINUM |

FULLY ASSEMBLED

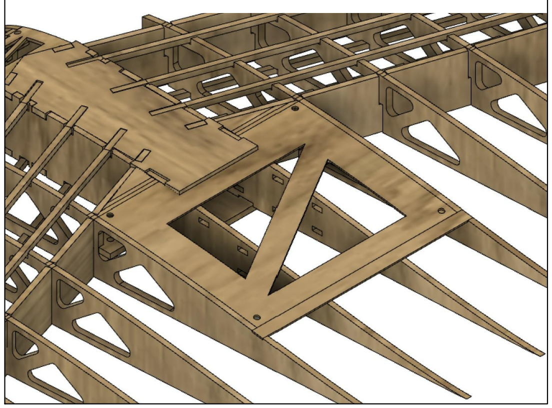


| | | | | | |
|---|---|---|---|---|---|
| | PROJECT<br>AE Senior Design | | | | |
| | TITLE<br>Front Hatch Assembly Mk. II<br>Team 8 Penny Pinchers | | | | |
| APPROVED | SIZE | CODE | DWG NO | | REV |
| CHECKED | B | | | | A |
| DRAWN Spencer Lueckenotto 4/1/2021 | SCALE 1:4.5 | | WEIGHT | SHEET 1/1 | |




DETAIL A
SCALE 1:2

FULLY ASSEMBLED

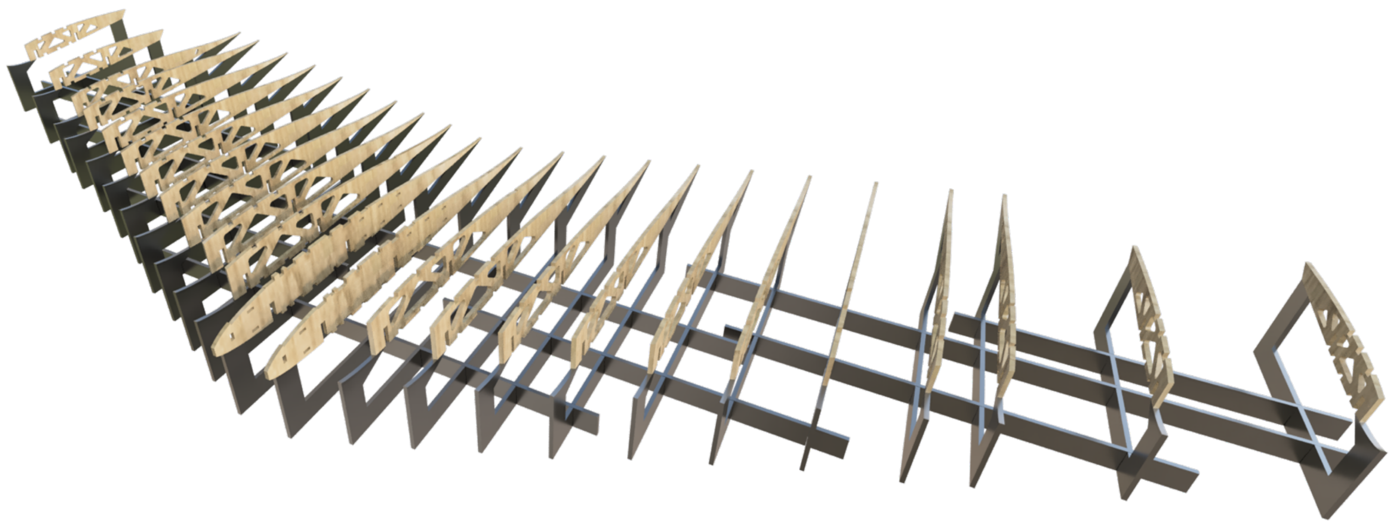


| PARTS LIST | | | |
|---|---|---|---|
| ITEM | QTY | PART NUMBER | MATERIAL |
| 1 | 1 | RIGHT FRONT SPAR | 1/8 BALSA |
| 2 | 1 | RIGHT REAR SPAR | 1/8 BALSA |
| 3 | 1 | LEFT FRONT SPAR | 1/8 BALSA |
| 4 | 1 | LEFT REAR SPAR | 1/8 BALSA |
| 5 | 1 | RIB01 | 1/8 BALSA |
| 6 | 2 | CONNECTOR PLATE | 1/8 BALSA |
| 7 | 1 | MOTOR MOUNT | 1/8 BASS |
| 8 | 2 | MOTOR SIDE PLATE | 1/8 BALSA |
| 9 | 2 | AFT FRONT RIGHT CORNER SOCKET | 1/8 BALSA |
| 10 | 2 | AFT REAR RIGHT CORNER SOCKET | 1/8 BALSA |
| 11 | 1 | REAR PAYLOAD PANEL | 1/16 BALSA |
| 12 | 1 | REAR PAYLOAD PANEL SUPPORT | 1/16 BALSA |
| 13 | 1 | MOTOR | ALUMINUM |
| 14 | 2 | RIB02 | 1/8 BALSA |
| 15 | 4 | HATCH BOLT | NYLON |

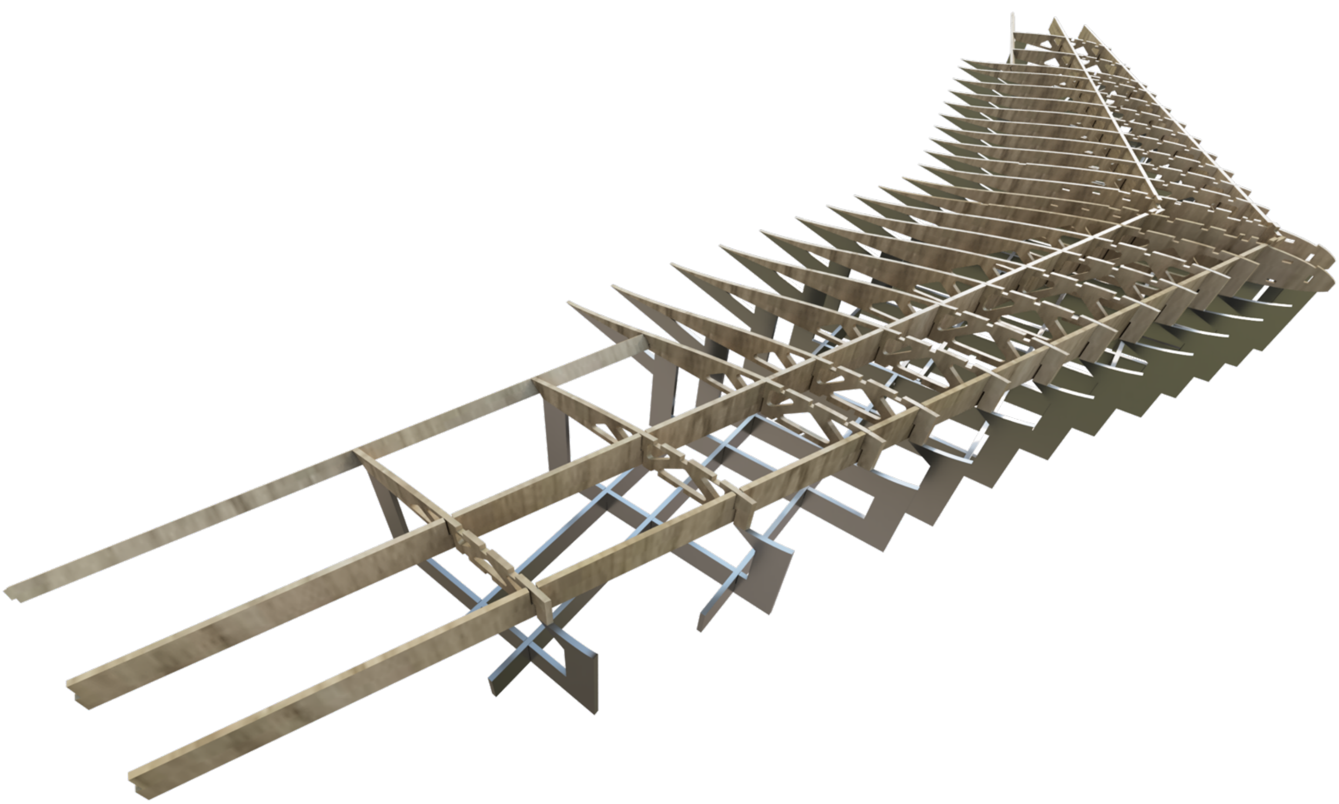
| | | | | | |
|---|---|---|---|---|---|
| | PROJECT<br>AE Senior Design | | | | |
| | TITLE<br>Rear Hatch Assembly Mk. II<br>Team 8 Penny Pinchers | | | | |
| APPROVED | SIZE<br>B | CODE | DWG NO | | REV<br>A |
| CHECKED | | | | | |
| DRAWN Spencer Lueckenotto 4/1/2021 | SCALE 1:4.5 | WEIGHT | | SHEET 1/1 | |

# I. Construction Instructions

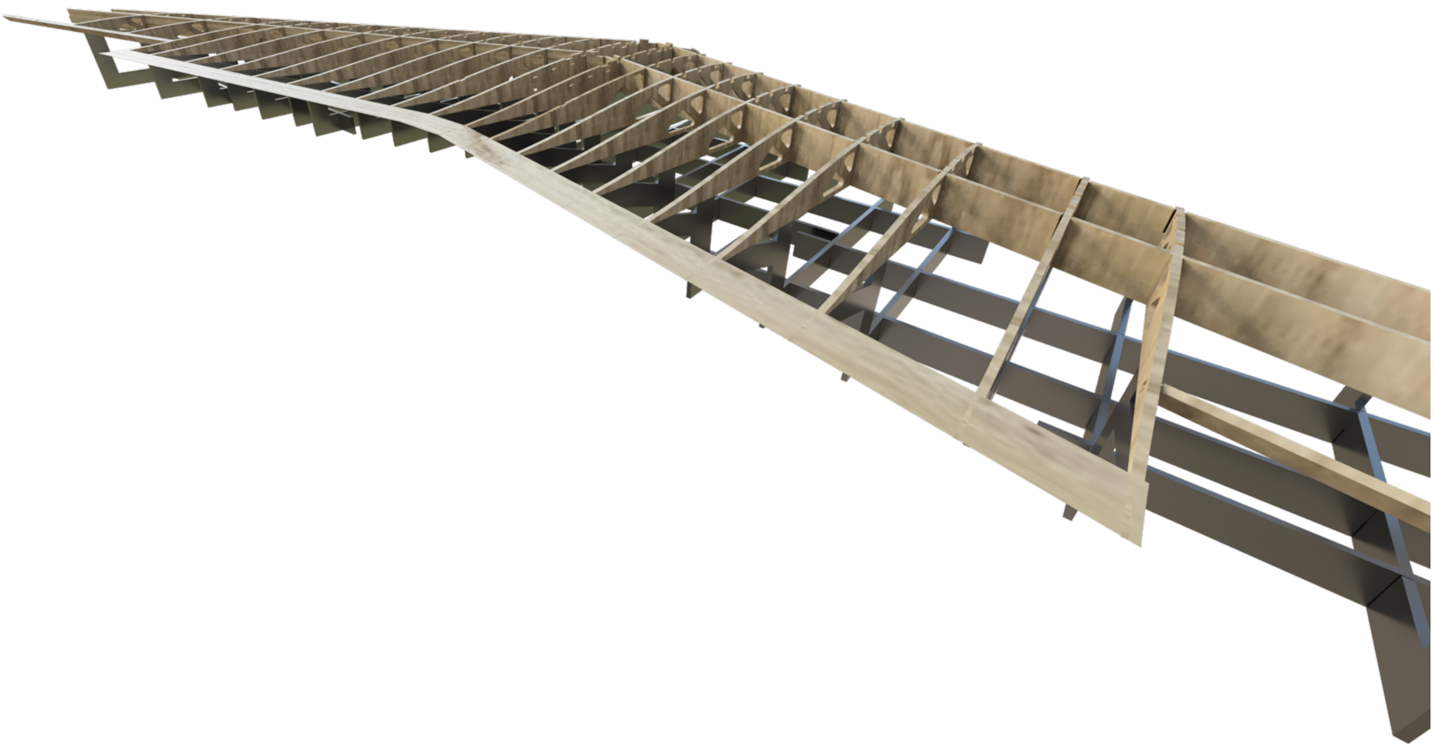
## 1. Wing Tooling Assembly



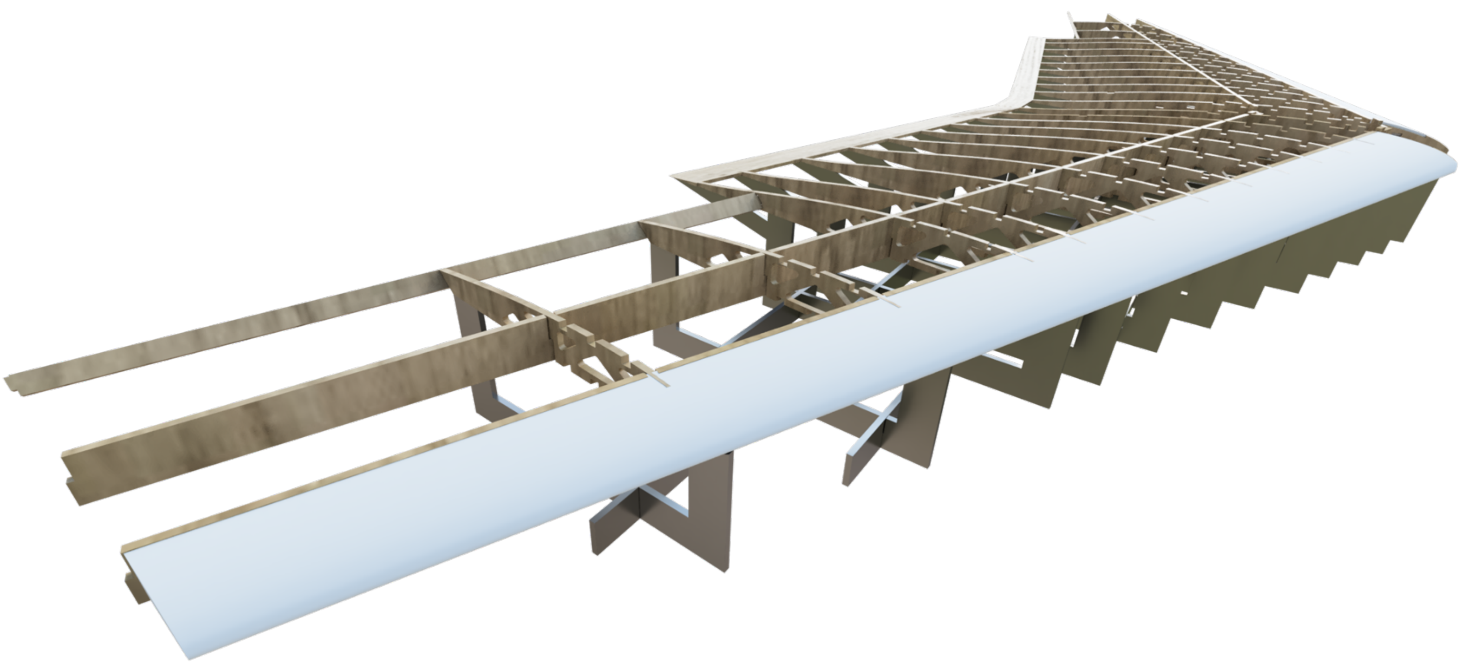
## 2. Spar Installation



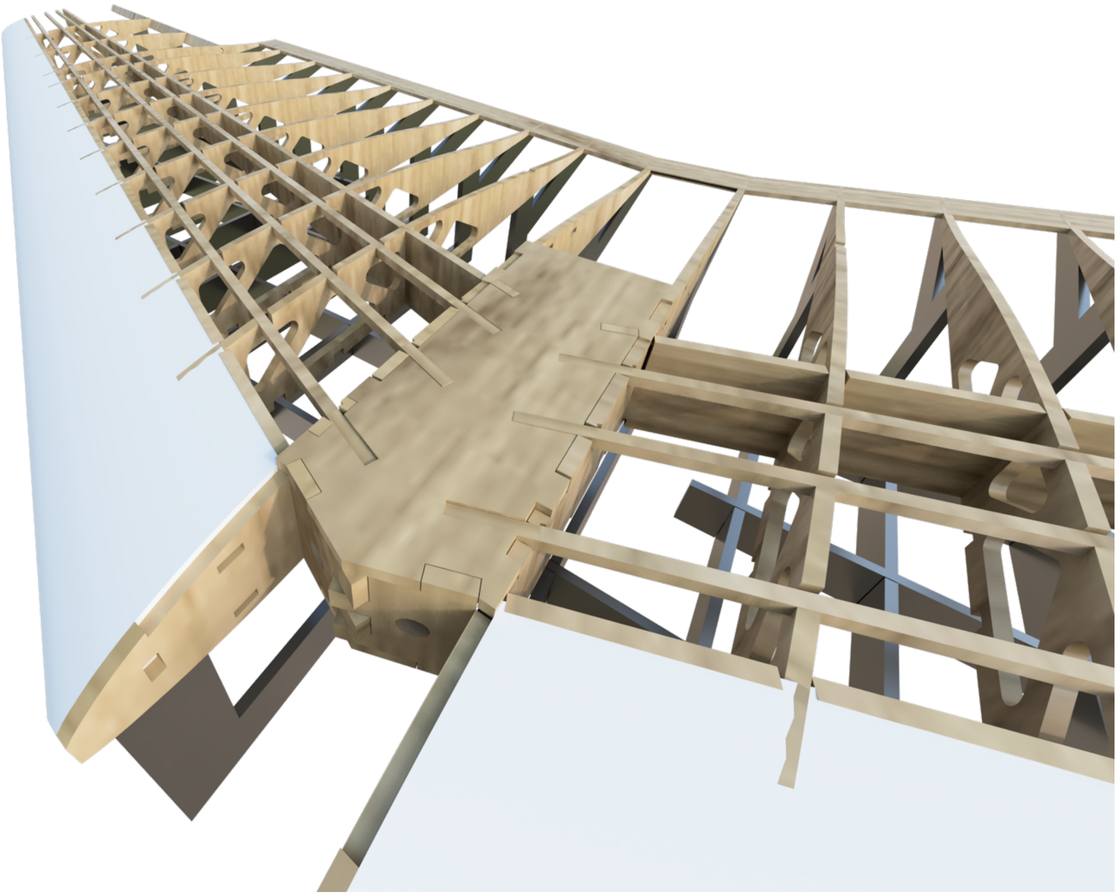
## 3. Wing TE Top Skin Application



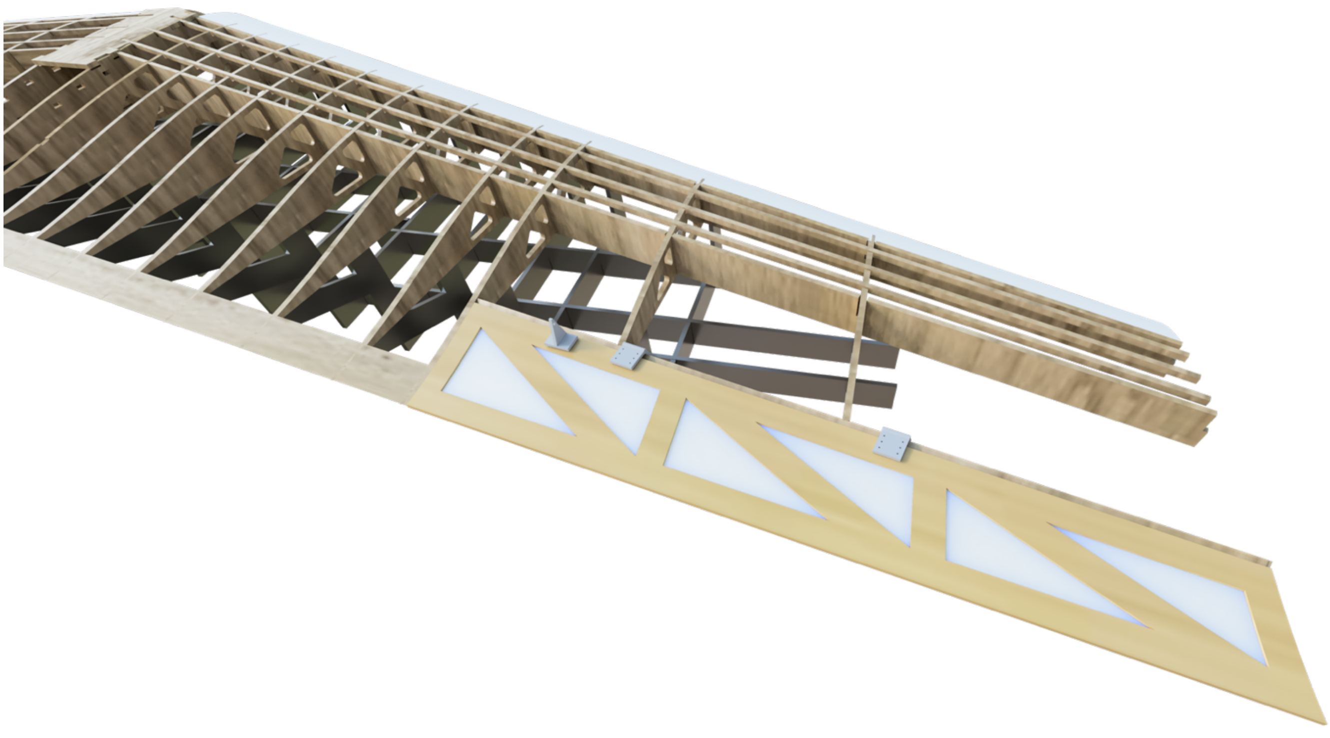
## 4. LE Installation



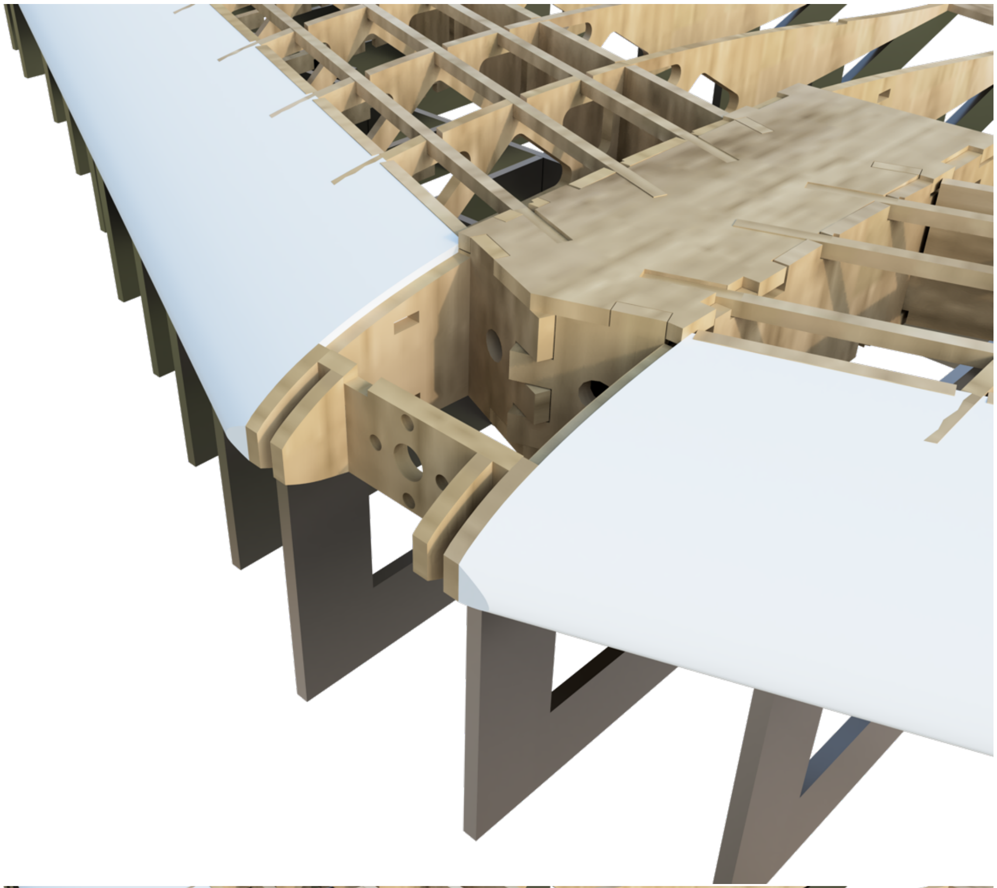
## 5. Top Stringer Installation

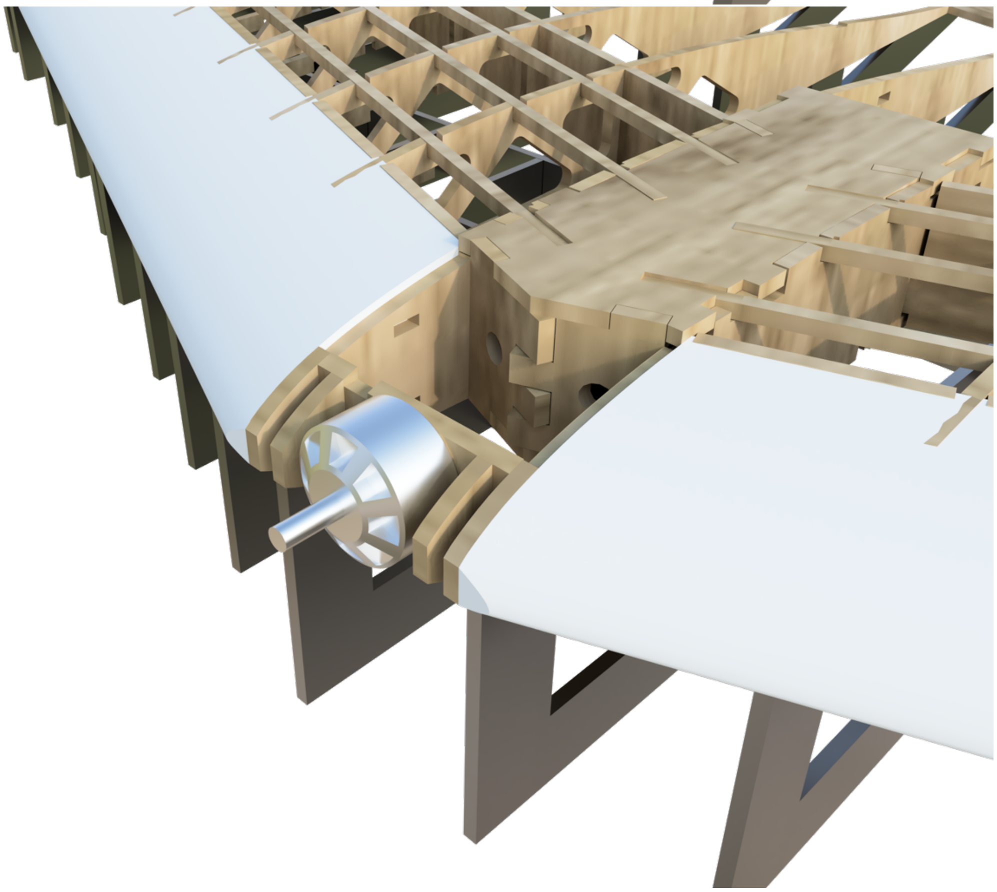


## 6. Elevon Assembly and Mounting

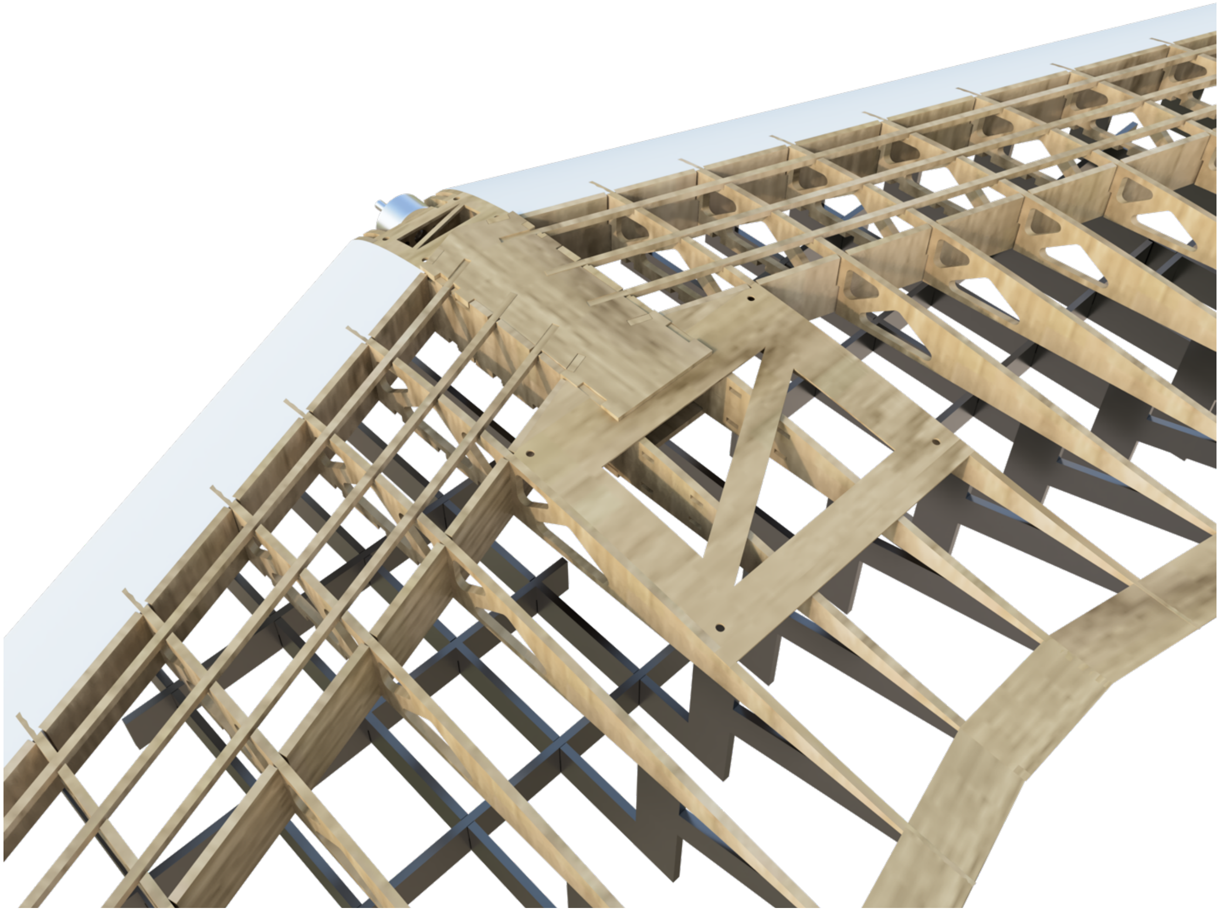


## 7. Motor Mount Assembly and Mounting

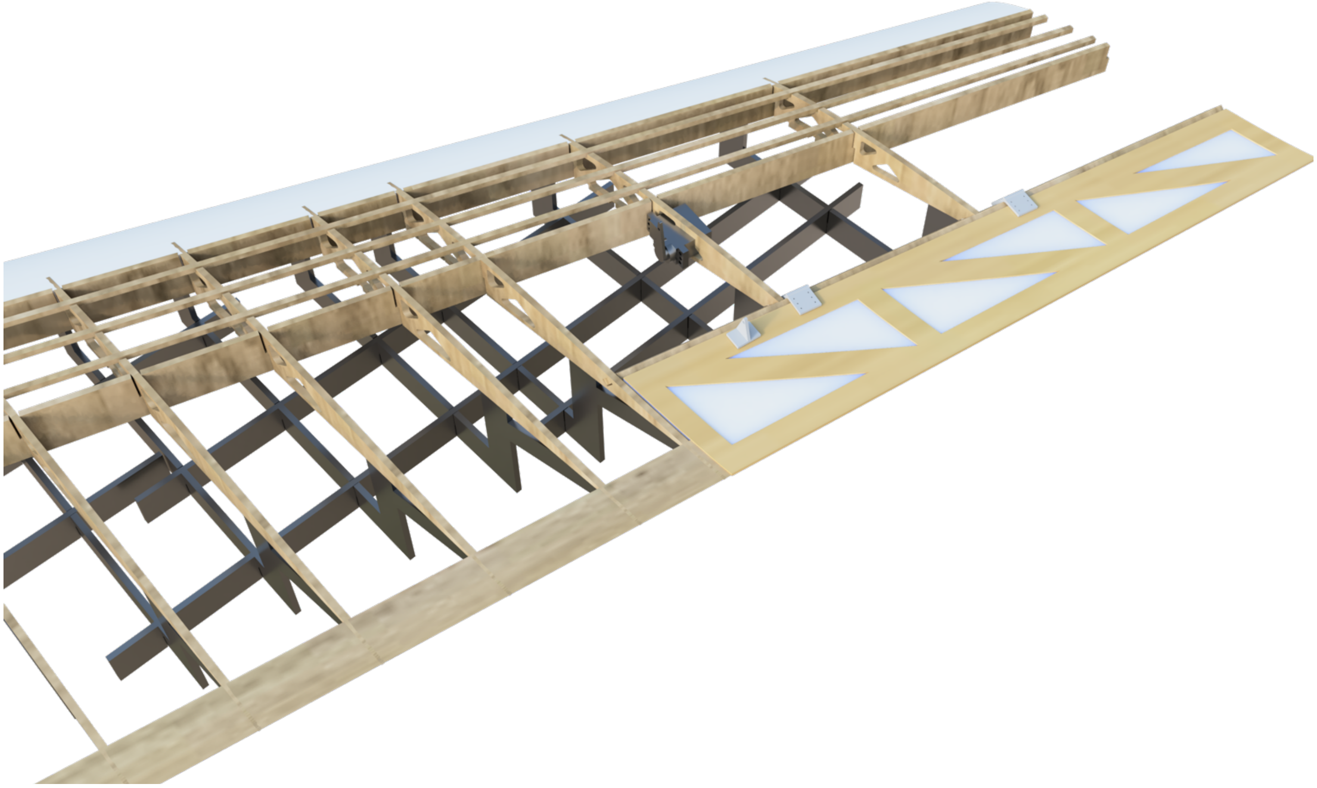




## 8. Payload Bay Panel Installation

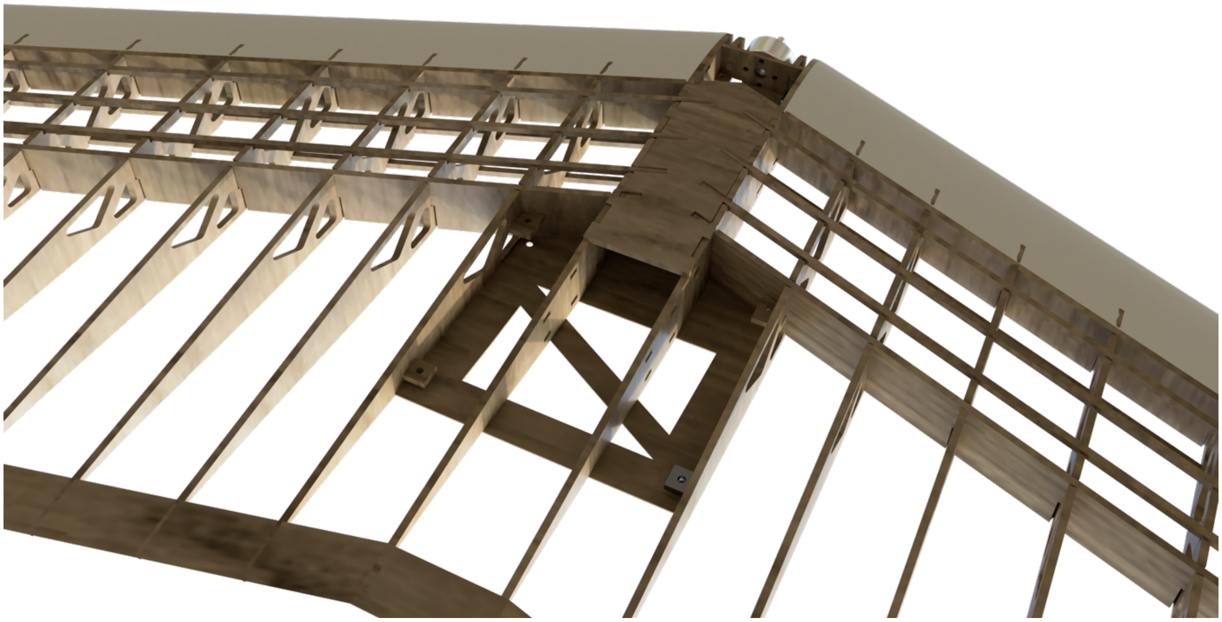


## 9. Servo Installation



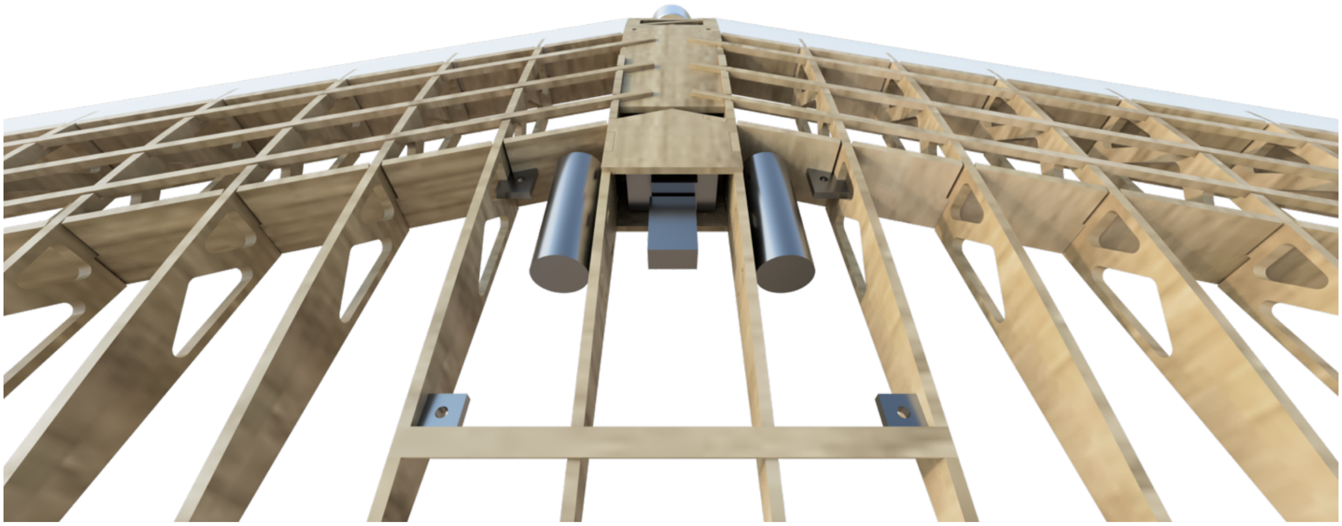
## 10. Break Wing Out of Tooling

## 11. Bottom Stringer Installation

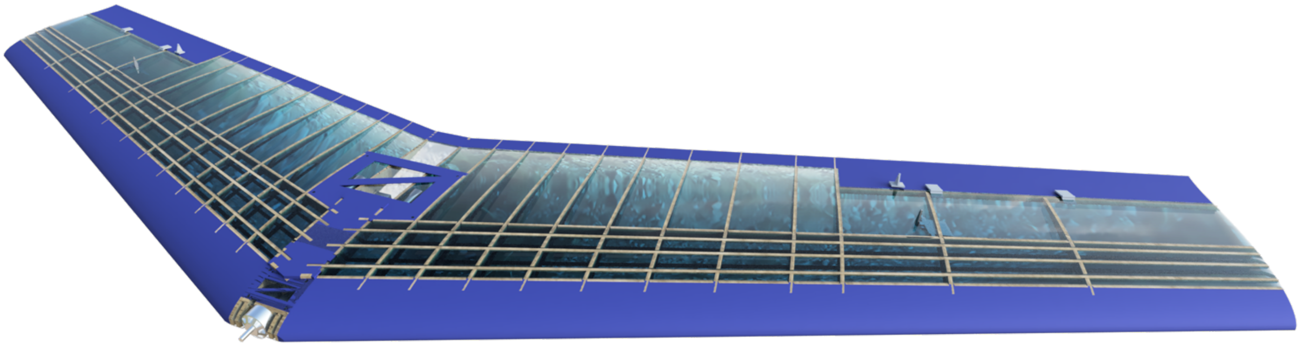


## 12. Wing TE Lower Skin Application

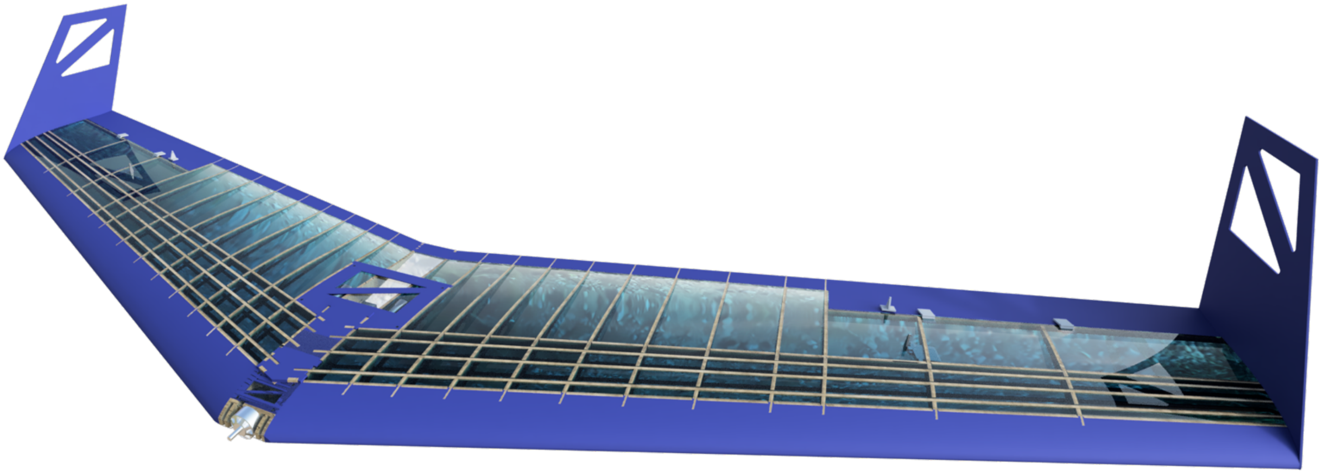
## 13. ESC/RX Installation



## 14. Coverlite Application

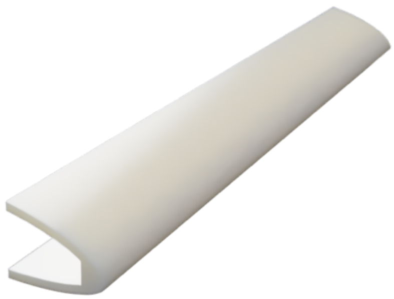


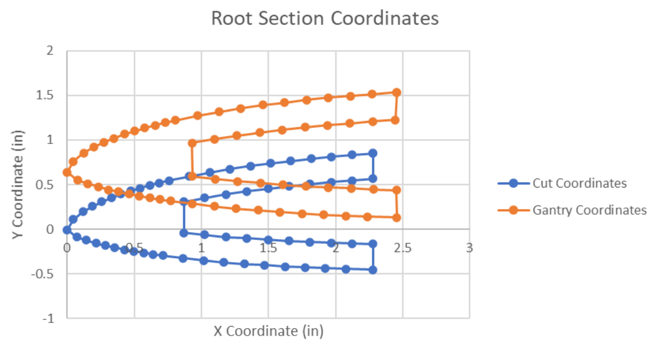
## 15. Winglet Mounting

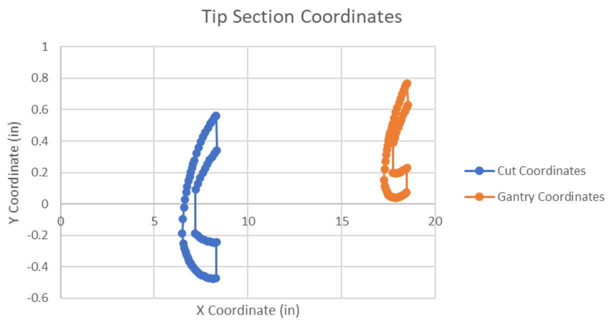


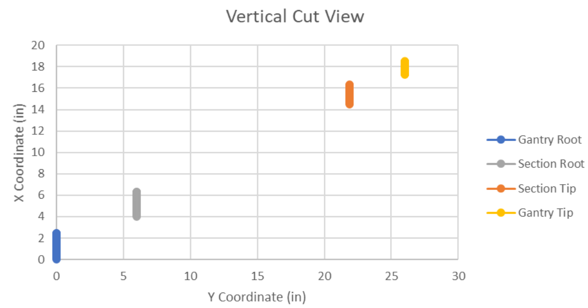
# II. Laser and Foam Cutting Requests

## 1. Leading Edge Foam Cut

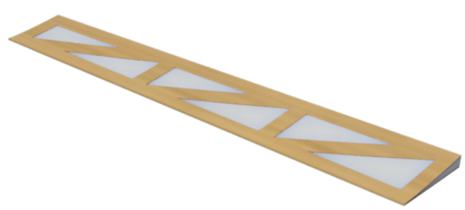


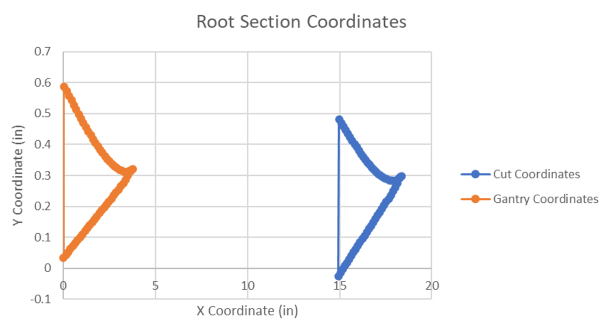


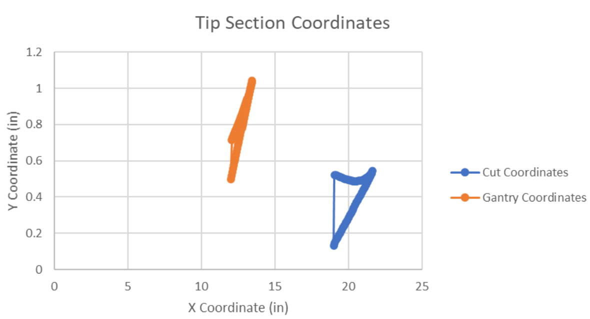



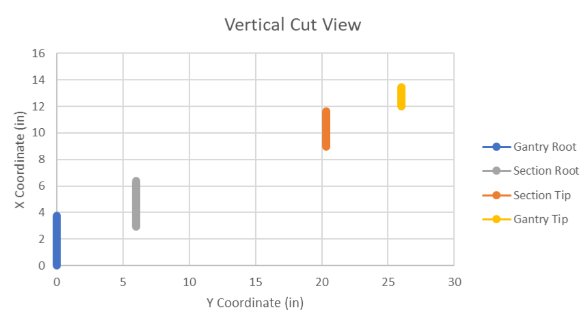




## 2. Elevon Core Foam Cut

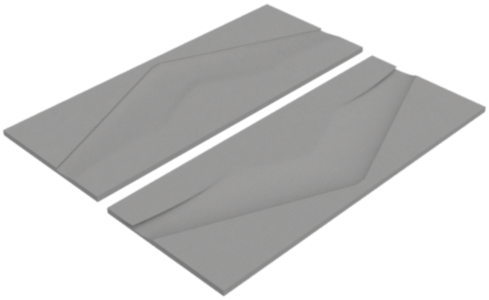


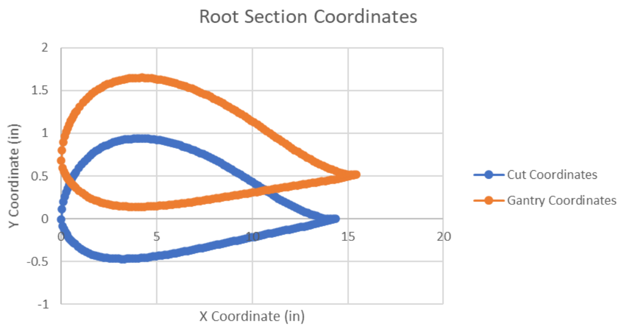


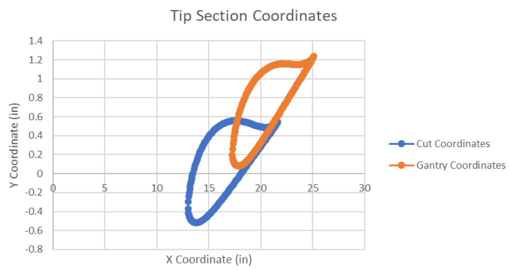



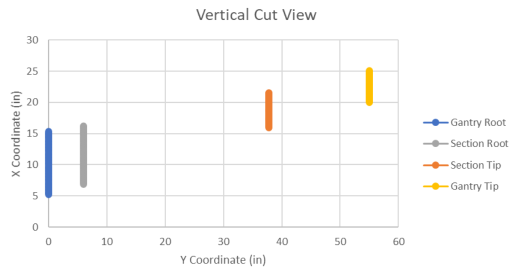



### 3. Foam Core Cut for Transport/Storage






### 4. Laser cut files included in submission

## III. Standard and non-standard requested materials and components

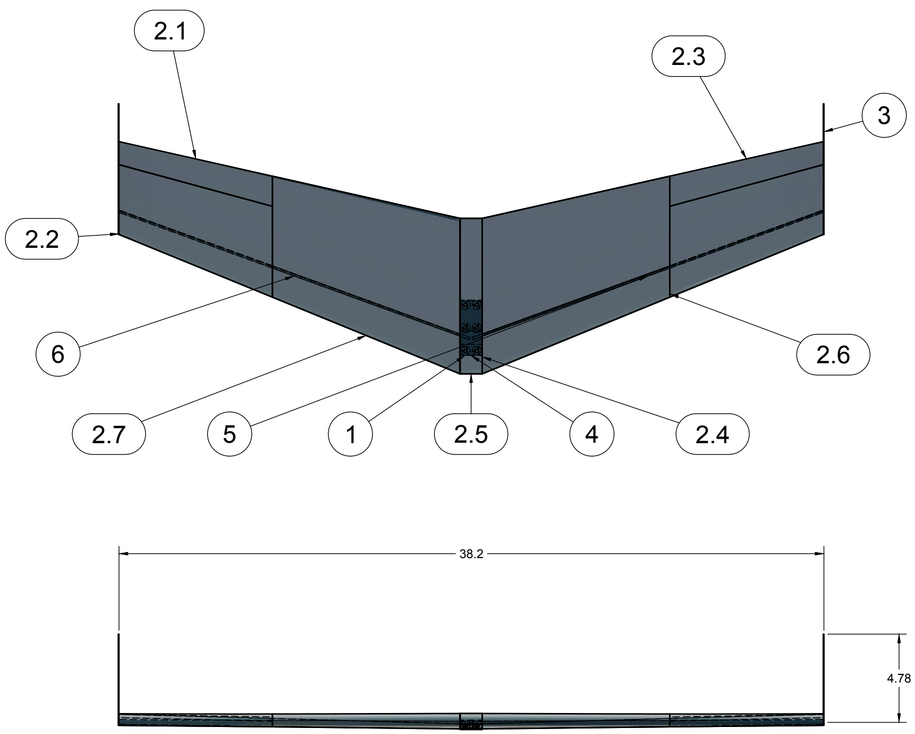
***Penny Pinchers***

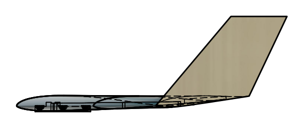
**Aircraft Inventory & Costs**

| **Item** (equipment, materials, parts, laser cutting, etc.) | **Unit Cost** | **Quantity** | **Total Cost** | **Vendor** (name, http, WSU, etc.) | **Stock #** |
|---|---|---|---|---|---|
| Storm 14.8V 200mAh 35C LiPo Battery Pack | $12.90 | 2 | $25.80 | Helipal.com | LPB-14820035-JST |
| DIATONE MAMBA TOKA 2203.5 2650KV RACING MOTOR | $19.99 | 1 | $19.99 | pyrodrone.com | 94C-9507 |
| Slow Flyer Propeller, 9 x 6 SF | $2.71 | 3 | $8.13 | Towerhobbies.com | APC09060SF |
| FrSky RX6R 2.4G Receiver | $27.99 | 1 | $27.99 | Towerhobbies.com | CSE010012900 |
| Talon 15-Amp 17V ESC w/8-Amp BEC | $34.95 | 1 | $34.95 | hobbyking.com | 9351000106-0 |
| HS-65MG Sub-Micro Analog Metal Gear Servo | $29.99 | 2 | $59.98 | Towerhobbies.com | HRC32065S |
| 1/16 balsa per sq ft | $4.74 | 2 | $9.48 | WSU | |
| 1/8 balsa per sq ft | $6.72 | 11 | $73.92 | WSU | |
| 1/8 x 1/8 balsa per ft length | $0.28 | 36 | $10.08 | WSU | |
| 1/32 balsa per sq ft | $4.74 | 4 | $18.96 | WSU | |
| eps foam 2 in thick per sq ft | $0.90 | 20 | $18.00 | lowes.com | 15357 |
| coverlite per sq ft | $1.64 | 10 | $16.40 | WSU | |
| 1/8 bass per sq ft | $5.16 | 1 | $5.16 | WSU | |
| m3 nylon bolts | | 8 | $0.00 | WSU? | |
| | | **TOTAL AIRCRAFT COST** | **$328.84** | | |

# IV. Wind Tunnel Model

## 1. 3-View Drawing



| PARTS LIST | | | |
|---|---|---|---|
| ITEM | QTY | PART NUMBER | MATERIAL |
| 1 | 6 | 90975A012_ZINC-PLATED STEEL TEE NUT INSERTS | STEEL |
| 2 | 1 | FOAM BODY | POLYSTYRENE, EXPANDED |
| 2.1 | 1 | RH ELEVON | POLYSTYRENE, EXPANDED |
| 2.2 | 1 | RH OUTBD | POLYSTYRENE, EXPANDED |
| 2.3 | 1 | LH ELEVON | POLYSTYRENE, EXPANDED |
| 2.4 | 1 | LH INBD | POLYSTYRENE, EXPANDED |
| 2.5 | 1 | CS | POLYSTYRENE, EXPANDED |
| 2.6 | 1 | LH OUTBD | POLYSTYRENE, EXPANDED |
| 2.7 | 1 | RH INBD | POLYSTYRENE, EXPANDED |
| 3 | 2 | WINGLET SCALED | 1/16" BASSWOOD |
| 4 | 1 | MOUNTING PLATE | PLA |
| 5 | 1 | LEFT SPAR | 1/8" BASSWOOD |
| 6 | 1 | RIGHT SPAR | 1/8" BASSWOOD |

SCALE BAR

2" 6"

ALL DIMENSIONS IN INCHES UNLESS OTHERWISE NOTED

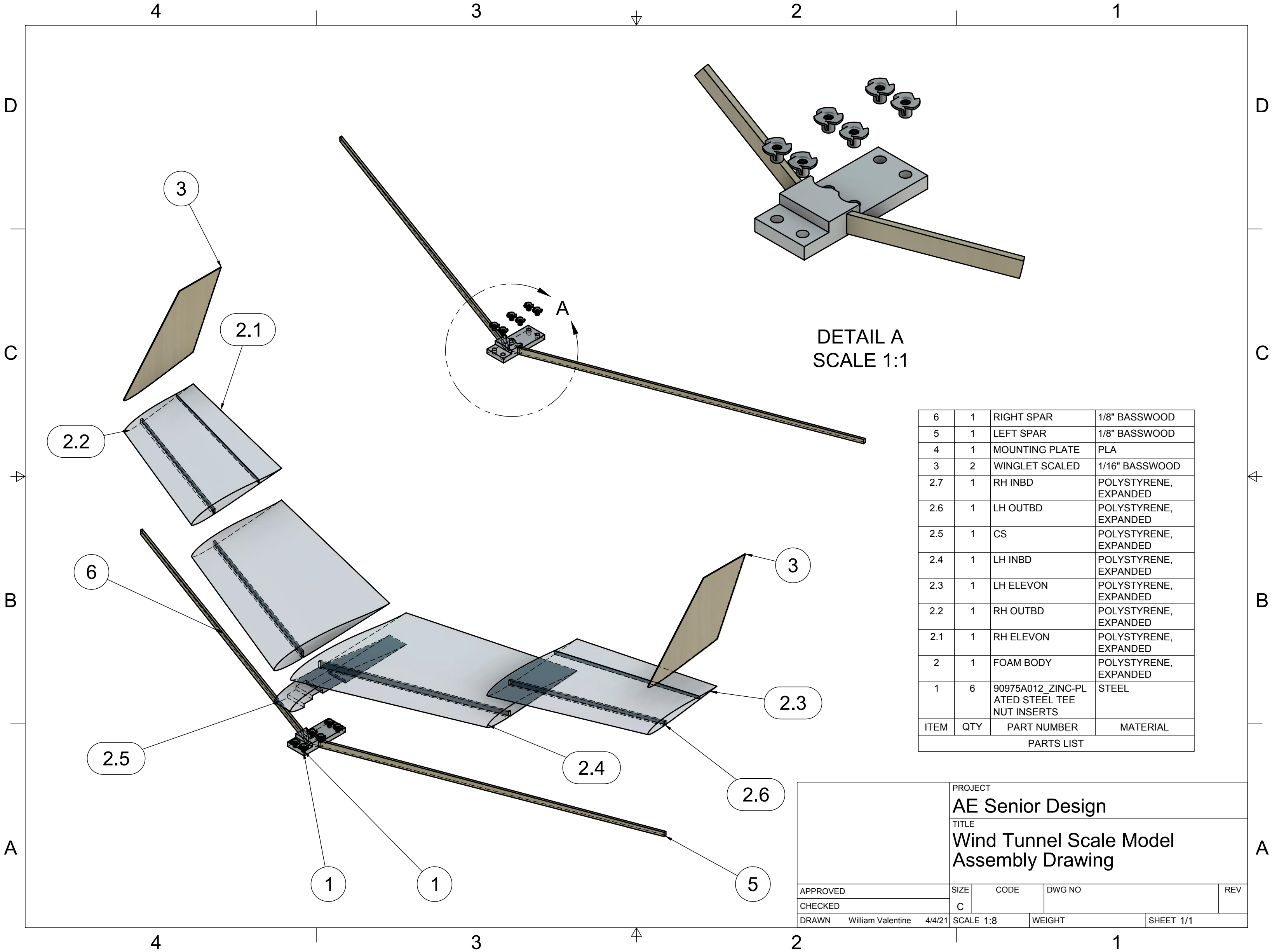
NOT ALL DIMENSIONS SHOWN, REFER TO REFERENCE SCALE AT BOTTOM LEFT

PROJECT: AE Senior Design

TITLE: Wind Tunnel Scale Model

| | | | | | |
|---|---|---|---|---|---|
| APPROVED | | SIZE C | CODE | DWG NO | REV |
| CHECKED | | | | | |
| DRAWN | William Valentine 4/4/21 | SCALE 1:4 | WEIGHT | SHEET 1/1 | |

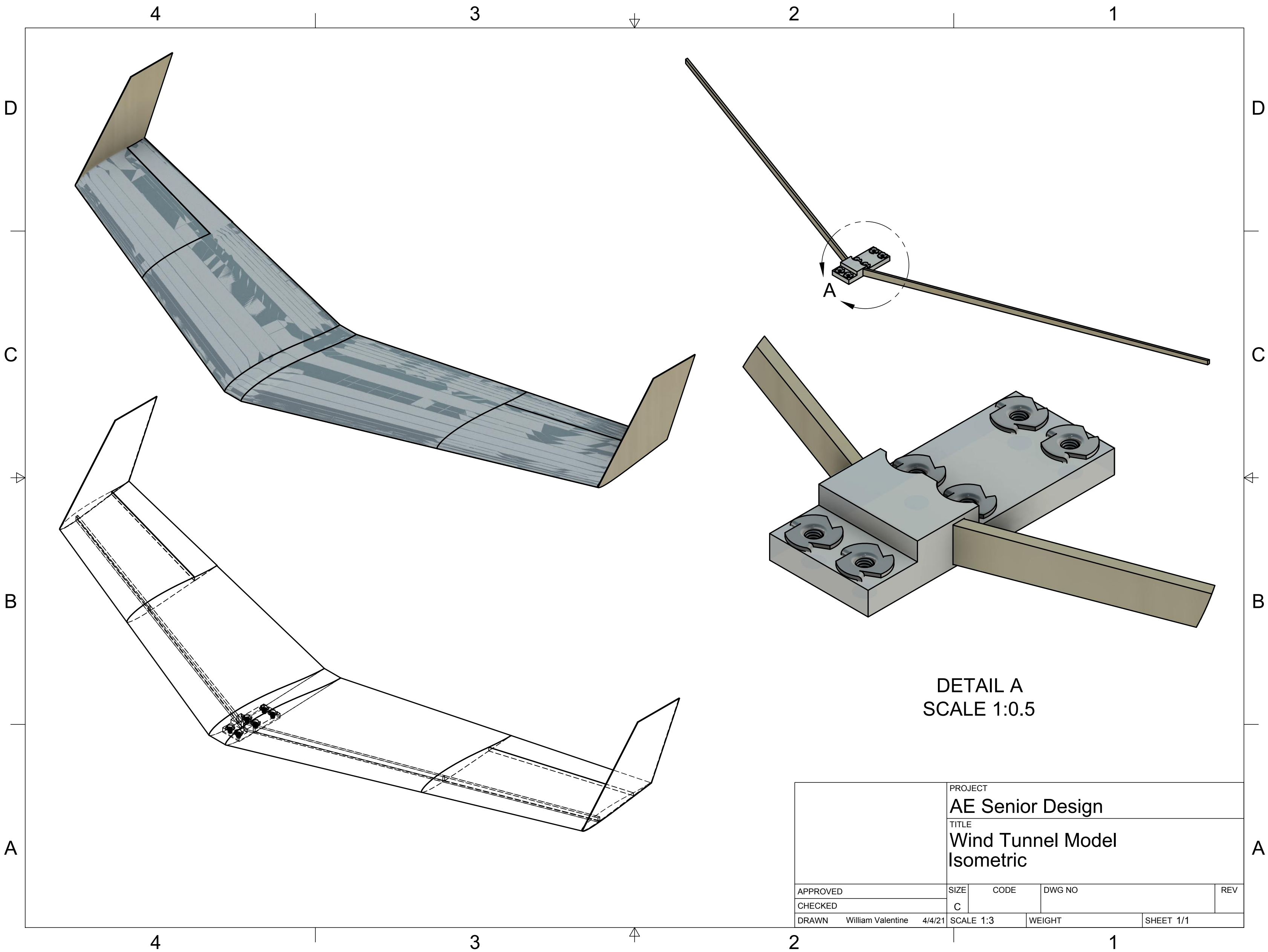
## 2. Assembly Drawing




| | | | |
|---|---|---|---|
| 6 | 1 | RIGHT SPAR | 1/8" BASSWOOD |
| 5 | 1 | LEFT SPAR | 1/8" BASSWOOD |
| 4 | 1 | MOUNTING PLATE | PLA |
| 3 | 2 | WINGLET SCALED | 1/16" BASSWOOD |
| 2.7 | 1 | RH INBD | POLYSTYRENE, EXPANDED |
| 2.6 | 1 | LH OUTBD | POLYSTYRENE, EXPANDED |
| 2.5 | 1 | CS | POLYSTYRENE, EXPANDED |
| 2.4 | 1 | LH INBD | POLYSTYRENE, EXPANDED |
| 2.3 | 1 | LH ELEVON | POLYSTYRENE, EXPANDED |
| 2.2 | 1 | RH OUTBD | POLYSTYRENE, EXPANDED |
| 2.1 | 1 | RH ELEVON | POLYSTYRENE, EXPANDED |
| 2 | 1 | FOAM BODY | POLYSTYRENE, EXPANDED |
| 1 | 6 | 90975A012_ZINC-PLATED STEEL TEE NUT INSERTS | STEEL |
| ITEM | QTY | PART NUMBER | MATERIAL |
| PARTS LIST | | | |

| | | | | | |
|---|---|---|---|---|---|
| | PROJECT AE Senior Design | | | | |
| | TITLE Wind Tunnel Scale Model Assembly Drawing | | | | |
| APPROVED | SIZE C | CODE | DWG NO | | REV |
| CHECKED | | | | | |
| DRAWN William Valentine 4/4/21 | SCALE 1:8 | | WEIGHT | SHEET 1/1 | |

## 3. Isometric Drawing



# 4. Wind Tunnel Structural Validation

## a. Geometry

The spar is made of 1/8" basswood and makes up 50% of the airfoil height at the quarter-chord. For the root chord length of 8.43 inches, this results in a spar that is 0.42 inches in height. The total length of the considered beam is 20.30 inches after accounting for sweep.

## b. Loads

Since the wind tunnel model is mounted upside-down relative to normal orientation, the weight will need to be considered in addition to the lift of the wing. From the foam airfoil and the basswood spar, the weight distribution along the quarter-chord is conservatively assumed to remain the same as the root, 0.005 lbf/in. The lift is calculated below using a maximum lift coefficient of 0.83 and dynamic pressure of 1.99 psf:

$$L = qSC_L = 1.99 * 1.8 * 0.83 = 2.97\ lbf$$

Conservatively assuming a uniform lift distribution, the lift distribution along the quarter-chord is 0.073 lbf/in.

$$w = 0.005\frac{lbf}{in} + 0.073\frac{lbf}{in} = 0.078\frac{lbf}{in}$$

$$V = wL = 1.58\ lbf$$

$$M = \frac{wL^2}{2} = 16.08\ in - lbf$$

## c. Section Properties

The 99% certainty value for the Young's moduli of the pink foam and basswood are used to find the modulus-weighted area moment of inertia of the section relative the pink foam modulus:

$$I' = 0.50\ in^4$$

## d. Stresses

The bending stress is derived from the standard bending stress equation and ratioed by the Young's modulus of the material at the location in question to the pink foam modulus. For the pink foam airfoil, half of the maximum airfoil is considered as the extreme fiber, while half of the spar height is considered the extreme fiber for the basswood.

$$\sigma_b = \frac{My}{I}$$

$$\sigma_{foam} = \frac{16.08 * 0.42}{0.50} * 1 = 27\ psi$$
$$\sigma_{bass} = \frac{16.08 * 0.21}{0.5} * 426 = 2916\ psi$$

The 99% certainty allowable tensile strength is used for the foam and the basswood:

$$\sigma_{foam} = 50\ psi$$
$$\sigma_{bass} = 4600\ psi$$

## e. Margins of Safety

A factor of safety of 1.5 is considered for the wind tunnel model. The minimum margins of safety are found from the allowable stress and the applied stress for each material location:

$$M.S. = \frac{\sigma_{allow}}{FS * \sigma_{applied}} - 1$$
$$M.S._{foam} = \frac{50}{1.5 * 27} - 1 = 0.21$$
$$M.S._{bass} = \frac{4600}{1.5 * 2916} - 1 = 0.05$$

All margins are shown to be positive, therefore, the structure will not fail.

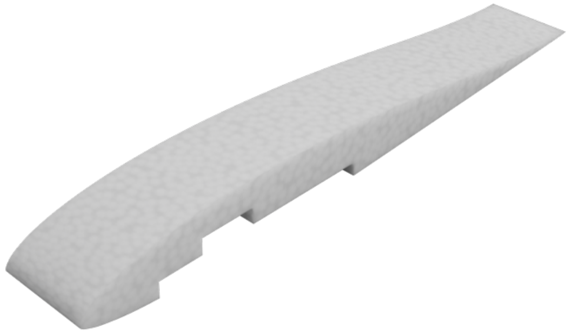
## 5. Foam Cut Files

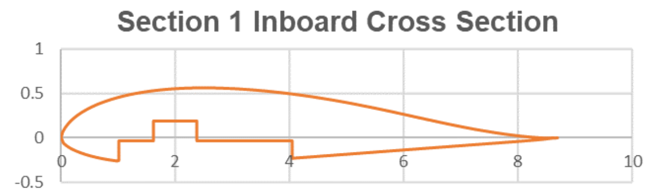
-There is a total of 5 foam cut files. Two for each wing and one center section. The center section cutout includes a cut for the 3D printed spar joining component. The inboard wing cut includes a slot for the spar to slide in, and the outboard cut includes the spar cut as well as a cut for the elevon.

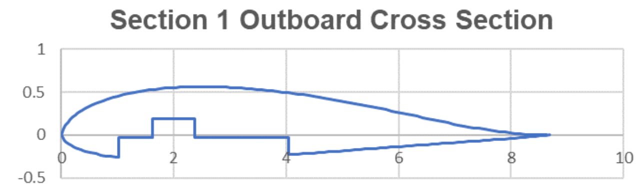
-Epoxy will be used to glue the sections together, as well as secure the winglets to the outboard foam sections.

-The wind tunnel model will be covered in Coverlite in order to match the surface of the actual vehicle.

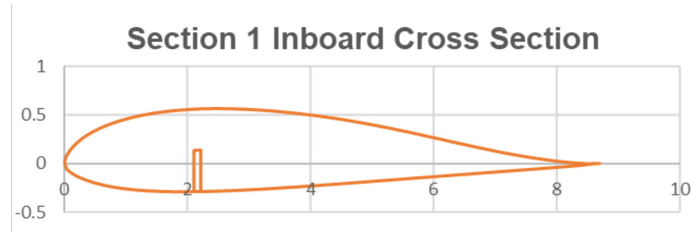
a. Center Section Foam Cut

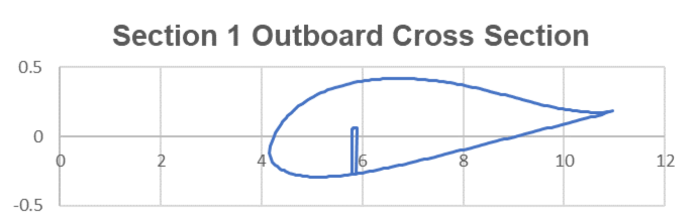




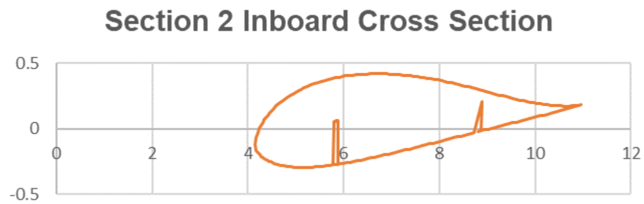



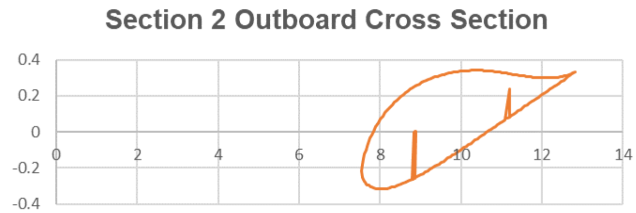

b. Inboard Wing Section Foam Cut



c. Outboard Wing Section Foam Cut




d. Foam Cut Sections Assembled

## 6. Wind Tunnel Flow Similarity

| Wind Tunnel Flow Similarity Calculations | | | | | |
|---|---|---|---|---|---|
| Full Vehicle | | | Wind Tunnel Model | | |
| S | 5 | ft^2 | S | 1.8 | ft^2 |
| Rho | 0.00229 | slug/ft^3 | Rho | 0.00229 | slug/ft^3 |
| Cruise Speed | 25 | ft/s | Cruise Speed | 41.67 | ft/s |
| Reynold's # | 161,470 | | Reynold's # | 161,470 | |
| Dynamic Pressure | 0.72 | lbf/ft^2 | Dynamic Pressure | 1.99 | lbf/ft^2 |

## 7. Geometry

-Wind tunnel model is 60% scale of full vehicle in order to keep wingspan below 80% of tunnel width.

| Wind Tunnel Mode Geometry | | |
|---|---|---|
| Scale: | 60% | |
| AR | 5.61 | |
| S | 1.8 | ft^2 |
| Span | 3.18 | ft |
| Taper Ratio | 0.6 | |
| C/4 Sweep Ang | 20 | deg |
| LE Sweep Angle | 22.2 | deg |
| TE Sweep Angle | 12.97 | deg |
| Root Section Span | 1.2 | in |
| Root Section Chord | 8.43 | in |
| Root Chord | 8.43 | in |
| Tip Chord | 5.06 | in |
| Cbar | 7.60 | in |
| Wing Twist | -6 | deg |

## 8. Wind Tunnel Model Renderings

## 9. 3D Printed Mounting Plate Drawing

-3D printed mounting plate serves two purposes. It joins the two basswood spars at the root, as well as provides a mounting fixture for the model to attach to the wing tunnel balance. Epoxy will be used to secure the spars to the mounting plate. The tee nuts will be inserted into the six mounting holes on the mounting plate before the plate is secured into the model.