the world's best designers united

SwitchBlade 90

High Performance Sport Jet

Fully 3D Printable

User Guide

Wingspan 1200mm (47.25")

Donald Wright

Here's what may be the best printed 90mm sport jet. The 90mm EDF fan unit is available from many sources and is arguably the most bang for the buck as you move up to larger jets. Going larger increases the cost exponentially in almost every aspect. The 90mm EDF, at this time, is the most cost effective large sport jet.

Discover what the most of the jet flying RC community has;

- Sport jets are fun! Here's a link to the DEMO Flights – (right gear didn't extend)
- Sport jets can fly a very large flight envelope – from very fast to extremely slow
- Unlike designs that try to emulate warbirds, sport jets are a clean sheet and often boast very generous wing area in comparison.
- Increased resistance to stall, typically breaking cleanly and predictably.
- The 90mm sport jet fits in one piece in most mid to full size SUVs.
- The size has a large presence in the air – smaller jets get out of visual range too easy.

And a Printed version has these benefits

- Design your own livery – from mild to wild
- Less expensive operation and repair
- Extensive product support from 3DLabPrint and 3DLabGang by way of forums.
- Extensive and exclusive filaments, robust PolyAir PLA and PolyLight LW-PLA
- Easier to make the jump to larger jets – experienced pilots may be able to successfully maiden this design as their first jet.

A note about this kit design;

It's not recommended for beginning builders. This is a complex design and even though much effort, design and forethought have been brought to bear on this project, it will still take a practiced hand to assemble, outfit, program and fly successfully. That's not to say that a beginner can't do it – it's just a heads-up that this project ranks among the most extensive print projects and RC projects – A successful build and maiden will be exhilarating and a worthwhile accomplishment. Please read through the instruction manual and accompanying pictures and drawings before printing and assembly – there are many considerations and choices to be made.

1. Many elements of the design incorporate product suggestions from other commonly available airframes. Such as the landing gear – a Freewing design used on their very successful Stinger 90. But other gear and parts may be substituted as the builder wishes, this is where the experience and skill of the builder come in.

Here are just a few of the innovations applied to this new design;

- Carbon hinged tail control surfaces
- Hidden Pin Hinged Ailerons and Flaps
- Battery strap slots
- Adequate cooling intakes
- Robust double wall fuselage
- Lightweight single layer printing and webbing
- Plenty of space for different powerplants, ESC's and batteries
- Efficient ducting and minimal fuse cross section
- Top access construction – full canopy removable exposes complete interior
- Modular construction
- Servo covers and internal wire routing though the wingtips
- Fully enclosed gear with working and automatic gear covers
- Carbon reinforced wings – Carbon stressed fuselage
- Three different canopy choices, Bubble, Fighter and blank for creating painting your own design
- Files and allowances for super bright landing/orientation lights
- Extensive use of Lightweight PLA and Regular PLA.
- Proven main airfoil.
- Integrates well with State-of-the-Art gyro and stabilized RX's.
- Generous flaps for slow and controllable flight.

- Fully exposed and cooled ESC placement.

Let's get to it.

If you have questions or run into trouble, visit the 3DLabGang forums and find the dedicated thread for this project.

Notes on Materials (note hyperlinks for suggestions)

1. 3D LabPrint PolyAir and PolyLight PLA and LW-PLA printing material. Use a brand that you've trusted before and know the printing parameters for. The supplied "Gcode" files are files that have been set up for Prusa type machines at a size of 200x 200 x 200 and use readily available PLA and LW-PLA. You may find that these files work without any modification. If you need to make parameter changes you might want to start with the supplied "factory" files. These are Simplify 3D files and a great way to understand the "single line" printing processes and how the particular Gcodes were arrived at, and the orientation of parts. Otherwise, the supplied STL files are also supplied as well as "ini" files for basic Cura settings. There is a "schedule of parts where the basic print parameters are called out for each part. Pay special attention to parameter changes at different points/layers within each part. The infill for this project is either 3% or 10% Rectilinear and often there is a combination of both within a single part – wing parts for example will vary around hinges, giving more strength where needed. Pay special attention to the supplied S3D Factory files and part orientation, in most cases the part has been rotated to take advantage of the orientation of the infill, giving the part the most strength.
2. Motor/EDF – 90mm fan - 93.5mm outside case diameter, 68mm in case length in either metal or plastic housing. Either with a bellmouth or without. More fan blades the better - for thrust and best sound. This comes with a high current draw penalty and lower flight times of course. Sport jets in this size range typically have a 3-1/2 to 4 minute timer. The designs allows for a forward or afterward placement of the fan unit to help with the CG. 6S capable motor. This motor/fan has been tested and found more than adequate. A high performance Fan/Motor combination is recommended. For those needing a little more space, those using an Eflite Viper 90 motor setup for example, there are alternative parts with larger cavities – up to 95.5mm OD, 77.5mm Length and bell diameter

of 103.5mm – use parts Fuse A9X, Fuse A10X and Canopy FX. Be sure of your motor fan combination before assembly – they cannot be changed afterward. If you find a motor/combination that cannot be accommodated, write to 3DLabPrint with a specific size request, if there are a number of requests for a different size, perhaps a file modification will be made for you.

3. Battery – Test flights were made with a good/high quality 5000mah 6S battery. Minimum 50C recommended. Always consider battery weight/placement for CG purposes. Batteries with a higher C rating are always preferred and batteries with high C ratings are getting considerably lighter. Don't fasten your motor/fan combination until airframe is nearing completion, you can slide motor fore and aft a bit to help with CG placement.
4. ESC – Any good quality ESC will work. 130 Amp minimum size recommended. There are several servos in this design, retractable gear and a gyro/stabilized system requires a little more amperage than most designs. For safety's sake, typically the voltage regulator that supplies power to the controls is a separate unit. An 8amp unit can be thought of as a minimum suggestion.
5. RX/TX – A programmable radio is typically used in designs like this – a minimum of seven channels, eight preferred for the RX. Three being for gear, front gear door and flaps. But there are numerous benefits to more channels. Especially if using capable Spektrum RX's with SAFE and telemetry technology. Adjustable on the fly gain, panic, flight modes, separate steering servo (with separate from rudder trim) and mixing abilities are all benefits to flying high performance aircraft. This advanced design assumes use of programmable radios and an understanding of such.
6. Servos – A combination of different servos and sizes are needed. Specific size servo cases are molded into the design, tabs may need to be cut off in some cases. Digital servos are a better choice when gyro/stabilization is used and metal gears are better for withstanding rough landings.
7. Various bits and some screws for motor mounts etc. Velcro and a battery strap are needed.
8. Decal Sheets - if you wish to use the included graphics. This Decal Suggestion may also be found on Ebay.
9. Carbon – You'll need carbon rod and tube to successfully complete a strong model. See the bill of materials for the sizes, types and lengths.

10. Servo Extensions - will be needed with this design. However, due to tight clearances, it's best to obtain servo wire and make your own. It's easiest to simply cut the existing servo cord in half and carefully solder a length to the servo end, then rout the bare end through the airframe during assembly, with all marked and bare ends terminating in the RX area, then clip the leads to the needed length and carefully solder the RX ends to the extensions. Use the appropriate size heat shrink (don't direct heat onto any printed part) on each connection and be absolutely sure of your solder joints and skill – this task is one that requires skill and is why this airframe is truly a "builders" kit. There are two levels in the battery compartment. Underneath the battery floor there is ample room for the Receiver and accompanying wiring to be tucked away, the result is a neat, safe and tidy installation. There are two channels out of the fuselage in this area for antenna exits.

Bill of Materials (note hyperlinks for suggestions)

1. 1.2 kg of PolyLight LW-PLA
2. .33 kg of PolyAir PLA (prototypes tested with ASA in lieu of PLA for a weight savings of +/-50g, ASA printing requires prior experience with ASA material)
3. Fan/Motor – Most Freewing designs will fit without modification. Alternate files supplied for larger fans like Eflie Viper 90. (Fan and Motor) or FMS Viper Clone
    1. Basic Fan Housing – 93.5mm OD, 67mm Length, 102.5 OD Bell, 117.5mm OA width over tabs.
    2. Large Fan Housing - 95.5mm OD, 77.5mm Length, 103.5 OD Bell, 117.5mm OA width over tabs. (Use Fuse files A9X, A10X and Canopy file FX)
4. ESC – Any quality brand ESC should fit and work just fine – this size fan begins with a minimum requirement of around 130amps. Here are a few examples, Avian 130 FreeWing 130 HobbyWing – it's your decision to use a separate or integral BEC to power the RX/Servos/Gear/etc.
5. Carbon -
    1. Wing – Imbedded Carbon Tube 8mm x 335mm (x2)
    2. Wing – Front Spar Carbon Tube 8mm x 480mm
    3. Wing – Middle Spar Carbon Tube 10mm x 660mm

4. Wing - Rear Carbon Spar – Carbon Tube 8mm x 790
5. Stabilizer – Front Spar – Carbon Tube 6mm x 117mm
6. Stabilizer – Rear Spar – Carbon Tube 6mm x 290mm
7. Fin – Front Spar – Carbon Tube 6mm x 115mm
8. Fin – Rear Spar – Carbon Tube 6mm x 155mm
9. Fuselage – Side Gear Spars – 6mm x 410mm (x2)
10. Fuselage – Tension Rod – Carbon Rods 1mm x 812mm (long, cut after installation)
11. Elevator – Hinge Pins – Carbon Rods 1.5mm x 225mm (x2)
12. Rudder – Hinge Pin – Carbon Rod 1.5mm x 190mm
13. Front Gear Doors – Hinge Pins – Carbon Rods 1mm x 250mm (x2)

6. Landing Gear - Freewing Stinger Landing Gear may be found here Nose Gear Full Set possibility many other outlets online. The benefit to this gearset is that they are reasonably tough, withstanding hundreds of landings in testing. And they are a good value. The model is sized for this gearset without any modification needed. Any retract mechanism of this size (38.5mm MountWide, 33mm Mount Length, 66.5mm Overall Length, 26.5mm Case Deep and 17.5mm Case Width) is a drop-in fit as well, although you will have to fabricate your own wire or struts to complete the project if you find you have to use a retract mechanism without supplied struts. If you make your own struts the main wheels are 16mm x 65mm and the front wheels are 16mm x 45mm.
7. Servos – Nine (9) servos are required – Two for Ailerons, Two for Flaps (1 Reverse) Two for Elevator (1 reverse) One (1) for Rudder, One (1) for Front Gear door, One (1) for Front Wheel Steering. Main servos are 17g Metal Geared Digital (recommended) with Steering being a 9g Metal Geared Digital and Front Gear Door being a 9g Plastic Geared Digital.
   1. 5 pcs – Freewing 17g Metal Gear Servo
   2. 2 pcs – Freewing 17g Metal Gear Servo (Reversed)
   3. 1 pcs – Freewing 9g Metral Gear Servo
   4. 1 pcs – Freewing 9g Plastic Gear Servo

Other servos may be used as long as the case size for the 17g are 28.5mm x 13.5mm x 30mm and 9g are 23.5mm x 12.2mm x 26.4mm

Mounting tabs will be cut off for the Ailerons, Flaps, Elevator and Rudder Servos, they will be glued in position with Flexible or dabs of CA, whatever method you deem applicable.

8. Freewing Stinger Pushrod Set – this set will allow you to outfit the airframe control surfaces with very accurate and smooth running controls. You will have to do little if any modifications – these are available from Motion here and other places too.

9. Robart 1/8" Steel Pin Hinge Points #308– 12pcs are needed for Ailerons and Flap control surfaces – Can be found at Motion here and other places too.

10. Freewing Metal Ball Links – these work well with the Pushrods and are much stronger than the drilled hole and Z bend method of connecting to control surface horns.

11. Freewing 1.2mm Ball Head Buckles – these are extras, good to have for assembly of control surfaces.

12. Freewing Servo Arm with Link Stop – this is a valuable part for connecting the steering servo to the steering arm.

13. Servo Wire – Of course you can use pre-made servo extension wires, but these are never in the length that you want or need, they add complexity and are a disarray in the Receiver compartment. If you make your own extensions, you'll be able to control just how much wire you need and you eliminate all the extra plug-in connections where each one is another point of failure. Learn to solder your own extensions in between the existing servo wire – get some extra small heat shrink tubing for each solder joint, and then a slightly larger tube to cover all three wires – super simple and the elimination of a failure point. A bit more work, but results in easier fishing of wires through cramped wire chases too. Search for 22-26ga RC servo wire online – plenty of options. 3/32" heat shrink for individual servo wires and 3/16" heat shrink for over all three. If you can build this plane, you can learn to solder wires professionally. There are many videos online to help with this too! Servo Wire 22ga Servo Wire 26ga 3/32"Heat Shrink Tubing 3/16" Heat Shrink Tubing

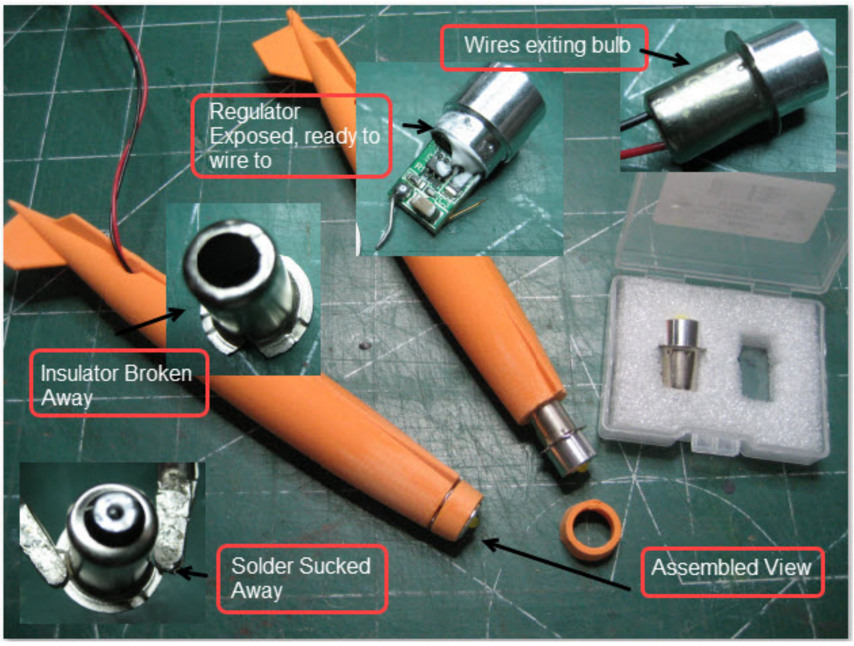
14. Landing Lights – Sport jets, when coupled with modern SAFE Receivers can easily fly safely farther away from the operator than in the past. The issue then becomes orientation, having the airframe lighted helps solve this problem. This design supplies files for one, two or three high intensity LED landing lights. One in the nose and/or two on wing fences in the form of wing tanks. These are the lights used. They are typical

Maglight Flashlight LED replacement bulbs, They are powered with 6-25v DC. They have a small internal voltage regulator that allows different supply voltages (different number of battery cells) There are different deals all the time on Amazon and other places, they can be found online for as little as $3.20 a piece.

These lights are bright enough to be seen in full sunshine and will help enormously with plane orientation at any distance. There two ways to wire them, solder directly to the bulb case, which can be a bit of a problem at times because the internal ground wire is simply touching the case, vibration can allow the bulb to become intermittent. The preferred way is to use a de-soldering device or de-soldering tape to remove the solder from the positive end of the bulb, use pliers to pull the assembly apart, exposing the regulator board. Crush and remove the glass insulator from the end. Solder your fine insulated wires directly to the board paying attention to positive and negative. Reassemble the bulb with the wires coming through the bulb end, then fill the end with a small shot of hot-glue.

Then assemble the bulb into the printed nose of the front of the airplane and/or the two side pylon wing tanks. Route the wires to the internal bay and solder together and to a female 6s balance tap connector, You can use the full pack voltage of 25.2v, but best to pick a 3S position and feed 12.6 to the bulbs. The amp draw if very light, you may not notice any difference in the cells – but you balance charge your lipos anyway, right?

Once you fly planes with bright landing/orientation lights, you'll never go back. And you can fly late in the evening when others have gone home.



General specifications

Length: 1422mm (56in)

Wingspan: 1200mm (47-1/4in)

Height: 355mm (14in)

Wing area: 28.66 dm2 (444 sq in)

Wing loading: approx. 136 g/dm2 w/769g battery pack

Airfoil: semi-symmetrical

Print weight: @1556g

Empty weight AUW (w/o battery): 3175g (7lbs) (airframe, esc, servo, fan)

Takeoff weight (6S 5000mah lipo 769g) <3900g (8.6lbs)

Note – careful use of LW-PLA will result in a very flyable airframe at recommended settings, LW-PLA used globally in the prototypes was at a 65% feed rate (a savings of 35% weight over regular PLA) higher rates and weight savings may be experimented with at strength penalty of course.

Sport Jets

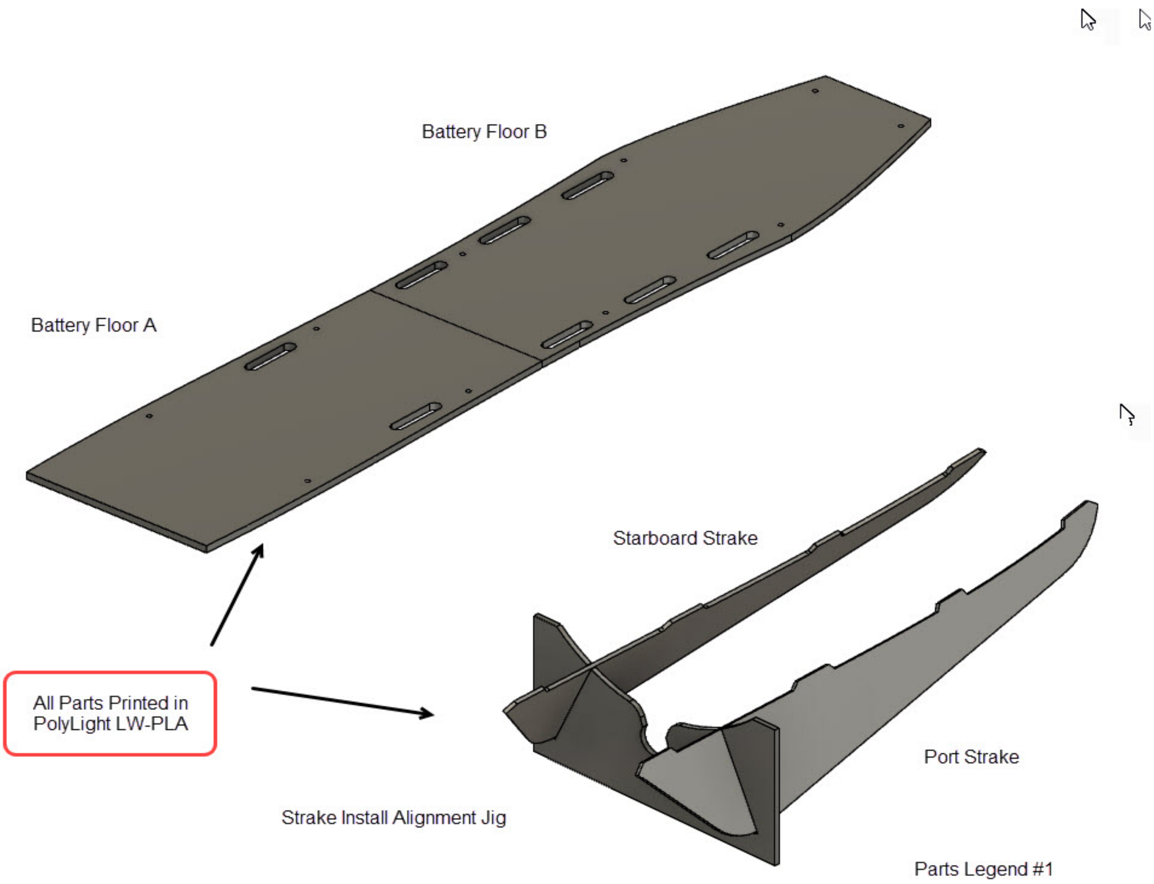
The full scale sport jet is a relatively recent addition to flight. Up until recently jets were the exclusive realm military, business, public and freight transport and the uber rich. But the advent of small turbines has changed the playing field. Small turbines have been successfully fabricated using modern materials, methods of machining and controlled by onboard computers. Beginning with planes like the BD-5 Sport Jet and most recently the SubSonic's sport jet from Sonex Sport Aircraft we're now seeing successful airframes come to market.

In the RC world, we've been overrun with "military" EDF's which fly pretty good, but they are mostly constrained by representing the full scale, which in many cases results in model planes with higher wing loadings and cheater holes, or larger than scale intakes. Sport jets on the other hand, ignore those requirements and start with a clean sheet, designing for the needed and wanted flight envelope.

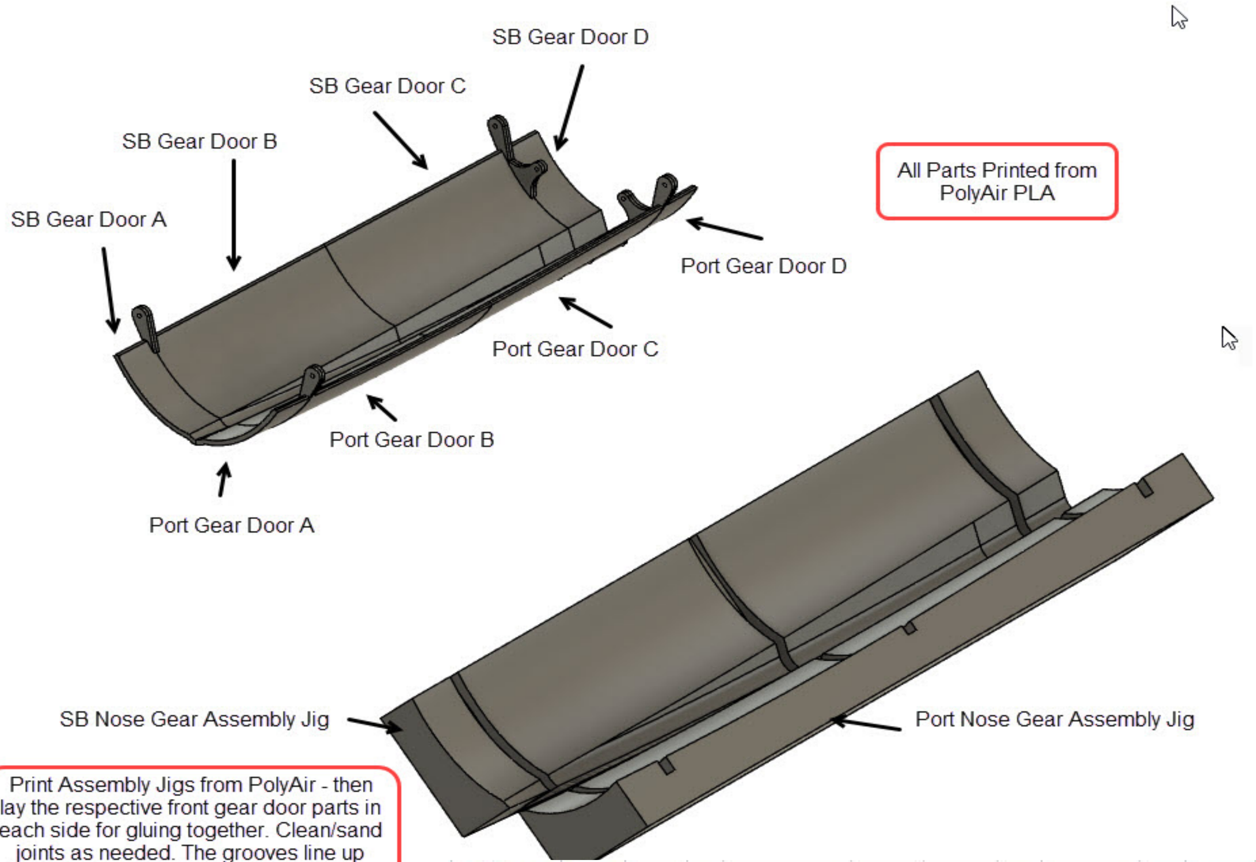
The SwitchBlade 90 is a culmination of much research and incorporating the best of the best, - proven airfoils, wing loading, access and most of all, the ability to print your own Sport Jet. You'll be rewarded with a predicable tracking airframe that cuts cleanly through the air. An airframe that is just the right weight to keep you flying when other guys are packing up due to wind. Couple it with the modern SAFE receivers and you'll have a bird that is rock solid in all conditions, even low light. You'll put hundreds of flights on this bird and each landing will be a master class instead of a white knuckled event. If you are using the modern SAFE RX's write to me here, and I'll send you a white paper on how to program these RX's to allow short/small field performance – information that is not in the tutorials or videos.

This model is not for beginning RC pilots. The assumption is that you've successfully maidened and flown all manner of RC airframes and that you're an accomplished printer and builder.

Parts Legends



Parts Legend #1



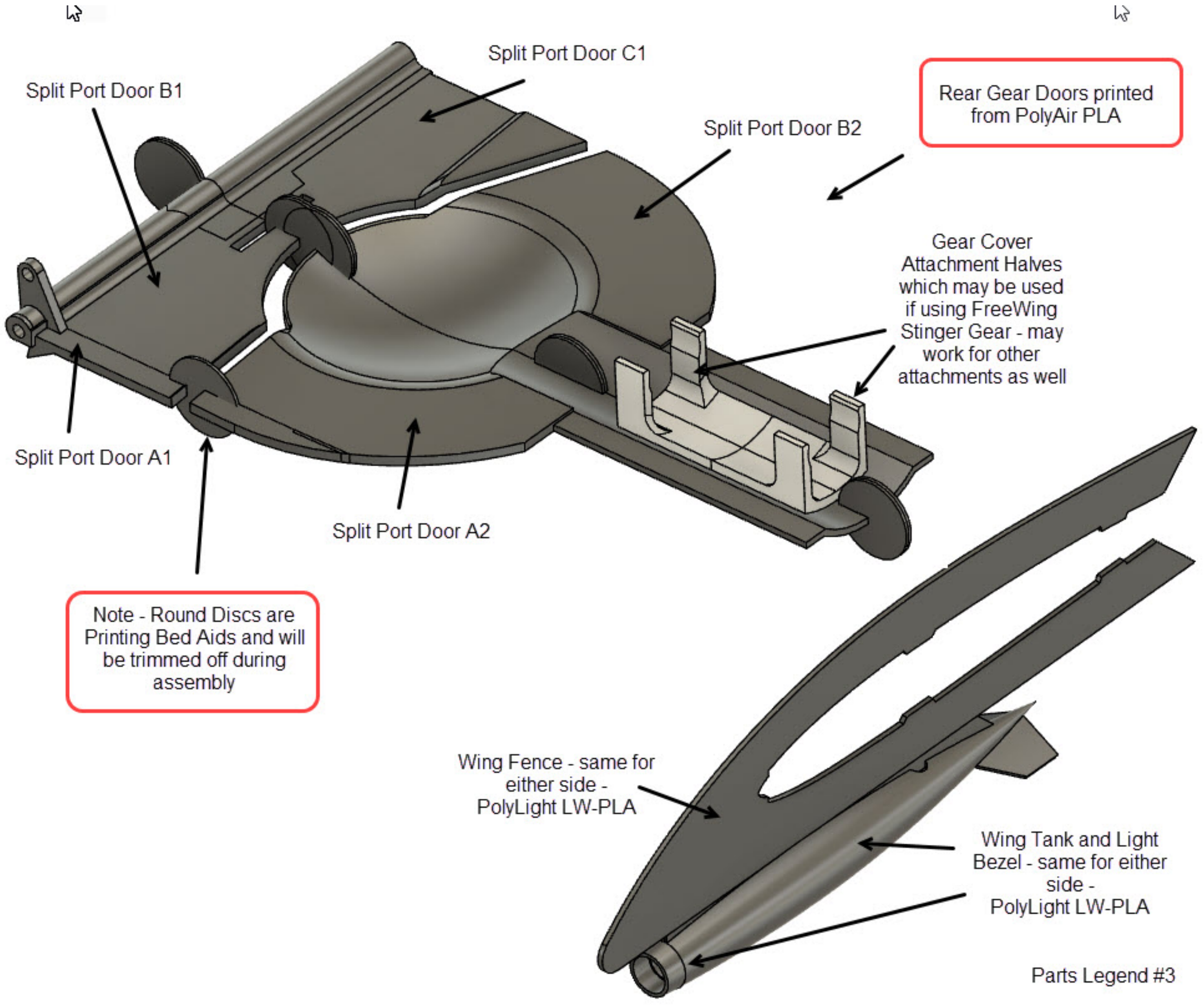
All Parts Printed from PolyAir PLA

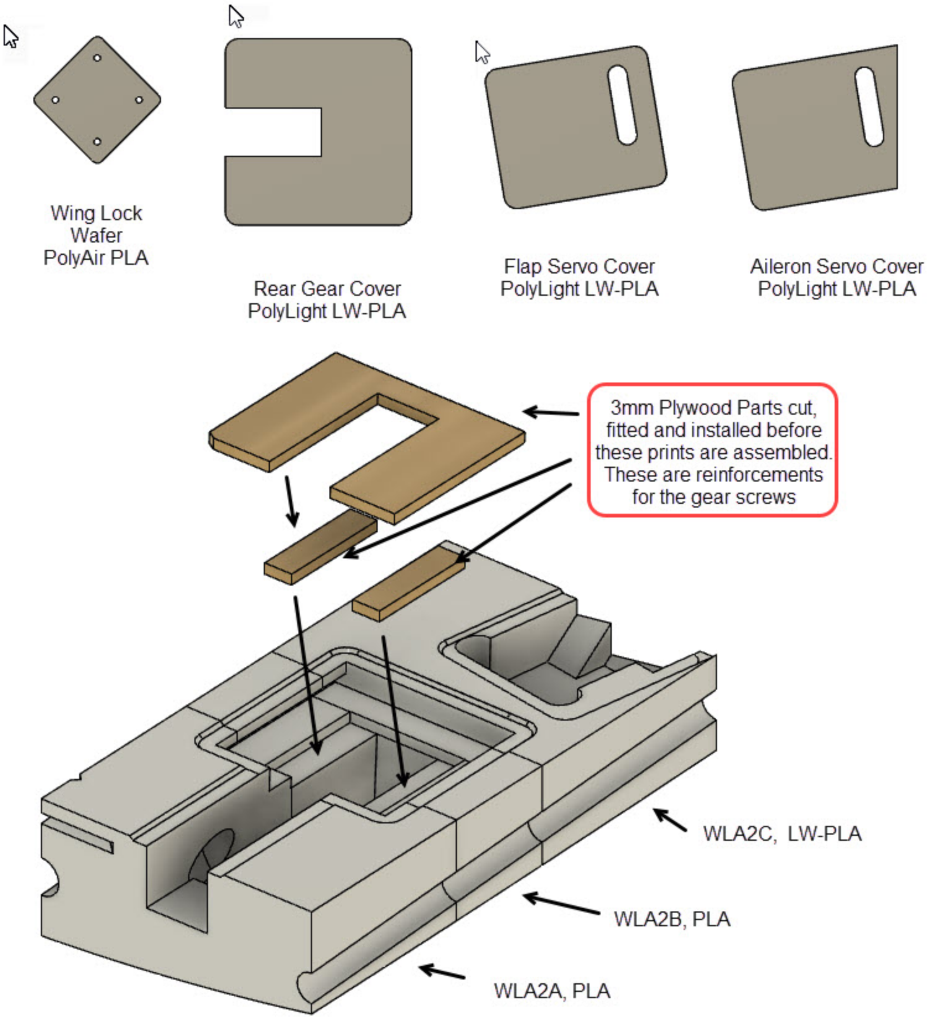
Print Assembly Jigs from PolyAir - then lay the respective front gear door parts in each side for gluing together. Clean/sand joints as needed. The grooves line up with the gluejoints. This will make perfect part Gear Doors.

Print Weights

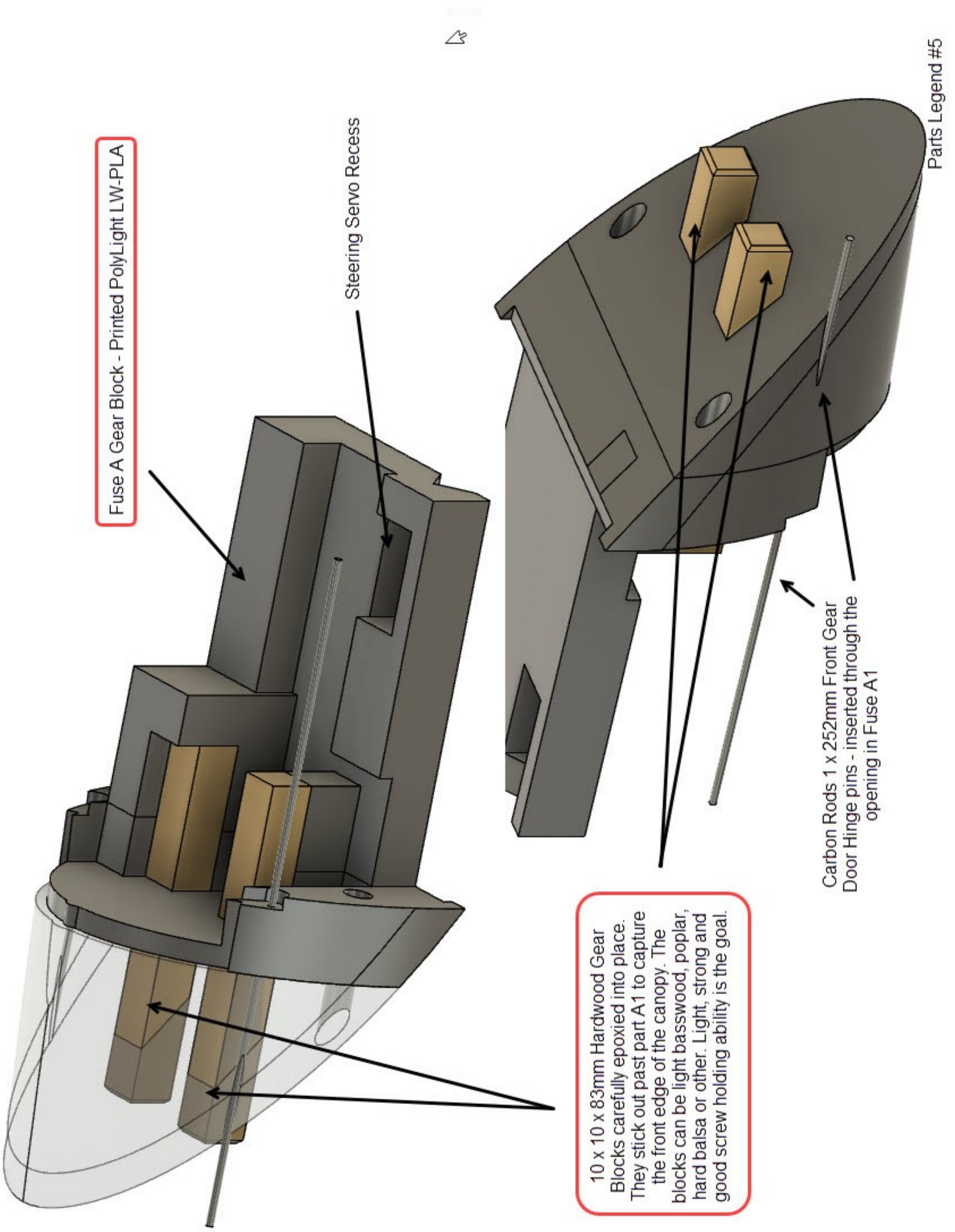
Weights

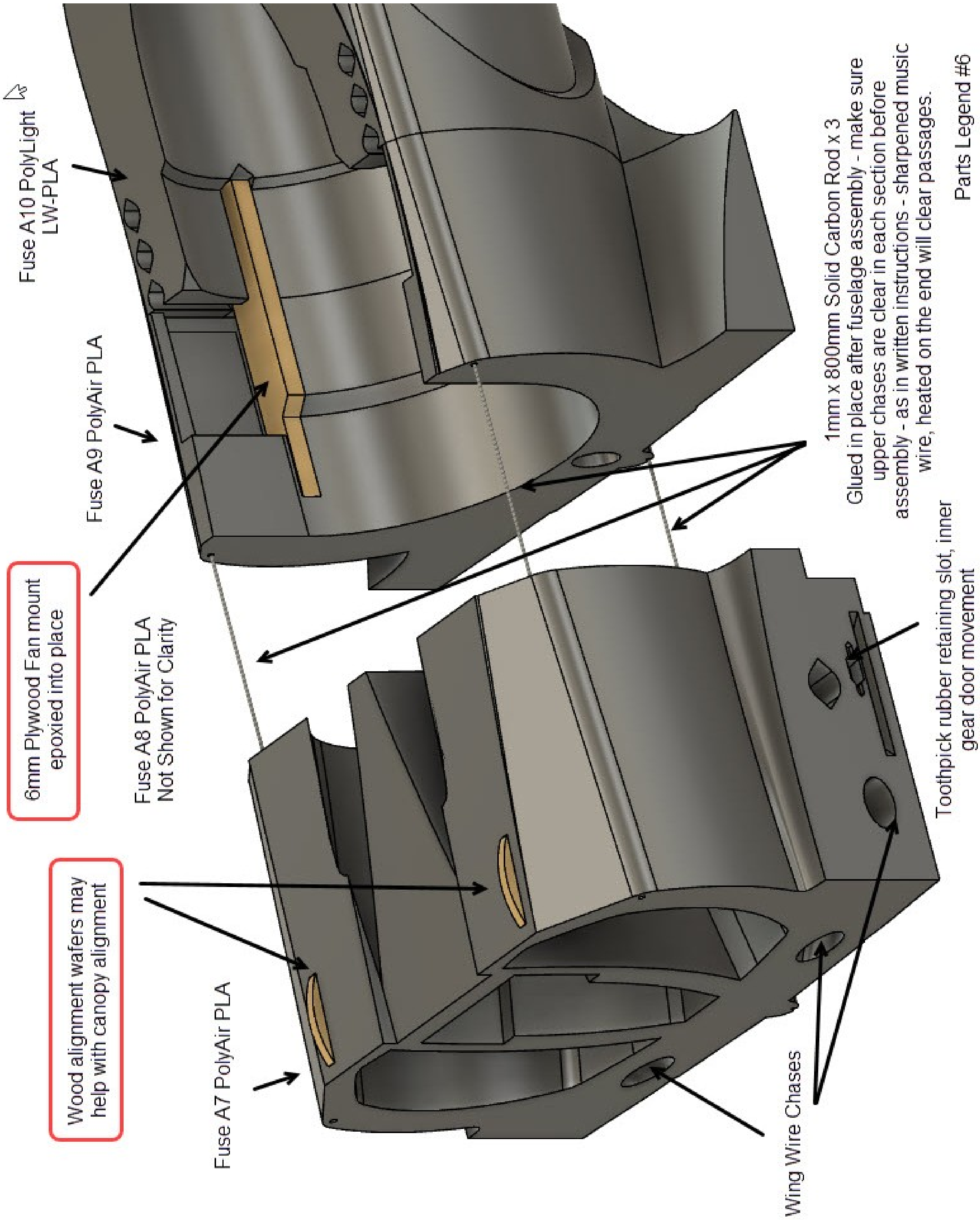
Canopy	A	33	g	Wing	A1	37	g	Stab	A	2	g
	B	44	g		A2A	19	g		B	14	g
	C	36	g		A2B	12	g		C	1	g
	D	33	g		A2C	14	g		D	1	g
	E	34	g		A3A	4	g	Elev	A	2	g
	F	32	g		A3B	3	g		B	8	g
Fuse	A1	9	g		A3C	6	g		C	1	g
	A2	7	g		B1	11	g		D	1	g
	A3	46	g		B2	31	g		F	1	g
	A4	20	g		B3	19	g	Flp	1	16	g
	A5	57	g		C1	12	g		2	10	g
	A6	96	g		C2	23	g	Ail	1	5	g
	A7	141	g		TipA	1	g		2	12	g
	A8	81	g		TipB	4	g	Rudder	A	2	g
	A9	59	g	Fin	A	2	g		B	10	g
	A10	86	g		B	11	g		C	2	g
	A11	90	g		C	13	g		D	2	g
	A12	59	g		D	3	g				


Split Port Door C1
Split Port Door B1
Rear Gear Doors printed from PolyAir PLA
Split Port Door B2
Gear Cover Attachment Halves which may be used if using FreeWing Stinger Gear - may work for other attachments as well
Split Port Door A1
Split Port Door A2
Note - Round Discs are Printing Bed Aids and will be trimmed off during assembly
Wing Fence - same for either side - PolyLight LW-PLA
Wing Tank and Light Bezel - same for either side - PolyLight LW-PLA
Parts Legend #3



Parts Legend #4


Fuse A Gear Block - Printed PolyLight LW-PLA
Steering Servo Recess
Parts Legend #5
Carbon Rods 1 x 252mm Front Gear Door Hinge pins - inserted through the opening in Fuse A1
10 x 10 x 83mm Hardwood Gear Blocks carefully epoxied into place. They stick out past part A1 to capture the front edge of the canopy. The blocks can be light basswood, poplar, hard balsa or other. Light, strong and good screw holding ability is the goal.

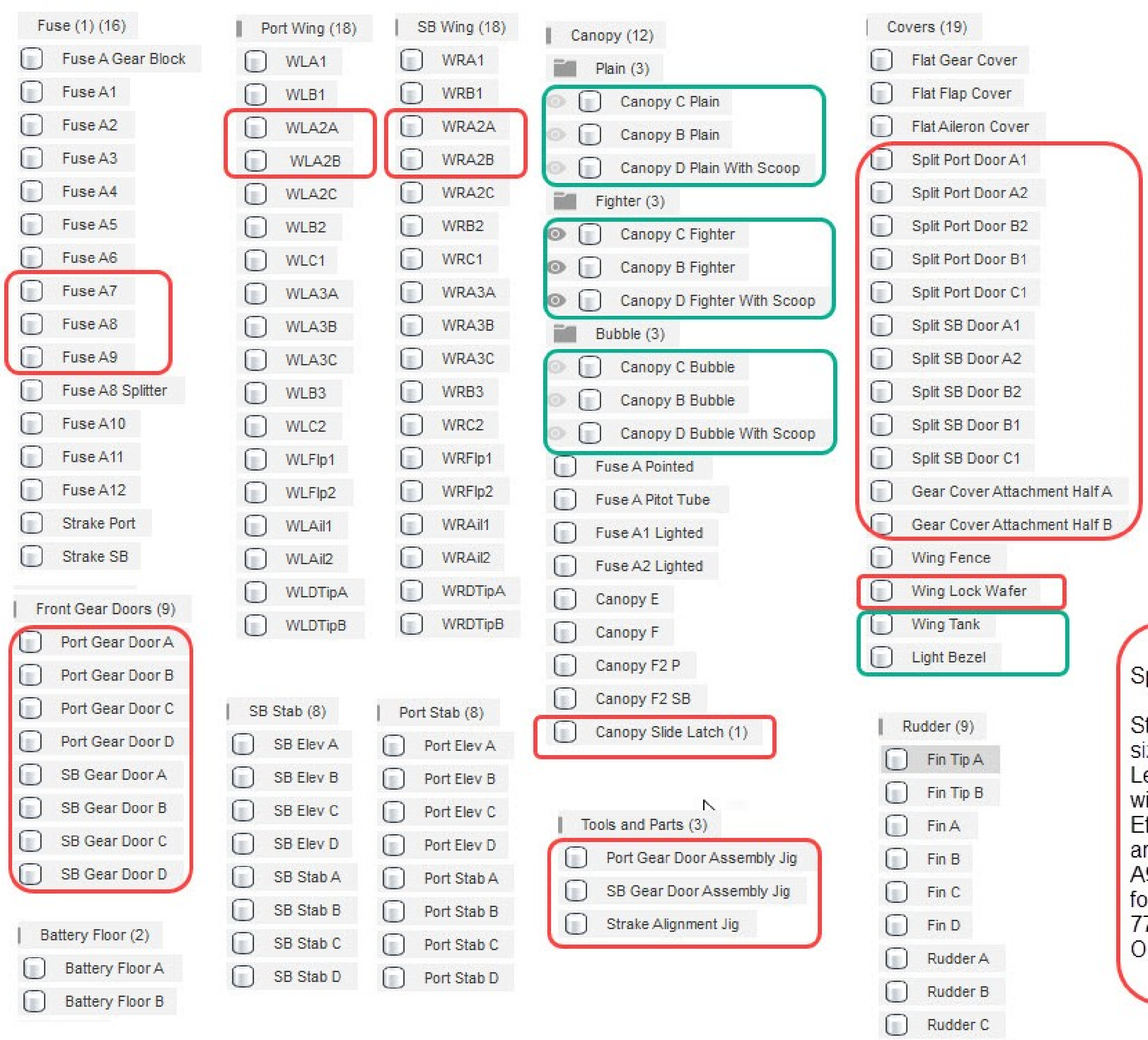

Fuse A10 PolyLight LW-PLA
Fuse A9 PolyAir PLA
6mm Plywood Fan mount epoxied into place
Fuse A8 PolyAir PLA Not Shown for Clarity
Wood alignment wafers may help with canopy alignment
Fuse A7 PolyAir PLA
Wing Wire Chases
Toothpick rubber retaining slot, inner gear door movement
1mm x 800mm Solid Carbon Rod x 3
Glued in place after fuselage assembly - make sure upper chases are clear in each section before assembly - as in written instructions - sharpened music wire, heated on the end will clear passages.
Parts Legend #6

A listing of all printed parts needed

(and some options)

Parts outlined in RED are printed from PolyAir PLA

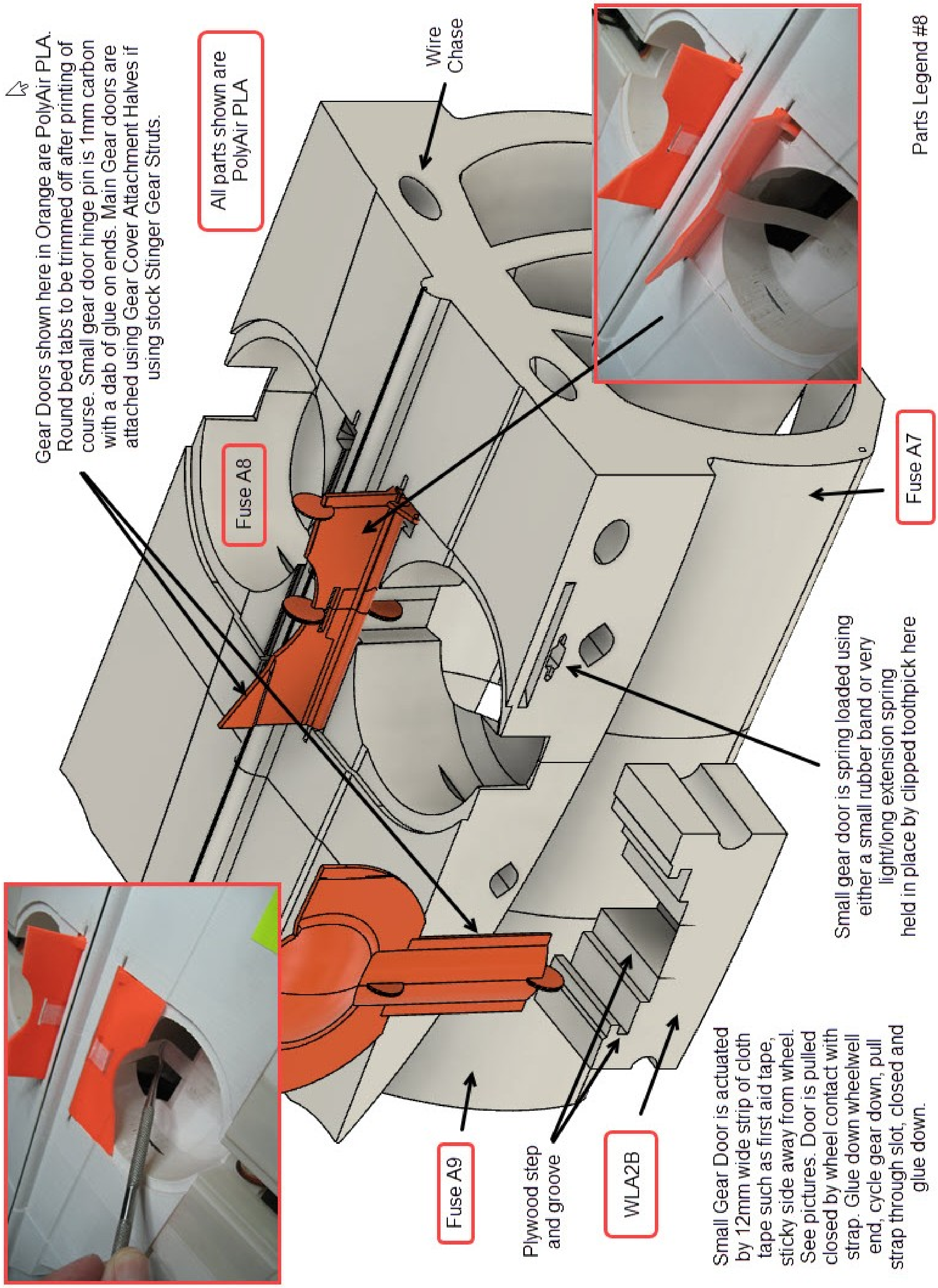
All other parts are printed from PolyLight LW-PLA

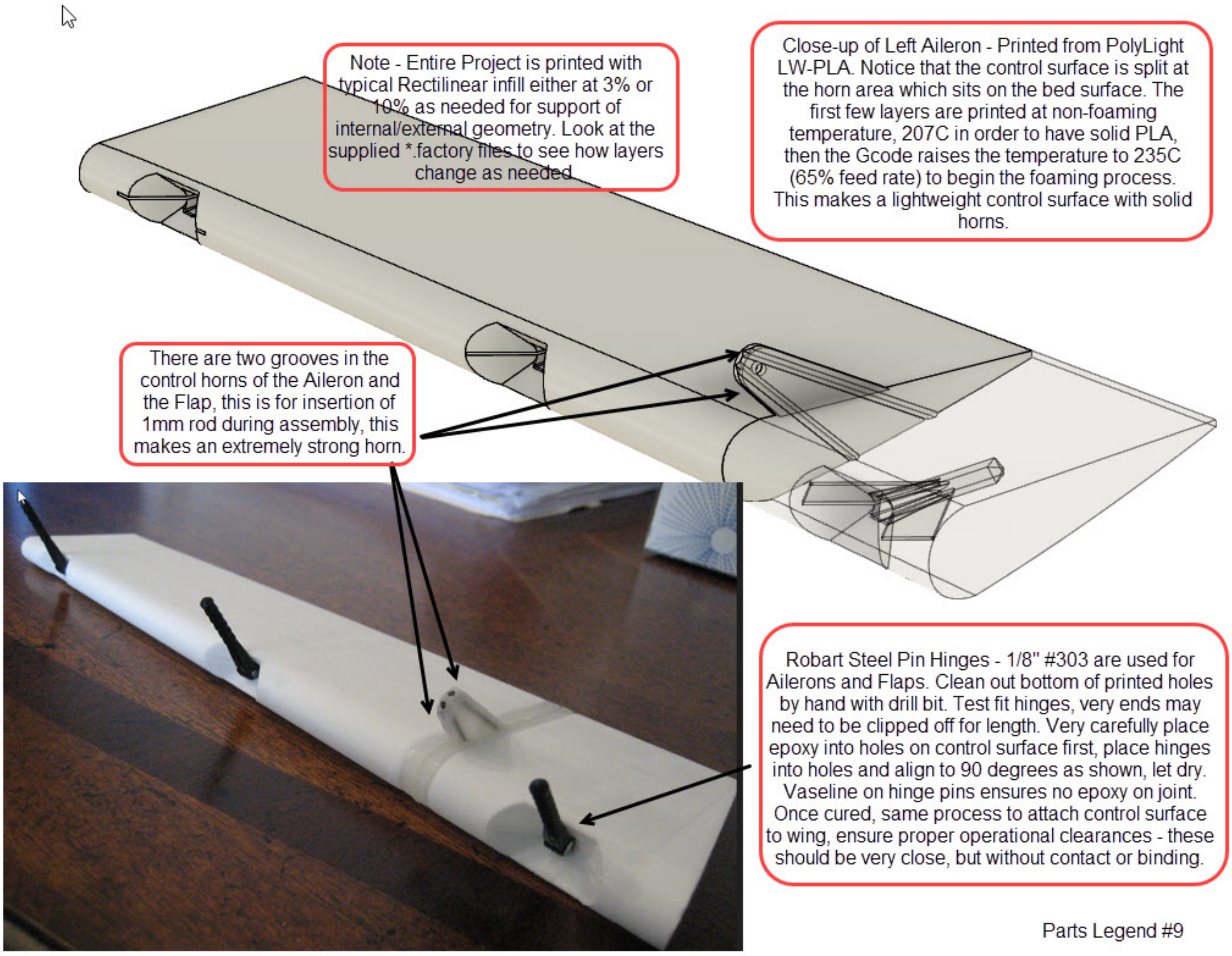


Special Note for Larger Fans

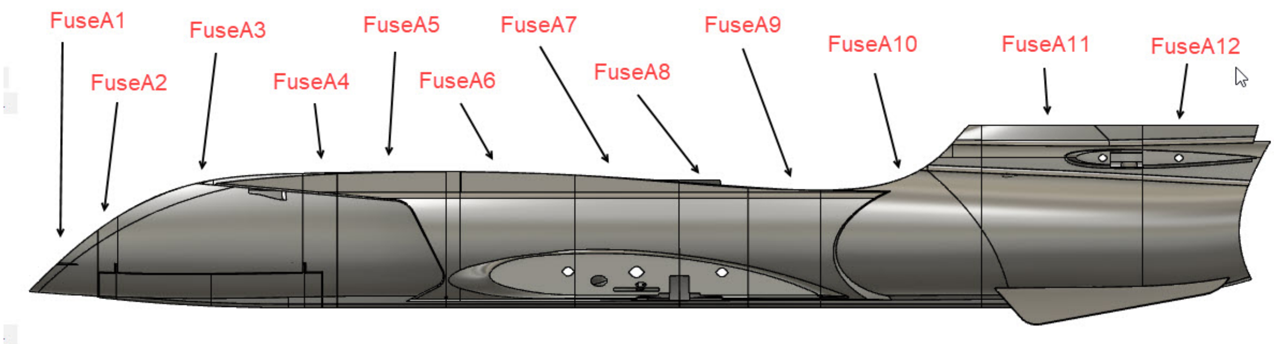
Stock design is for Freewing size fans, 93.5mm OD, 67mm Length, 102.5 Bell OD, 117.5 tab width.
Eflite Viper Fans are a bit larger and can use supplied Fuse Files A9X, A10X and Canopy File FX for fans sizes up to 95.5mm OD, 77.5mm Length, 103.5mm Bell OD, 117.5 tab width.

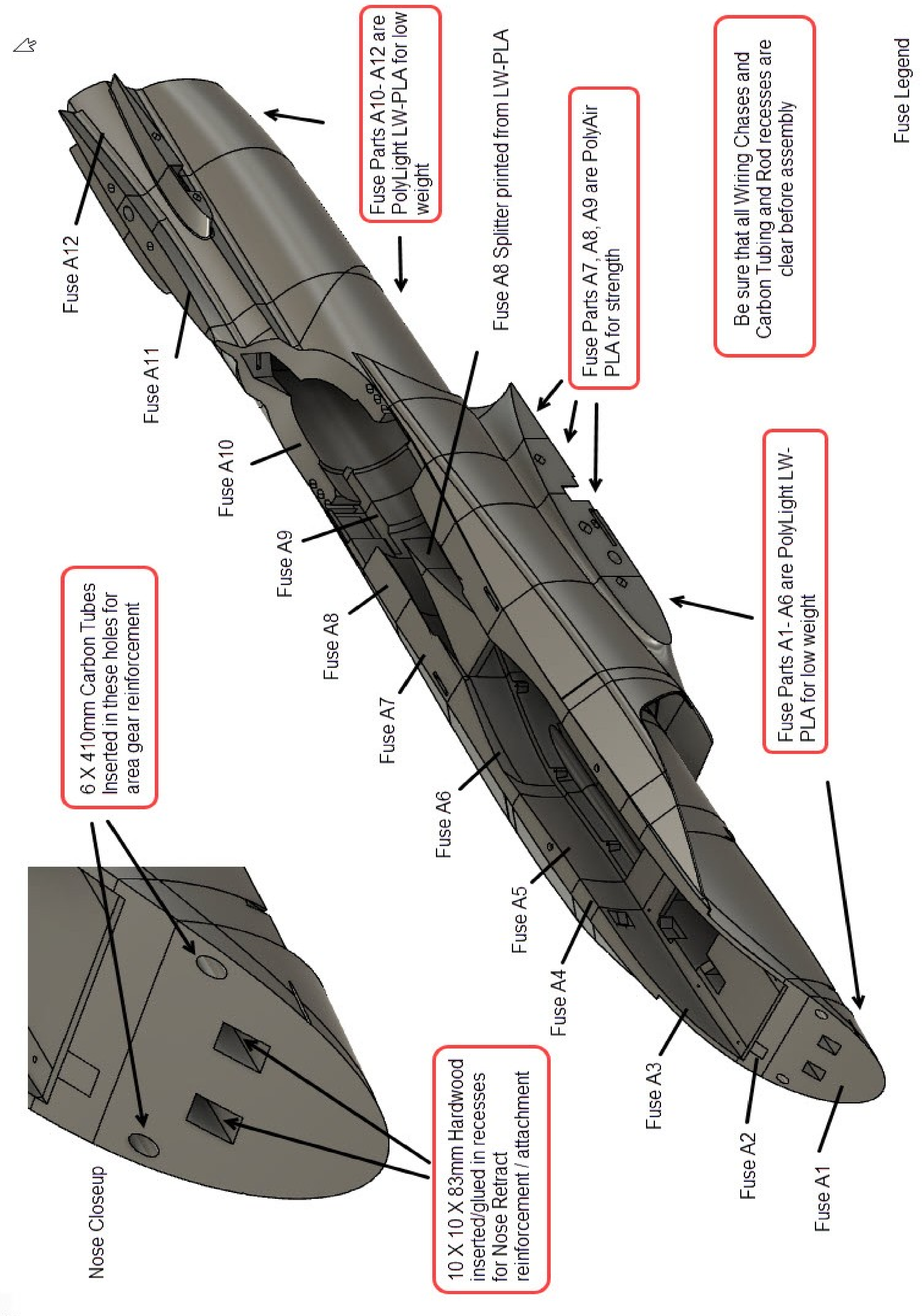
Parts Legend #7

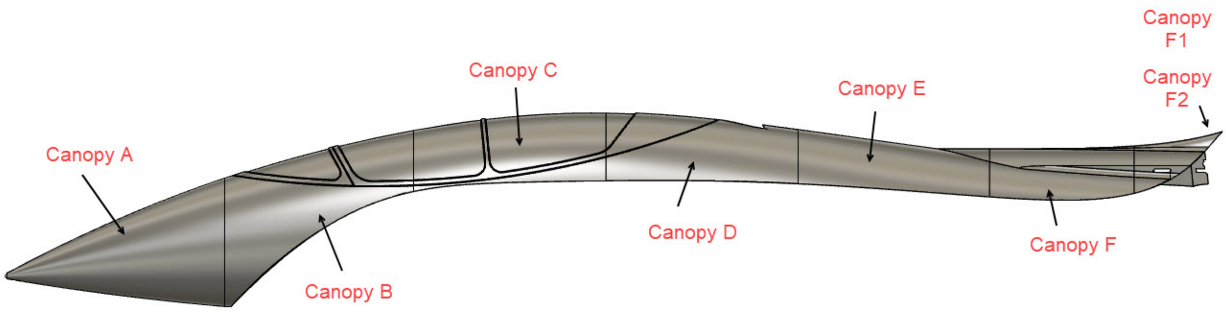

Gear Doors shown here in Orange are PolyAir PLA. Round bed tabs to be trimmed off after printing of course. Small gear door hinge pin is 1mm carbon with a dab of glue on ends. Main Gear doors are attached using Gear Cover Attachment Halves if using stock Stinger Gear Struts.
All parts shown are PolyAir PLA
Wire Chase
Parts Legend #8
Fuse A8
Fuse A7
Small gear door is spring loaded using either a small rubber band or very light/long extension spring held in place by clipped toothpick here
Fuse A9
Plywood step and groove
WLA2B
Small Gear Door is actuated by 12mm wide strip of cloth tape such as first aid tape, sticky side away from wheel. See pictures. Door is pulled closed by wheel contact with strap. Glue down wheelwell end, cycle gear down, pull strap through slot, closed and glue down.

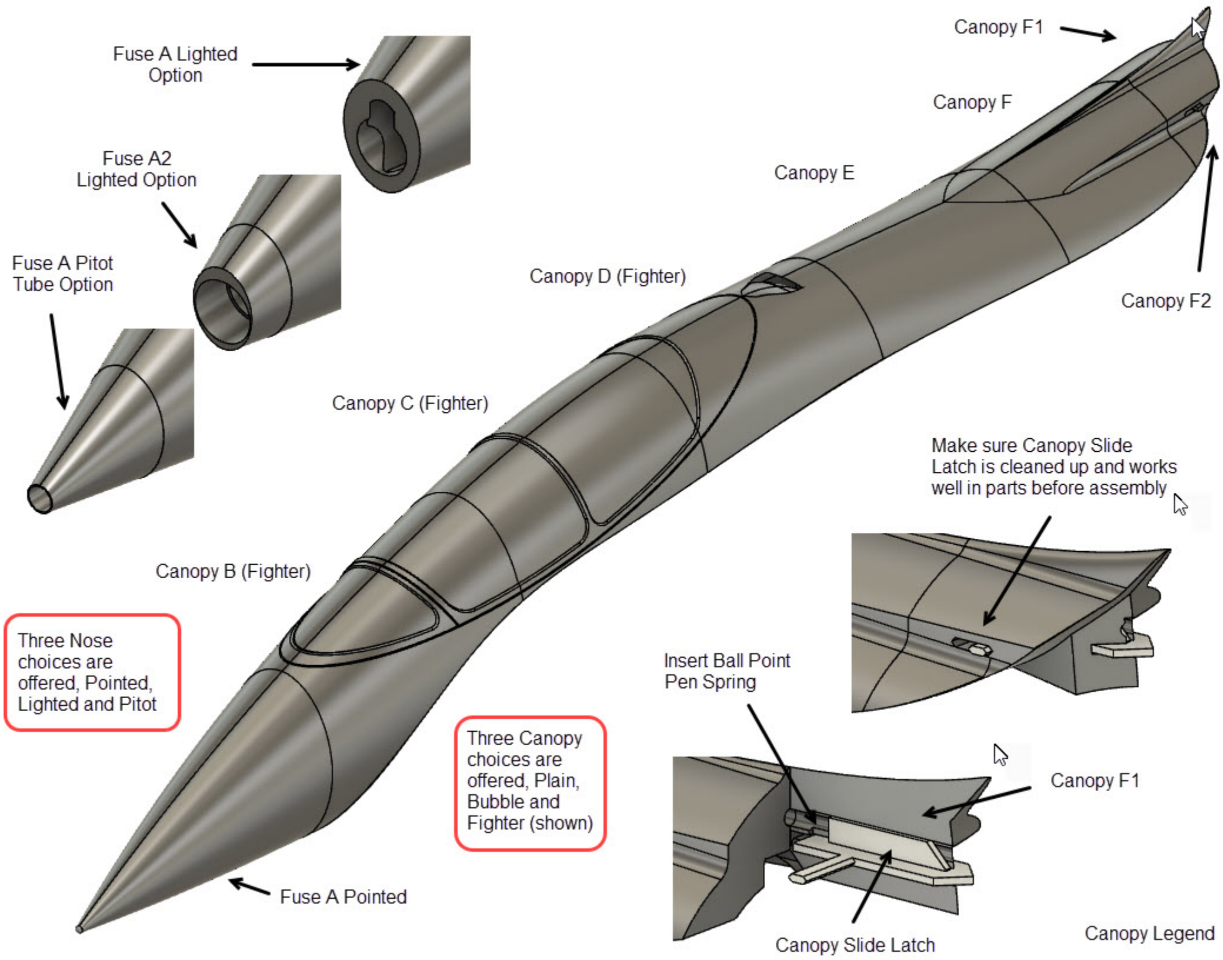


Parts Legend #9



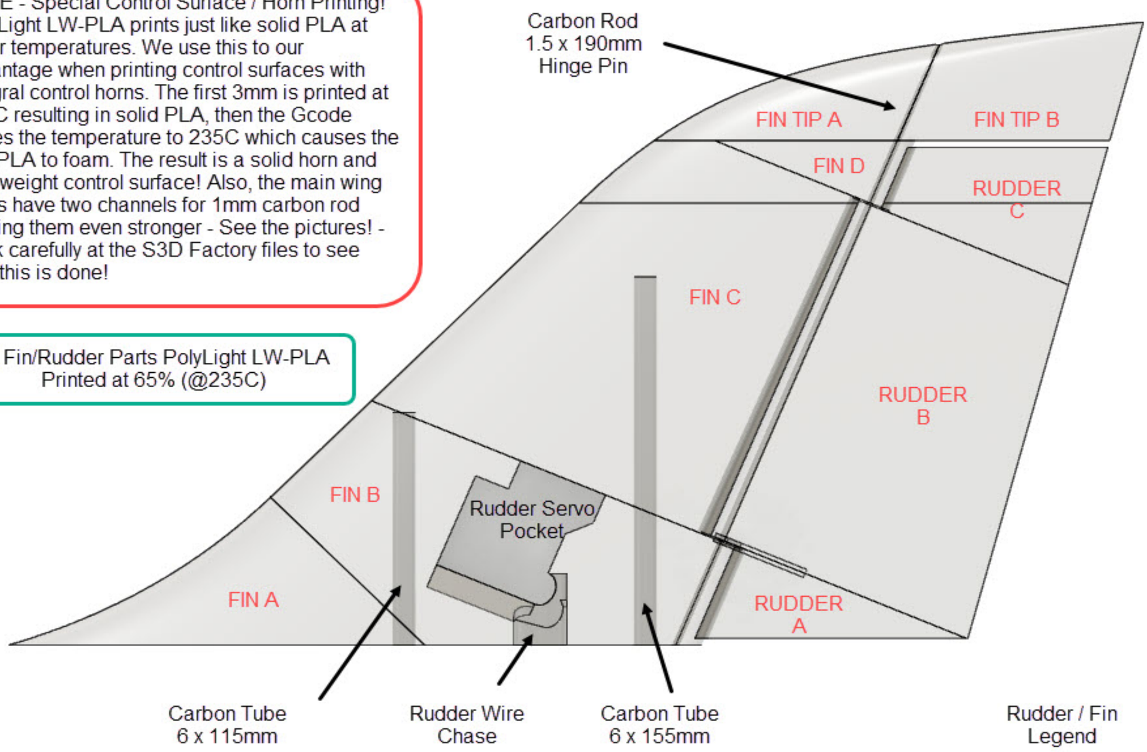

Fuse Legend
Be sure that all Wiring Chases and Carbon Tubing and Rod recesses are clear before assembly
Fuse Parts A7, A8, A9 are PolyAir PLA for strength
Fuse A8 Splitter printed from LW-PLA
Fuse Parts A10- A12 are PolyLight LW-PLA for low weight
Fuse Parts A1- A6 are PolyLight LW-PLA for low weight
Fuse A12
Fuse A11
Fuse A10
Fuse A9
Fuse A8
Fuse A7
Fuse A6
Fuse A5
Fuse A4
Fuse A3
Fuse A2
Fuse A1
6 X 410mm Carbon Tubes Inserted in these holes for area gear reinforcement
10 X 10 X 83mm Hardwood inserted/glued in recesses for Nose Retract reinforcement / attachment
Nose Closeup


Canopy A
Canopy B
Canopy C
Canopy D
Canopy E
Canopy F
Canopy F1
Canopy F2

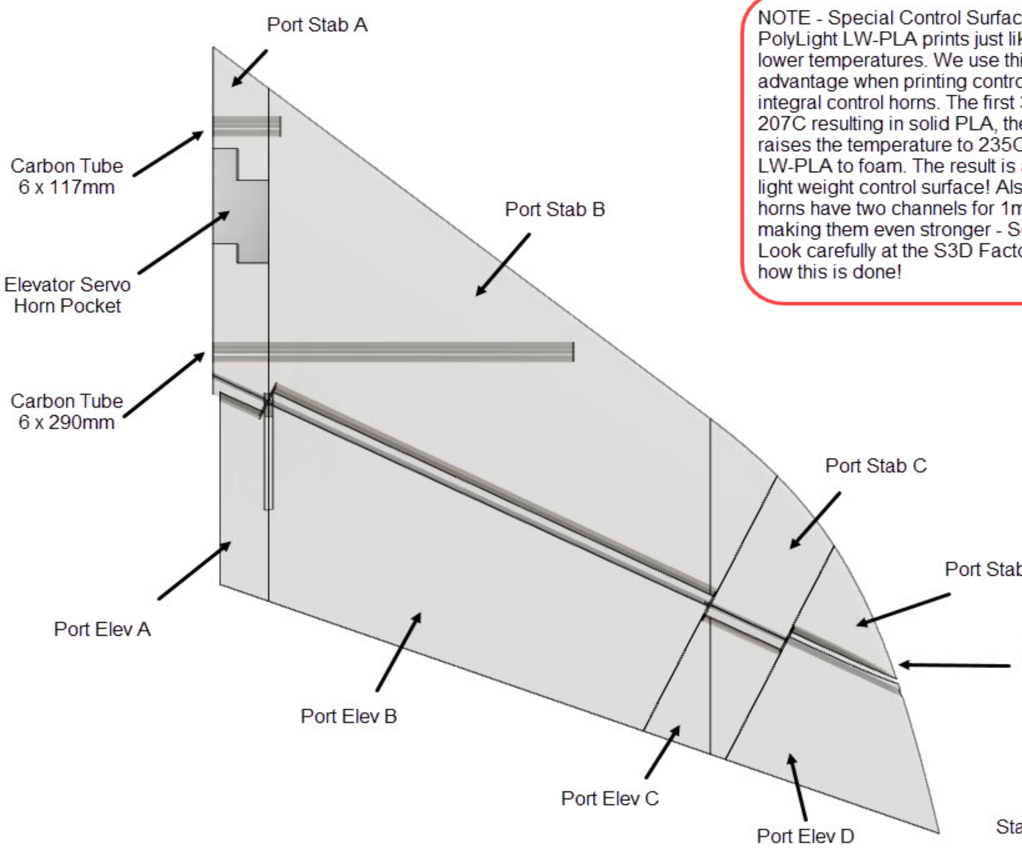

Fuse A Lighted Option
Fuse A2 Lighted Option
Fuse A Pitot Tube Option
Canopy F1
Canopy F
Canopy E
Canopy F2
Canopy D (Fighter)
Canopy C (Fighter)
Canopy B (Fighter)
Three Nose choices are offered, Pointed, Lighted and Pitot
Three Canopy choices are offered, Plain, Bubble and Fighter (shown)
Fuse A Pointed
Make sure Canopy Slide Latch is cleaned up and works well in parts before assembly
Insert Ball Point Pen Spring
Canopy F1
Canopy Slide Latch
Canopy Legend

NOTE - Special Control Surface / Horn Printing! PolyLight LW-PLA prints just like solid PLA at lower temperatures. We use this to our advantage when printing control surfaces with integral control horns. The first 3mm is printed at 207C resulting in solid PLA, then the Gcode raises the temperature to 235C which causes the LW-PLA to foam. The result is a solid horn and light weight control surface! Also, the main wing horns have two channels for 1mm carbon rod making them even stronger - See the pictures! - Look carefully at the S3D Factory files to see how this is done!

All Fin/Rudder Parts PolyLight LW-PLA
Printed at 65% (@235C)

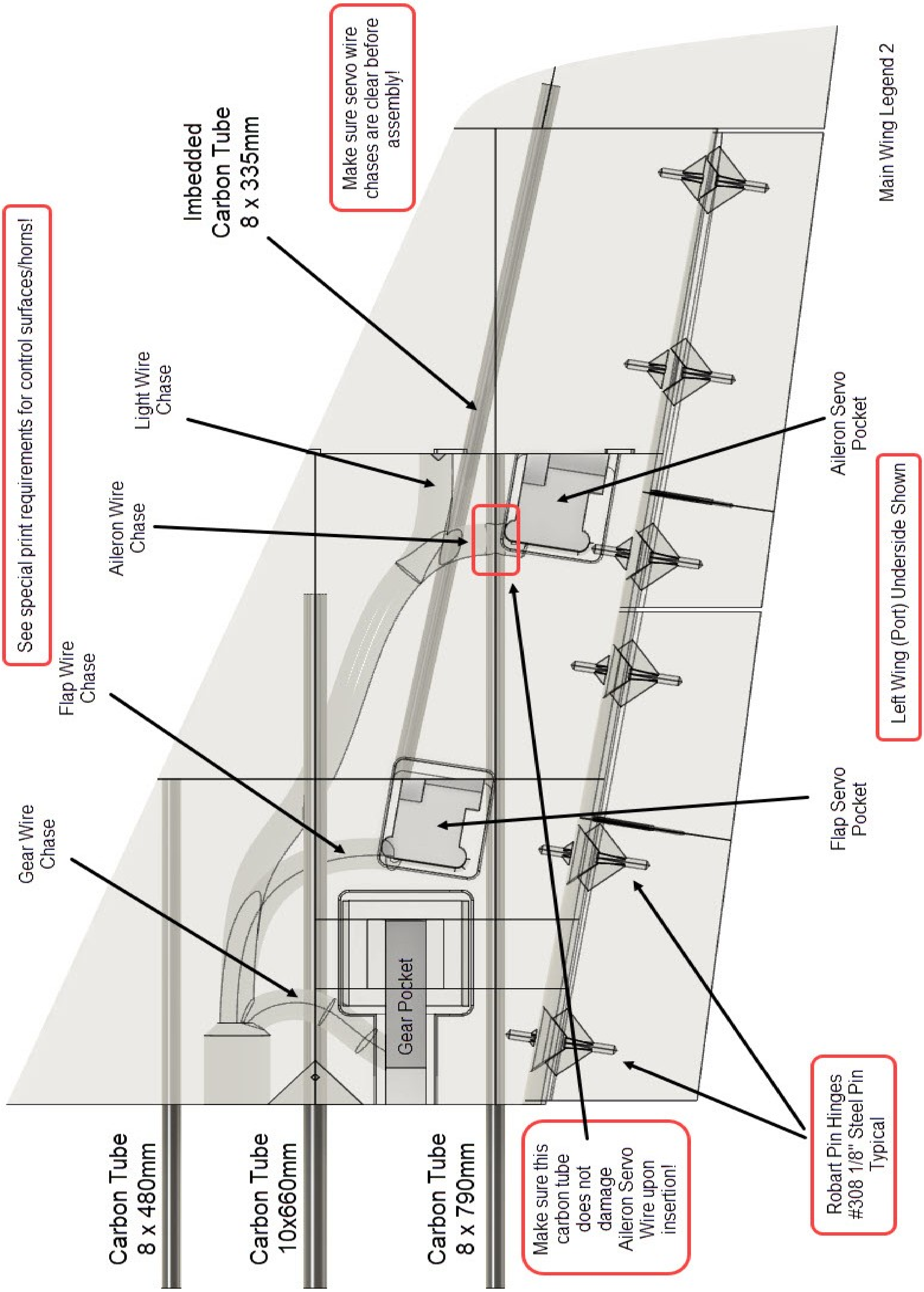


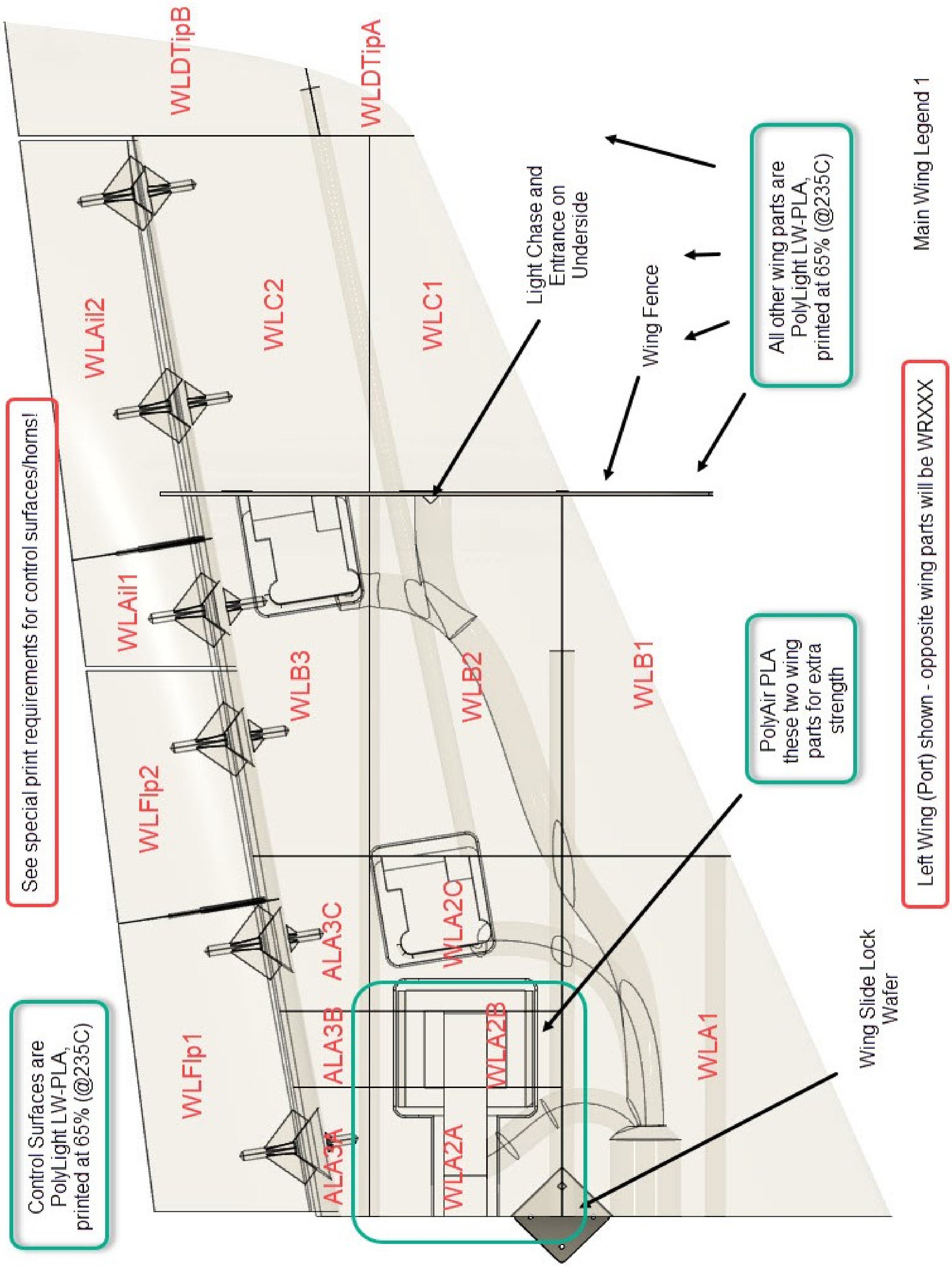
Rudder / Fin
Legend

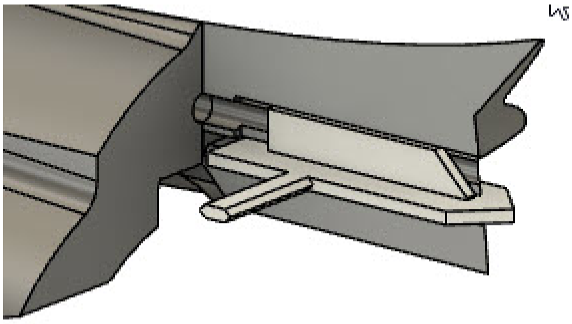


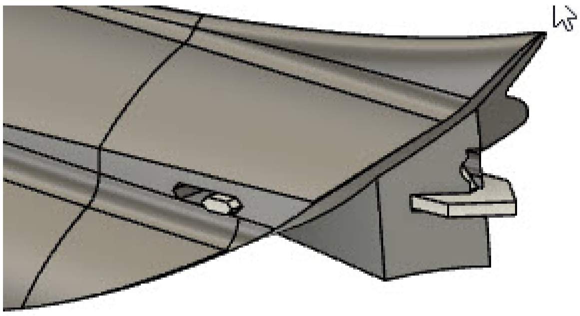
NOTE - Special Control Surface / Horn Printing! PolyLight LW-PLA prints just like solid PLA at lower temperatures. We use this to our advantage when printing control surfaces with integral control horns. The first 3mm is printed at 207C resulting in solid PLA, then the Gcode raises the temperature to 235C which causes the LW-PLA to foam. The result is a solid horn and light weight control surface! Also, the main wing horns have two channels for 1mm carbon rod making them even stronger - See the pictures! - Look carefully at the S3D Factory files to see how this is done!

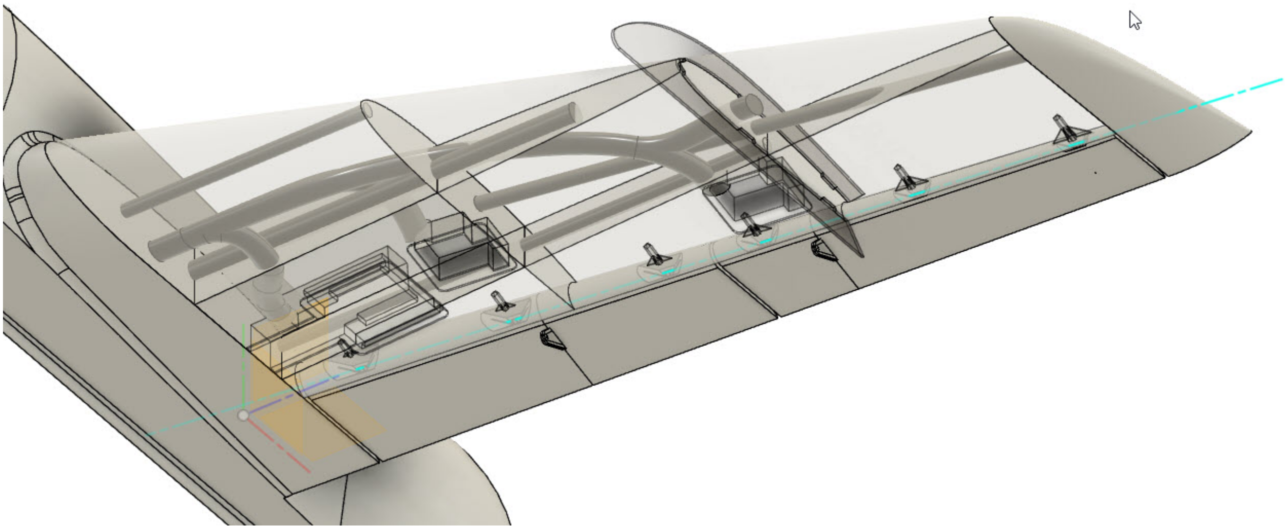
Stab / Elevator Legend

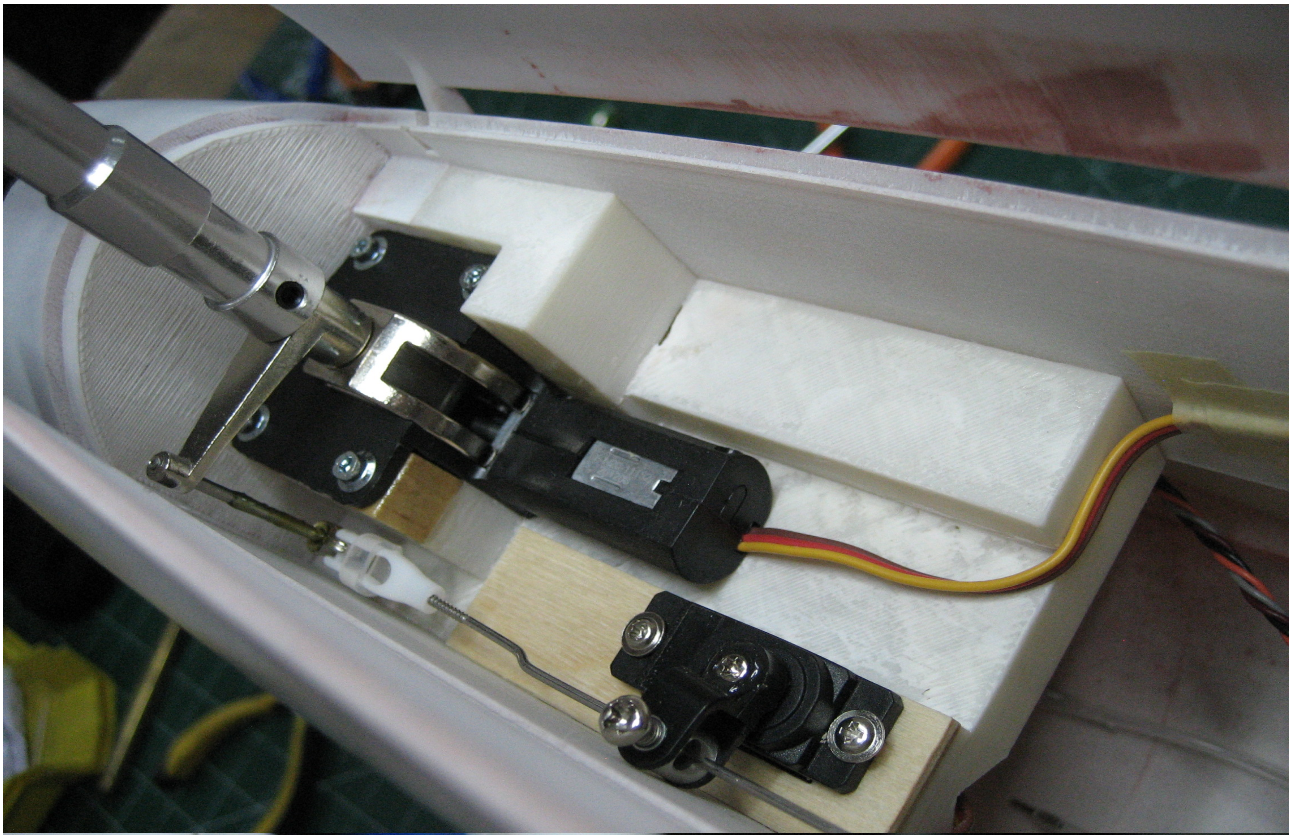

See special print requirements for control surfaces/horns!
Imbedded Carbon Tube 8 x 335mm
Make sure servo wire chases are clear before assembly!
Light Wire Chase
Aileron Wire Chase
Flap Wire Chase
Gear Wire Chase
Main Wing Legend 2
Aileron Servo Pocket
Left Wing (Port) Underside Shown
Flap Servo Pocket
Gear Pocket
Carbon Tube 8 x 480mm
Carbon Tube 10x660mm
Carbon Tube 8 x 790mm
Make sure this carbon tube does not damage Aileron Servo Wire upon insertion!
Robart Pin Hinges #308 1/8" Steel Pin Typical

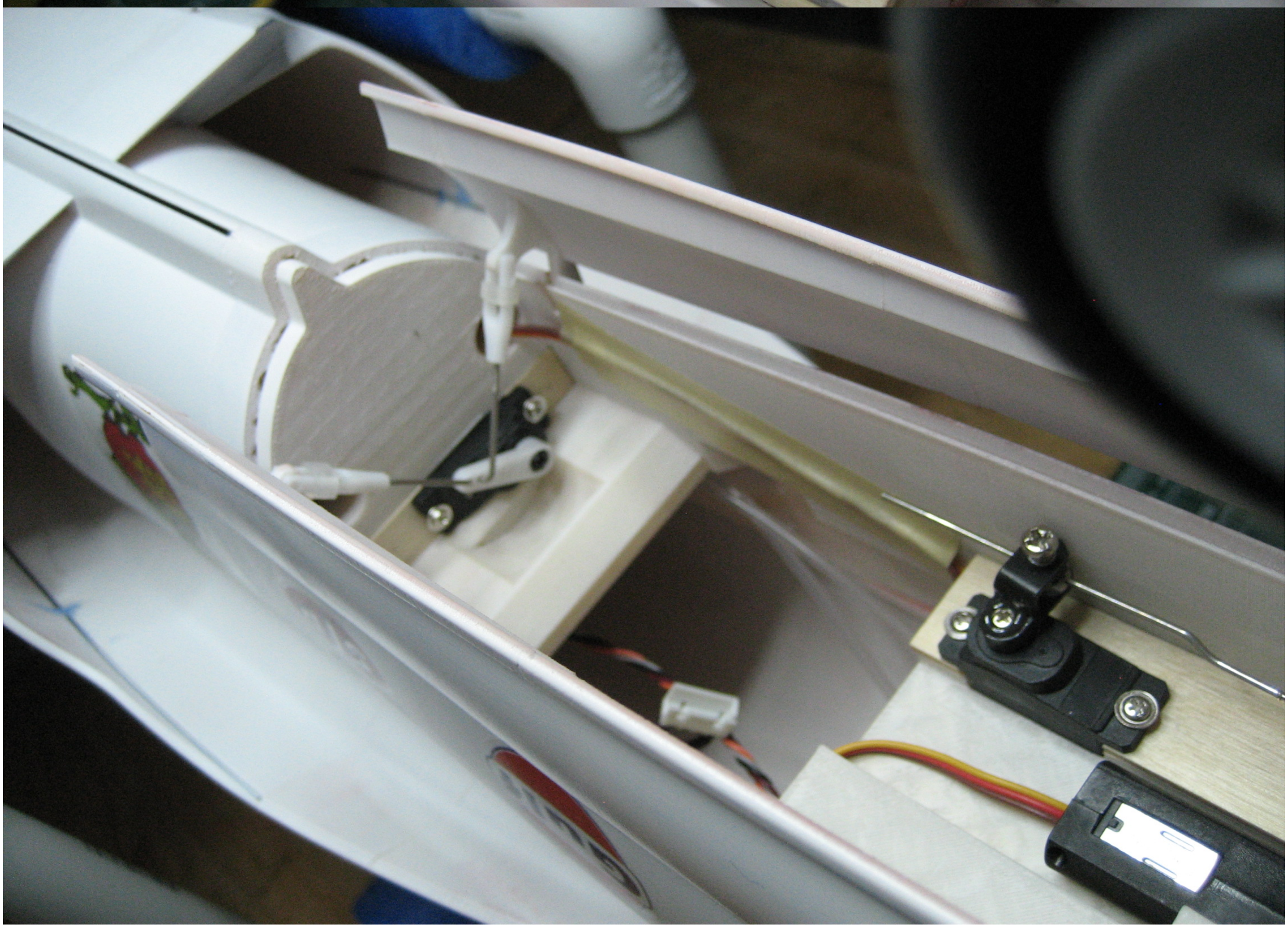

WLDTipB
WLDTipA
WLAil2
WLC2
WLC1
Light Chase and Entrance on Underside
Wing Fence
All other wing parts are PolyLight LW-PLA, printed at 65% (@235C)
Main Wing Legend 1
See special print requirements for control surfaces/horns!
WLAil1
WLB3
WLB2
WLB1
PolyAir PLA these two wing parts for extra strength
Left Wing (Port) shown - opposite wing parts will be WRXXX
WLFlp2
ALA3C
WLA2C
WLFlp1
ALA3B
WLA2B
ALA3A
WLA2A
WLA1
Wing Slide Lock Wafer
Control Surfaces are PolyLight LW-PLA, printed at 65% (@235C)

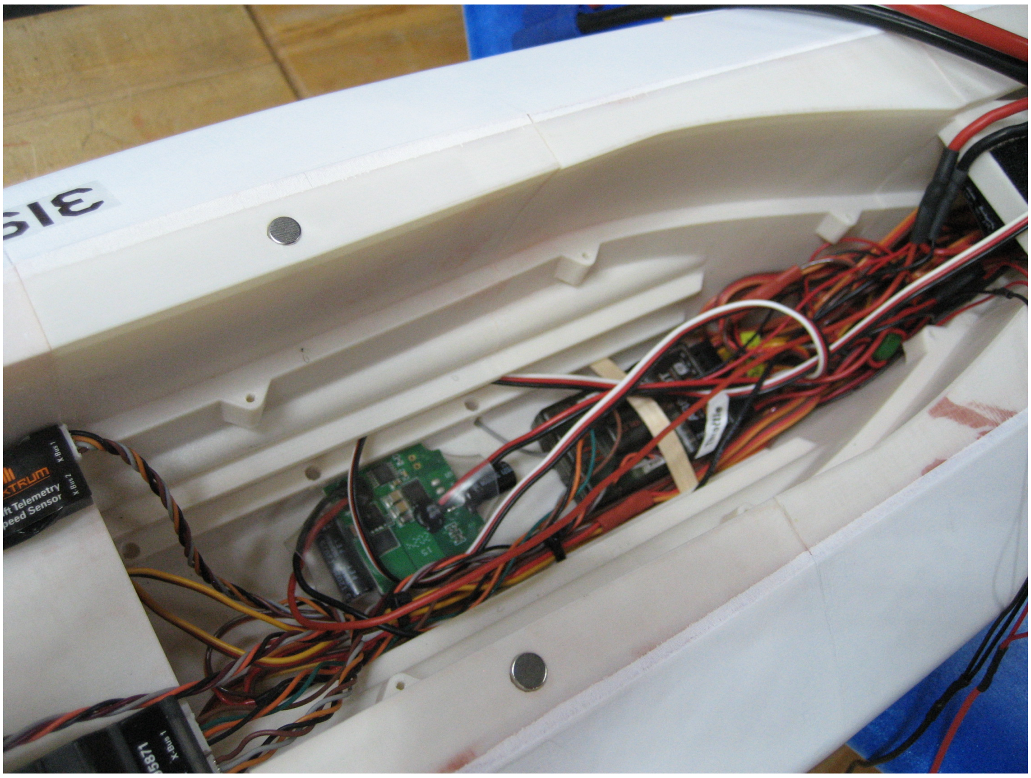


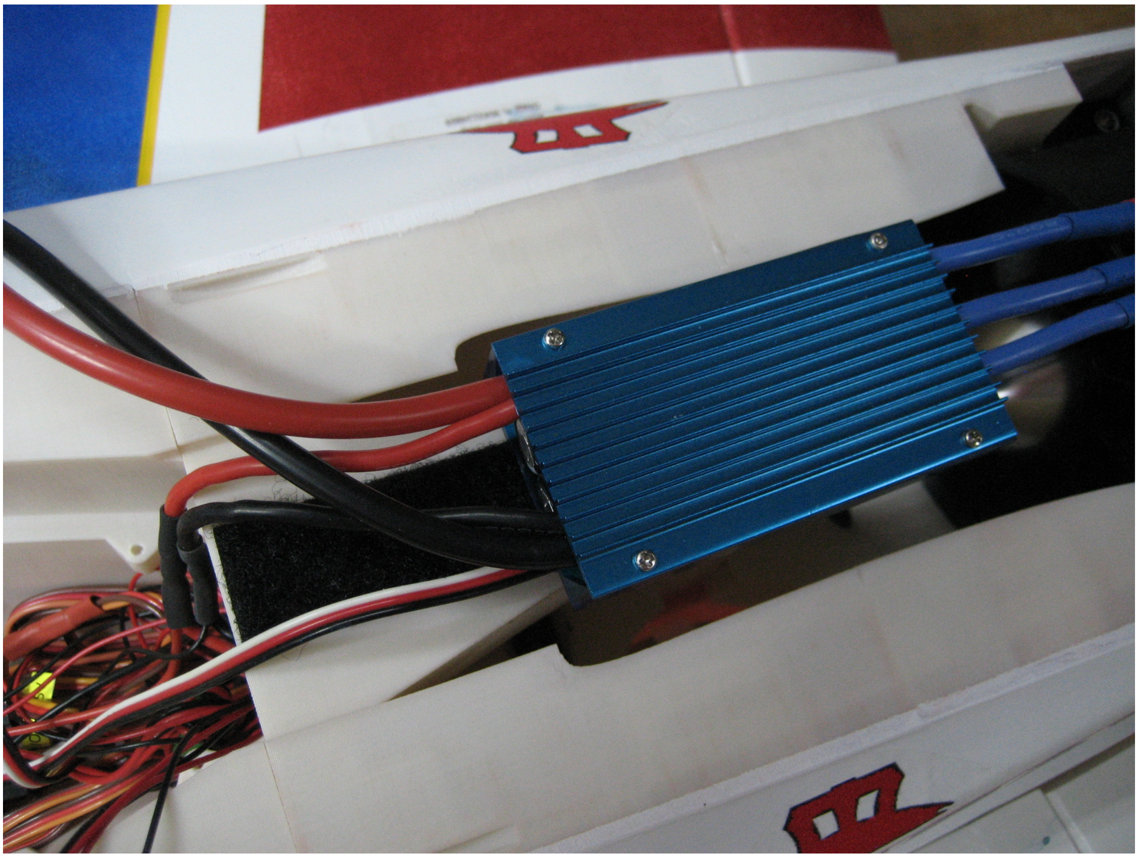


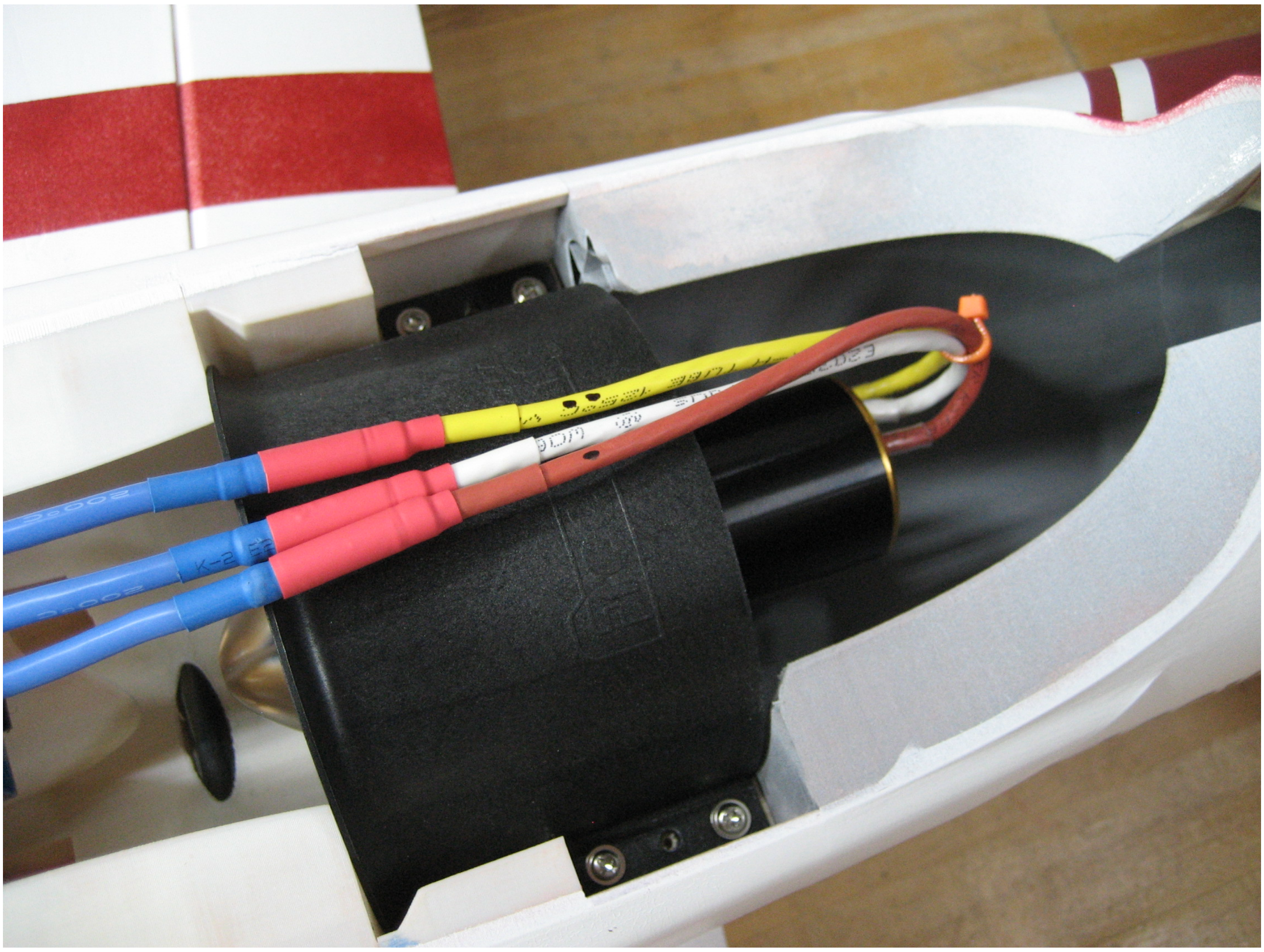


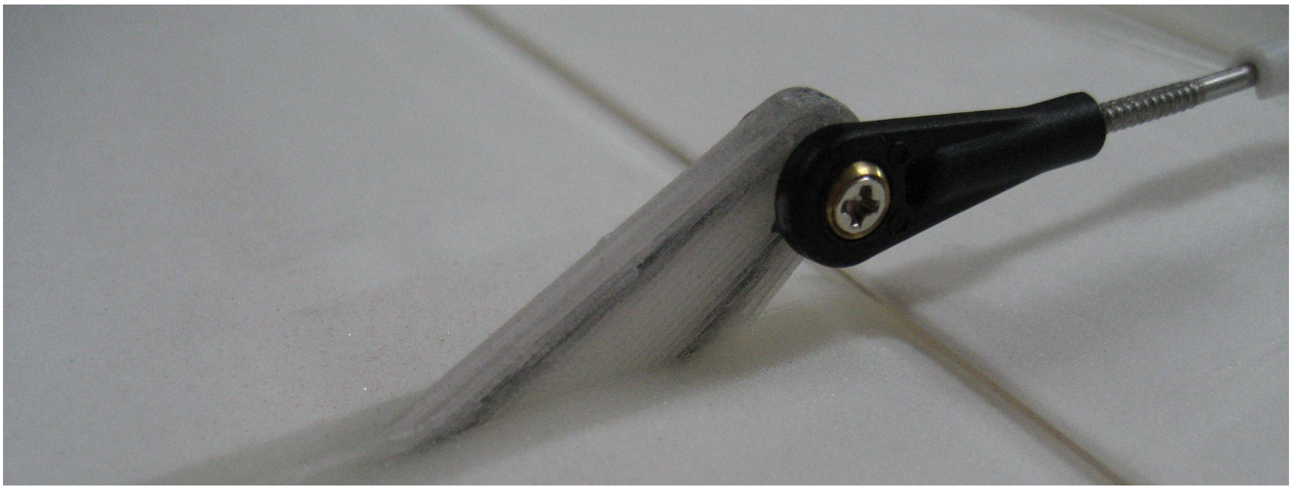






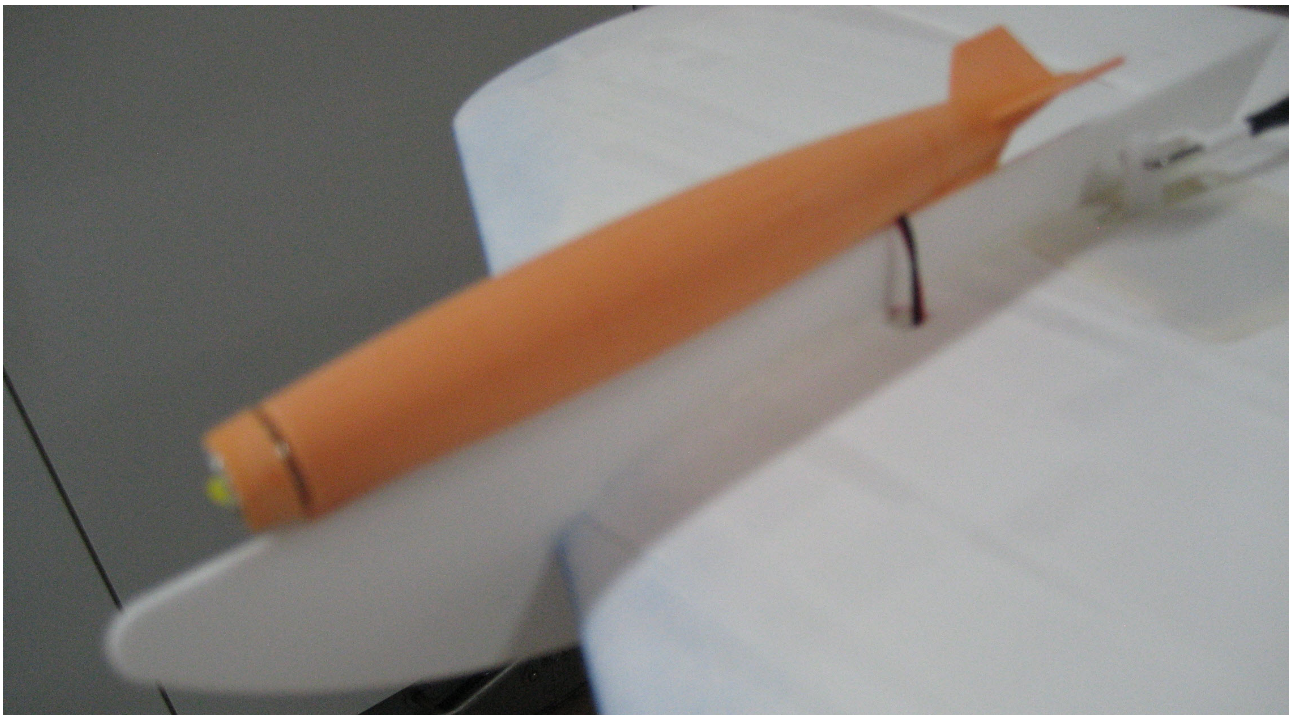


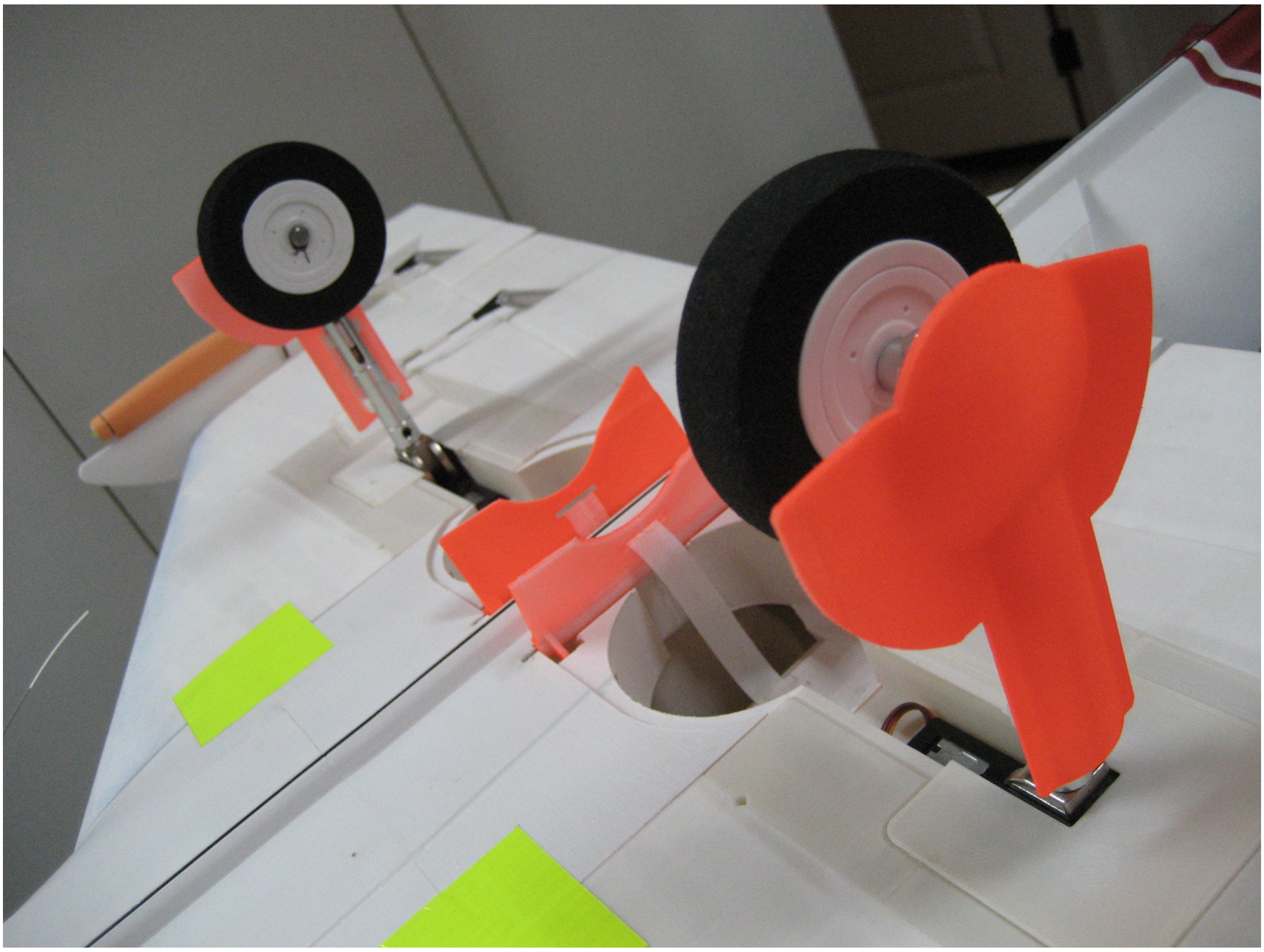





PENNZOIL
112


STP
Gulf
3DLab GANG
SUMMIT





Included:

1.STL 3d files

Universal STL files designed for use with desktop FMD 3d printers and slicer software as Simplify3D (recommend) CURA or MatterControl (these STLs are not compatible with Slic3r).

2.Factory files for Simplify3D slicer

With all our setting, this Factory files included all you need, note: we use PRUSA i3 ORIGINAL printers so you may need adjust the basic printing parameters to match your printer or use it as a start point for you, please give a look to Simplify3D

3.Step By Step PDF/VIDEO userguides

Apart from this userguide, please give a look to the Printing Guide with some Tips and Advices for airplane printing (Thin Wall Printing)

4.Gcodes

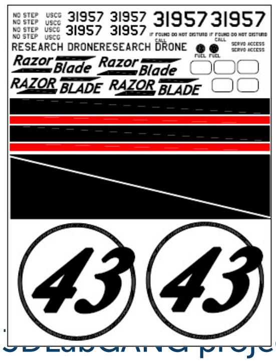
Basic Gcodes prepared for direct use, so universal as is possible. Should work with i3 style printers, you can try it out, but We can not guarantee that it will work with your printer. 100% works with PRUSA i3 ORIGINAL 3d printers...

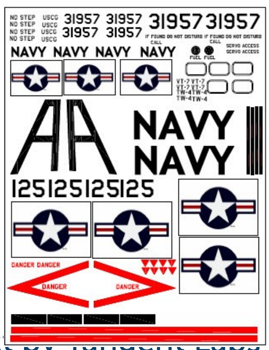
5.Prepared settings for CURA and MatterControl slicers

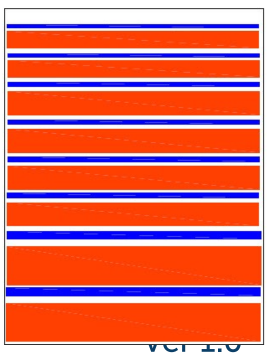
If you dont like Simplify3D for any reason, there is always possibility to use another free slicer you can use our basic setting (setting files) as a start point and edit it as you need.

6.Decal Sheets PDF –

Several pdf files are supplied for you to choose from. You may print these on readily available decal paper using your own inject printer.





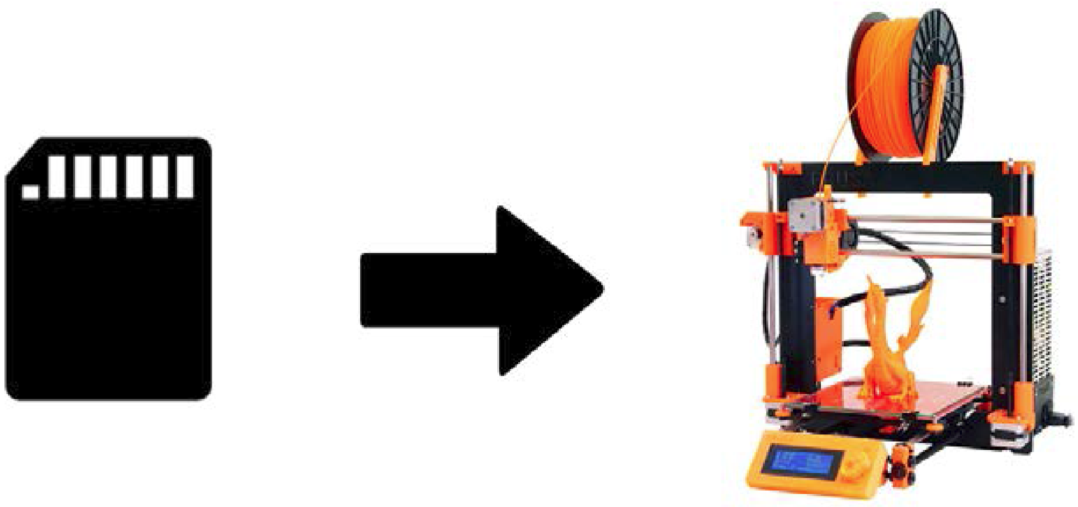


Printing

1. Gcodes Preparing

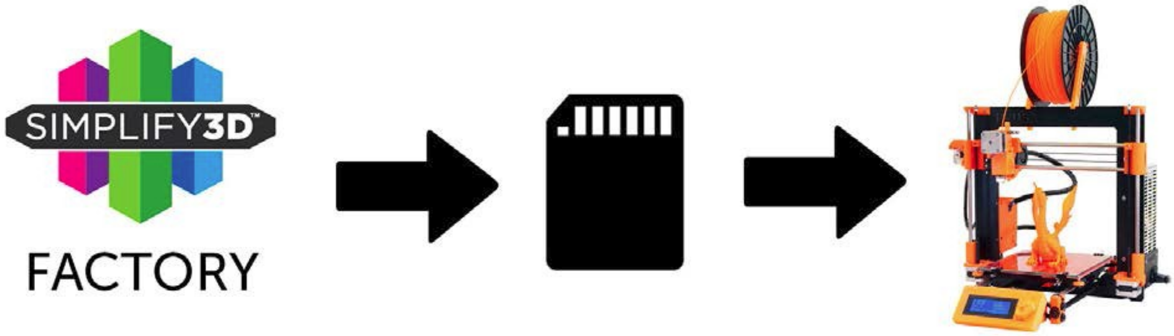
Options A Gcodes:

if your printer is i3 compatible you can directly use prepared gcodes, simply save each to SD card and let 3d printer do his job, HE temperature is set to 230 for best layer bonding, you can edit speed and temperature on your printer LCD only. If Gcodes does not work please proceed to the next options.



Options B Factory files Simplify3D (recommended)

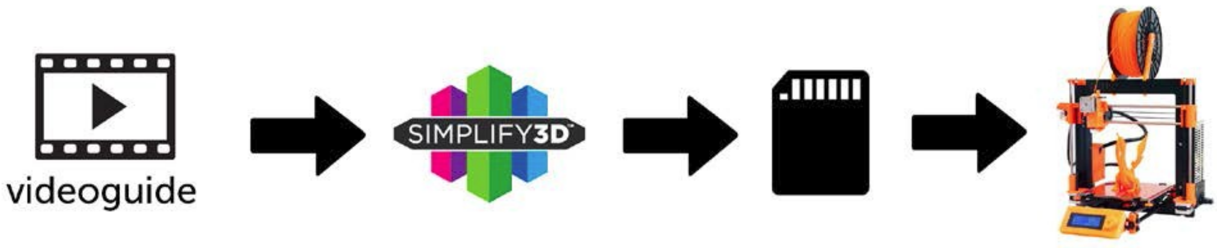
We prepare all you need in this files (basic FFF, parts arranged and so on...)
You can use this our setting as a start point and edit it as you need (adapt it for your printer),print only parts you need and so on... On most 3d printers it should work as it is, but please give a look to the setting and edit it if is different to your printer, we are not liable for damages resulting from the use of our settings. If this does not work please proceed to the next option.



options C Simplify3D manual setting (watch and learn)

Use our video guide 2 for proper setting... this is very good option and you will learn a lot about Simplify3D and become a 3d expert. Of course you spend a lot of time and YouTube pause button will become your friend.

options D CURA or MatterControl



MatterControl and CURA are free and also gives very good results and airframe is still strong enough, slicer setting is very easy.

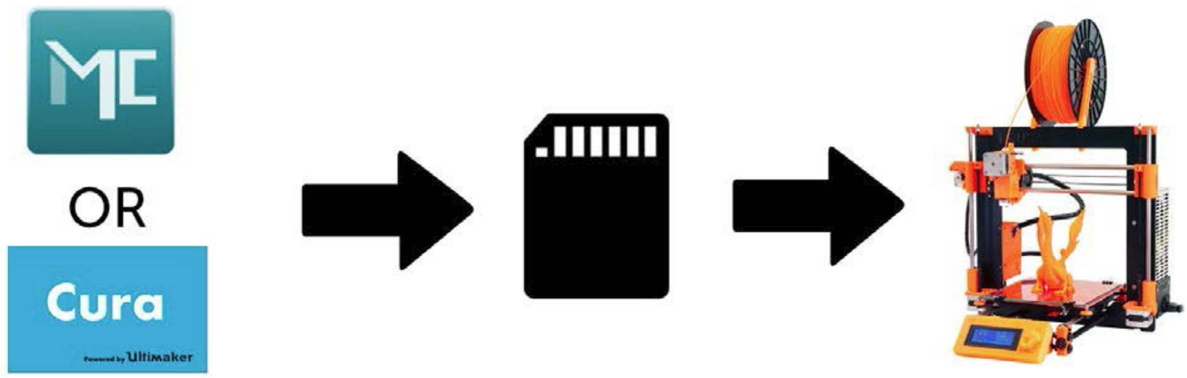
Please try find right extrusion multiplier and temperature for good weight and best layer bonding, give a look to parts weight list for proper multiplier setting.

You can also use our predefined CURA or MC slicer setting file included in package (always adapt it for your printer, change build volume, filament diameter and so on... depends on your printer!!!):

CURA_wing_fuse.ini (wing and fuselage and so on... parts)
CURA_ailer_elev.ini (only ailerons, elevator and rudder parts)
CURA_thick.ini (motor mount, battery holder, spinner)

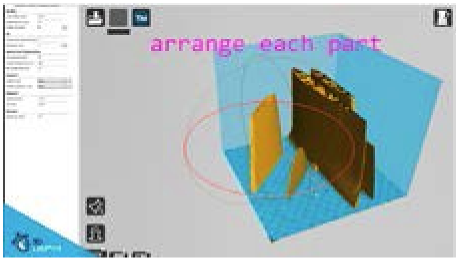
OR

MC_wing_fuse.slice (wing and fuselage and so on... parts)
MC_ailer_elev.slice (only ailerons, elevator and rudder parts)
MC_thick.slice (motor mount, battery holder, spinner)

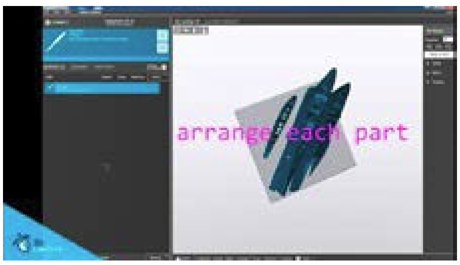


AND... please give a look at these VideoGuides;

Video Cura slicer setting



Video Matter Control slicer setting



2. Print it

Save generated Gcodes and insert SD card to your printer, prepare your printer and start printing, we prefer to use SD than direct connection via USB Note: ABS filament is not suitable or this...
Scaling the model will lead to unusable result!
video guide about printing
You will need: PLA filament - good quality and strong PLA (we need good layer bonding)
Strong hair spray (or your favorite adhesive bed surface)
Razor blade

AND... please give a look to VideoGuides: Video printing guide (similar to this 3D LabPrint Spitfire)

Basic Tips and Advice

Please Experiment with your extrusion multiplier...

Also HotEnd temperature is very important for strong result, please try increase temperature to find the best value (200 up to 260 celsius)

Turn OFF cooling fan for better layer adhesion (Hot End fan ON of course) we don't need it for our thin wall printing...

We tried a lot of filaments and so far PLA is still the best for our models (2016).
You can try also PETG and PC-max from Polymaker is very promising filament.

HEATED BED is very recommended, 60-70celsius (print without warping ends) (but please read personal note below)

Looks like any standard quality PLA is OK for our planes, BUT it always depends on combination PLA vs. Extruder vs. HotEnd.

We find that some color of filament has lower layer adhesion, always check if you are printing in a solid color.

Nowadays there is lot of 3dprinters on the market, most of them are OK for printing our aircraft (specific thin wall printing...) sufficient volume, heated bed, 0.4mm nozzle.

3D LabPrint Printing Guide

More on Printing Parts

Most all of this project is printed using the "single" line printing technique as outlined by 3DLabPrint However there is infill as supplied by the slicer in all parts, The infill used is Rectilinear, at 3% and 10% rates. This varies as needed due to the needed strength in many areas of the different parts. In many cases the part is oriented on the platen to take advantage of the direction of the infill as well. Pay attention to the included schedule of printing, the supplied S3D Factory files and the supplied Gcode that is optimized for the Prusa line of printers.

PolyAir PLA and PolyLight LW-PLA is from 3DLabPrint. PolyAir is printed at 220c with a bed temp of around 50c if printing on PEI Sheets. PolyLight is printed at 235c with a bed temp of around 50c as well.

You will also find that printing the control surfaces, horns down using LW-PLA at an initial temp of 207c, then transitioning to 235c, will result in a solid PLA horn then a foam control surface.

Layer height – 0.25mm for most parts

Nozzle Diameter - 0.4 mm

Time Lapsed Videos

Watch these videos on printing of a few parts – you'll see where 3% infill transitions to 10% infill then back to 3% on part WLC2.

Drop Tank Bezel, Drop Tank Light, Wing Tip, WLC1, WLC2

Personal Printing Note From the SwitchBlade Designer:

I've found that keeping a high bed temp (60c+) with thin parts causes radial shrinkage (5mm-20mm above the bed) during longer prints. My best printing now uses a low heat (35C) bed temp. I print on 3M Blue Original Painter's tape which I squeegee down on glass with a credit card. A slower first layer speed (60%) at the proper height, gives a great bond for the duration of the print. Make sure the temperature for your particular brand of PLA bonds each layer well. This may change slightly with different colors within the same brand. Accuracy with our prints depends on a tight, well setup machine, quality manufactured filament (diameter tolerance) and lastly accurate temperature management. Insulation on the hot end (such as a silicone cover or cotton padding) (see time lapse videos) helps the controller keep a rock steady temperature. Keeping a steady temperature minimizes visual print anomalies.

Additional note – I've been experimenting with PEI bed sheets from various 3D print suppliers and have had good success. If anything, large flat base prints, are almost impossible to remove – so it seems to be good for our single line printing, especially if you use an attached skirt of several lines on small parts.

Note; Most parts are printed with "2 Layers Bottom" as opposed to "0 Layers Bottom" - This offers a bit more gluing strength and a natural diaphragm for added integrity on this high speed model.

Note; Since the above notes on "bed adhesion" was made, I've found and experimented with many of the new "bed adhesive liquids such as Layerneer, Nano Polymer Adhesive, gluestick and others. The technology is now such that bed adhesion problems are mostly in the past – so much so that modern adhesive compounds with actually break the bed glass if one isn't careful – it's happened to me a few times. Prusa has their own proprietary bed materials which are very good, but it also is worthwhile to experiment. It takes a broad knowledge of bed adhesion when you consider all the modern filaments available – many of which are new to the market.

Part Printing Schedule -

Below you will see a table of parts. This table has the main parameters as it relates to slicer settings. If you use another slicer other than Simplify 3D, you can use this as a guide to make sure you get the required strengths in the proper areas. Each part may vary in any and all of these basic parameters. If you need to do any programming/slicing on your own, study the supplied *.Factory files and this table.

1. Layer Height
2. Extrusion Multiplier (LW-PLA is printed at 65% and 235c on prototypes)
3. # of Top Solid Layers
4. # of Bottom Solid Layers
5. # of Outline Perimeters
6. %Infill – (Rectilinear) watch part orientation (see *.Factory files)

7. From (this shows where this layer, or group of layers, starts)
8. To (this shows where this layer, or group of layers, ends
9. Temp (this shows what the temperature is for this layer (or group of layers)

Important Print Parameter Changes for each part, each parameter may change at some point during a single print at different heights/layers - supplied S3D Factory Files already reflect these settings -
Enable "Avoid crossing outline for travel movments" Max allowed detour factor "3" on Advanced Tab

LW-PLA	Layer Ht	Ex Mult	Top Solid Layers	Bottom Solid Layers	Outline Perimeter	Infill	From	To	Temp
Canopy B, C, D, E, F, FX	0.25	0.65	2	2	1	3%	Bottom	Top	235
Canopy F2	0.25	0.65	2	2	1	6%	Bottom	Top	235
Battery Floor A-B	0.25	0.65	3	3	2	20%	Bottom	Top	235
Fuse A1	0.25	0.65	2	2	1	3%	Bottom	Top	235
Fuse A2	0.25	0.65	2	2	1	3%	0	4.02	235
Continued Layer Settings	0.25	0.65	2	2	1	10%	4.02	5.2	235
Continued Layer Settings	0.25	0.65	2	2	1	3%	5.2	15.02	235
Continued Layer Settings	0.25	0.65	2	2	1	10%	15.02	16.02	235
Continued Layer Settings	0.25	0.65	2	2	1	3%	16.02	18.02	235
Continued Layer Settings	0.25	0.65	2	2	1	10%	18.02	Top	235
Fuse A3	0.25	0.65	2	2	1	3%	Bottom	Top	235
Fuse A4	0.25	0.65	2	2	1	3%	0	12.5	235
Continued Layer Settings	0.25	0.65	2	2	1	10%	12.5	29	235
Continued Layer Settings	0.25	0.65	0	2	1	10%	29	31.5	235
Continued Layer Settings	0.25	0.65	2	2	2	10%	31.5	Top	235
Fuse A5	0.25	0.65	2	2	1	10%	0	2	235
Continued Layer Settings	0.25	0.65	2	2	1	10%	2	4	235
Continued Layer Settings	0.25	0.65	2	2	1	3%	4	100	235
Continued Layer Settings	0.25	0.65	2	2	1	10%	100	Top	235
Fuse A6	0.25	0.65	2	2	1	3%	0	118	235
Continued Layer Settings	0.25	0.65	2	2	1	10%	118	Top	235
Fuse A10, A10X, A11, A12	0.25	0.65	2	2	1	3%	Bottom	Top	235
Gear Block	0.25	0.65	4	2	1	10%	Bottom	Top	235
Fin A	0.25	0.65	0	2	1	3%	Bottom	Top	235
Fin B, C, D, Fin Tip A-B,	0.25	0.65	2	2	1	3%	Bottom	Top	235
Rudder A	0.25	0.65	0	2	2	10%	0	0.25	207
Continued Layer Settings	0.25	0.65	0	6	2	10%	0.25	3	207
Continued Layer Settings	0.25	0.65	0	6	2	10%	3	Top	235

Rudder B	0.25	0.65	0	2	2	10%	0	0.25	207
Continued Layer Settings	0.25	0.65	0	6	2	10%	0.25	3	207
Continued Layer Settings	0.25	0.65	2	2	1	3%	3	Top	235
Rudder C	0.25	0.65	2	2	1	3%	Bottom	Top	235
Elev A	0.25	0.65	0	2	2	10%	0	0.25	207
Continued Layer Settings	0.25	0.65	0	6	2	10%	0.25	3	207
Continued Layer Settings	0.25	0.65	2	2	1	3%	3	Top	235
Elev B	0.25	0.65	0	2	2	10%	0	0.25	207
Continued Layer Settings	0.25	0.65	0	6	2	10%	0.25	3	207
Continued Layer Settings	0.25	0.65	2	2	1	3%	3	Top	235
Elev C, D	0.25	0.65	2	2	1	3%	Bottom	Top	235
Stab A, B, C, D	0.25	0.65	2	2	1	3%	Bottom	Top	235
Fence, Rear Strakes	0.25	0.65	2	2	2	20%	Bottom	Top	235
Servo Covers	0.25	0.65	3	3	2	10%	Bottom	Top	235
Tank Bezel	0.25	0.65	2	2	1	0%	Bottom	Top	235
Wing Tank Light	0.25	0.65	0	2	1	0%	Bottom	Top	235
Ail1	0.25	0.65	0	2	2	10%	0	0.25	207
Continued Layer Settings	0.25	0.65	0	6	2	10%	0.25	3	207
Continued Layer Settings	0.25	0.65	0	1	1	3%	3	27	235
Continued Layer Settings	0.25	0.65	0	1	1	10%	27	32	235
Continued Layer Settings	0.25	0.65	0	1	1	3%	32	46	235
Continued Layer Settings	0.25	0.65	2	1	2	10%	46	Top	235
Ail2	0.25	0.65	0	2	2	10%	0	0.25	207
Continued Layer Settings	0.25	0.65	0	6	2	10%	0.25	3	207
Continued Layer Settings	0.25	0.65	0	1	1	3%	3	56	235
Continued Layer Settings	0.25	0.65	0	1	1	10%	56	61	235
Continued Layer Settings	0.25	0.65	0	1	1	3%	61	148	235
Continued Layer Settings	0.25	0.65	0	1	1	10%	148	154	235
Continued Layer Settings	0.25	0.65	0	1	1	3%	154	173	235
Continued Layer Settings	0.25	0.65	2	1	2	10%	173	Top	235

Notes on the Part Printing Schedules

The table does not list mirrored parts such as W AC3, where the "L" or the "R" is left out, meaning that the settings for that part are for both the WLAC3 and the WRAC3. This holds true for all parts that are Wings, Stab, Gear Doors, etc.

When printing LW-PLA, be sure to enable, "Avoid crossing outline for travel movements. LW-PLA will continue to "string" between movements, if the head crosses open areas of the print, such as wire chases, cutouts, etc. it will leave residue that will need to be cleaned up before assembly. By enabling this parameter found on the last tab "Advanced" then the head will go around these openings and deposit the excess into the interior of the print harmlessly.

Flp1	0.25	0.65	0	2	2	10%	0	0.25	207
Continued Layer Settings	0.25	0.65	0	6	2	10%	0.25	3	207
Continued Layer Settings	0.25	0.65	0	1	1	3%	3	14	235
Continued Layer Settings	0.25	0.65	0	1	1	10%	14	20	235
Continued Layer Settings	0.25	0.65	0	1	1	3%	20	103	235
Continued Layer Settings	0.25	0.65	0	1	1	10%	103	109	235
Continued Layer Settings	0.25	0.65	0	1	1	3%	109	123	235
Continued Layer Settings	0.25	0.65	2	1	2	10%	123	Top	235
Flp2	0.25	0.65	0	2	2	10%	0	0.25	207
Continued Layer Settings	0.25	0.65	0	6	2	10%	0.25	3	207
Continued Layer Settings	0.25	0.65	0	1	1	3%	3	67	235
Continued Layer Settings	0.25	0.65	0	1	1	10%	67	74	235
Continued Layer Settings	0.25	0.65	0	1	1	10%	74	98	235
Continued Layer Settings	0.25	0.65	2	1	2	10%	98	Top	235
W A1	0.25	0.65	0	2	2	10%	0	0.31	235
Continued Layer Settings	0.25	0.65	0	2	2	10%	0.31	1.81	235
Continued Layer Settings	0.25	0.65	0	1	1	3%	1.81	154.06	235
Continued Layer Settings	0.25	0.65	0	1	2	10%	154.06	Top	235
W A2C (Platen Supports)	0.25	0.65	0	2	2	10%	0	0.31	235
Continued Layer Settings	0.25	0.65	0	2	2	10%	0.31	1.81	235
Continued Layer Settings	0.25	0.65	0	1	1	3%	1.81	21.3	235
Continued Layer Settings	0.25	0.65	0	1	1	10%	21.3	31.3	235
Continued Layer Settings	0.25	0.65	0	1	1	3%	31.3	50.8	235
Continued Layer Settings	0.25	0.65	0	1	1	10%	50.8	53.5	235
Continued Layer Settings	0.25	0.65	0	1	1	3%	53.5	65.8	235
Continued Layer Settings	0.25	0.65	0	1	2	10%	65.8	Top	235
W A3A	0.25	0.65	0	2	2	10%	0	0.31	235
Continued Layer Settings	0.25	0.65	0	2	2	10%	0.31	1.81	235
Continued Layer Settings	0.25	0.65	0	1	1	3%	1.81	30.6	235
Continued Layer Settings	0.25	0.65	0	1	1	10%	30.6	35.5	235
Continued Layer Settings	0.25	0.65	0	1	1	3%	35.5	54.5	235
Continued Layer Settings	0.25	0.65	0	1	2	10%	54.5	Top	235

W A3C	0.25	0.65	0	2	2	10%	0	0.31	235
Continued Layer Settings	0.25	0.65	0	2	2	10%	0.31	1.81	235
Continued Layer Settings	0.25	0.65	0	1	1	3%	1.81	29.8	235
Continued Layer Settings	0.25	0.65	0	1	1	10%	29.8	35.5	235
Continued Layer Settings	0.25	0.65	0	1	1	3%	35.5	65.8	235
Continued Layer Settings	0.25	0.65	0	1	2	10%	65.8	Top	235
W B1	0.25	0.65	0	2	2	10%	0	0.31	235
Continued Layer Settings	0.25	0.65	0	2	2	10%	0.31	1.81	235
Continued Layer Settings	0.25	0.65	0	1	1	3%	1.81	154.06	235
Continued Layer Settings	0.25	0.65	0	1	2	10%	154.06	Top	235
W B2	0.25	0.65	0	2	2	10%	0	0.31	235
Continued Layer Settings	0.25	0.65	0	2	2	10%	0.31	1.81	235
Continued Layer Settings	0.25	0.65	0	1	1	3%	1.81	154.06	235
Continued Layer Settings	0.25	0.65	0	1	2	10%	154.06	Top	235
W B3	0.25	0.65	0	2	2	10%	0	0.31	235
Continued Layer Settings	0.25	0.65	0	2	2	10%	0.31	1.81	235
Continued Layer Settings	0.25	0.65	0	1	1	3%	1.81	50	235
Continued Layer Settings	0.25	0.65	0	1	1	10%	50	56	235
Continued Layer Settings	0.25	0.65	0	1	1	3%	56	105	235
Continued Layer Settings	0.25	0.65	0	1	1	10%	105	114	235
Continued Layer Settings	0.25	0.65	0	1	1	3%	114	135	235
Continued Layer Settings	0.25	0.65	0	1	1	10%	135	136	235
Continued Layer Settings	0.25	0.65	0	1	1	3%	136	154.06	235
Continued Layer Settings	0.25	0.65	0	1	2	10%	154.06	Top	235
W C1	0.25	0.65	0	2	2	10%	0	0.31	235
Continued Layer Settings	0.25	0.65	0	2	2	10%	0.31	1.81	235
Continued Layer Settings	0.25	0.65	0	1	1	3%	1.81	153	235
Continued Layer Settings	0.25	0.65	0	1	2	10%	153	Top	235
W C2	0.25	0.65	0	2	2	10%	0	0.31	235
Continued Layer Settings	0.25	0.65	0	2	2	10%	0.31	1.81	235
Continued Layer Settings	0.25	0.65	0	1	1	3%	1.81	38	235
Continued Layer Settings	0.25	0.65	0	1	1	10%	38	45	235
Continued Layer Settings	0.25	0.65	0	1	1	3%	45	130	235
Continued Layer Settings	0.25	0.65	0	1	1	10%	130	136	235
Continued Layer Settings	0.25	0.65	0	1	1	3%	136	153	235
Continued Layer Settings	0.25	0.65	0	1	2	10%	153	Top	235

W Dtip	0.25	0.65	0	2	2	10%	0	0.31	235
Continued Layer Settings	0.25	0.65	0	2	2	10%	0.31	1.81	235
Continued Layer Settings	0.25	0.65	0	1	1	0%	1.81	114	235
Continued Layer Settings	0.25	0.65	0	1	2	10%	114	Top	235
PLA									
Canopy Slide Lock	0.2	1	2	2	2	15%	Bottom	Top	207-220
Fuse A7	0.25	1	2	2	1	3%	0	56	220
Continued Layer Settings	0.25	1	2	2	1	10%	56	76	220
Continued Layer Settings	0.25	1	2	2	1	3%	76	96	220
Continued Layer Settings	0.25	1	2	2	1	10%	96	Top	220
Fuse A8	0.25	1	2	2	1	3%	0	23.27	220
Continued Layer Settings	0.25	1	2	2	1	10%	23.27	42	220
Continued Layer Settings	0.25	1	2	2	1	3%	42	62	220
Continued Layer Settings	0.25	1	2	2	1	10%	62	Top	220
Fuse A9, A9X	0.25	1	2	2	1	3%	0	28	220
Continued Layer Settings	0.15	1	2	2	1	10%	28	31	220
Continued Layer Settings	0.25	1	2	2	1	3%	31	35	220
Continued Layer Settings	0.15	1	2	2	1	3%	35	40	220
Continued Layer Settings	0.25	1	2	2	1	3%	40	67	220
Continued Layer Settings	0.15	1	2	2	1	10%	67	Top	220
Strake Alignment Jig	0.25	1	2	2	2	10%	Bottom	Top	220
Gear Door Assembly Jig	0.25	1	3	3	1	10%	Bottom	Top	220
Gear Door A	0.2	1	1	6	1	0%	0	1.22	220
Continued Layer Settings	0.2	1	1	1	1	0%	1.22	Top	220
Gear Cover Attachment Half	0.2	1	0	0	2	0%	Bottom	Top	220
Split Doors	0.2	1	6	3	2	0%	Bottom	Top	220
W A2A	0.25	1	0	2	2	10%	0	0.31	220
Continued Layer Settings	0.25	1	0	2	2	10%	0.31	1.81	220
Continued Layer Settings	0.25	1	0	1	1	3%	1.81	54.5	220
Continued Layer Settings	0.25	1	0	1	1	10%	54.5	Top	220
W A2B	0.25	1	0	2	2	10%	0	0.31	220
Continued Layer Settings	0.25	1	0	2	2	10%	0.31	1.81	220
Continued Layer Settings	0.25	1	0	1	1	3%	1.81	31.8	220
Continued Layer Settings	0.25	1	0	1	2	10%	31.8	Top	220

Notes on the Part Printing Schedule

Pay attention to the Ailerons and Flaps – the print starts with the temperature low so the LW-PLA does not expand, this gives the horn full PLA strength, then the temperature rises for the rest of the print which makes a lighter part. Also, the horn area has two grooves for the insertion of 1mm carbon rods during assembly, makes a strong control horn!

3. Assembling printed parts

1. Note: Assembly suggestion – I've found this glue to be excellent and a much cheaper alternative to hobby shop comparables. Works with accelerator, safe for PLA, and LW-PLA bonds almost instantly with a bit of pressure, safe for most foams. Otherwise, you can use your favorite hobby shop medium CA, I like to use the foam safe due to lower fumes and its much more versatile.
2. Note; as many of you long time printers have now discovered, using CA accelerator will eventually discolor PLA and LW-PLA months down the road. The glue noted above will grab (without kicker) and hold parts especially if pressure is applied and held with blue tape, etc.
3. Note: Assembly suggestion – The use of true 3M Brand blue painter's tape is recommended for many assembly processes. As mentioned above, I have used it for bed adhesion and it works perfectly 99.9% of the time. When assembling portions of wing, I simply cut squares of the tape (I buy the 1.88" width) and use two or three squares as temporary "hinges" between two parts. I carefully line up the parts and squeegee the tape down using an old credit card. Then I open the parts like a book and carefully apply the glue, close the book, double check alignment and apply moderate pressure for a few seconds. Peel the tape off before it the glue kick completely to prevent leaving a stuck blue blemish. Super simple and effective.
4. I also use a full sheet of 180-220 grit sandpaper laid upon a flat surface to "dress" the mating surfaces of parts before assembly. This ensures there are no printing "artifacts" that might prevent good joint closures. Taking the time to make a series of different size/type of sanding sticks on tongue depressors, popsicle sticks, wooden yardstick sections and in different grits is a professional way to get best results, joints and finishes. This is important!
5. The fuselage parts A1 through A12 have various holes going through them for wiring, carbon rods/tubes, etc. Before assembly you must make sure the holes are clear and workable for each part. The Fuselage is a carbon stressed part that relies on three 1mm solid carbon rods almost the full length. There are holes at the 10 o'clock and 2 o'clock position and a V groove along the bottom of the airframe.

6. To ensure these holes are clear. Make some pointed music wire tools, about 300mm long, sharpened on one end and a safety bend on the other. These tools of various diameters when heated on the sharpened end, will/should easily clear/proof the hole for it's intended use.
7. Tools in these diameters will serve you well during the build – 1.5mm(1/16"), 1.4mm(3/64"+), 1mm(1/32"+)
8. Also, the holes for the 6mm, 8mm, and 10mm carbon tubes need to be cleared/proofed too. Use wooden dowels with a small wrap of 120/180 grit sandpaper taped to the end. A few slow turns using a hand drill will do the job quickly. This is especially helpful to clear/proof holes during the assembly process of the wings and forward fuselage sections.
9. This design uses 1.5mm solid carbon rod for the elevator and rudder hinge. If needed, carefully use the 1.4mm heated wire, preceding the 1.5mm wire to clear the printed holes. LW-PLA is not as accurate as PLA during the printing of really small details, holes may need a little help.
10. This design uses 1mm carbon rods for the front gear door hinges, you can use a small drill to clear/proof the holes in the gear doors, but on the fuselage, you may have to clear the printed holes with the heated 1mm wire.
11. Before assembly of any parts, also clear/check to make sure the servo wire chases are clear of printed debris as well.

Fuselage Assembly –

1. Fuse Parts A1 though A12 can be assembled into one unit. Use carbon rods, tube to help with alignment, but be careful not to glue them in place accidentally.
2. Fuse A Gear Block can be sanded, fitted to glue into place, see pictures.
3. 10Mm x 10mm x 83mm hardwood block can be sanded/fitted into place, glue sparingly with epoxy.
4. On the Fuse A Gear Block,, cut to fit and epoxy in place a piece of 3mm(1/8") plywood for attaching the steering servo by way of servo screws. See pictures.
5. Cut to shape and fit a piece of 6mm(1/4") plywood for the fan tab screws. These pieces will epoxy in place between fuse sections A9 and A10. See pictures.
6. Install carbon 6mm x 410mm tubes on both sides of front gear recess. Clean out hole with dowel/sandpaper on drill as described earlier if needed. Rods should be glued on both ends. To do this, push rods all the way through into the fan area and then apply a bit of medium CA around the tube, then using a stick push the rods forward until flush. Then using Thin CA, run a few drops around the front of the rods. Practice this process first without glue!

Wing Assembly –

1. As previously noted, make sure all wire chases are clear of printed debris, etc. Wing part legend for typical part WLA1 is – Wing/Left/distance from wing root/distance from leading edge.

   Assemble WLA1 and WLB1.

   Assemble WLA2A and WLA2B, cut 3mm(1/8") plywood gear plates and fit into previous assembly, epoxy into place, attach WLA2C and WLC1.

   Assemble WLA3A, WLA3B, WLA3C, WLB3, WLC2.

2. These wing assemblies have a flat mating face which can now be sanded/proofed flat on your full sheet sanding board. Double check all chases for clearance. Pre-assemble #1 strip to #2 strip using blue tape squares for temporary hinges. Unfold and apply CA glue, press and align faces together accurately – you only get one chance at this, be exacting. Then repeat process for assembling #2 to #3 for a complete wing minus tip.

3. Assemble WLDTipA and WLDTipB. Sand/proof flat on sanding board. Fit carbon tube 1mm x 8mm x 335 into wing end recess – if blocked, use sanding dowels on drill to clear path. Insert carbon and glue on wing tip accurately. Carbon does not need to be glued into position.
4. Repeat processes for right hand wing. Double check to make sure 8mm and 10mm carbon spars fit and slide into position well, otherwise use sanding dowels on drill to clear, LW-PLA sands very easily.

Ailerons and Flap Assembly

1. Cut four 1mm x 50mm long carbon rods. Check V-groove in horns of Flap and Aileron parts, if groove are not deep enough, use triangle file to clean to depth – the object is to be able to assemble the horn tightly together with the carbon rods in place. Leave the rods long, they are easily clipped and sanded flush afterwards. Using CA, Glue the two halves, WFlp1 and WFlp2 together. Same for WAil1 and WAil2.
2. Repeat the above process for the right hand flap and aileron.
3. Drill/clean out horn hole for control servo ball and install. Be careful not to overtighten – use supplied nylock nuts. Control balls are installed outboard.

Hinge installation -

1. The Robart pin style hinges are used per control surface. Check depth of hinge points in printed holes. If blocked, use 3mm(1/8") drill by hand to clear to depth. It may be necessary to clip the very ends of the hinge points to get the proper depth. Proper depth is the knuckle completely flush with the face of the hinge pocket.
2. Mix a small amount of epoxy and carefully insert into hinge holes with toothpick. Using a Q-Tip, wipe a small amount of vaseline around hinge knuckle to protect from glue. Carefully insert hinge point into control surface, and remove any excess glue. IMPORTANT, lay free hinge leaf flush and out 90 degree down on suface recess – this shows the proper geometry is correct for future assembly to wing – set aside and wait for hinge glue to cure.
3. Once cured, make sure the hinge points move freely. Fit each surface into wing recesses. Once again, if printed holes need to be cleared, use drill bit by hand, clip off the very end nub of the hinge points as needed – the object is to get the

control surface as close as possible to the wing recess without interference, be sure to allow for paint, etc. Use sandpaper on a small dowel to sand/clean the back recess of the wing for a good fit. Glue surfaces to wing using epoxy carefully applied with a toothpick into the holes. Here you can double check for proper operation before epoxy cures. Once cured, pull on control surfaces to make sure of proper and adequate installation – the life of the airframe depends on these installations.

Stab Assembly -

1. Proof/clean/sand parts and assemble Port Stab A, B, C and D together.
2. Same procedure above for Port Elev A, B, C and D.
3. Make sure servo pocket is cleared of print debris, easily done with a razor knife.
4. Proof/clear 6mm spar holes – testing with 6mm tube and sandpaper on a dowel /drill if needed.
5. Test fit printed hinge hole for clearance with a the carbon 1.5mm diameter pin. Most likely it will not fit. Using your sharpened 1.5mm music wire tool, heat the end with a small flame/candle and carefully push though the existing printed hole – this will melt the LW_PLA out of the way and result in a perfect hole. Be very careful and feel/follow the printed hole all the way through – it may take a few tries as the heated wire cools quickly. Do not force and do not deviate from printed path -failure simply means that you need to print the parts over. If you fail, you may find it easier to clear/proof the holes before assembling parts.
6. Drill out the control horn for the servo arm ball, install the ball outboard on the Elevator.
7. Test fit the carbon rod 1.5mm x 225mm into the hinge and make sure the parts move effortlessly – the goal is a smooth/free moving surface with minimal to no slop or excess play. The hinge pin is held in place with a dab of flexible glue on the very end of the carbon at part ElevD. This will allow you to remove the pin during fabrication or repair.

Rudder Assembly -

1. Proof/clean/sand parts and assemble Fin A, B, C and D together

2. Same procedure above for Rudder A, B, and C
3. Assemble FinTipA and FinTip B – sand/proof flat surface
4. Proof/clear 6mm spar holes – testing with 6mm tube and sandpaper on a dowel /drill if needed.
5. Make sure servo pocket is cleared of print debris, easily done with a razor knife.
6. Fit carbon 1.5mm x 190mm hinge pin using same technique as described in #5 in Stab Assembly.
7. Drill out the control horn for the servo arm ball, install the ball upward on the Rudder.
8. Assemble Rudder to Fin as outline in techniques for Stab/Elev

Canopy Assembly -

1. You've made your choices as to Plain, Bubble or Fighter canopy cockpit shape. As well as decided if you want a lighted nose or a pointed nose, there is also an option for a pitot tube hole which fits the Spektrum airspeed sensor tubing.
2. Clean/Proof/Sand - then carefully assemble Canopy part A, B, C, D, F. You can use the assembled fuselage for proofing the squareness of joints. Attention to detail here will yield a very well fitting canopy.
3. Canopy parts F1 and F2 may need to sanded/proofed and prepped before assembly. Using the PLA printed Canopy Slide lock, make sure there is smooth and free movement, sand clean and fit these parts together to insure all works well. Insert a ball point pen spring into the recess and assemble with CA, being very carefully obviously to keep slide free moving.
4. Sand end of F1/F2 assembly flat and glue to the end of the canopy assembly at "F". This will result in a completed canopy.
5. Test fit to fuselage by placeing canopy front onto the protruding gear blocks, then interring the printed shaped key recess on the fuselage, pulling back the slide in the process. Clean/clear/sand as needed to get a secure and clean operation.

Front Gear Doors – Here's a Video

1. Front PLA gear doors are in several pieces – clean brim and printing artifacts away.
2. The SB and Port Nose gear assembly jigs are printed each in one piece out of scrap PLA.
3. Using the assembly jigs as a guide/bed, assemble the Gear Door parts A, B, B and D using CA. You'll find there are grooves in the assembly jig that keep the glue glear of the jig – don't want to glue the door to the jig!
4. Using a 1mm drill by hand, clear the gear door pivots for the 1mm carbon rod hinge pin.
5. Using the same technique as describe in #5 of the Stab/Elev assembly, clear the holes for the gear door hinge pin with a heated 1mm music wire. Be very careful to find the exiting printed holes, Failure here will be troublesome. The result will be free moving and accurately closing front gear doors.
6. Actuation of front gear doors requires the use of the small 9g plastic gear servo and accurate fabrication of the push-rods/wire. See included pictures. Use the TX programming to time the gear/door timing events. There are videos online for your particular radio brand for doing this.

Fuselage Carbon Installation -

1. As noted previously, there is 1mm carbon rods to insert/attach to the fuselage assembly.
2. Slide the 1mm rods into the printed/cleared holes at the 10 o'clock and 2 o'clock positions. You'll find the rods ending up in the underside of the air intakes. Glue the rods down into the recesses inside the intakes. Tape may help here to keep them down until dry.
3. Once the rods are firmly attached in the intakes, use thin CA on the carbon rods that stick out in the end of Fuse A12, You can put a little tension on these rods as the glue wicks down the rod and sets.
4. The underside of the fuselage has a V-groove running the length. Clean out this groove with a triangle file, then fit and glue into place a 1mm carbon rod, glued continuously along the length.

Light Pods -

1. See picture for suggested light bulb wiring/assembly.
2. Assemble bulb/wire into pod as shown in picture.
3. Wing Fence, printed from LW-PLA is attached to the wing using the slots and tabs printed into the parts.
4. Accurately attach light pods to the bottom of the wing fences using medium CA, Run the wire through the wing using a thin plastic tube/feeler for help.

Main Gear Doors – Here's a Video

1. Main gear doors installation depend on several decisions. If you've decided to use and have acquired the suggested retractable gear then the installation will be rather straightforward. Installation of the gear doors will be optional, but they do work and offer some aesthetics and aerodynamic benefits. These instruction assume this is the case.
2. The use of the suggested gear will require lengthening the servo control wires as previously noted.
3. Install the main gear in each individual wing and test operation with a servo tester.
4. Clean the printed main gear doors of brim and any printing artifacts and assemble the parts as shown in the sketches and pictures.
5. The inner gear door covers are hinged to the fuselage by way of a 1mm carbon rod. The same heated music wire technique may be needed to clear the gear door hinge hole for clearance. The inner gear doors are attached to the fuselage with a dab of flexible glue on either end of the carbon rod. The door is actuated by means of a rubber band through the chase and held in place in the wing root area by a section of toothpick or other. A very light spring of appropriate length may be used if you have one available – just make sure it is not too strong to prevent the door from closing. Use a cloth strap (medical tape works well) fastened to the wheel well, and then pulled over the closed gear, up through the slot and over the closed gear door, Fasten with a drop of CA -check for proper

operation. There is a 3mm gap between the doors to allow some draft through to the fan,, as opening the doors expose inlets to the fan allowing for more air during the slower landing/taking off phase of flight. See pictures and drawings for help in configuration.

Final assembly -

1. Bind your RX on the bench, connect the ESC and EDF and determine correct motor direction. Mark the wires and disconnect.
2. Apply a strip of Velcro onto the battery area.
3. Feed a battery strap through the fuselage slot.
4. Stabilizer and Fin are held in place with small dabs of flexible glue
5. Main wing is held on place with the printed PLA wing lock and small screws
6. Install and final wire your servos. A small dab of flexible glue holds them in place. Attach the recommend control arms and adjust/neutralize the surfaces.
7. Fit the servo covers into place and use a very small dab of flexible glue to hold them there.
8. Install the rear Strakes on the bottom rear of the fuselage, use the printed guide for help with alignment.

Setup

1. Control surface throws –
    1. Ailerons up/down – High Rates – 32mm, Low Rates – 28mm - Expo 45%
    2. Flaps Takeoff – 22mm, Elev down 1/2mm, Land -36, Elev Down 1mm
    3. Elevator - High Rates – 20mm, Low Rates – 17mm - Expo 30%
    4. Rudder - High Rates – 45mm, Low Rates – 35mm - Expo 15%
2. Center of Gravity (CoG) – **115mm** (+-5mm and **wheels up**) from leading edge at wing root (joint between wing and fuse) Note – Plane can easily be nose heavy so watch assembly weight in this area. Fan/Motor may be slid backwards to help. Lipo batteries with higher C ratings are falling in weight, - 6S batteries with a 5000mah capacity are now weighing in at 768g, and that's at 75C! A full 100g

lighter than batteries of just a couple years ago. But plane has been flown successfully with battery weights up to 889g

Livery

I like to paint my planes with a coat of Minwax Polycrylic or Deluxe Eze-Kote a modified waterbased urethane product (WPU) that goes on thin, dries quickly without brush marks, sands easy if needed. Being a urethane, it is essentially an adhesive, which adds a bit of strength to our printed planes by "filling" in the record grooves of the printing process. This material is super, try it, you'll find many uses for it!

A coat of clear and then use any rattle can paint for graphics as wanted. Or use the supplied PDF, water slide decals, and your inkjet printer to make perfect professional looking graphics. Another coat of clear seals the decal edges once applied. Have fun here and personalize your SwitchBlade. Callie Graphics can resize any stock vinyl graphics for this airframe – These Graphics for their T-45 BAE Hawk look good and they can be scaled up to 1/9.5 for this airframe.

Flying

For a successful maiden flight you need several things in your favor.

1. Correctly setup airframe
2. Confirmed CoG
3. Confirmed Neutral Flight control surfaces, moving in the right direction. Check gyro response and it's directions too! (if using a stabilized RX)
4. Fully charged battery
5. Wind down the runway helps to lower ground speed during takeoff and landing.
6. A flight plan – what are you going to do after take-off? Check aileron trim, check elevator trim, flaps up, flaps down, gear up, gear down.
7. Landing – a high approach on final, takeoff flaps are fine if there is any headwind, if no wind use full flaps – light throttle, push the nose down to maintain airspeed and make the end of the runway. Don't get too slow! After crossing the threshold, neutralize the elevator, cut power, pull flare as the plane settles into ground effect - touching down on the mains is critical with jets, a

nose gear touchdown results in a pogo landing that gets progressively worse – might be better to hit the gas and go around.

The SwitchBlade is the culmination of much research, flight time, study of similar designs and choosing the best of the best. During prototype testing the SwitchBlade did not exhibit any bad habits or tendencies – she's mild mannered and a joy to fly. If you can imagine a maiden flight of a completely new design that has never flown before – you can imagine my experience. Is the CG right? Are the control surfaces moving enough, the right amount of expo? What did I forget? All of this is in your mind as you push the stick forward and see your baby pick up speed down the runway. But after a gentle takeoff and predicable handling, it's all worthwhile. I'll always remember seeing it rotate and lift off the runway for the first time – a massive accomplishment, one that I hope you too will enjoy!

All the best, Don – and the 3DLabGANG

P.S. I'm also a writer. If you are a reader of suspense novels you will enjoy my book, "Found Money." Available on Amazon

An elegant and simple design is the result of an investment of sweat equity from the designer. Please honor that investment and keep these files private. Thank you.