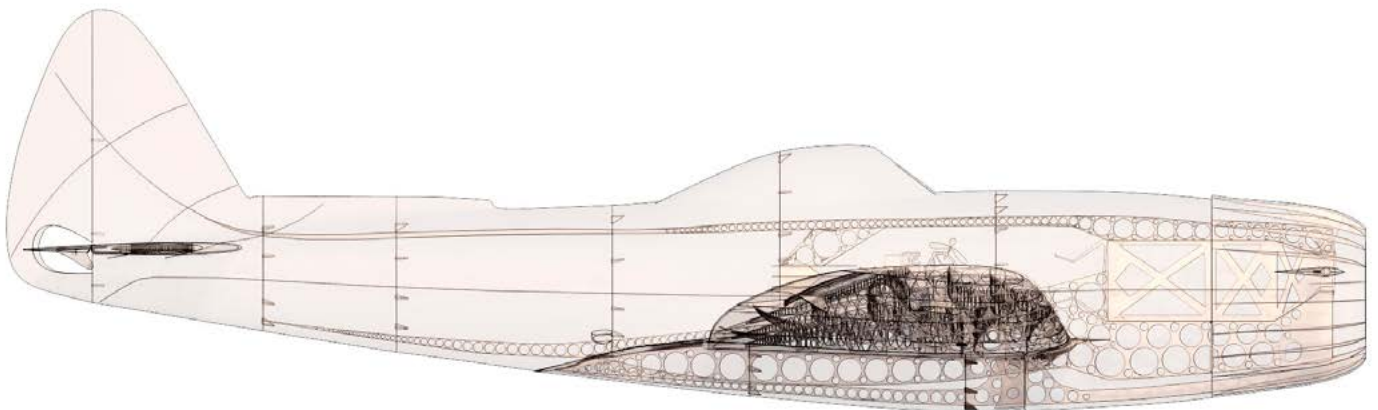# User Guide

rev. 2016/09

Fully 3d printable

Republic P47 N15 Thunderbolt

scale 1:12, wingspan 1160mm (45.7in)

3D Lab Print P 47 N15 Thunderbolt — fully printable R/C plane for your home 3Dprinter

**Future of flying - Print your own plane**

We still trying move things further, so this project is again full of other improvements for better durability , easier assembly , better geometry solution and so on..., we hope you enjoy it, although this print may test your competencies to and quality of your printer (welcome to the thin wall printing)

The first fully printable airplanes with suitable files prepared for your 3Dprinter.
Flight charecteristics are comparable or even better than classic build model airplane.
Simply download and then print it anytime you need only for $10 (filament cost).
This is not a dream, now you can print this HI-TECH .... at home, print spar parts, and so on...

Extensive hi-tech 3d structural reinforcement which makes the
model very rigid while still maintaining lightweight airframe and exact airfoil even when it is made only from plastic. This perfect and exact 3d structure is possible only due to aditive 3dprinting technology. So welcome to the 21th century of model flying. Be The first at your airfield.

Easy to assembly, you do not need any extra tool or hardware, you only need to
glue printed parts together and make pushrods for control. The rest of the assembly is very easy.Simply add brushless motor, ESC, servos and radio system. Don´t worry, detailed step by step PDF/VIDEO is included.
You will get superb performance airplane with High efficient powerplant which let you fly 7+ minutes at full throtle with the speed exceeding 150 kph (HP setup). On the other hand low stall speed is achived for easy landing.
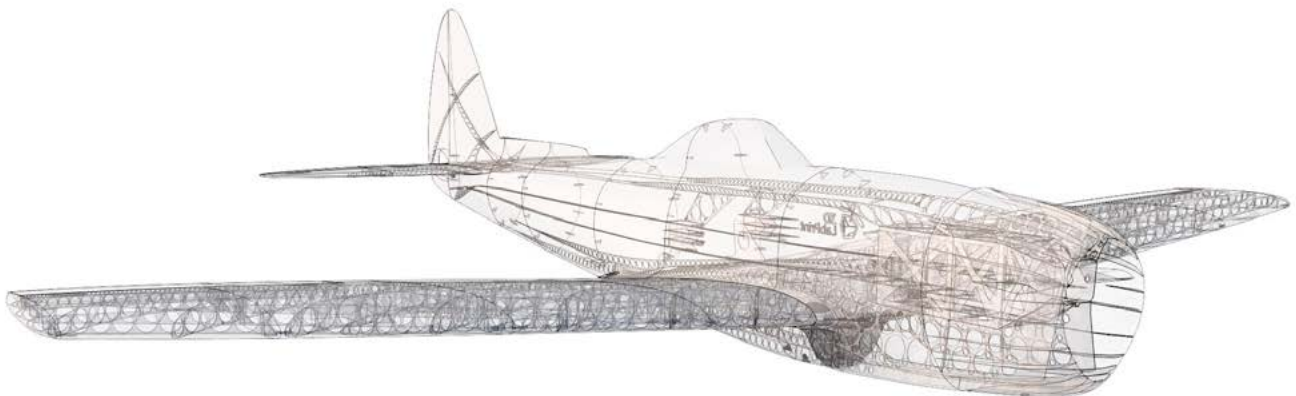
General specifications:

Lenght:	970mm (38.2in)
Wingspan:	1160mm (45.7in)
Height:	291mm
Wing area:	24.5 dm2
Wing loading:	51.0 g/dm2
Airfoil:	aircombat modificated
Print weight:	740g
Takeoff weight (6s 2200 lipo):	1250g
Max takeoff weight:	1470g
Never exceed speed, VNE:	205km/h
Design maneuvering speed, VA:	165km/h
Stall speed, VS:	27km/h

Powerplant

Propeller:	Aeronaut ELP 11/6-7 or APC 11/5.5−7
Motor:	AX-4008Q/620KV, 22pole brushless HE electric motor
ESC:	Castle Creations TALON 25 or any 30-40/6s ESC
Battery:	Turnigy nanotech 2200 mAh/6s/22.2V, 353g, 25C

Performance measurment

Max RPM and Amps (static):   11 500/min with APC 11/5.5, current 32A
                                  11 000/min with APC 11/7, current 35A

Max RPM and Amps (level flight): 13 700/min with APC 11/5.5, current 22A
                                  12 400/min with APC 11/7, current 24A
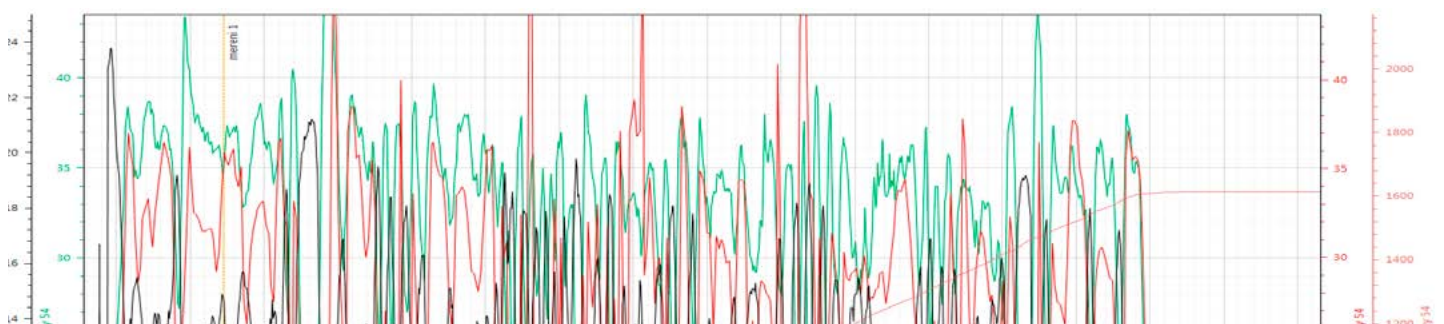
Max speed VH (level flight):   130 km/h – 67.5kn – 78 mph with APC 11/5.5
                               142 km/h – 73kn – 84 mph with APC 11/7

Rate of climb: 28 m/s (5 373 ft/min) with APC 11/5.5
                               30 m/s (5 728 ft/min) with APC 11/7

Flight time (6s 2200mAh/full):   8:40 with APC 11/5.5
                                      7:30 with APC 11/7

Republic P47 N15 Thunderbolt, History

The Republic P-47 Thunderbolt is one of the largest and heaviest fighter aircraft in history to be powered by a single 4 stroke internal combustion engine. It was built from 1941-1945. It was heavily armed with eight .50-caliber machine guns, four per wing. When fully loaded, the P-47 weighed up to eight tons, and in the fighter-bomber ground-attack roles could carry five-inch rockets or a significant bomb load of 2,500 pounds; it could carry more than half the payload of the B-17 bomber on long-range missions (although the B-17 had a far greater range). The P-47 was designed around the powerful Pratt & Whitney R-2800 Double Wasp engine—the same engine used by two very successful U.S. Navy fighters, the Grumman F6F Hellcat and Vought F4U Corsair, the latter aircraft itself the first to fly with Double Wasp power in late May 1940—and was to be very effective as a short-to-medium range escort fighter in high-altitude air-to-air combat. When deployed as a fighter-bomber with its usual "double quartet" of heavy-caliber M2 Browning machine guns, it proved especially adept at ground attack in both the World War II European and Pacific Theaters

The P-47N was the last Thunderbolt variant to be produced. It was designed as an escort fighter for the Boeing B-29 Superfortress bombers flying raids on the Japanese home islands. Increased internal fuel capacity and drop tanks had done much to extend the Thunderbolt's range during its evolution, and the only other way to expand the fuel capacity was to put fuel tanks into the wings. Thus, a new wing was designed with two 50 U.S. gal (190 l) fuel tanks. The second YP-47N with this wing flew in September 1944. The redesign proved successful in extending range to about 2,000 mi (3,200 km), and the squared-off wingtips improved the roll rate. The P-47N entered mass production with the uprated R-2800-77(C) engine, with a total of 1,816 built. The very last Thunderbolt to be built, a P-47N-25, rolled off the production line in October 1945.

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 (this STLs are not compatible with Slic3r).
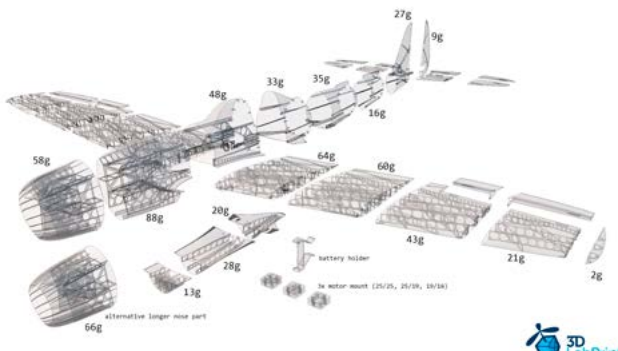
2.Factory files for Simplify3D slicer

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
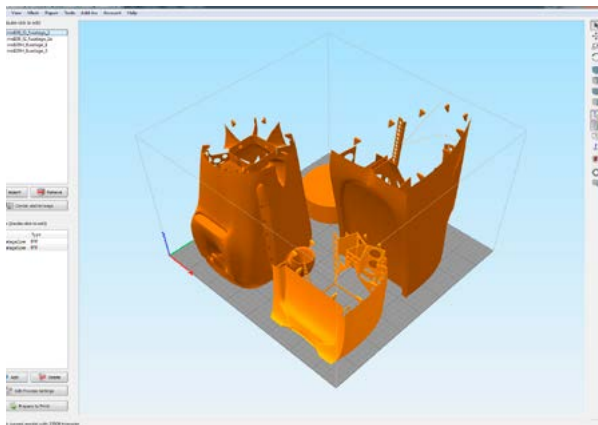
3.Step By Step PDF/VIDEO userguides

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.
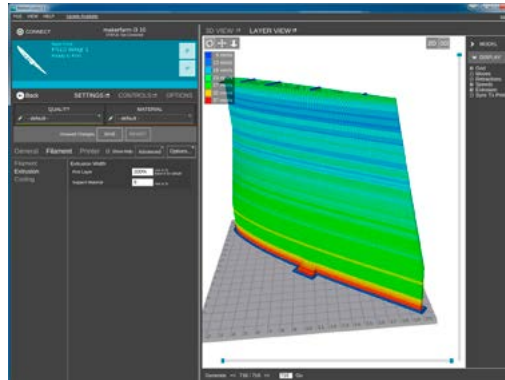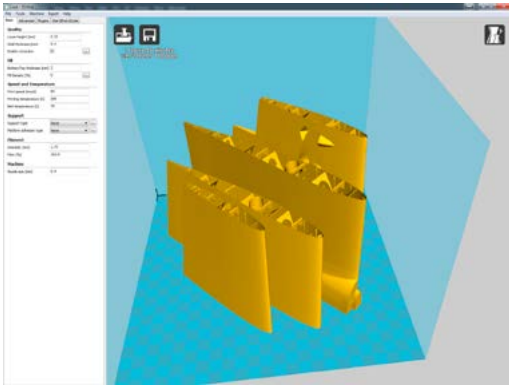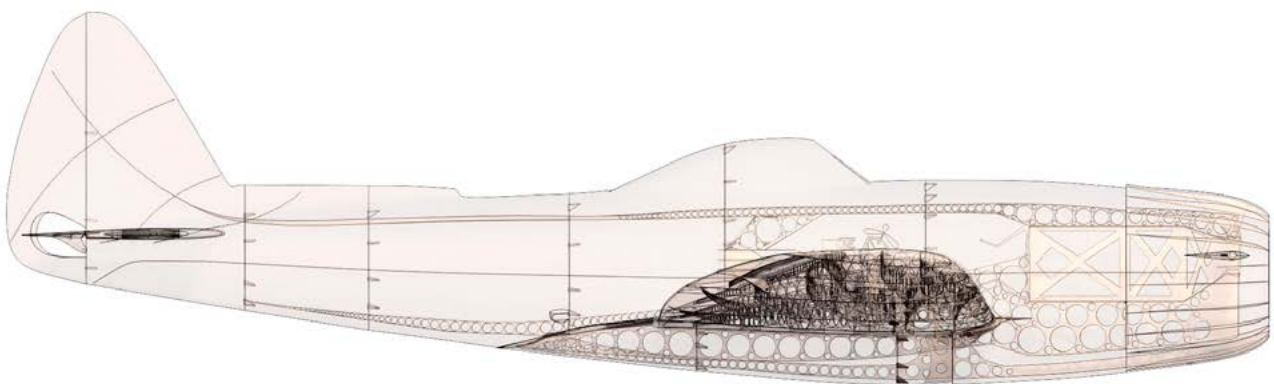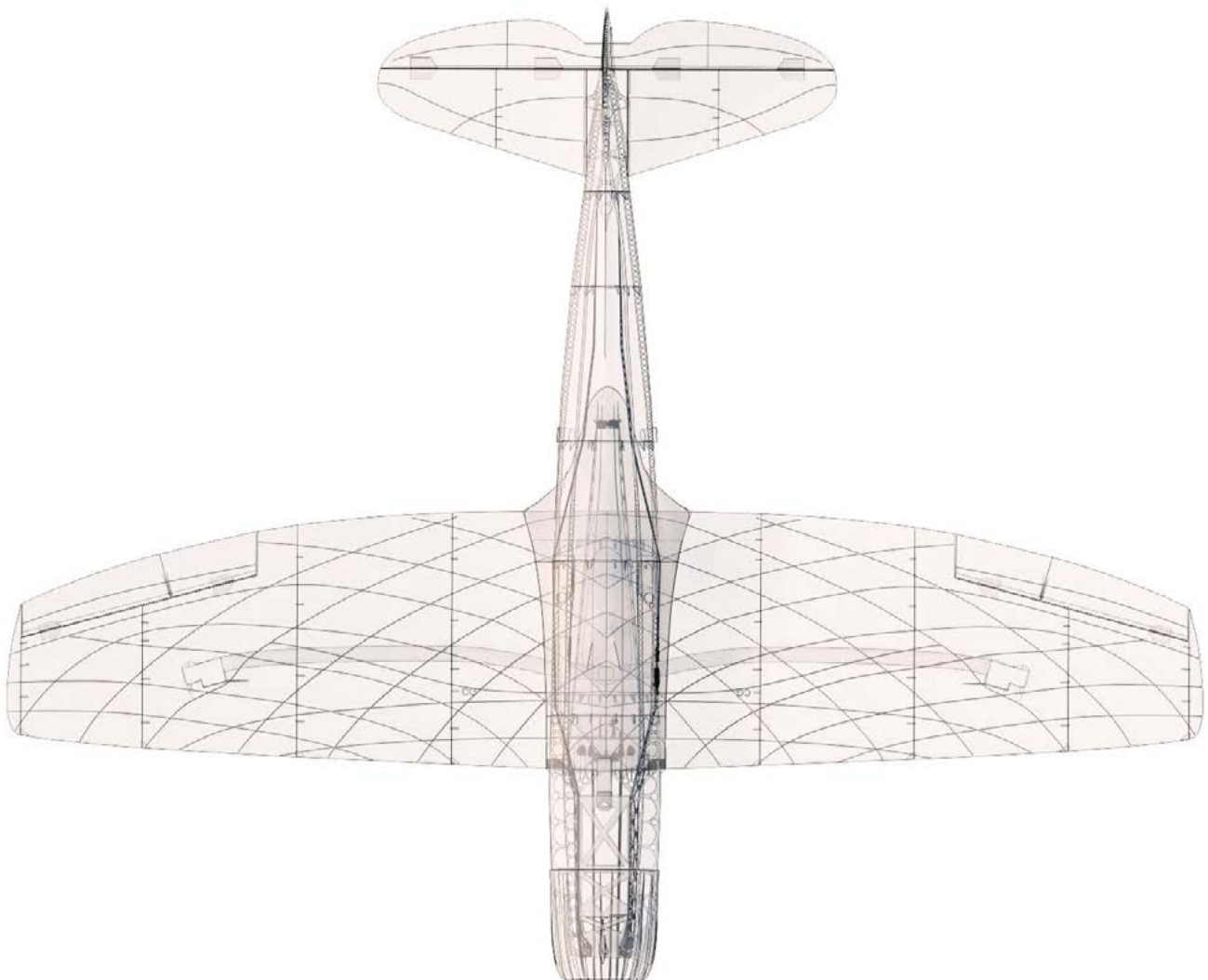

6.Scale markings PDF

Let print on thin adhesive foil and place on the model as needed, violet cut lines included...

P-47N Thunderbolt
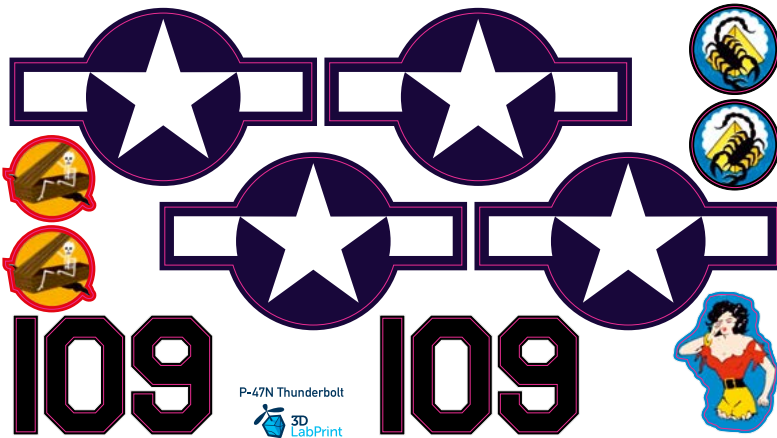
7.Stand

If you need this plane just for decorative or demonstrative reason...
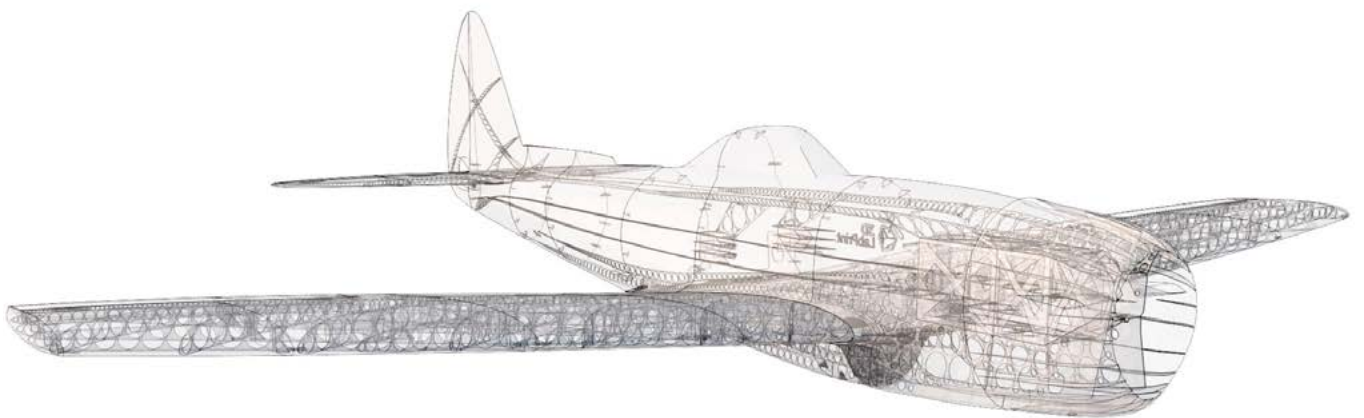
970mm(38.2in)

1160mm(45.7in)

Step By Step PDF/VIDEO userguide

1. Choose airplane at www.3Dlabprint.com, our Facebook for live information...

Basic requirments (P47 N15):
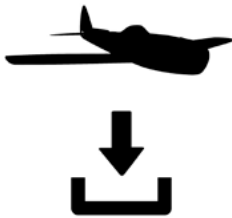min volume 195/195/150mm (250/120/150)
nozzle 0.4mm recommended (0.35 or 0.5mm alternatively)
Heated Bed recommended
PLA filament (or PETG, APLA, htPLA, PC-max....) not ABS

If you feel a little bit confused you can download wing test part from our websites or thingi-verse, (the biggest part). Or contact support@3dlabprint.com

2. Create account, download

You will get download link for all files to your email (zipped) or you can log in to your account and download directly from our websites.

## 3. Gcodes preparing

options A Gcodes:
if your printer is i3 comptatible 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.
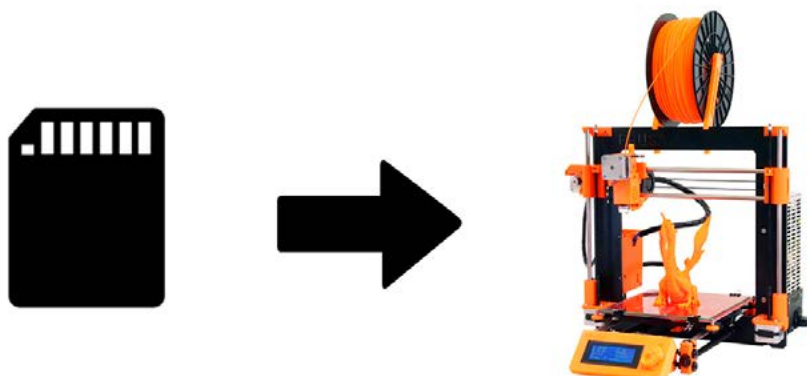
## options B Factory files Simplify3D (recommended)

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 moust 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
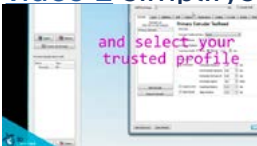option.
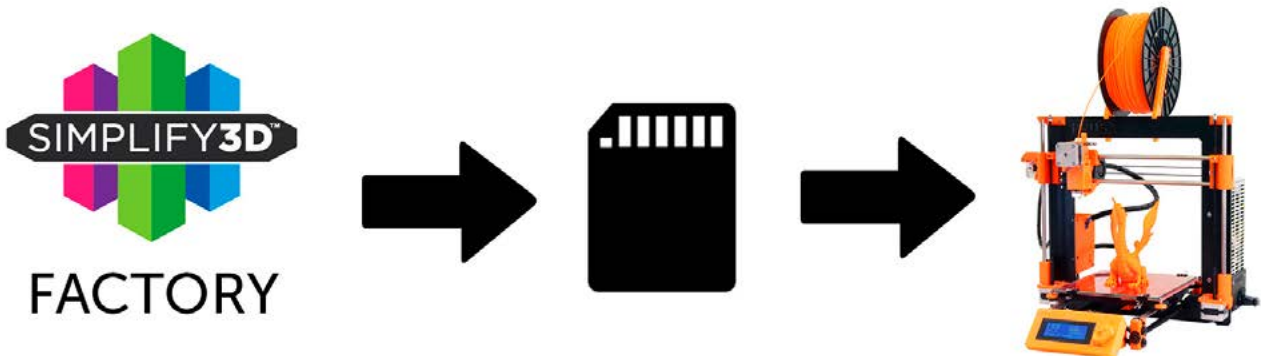
options C Simplify3D manual setting (watch and learn)

Use our video guide 2 for proper setting... this is very good option and you will learn a lot
about Simplify3d and become an 3d expert. Of course you spend a lot of time and youtube
pause button will become your friend.
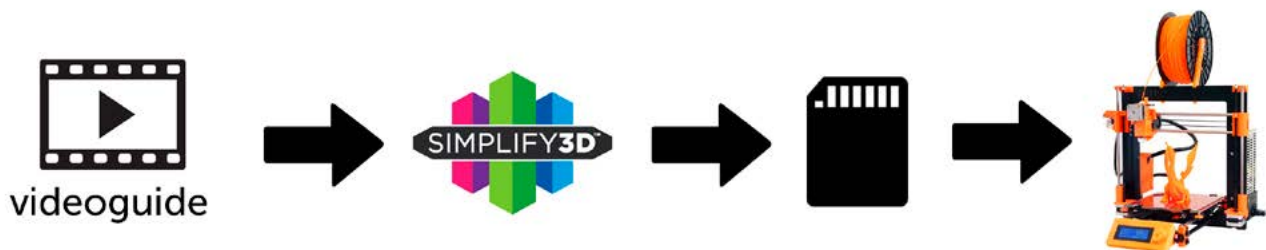
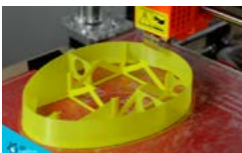## AND... please give a look to VideoGuides:

video 2 Simplify3D setting

video 2.1 before start printing

video about Thin Wall Printing

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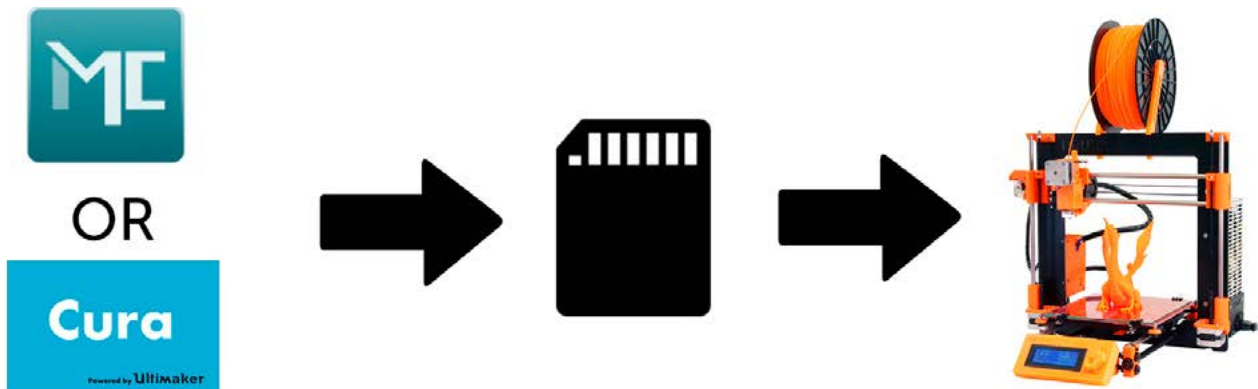CURA_ailer_elev.ini   (only ailerons, elevator and rudder parts)
CURA_thick.ini   (motor mount, battery holder, spinner)
OR
MC_wing_fuse.slice   (wing and fuselage and so on... parts)
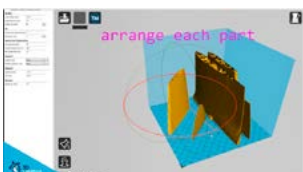MC_ailer_elev.slice   (only ailerons, elevator and rudder parts)
MC_thick.slice   (motor mount, battery holder, spinner)
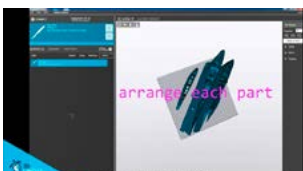

AND... please give a look to VideoGuides:

video CURA slicer setting

video CMatterControl slicer setting

4. 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 for this...
Scaling the model will lead to unusable result!
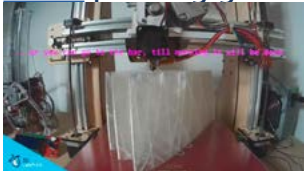video guide about printing
you will need: PLA filament - good quality and strong PLA (we need good layer bonding)
             Strong hair spray (or your favorite adhesive bed surface)
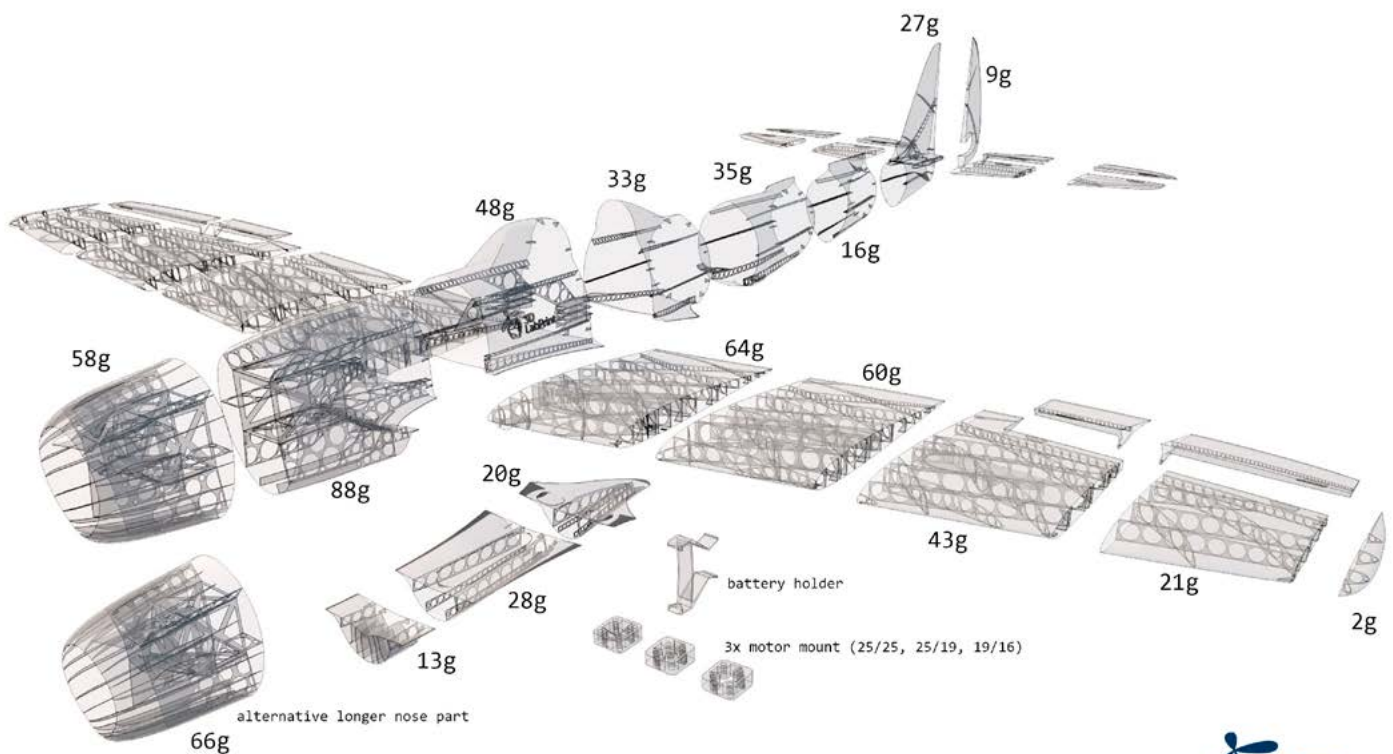   Razor blade

AND... please give a look to VideoGuides:

video printing guide

Main parts weight list:

Basic Typs and Advices

Plese Experiment with your extrusion multiplier...
Also HotEnd temperature is very important for strong result, please try increase tempera-
ture to find the best value (200 up to 260 celsius)
Turn OFF cooling fan for better layer adhesion (HE fan of course ON) we dont need it for
our thin wall printing...
We try lot of filaments and so far PLA is still the best for our models (2016).
You can try aslo PETG and PC-max from polymaker is very promising filament.

HEATED BED is very recommended, 60-70celsius (print without warping ends)
Looks like any standard quality PLA is OK for our planes, BUT it always depends on combi-
nation PLA vs. Extruder vs. HotEnd.
We find that some color of filament has lower layer adhesion also.
Nowadays there is lot of 3dprinters on the market, very most of them is OK for printing our
aircrafts (specific thin wall printing...) suficient volume, heated bed, 0.4mm nozzle.

Please give a look to Printing Guide:

5. Assembling printed parts

5.1 Wing assembling

Glue wing parts with CAglue together, use activator and instal ailerons...

See video guide #4

you will need: CA Glue - medium or similar medium viscosity CA glue

Activator for CA Glue or similar, but not-mechanical is better

AC Hinge Sheet or similar

Scissors

Snap knife

Some cloth for wiping CA glue...
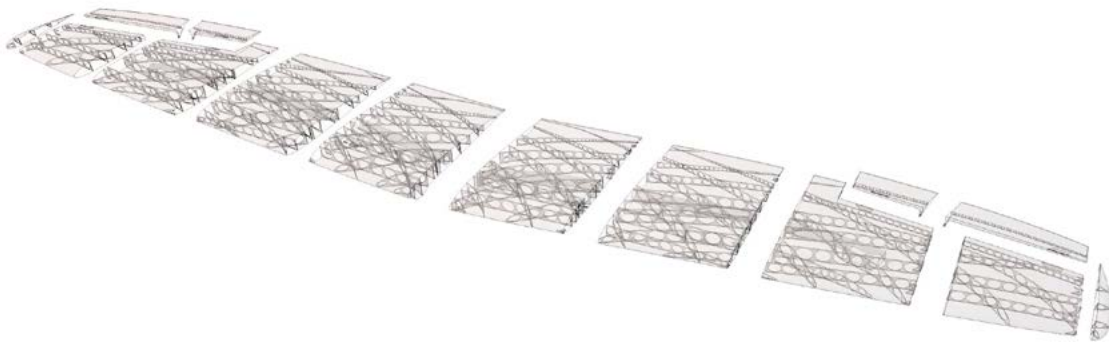
5.2

Glue with CAglue fuselage parts together, use activator, instal elevator, fine tune parts shape with knife or sandpaper. Assembly wing and underfuselage part. When gluing part 1 and 2 remember there is on the upper side air outcome.

See video guide #5

you will need: CA Glue - medium or similar medium viscosity CA glue

Activator for CA Glue or similar, but not-mechanical is better

AC Hinge Sheet or similar

Scissors

Snap knife or Sandpaper

Optionaly some cloth for wiping CA glue...
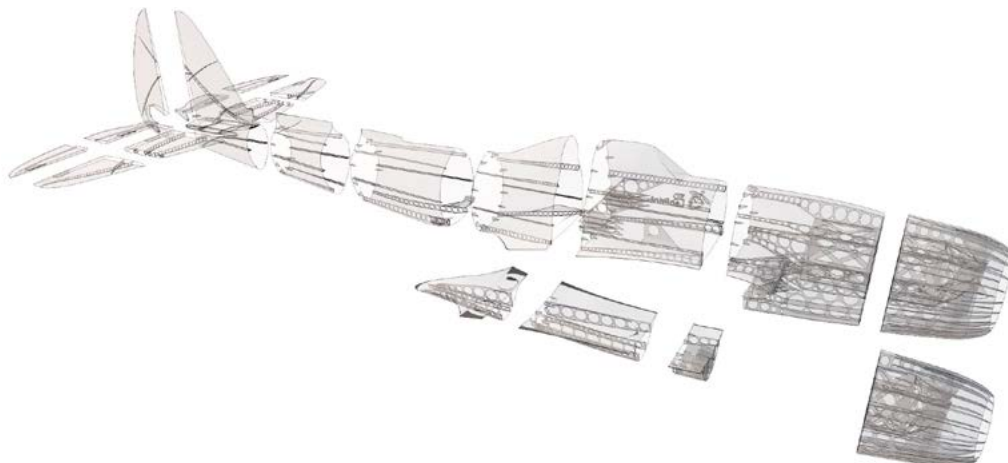
6. R/C equipment

6.1 motor setup

HIGH PERFORMANCE SETUP prop 11/5,5, 11/7 fast:
See video guide #6 (for HP setup)
you will need: Motor – AX-4008Q-620KV
Speed controler (ESC) – or any 30-40A/6s or you can use heavier
one to move CG forward...
3x PAIRS, 3.5mm Gold Connectors - optional
Li-Pol Battery 2200mAh/6s or 2x 2200/3s (use 2to1 serial connector)
Male XT60 connector
Shrink Tube black
Solder wire and Soldering Iron
Hands free Holder - optional
printed motor mount (25/25)

ECO PERFORMANCE SETUP(spent only 30 bucks without any soldering)prop 11/5,5, 11/7:
you will need: Turnigy D3530/14 1100KV or similar 3530-35 1100kv
40Amps Electronic Speed Controller

Turnigy 2200mAh 3S 20C or similar 2200-3000/3s

printed motor mount, find the one which fits... (25/19)

You can use own setup instead... with suficient thrust and weight, use fuselage_1_conversion part (always check C of G maybe you will need some wights in nose)

6.2 servos

Test and center all servos with servo tester or transmitter, then instal horns in midle position and cut wing Servos mount... use HXT900 or any 21x21x23mm
See video guide #7
you will need: 3x 9g Servo HXT900
4x Servo Lead Extension or similar
Snap knife
Soldering Iron or Small handsaw or Dremel

7. R/C Equipment instaling

Instal prepared RC equipment: Motor, ESC, Servos...
Nose and motor mount are already in angle for compensating rotating propeller stream.
See video guide #8
you will need: Printed motor mount, find the one that fits for your motor...
     2-4x Screw 3/12-30mm depends on motor-mount
     Small screwdriver+
     Your earlier prepared R/C equipment
     3x Self Tapping Screw M3x8mm or similar

8. Pushrods

Made 2x steel pushrod for ailerons and connect within servos and arms then use carbon tube+clevis and make pushrod for elevator...
See video guide #9
you will need: Steel pushrod, diameter 1.2mm
     Pliers
     Carbon tube 4/3 750mm
     Clevis
     Threaded end
     CA Glue - medium
     Activator for CA Glue or similar, but not mechanical is better

9. Finalization

Instal your reciever, connect batery, setup servos and etc. with your trasmitter, lock servo position, then instal propeller...
!!!Make sure that the battery is placed properly and secured with wing battery holder, if battery moves during flight it can shifts the center of gravity backwards and aircraft will be uncontrollable!!!
See video guide #10
you will need: Your own Rx/Tx system
     Li-Pol Battery 2200mAh/6s – Turnigy nano-tech
     Rubber rings
     Foam strip for Li-Pol battery
     Scissors
     Velcro
     Propeller APC Style 11/5,5 or similar
     Small screwdriver+
   CA Glue - medium + activator

 Never set ESC with instaled propeller, this is very dangerous!!!

10. Go flying

Before flight check: **center of gravity is very important** (move it forward for the first flights see CG markings and chapter 11 bellow), battery properly charged, ailerons and elevator deflection check, your own flying skills or RC simulator training...
Then go flying: set full throtle, put the elevator little upwards (1-2mm) and throw it energetically to the wind approx 10 grades up, wait till plane gain speed, then fly it in your manner...
See video guide #11
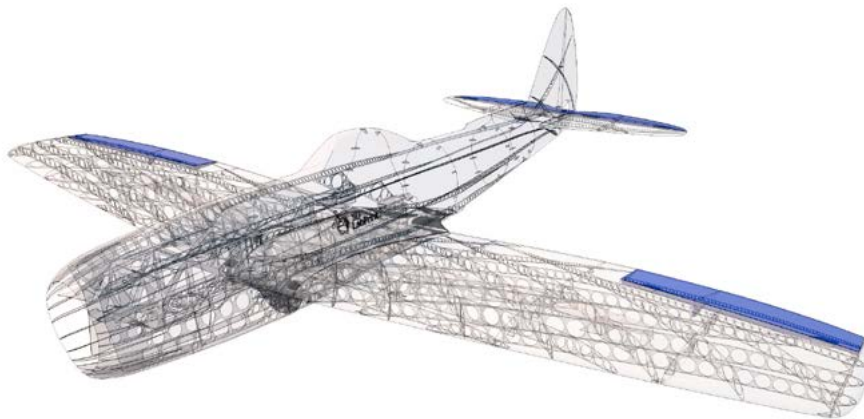
11.Pilots Please Attention!!!

For the first flights we recommend set center of gravity of the airplane by about 5 mm forward of the CG tag (nose heavy, this increases the stability) is also good to increase expo settings on your transmitter for elevator and ailerons to 80 % (this calms response from your stick inputs)
Also you can decrease elevator and ailerons deflection.
Make sure the battery is well fixed in proper possition if it moves during flight it will cause move CoG aft and will lead to uncontrolable flight behavior...

You can then return to the center of gravity (balance aircraft)the CoG points and expo set to 60 % as stated in the video/instructions... this gain back extra maneuverability when you will be sure with flying your airplane.

!!!Never fly aft positioned CoG!!!

And Please, use this files only for your own purpose, do not send further... Thank you very much