3D LabPrint

User Guide

rev. 2018/07

Fully 3d printable

Mig-15BIS - electro ducted fan airplane

scale ~1:7,3, wingspan 1385mm (54,5 inch)

Mig -15BIS – fully printable R/C plane for your desktop 3Dprinter

Future of flying - Print your own plane. Speedy guide

We're still trying to move things further, so this project is again full of improvements for better durability, easier assembly, better geometry solution and more..., we hope you enjoy it, although this print may test your abilities and quality of your printer...

Welcome to the thin wall printing!

The first fully printable airplanes with files prepared for your 3Dprinter, with flight characteristics, comparable or even supperior to classic build model airplane.
This is not a dream, now you can print this HI-TECH at home. Simply download and print the whole plane or spare parts anytime you need just for a cost of filament only about $40

Extensive hi-tech 3d structural reinforcement making the model very rigid while maintaining a lightweight airframe and exact airfoil even it's just a plastic. This perfect and exact 3d structure is possible only thanks to additive 3dprinting technology. So welcome to the 21st century of model flying and be the first at your airfield.

Easy to assemble, 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.
We designed this aircraft the way you don't need any nuts or aditional joining elements, just click all printed parts together.
You will get a superb performing training and durable airplane able to withstand even hard landings (easily changeable landing gear). Our Mig-15BIS is a spin-stall proof plane even in low speed tight turn.

General specifications:

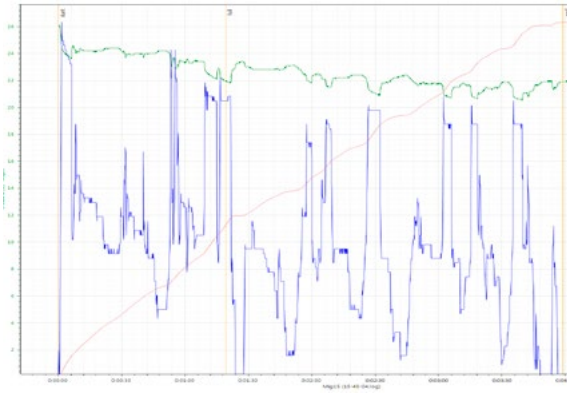
Length:	1385mm / 54.5 inch
Wingspan:	1385mm / 54.5 inch
Height:	505 mm / 19.7 inch
Wing area:	30,41 dm2 / 3.26 sq foot
Wing loading:	100 g/dm2 / 27 oz at sq foot
Center of gravity:	224mm (8.81 inch) from LE See CG tags on wings...
Airfoil:	3DLabPrint modified
Print weight:	1817 g / 64.0 oz
Empty weight (w/o battery):	2164 g / 76.3 oz
Takeoff weight (2x 3s 3700 lipo):	3093 g / 109.6 oz
Max takeoff weight:	3300 g / 116.4 oz
Never exceed speed, VNE:	200 km/h / 125 mph
Design maneuvering speed, VA:	120 km/h / 75 mph
Stall speed:	50 km/h / 15 mph

Powerplant

EDF:	90mm for 6S Li-Pol
Motor:	1750kV
ESC:	100A Electronic Speed Controller or similar 80-100Amps
Battery:	2x Li-Pol 4000mAh/3s (40-65C), at least 345g / 12.2oz, 65C (fuselage space for 3000-6000mAh packs)

Performance measurement

Max speed VH (level flight):	150 km/h 80 kn 90 mph with 6s Li-Pol
Rate of climb:	46 m/s (10 673 ft/min)
Flight time (2x 3s 2700mAh):	6:00min



Mig-15BIS, History

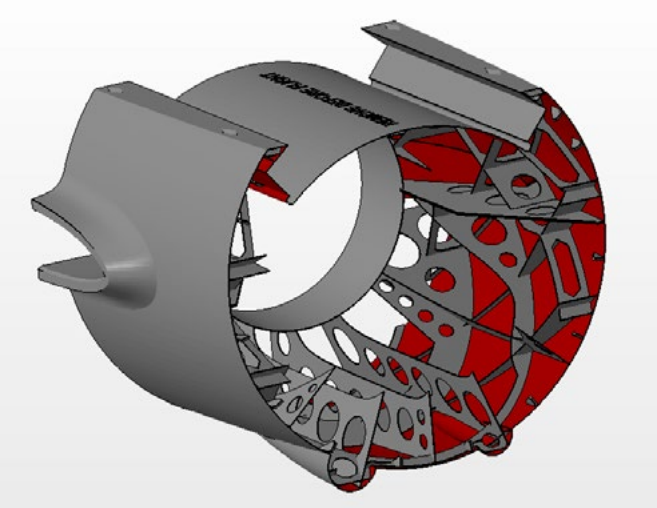
The Mikoyan-Gurevich MiG-15 Fagot was a jet fighter aircraft developed by Mikoyan-Gurevich OKB for the Soviet Union. The MiG-15 was one of the first successful jet fighters to incorporate swept wings to achieve high transonic speeds. In combat over Korea, it outclassed straight-winged jet day fighters, which were largely relegated to ground attack roles, and was quickly countered by the similar American swept-wing North American F-86 Sabre.

The MiG-15 is believed to have been one of the most widely produced jet aircraft ever made; in excess of 12,000 were manufactured. Licensed foreign production may have raised the production total to over 18,000. The MiG-15 remains in service with the North Korean Air Force as an advanced trainer.

Included:

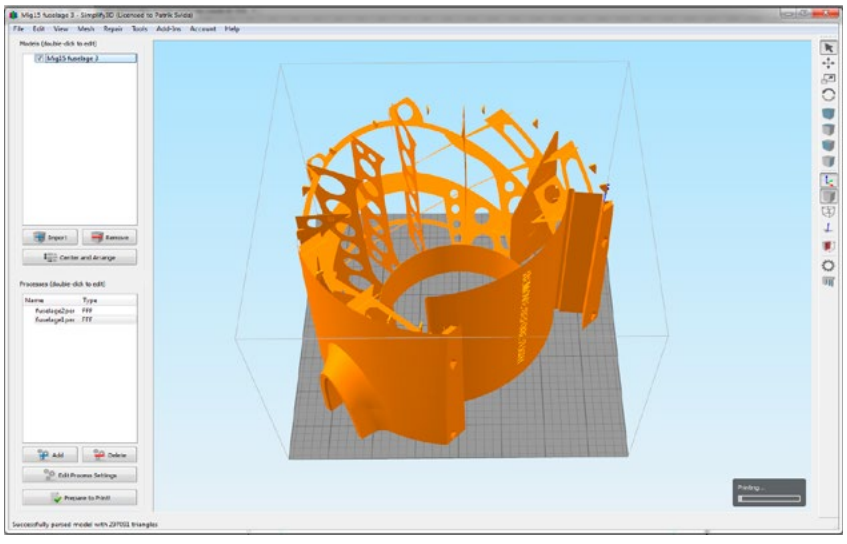
1. STL 3d files

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



2. Factory files for Simplify3D slicer

with all our settings, these Factory files include all you need. Note: we use PRUSA i3 ORIGINAL printers so you may need to adjust the basic printing parameters to match your printer or use it as a starting point for you. Please look at Simplify3D



3. Step By Step PDF/VIDEO userguides

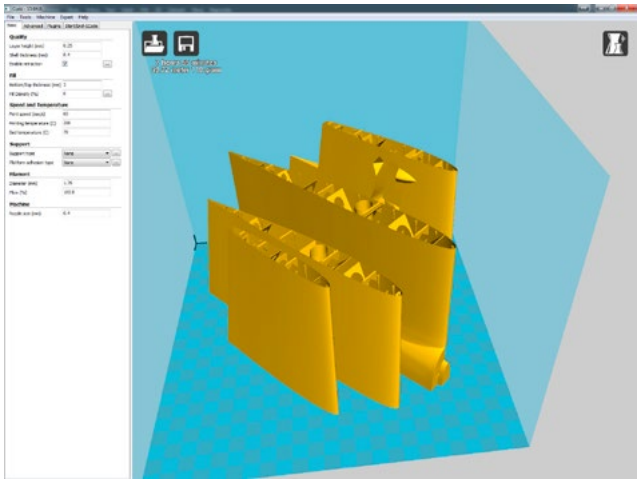
Apart from this userguide, please look at the Printing Guide with some Tips and Advice for airplane printing (Thin Wall Printing).

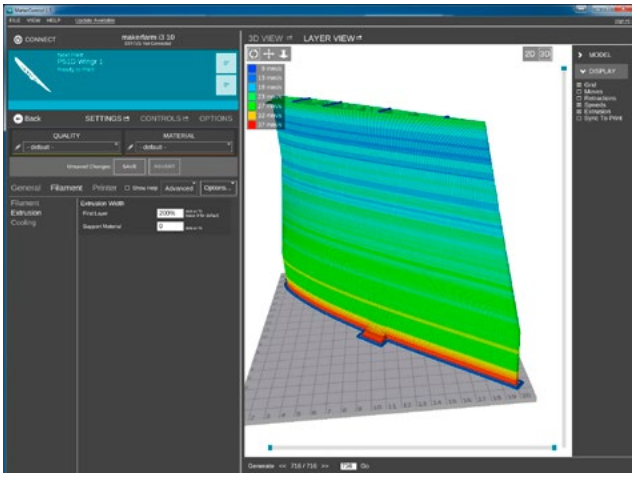
4. Gcodes

Basic Gcodes prepared for direct use, as universal as possible. Should work with i3 style printers. You can try it out, but we can't guarantee it works with your printer.
These files are 100% workng with PRUSA i3 ORIGINAL 3d printers.

5. Prepared settings for CURA and MatterControl slicers

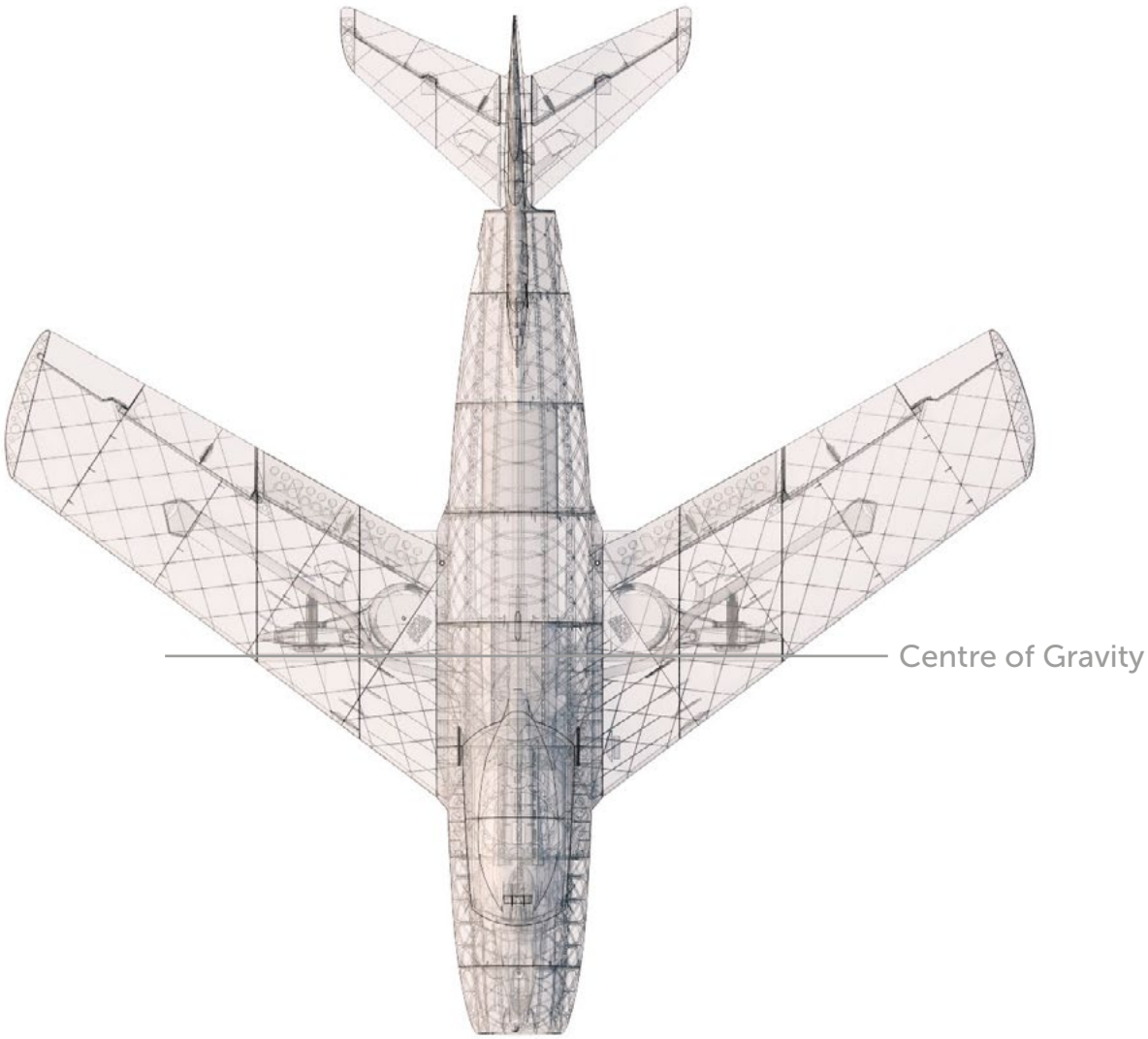
If you don't like Simplify3D for any reason, there is always the possibility to use another free slicer. You can use our basic setting (setting files) as a start point and edit it as you need.



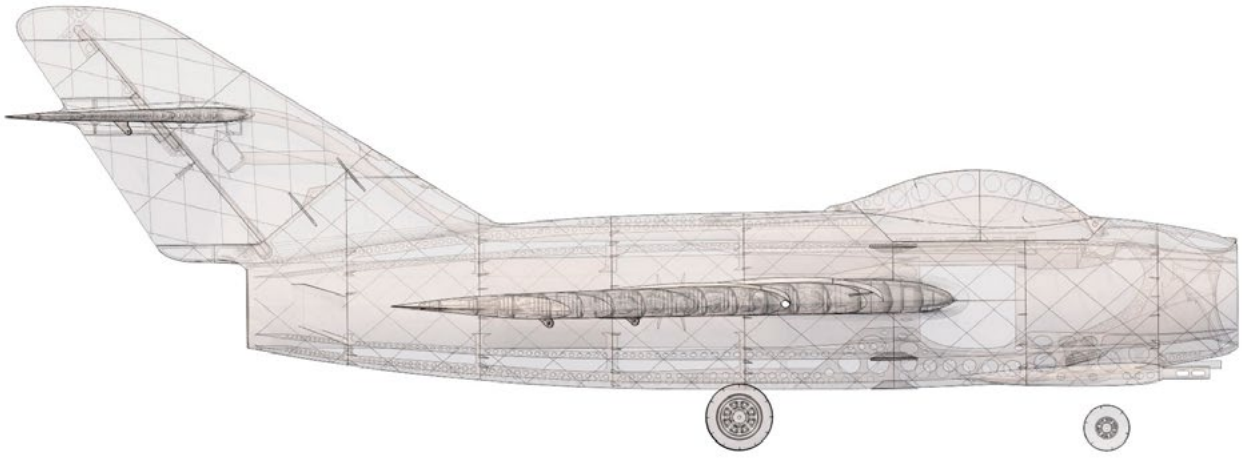


6. Scale markings PDF

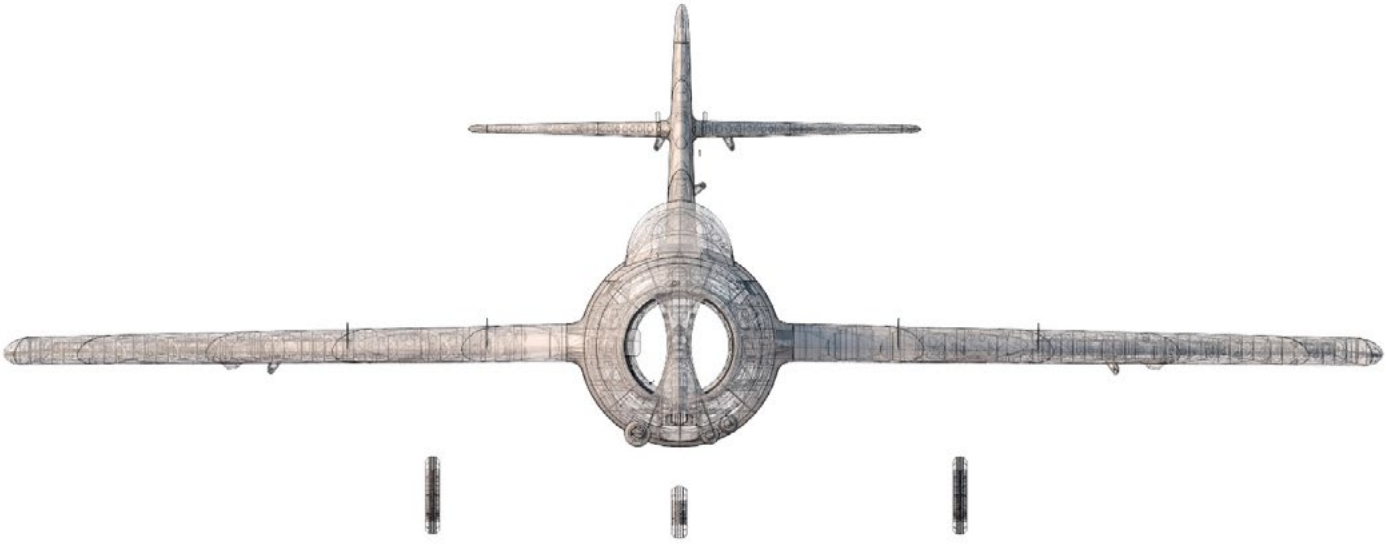
Print this scale PDF at thin self tape advertisement foil and place it on the model as needed.
Violet cut lines included.



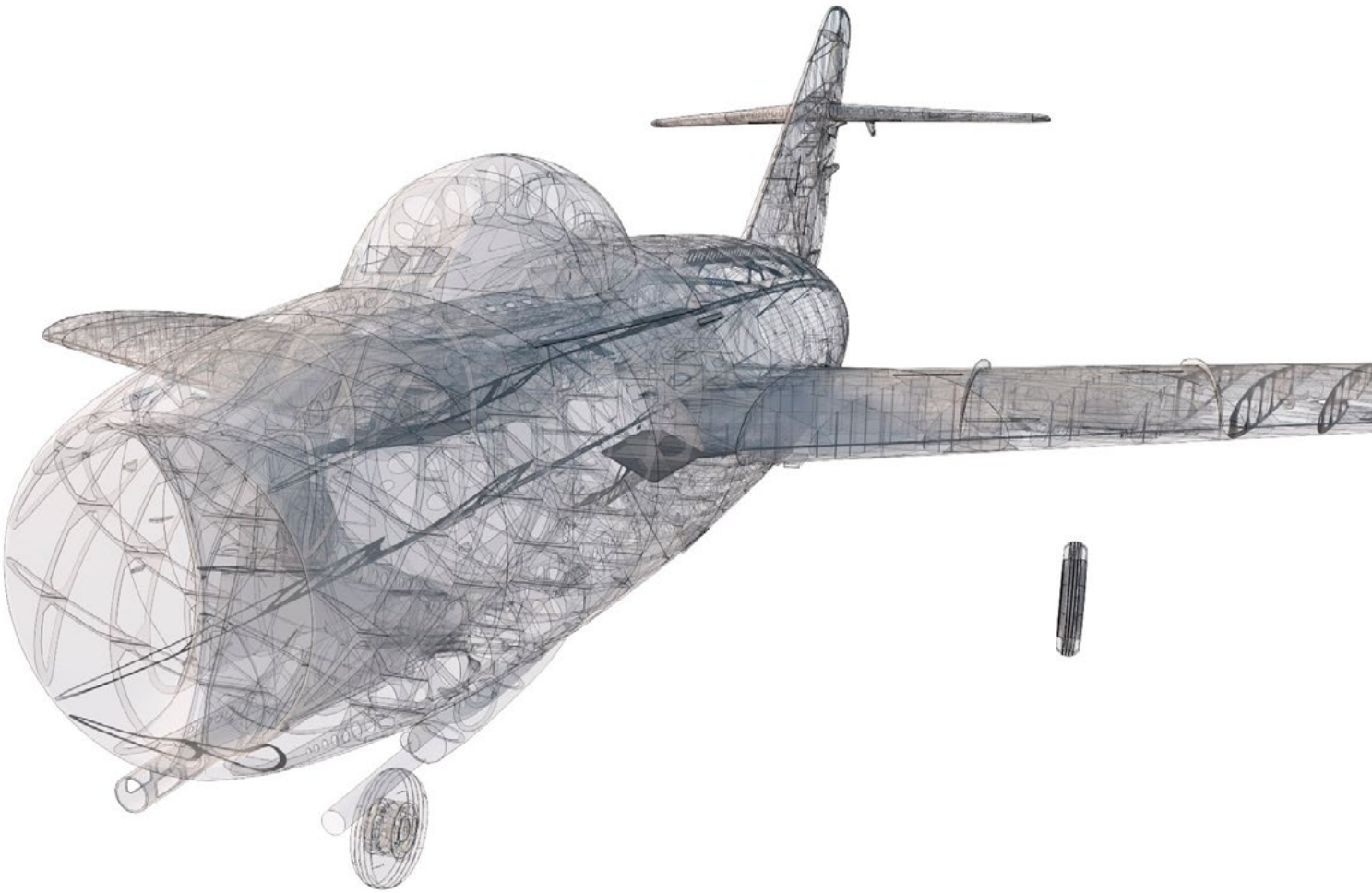
Wing area: 30,41 dm2 / 3.26 sq foot



Lenght: 1385mm / 54.5 inch



Wing span: 1385mm / 54.5 inch



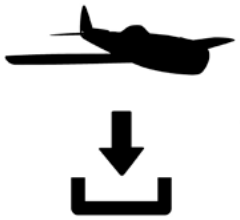
Step By Step PDF/VIDEO userguide

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

Basic requirements for Mig-15BIS are 200/200/175mm build volume. recommended nozzle size 0.4mm (alternatively 0.35 - 0.5mm), heated bed is very recommended.
PLA filament (or PETG, APLA, htPLA, PC-max.... not ABS) and some flex for tires...
If unsure you meet the requirements, you can download and try to print test part from our FORUM (usualy the biggest part)

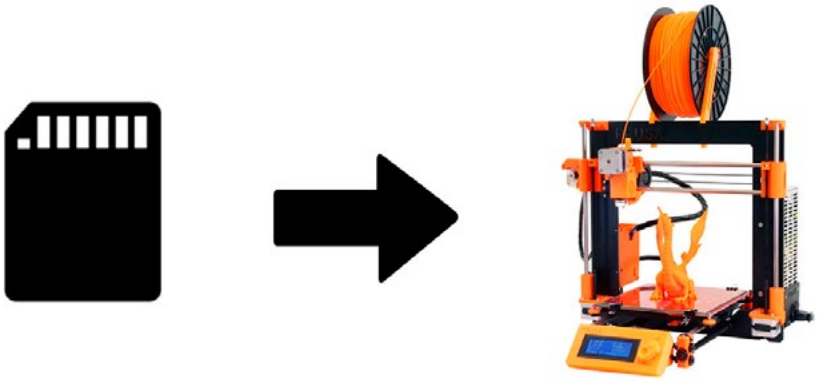
2. Create account, download

You will receive the download link for all files via e-mail right after the payment has been completed or you can log in to your account and download directly from our website.



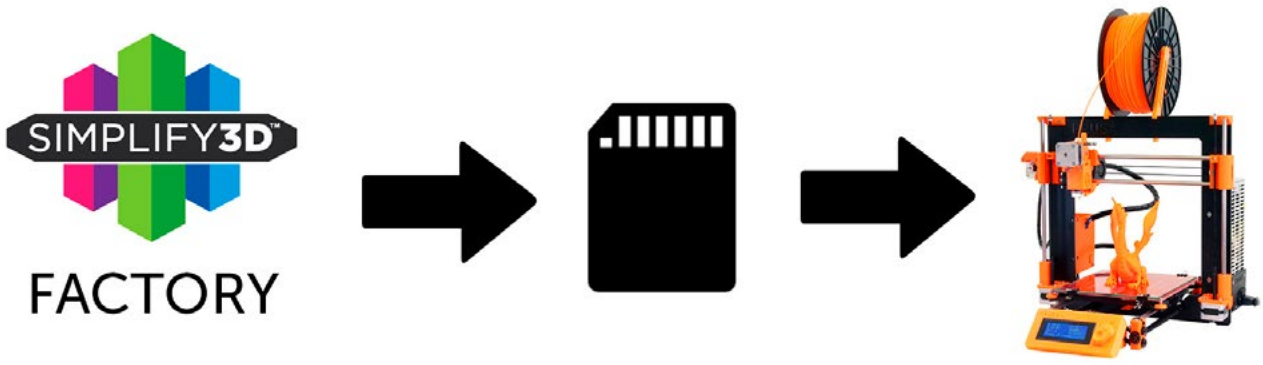
3. Gcodes preparing

option A Gcodes:
You can use the precompiled gcodes if your printer is compatible with Prusa i3. Simply save each file to SD card and let 3d printer do it's job. For best layer adhesion is the HE temperature set to 230°C. You can edit speed and temperature through your printer LCD or add a custom start script to the beginning of the Gcode if needed. Please proceed with the other options if the precompiled gcodes doesn't work for you.



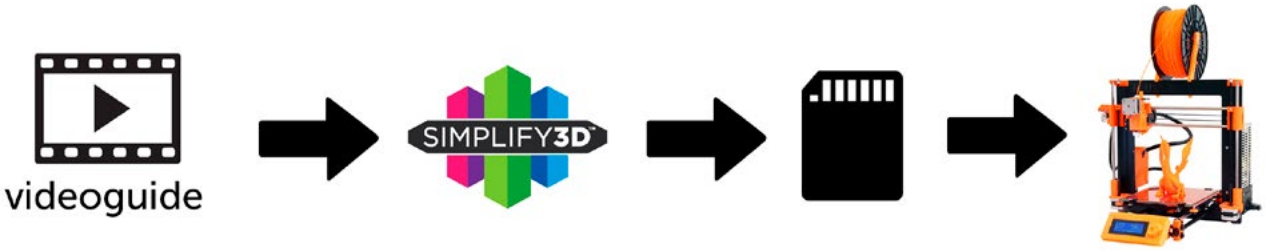
option B Factory files Simplify3D (recommended)

We prepared all you need in thess files (basic FFF profiles, parts layout, and so on...)
You can use our setting as a starting point and edit according to your printer needs, print only the spare parts, etc... It should work as it is for most printers, but please go through the settings and edit it as needed. We are not liable for any damage resulting from the use of our settings. If for any reason this does not work for you, please proceed to the next option.

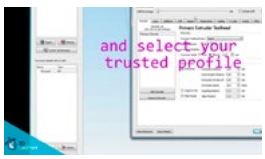


option C Simplify3D manual setting (watch and learn)

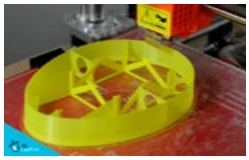
Use our Guide to build your own factory file. This is a very good option to learn a lot about Simplify3D and become a 3D expert. Of course you spend a lot of time and the You-Tube pause button will become your best friend. For simplification we show only our basic setting (wings and fuselage), please use our prepared Factory files as a reference for the rest of parts, like motor mounts, control surfaces, etc.



AND... please watch our VideoGuides:



video 2 Simplify3D setting

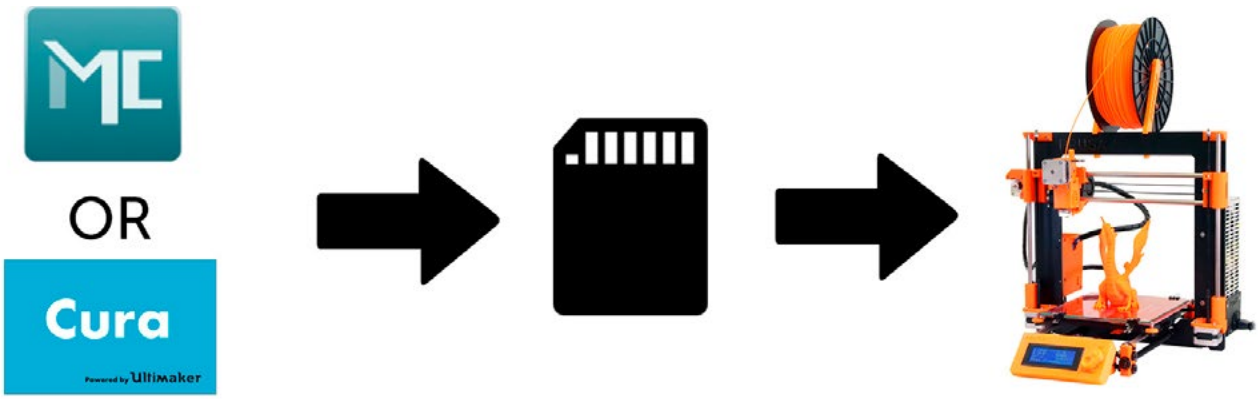


video about Thin Wall Printing

option D CURA or MatterControl (considered as the last resort, we recommend Simplify3D)
MatterControl and CURA are free and provide good results. The airframe is still strong enough, but don't expect the best quality. Both slicers lacks some very useful features, and finer settings, like multiple processes according to Z height, retraction options, layer start, etc. Please try to find the best extrusion multiplier and temperature for good weight and best possible layer bonding. Look at parts weight list for proper multiplier settings.

As a starting point you can use our predefined CURA or MC slicer setting file included in the package (always adapt it for your printer, change build volume, filament diameter, etc... according to your printer!!!) for some thick part you'll need to use support structure:

CURA_wing_fuse.ini	(wing and fuselage (expect1) parts) + CURA_wing_tip.ini
CURA_ailer_elev.ini	(only ailerons, elevator and rudder parts)
CURA_thick.ini	(fuselage1 only, struts, holders, landing gear...)
OR	
MC_wing_fuse.slice	(wing and fuselage (expect1) parts) + MC_wing_tip.slice
MC_ailer_elev.slice	(only ailerons, elevator and rudder parts)
MC_thick.slice	(fuselage1 only, struts, holders, landing gear...)



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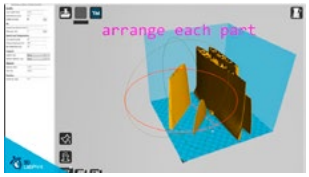
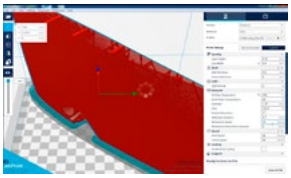
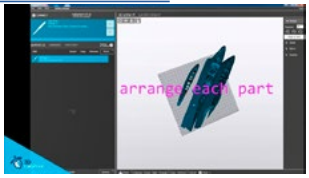


video CURA slicer setting



CURA 2.3.1 import setting

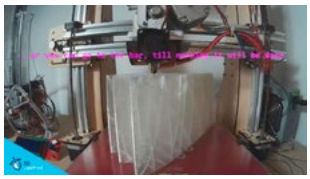


4. Print it

Save generated Gcodes and insert SD card to your printer, prepare your printer and start printing. We prefer to use SD rather than a direct connection via USB Note: ABS filament is not suitable for this. Scaling the model will lead to unusable result!
Note: ninja flex or simmilar fillaments can stick very hard to PEI based surfaces, be careful...

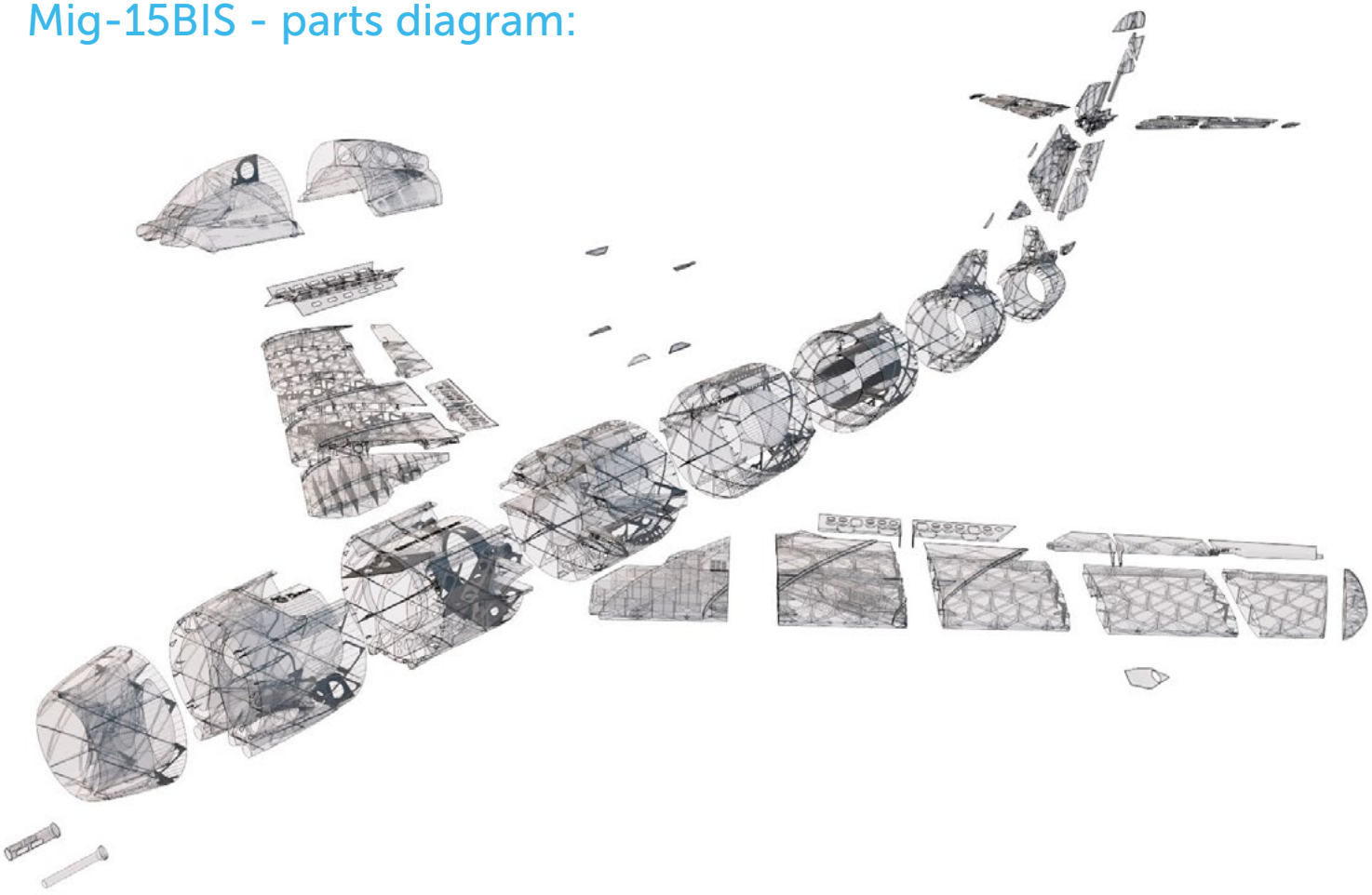
Video guide about printing:
You will need: PLA filament - good quality and strong PLA (we need good layer bonding)
Strong hair spray (or your favorite adhesive bed surface)
Razor blade
(disregard with PEI or simmilar bed surface, Mk2...)

AND... please watch our VideoGuides:



video printing guide

Mig-15BIS - parts diagram:



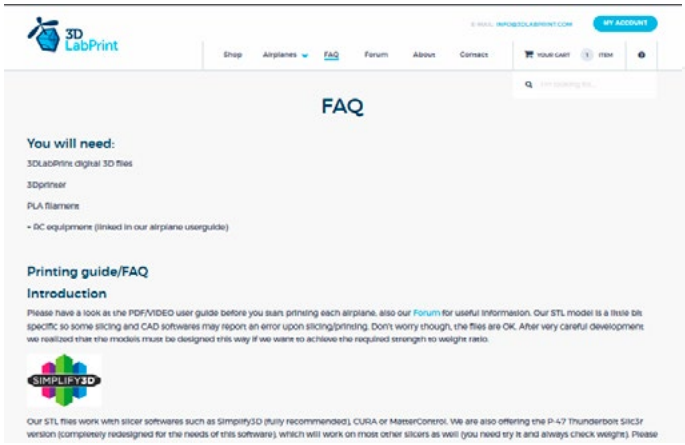
Basic Tips and Advice

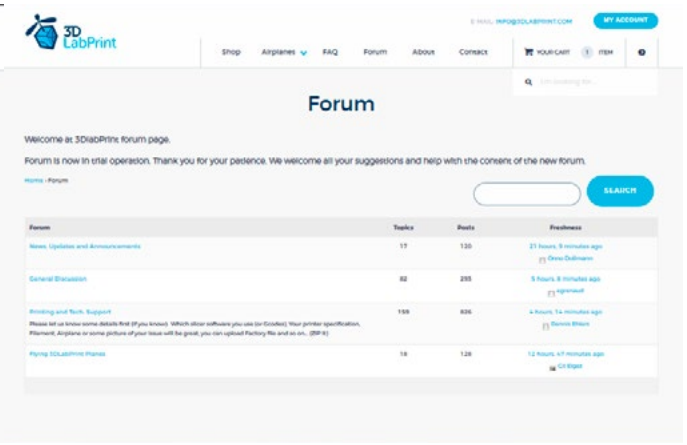
Please experiment with your extrusion multiplier to achieve the same weights as in the list. HotEnd temperature is very important for a strong result. The reason is the plastic leaving the nozzle has to melt the previous layer to create solid joint. Please try increasing the temperature to find the best value (215° up to 260° Celsius). Turn OFF cooling fan (Heatbreak fan of course has to be left ON). Thin walls easily cools down on its own and the cooling fan worsens the layer bonding. You can use cooling fan for thick parts if needed...

Heated bed is very recommended, use 50-60° Celsius to print without warping ends.
Any standard quality PLA is suitable to print our planes, but the result depends on combination of PLA vs. Extruder vs. HotEnd.
Some colors and brands of filament has lower layer adhesion, please do experiment with it.
There are a lot of 3dprinters on the market, most of them are OK for printing our aircraft (specific thin wall printing...) with sufficient volume, heated bed, 0.4 mm nozzle.

Please see the FAQ and our Forum for more information:

Need a help? our Forum is the best place... where we can help you





5. Assembling printed parts

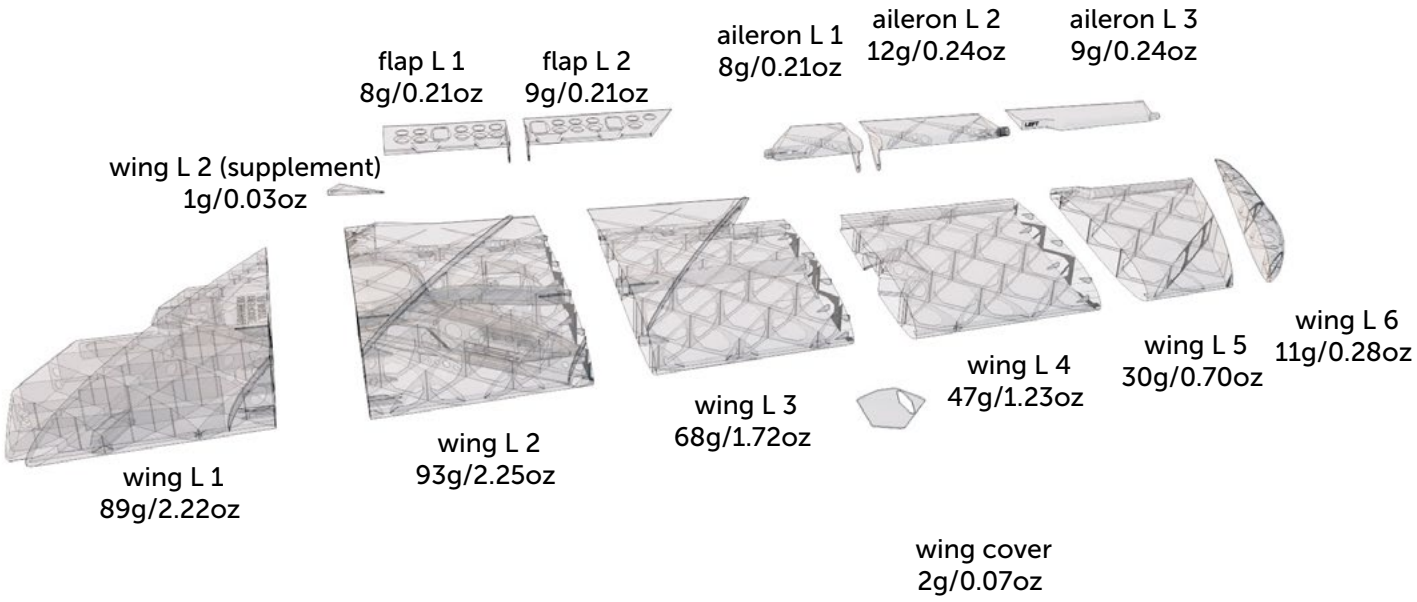
5.1 Wing assembly

Glue wing parts together using CA glue (position locks will help you), use activator. Install ailerons and flaps. You can use snap knife to trim shape of some printed parts (mostly for the installation of the landing gear and ailerons), but usualy it is not necessary. Glue wing parts L1-L4, aileron L1 and L2, glue wing L5 to fix aileron in place, glue aileron L3, and at last glue wing part L6. Glue both parts of flaps together and use suitable 1 mm carbon rod or wire to fix them. Try if you could easily push the 8 mm wing carbon spar inside the slot.

NOTE: aileron part L3 must be glued after wing L5, wing part L6 must be glued as a last, after instaling and gluing ailerons!!! (ailerons are locked with L5 and L6 parts). Repeat the process for the other wing.

See video guide #4

you will need:
- CA Glue - medium or similar medium viscosity CA glue
- Activator for CA Glue or similar, but gas presurized aerosol is better
- Snap knife
- 1mm carbon or steel rod



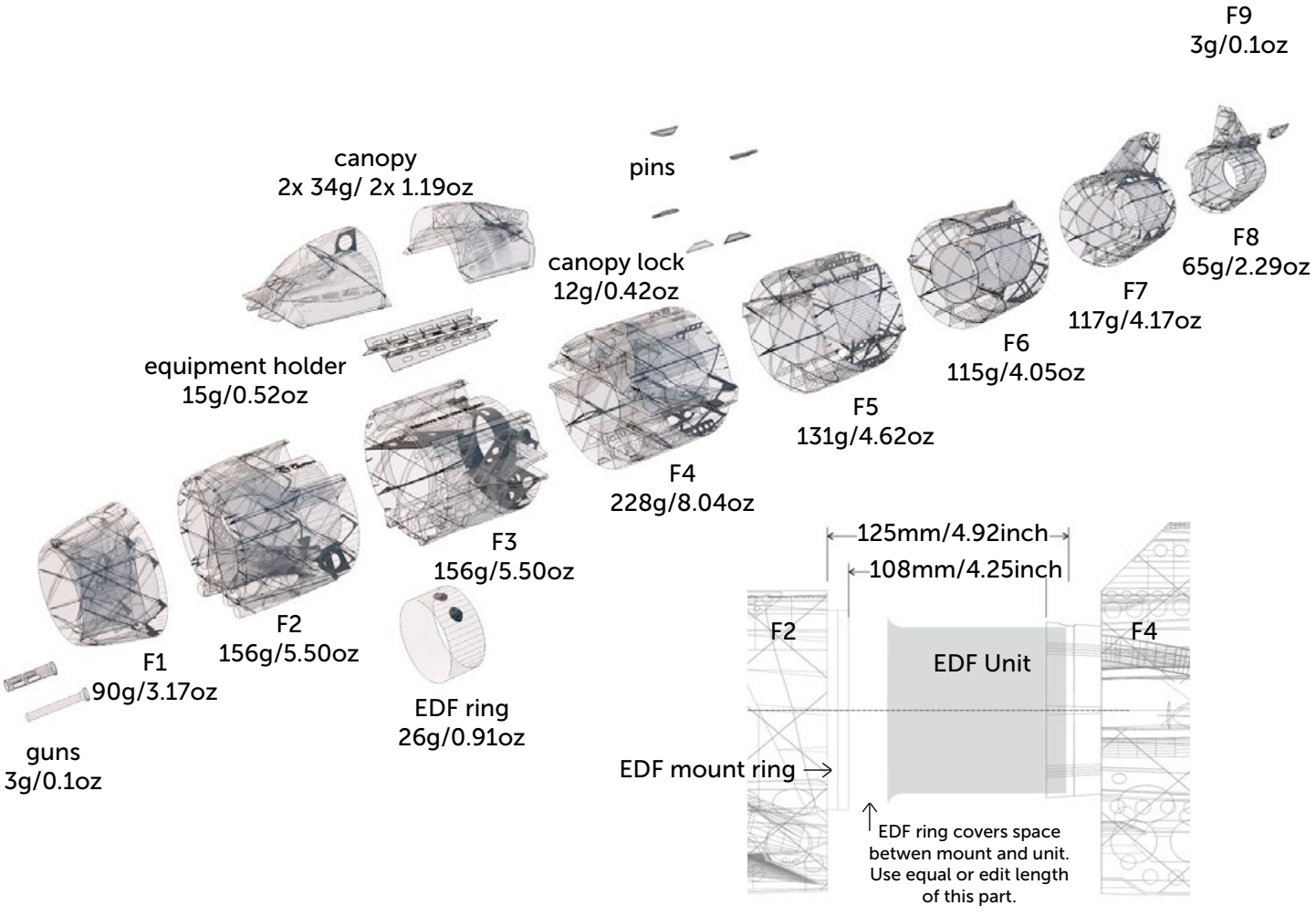
5.2 Fuselage assembly

Glue fuselage parts together using CA glue (position locks and pins will help you), use activator.
You can use snap knife to trim shape of printed parts, but mostly this is not necessary.
Glue the 10mm EDF ring mount (accessories) to the part F2.
Glue F1-F4 fuselage parts. Insert pen spring to F5 part, insert canopy lock, glue F5 to fuselage and test a canopy lock functionality. Glue all other fuselage parts F6-F9. Glue canopy parts and test the perfect fit with fuselage and canopy lock functionality.

NOTE: Don't glue the tailparts yet!!! (for rudder, elevator and stabilizers proceed to next step)

See video guide #5

You will need: CA Glue - medium or similar medium viscosity CA glue
Activator for CA Glue or similar, but gas presurized aerosol is better
1x ballpoint pen spring (old ballpoint pen spring will work fine)
Snap knife
Soldering Iron or any hot tool

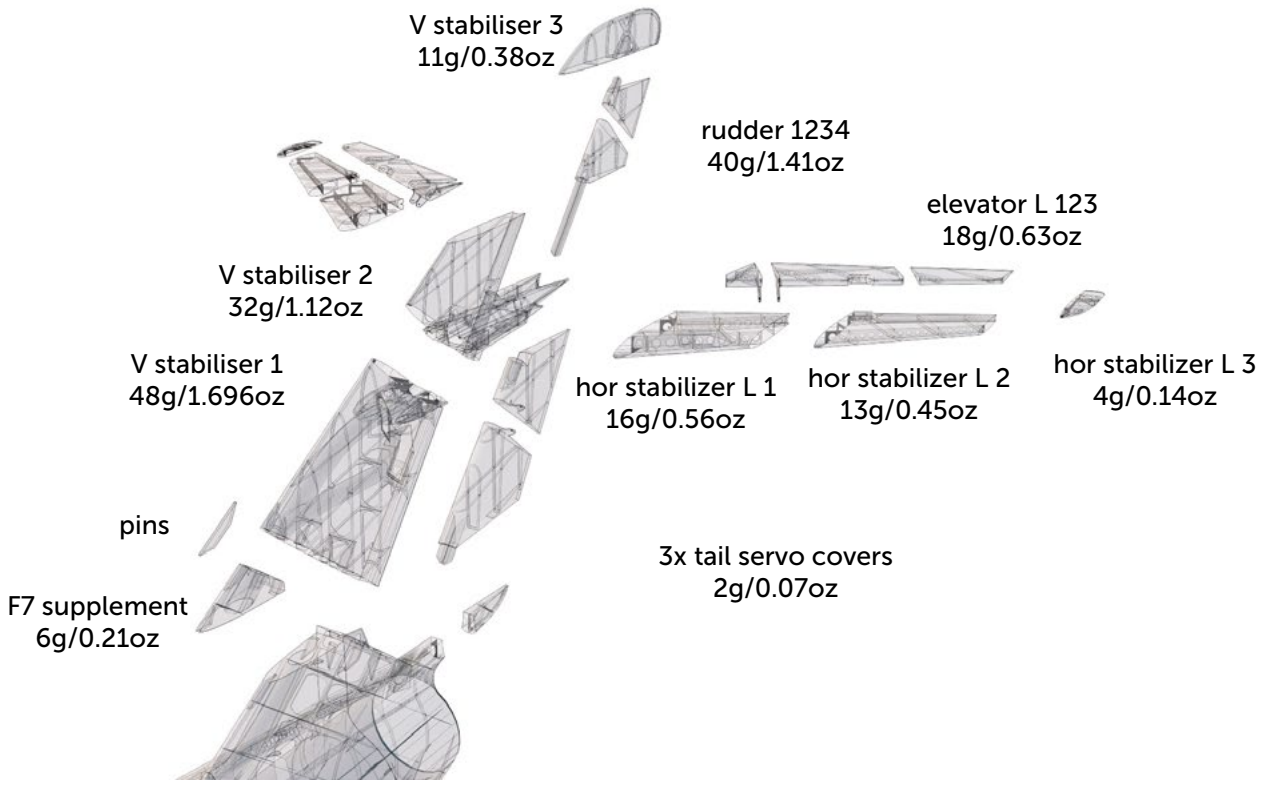


5.3. Fuselage tail - rudder, elevator pushrods and servos

Now is a good time to install tail stabilizers, elevator, rudder and pushrods. You can use snap knife to trim shape of printed parts. Glue rudder parts, vertical stabilizer and glue it to fuselage. Upper part of rudder holds bottom and V3 part holds rudder. Use shaped 1 mm / 14AWG pushrod wire or carbon rod for elevator hinge. You can use hot wire to push through the holes.
Extend cables of 3x Hitec HS-65MG, HK-15179B or similar servos 23x23x12mm size. Glue servos to prepared holes in stabilisers. Make Z bend or use your favourite pushrods links. We like these Pushrod Keepers. Thread pushrods and glue the elevator and rudder in correct position using CA glue.
NOTE: Assemble the horizontal stabiliser with elevator, hinges and servos on your desk. Glue it to the tail as a last step.

See video guide #6
See video guide #7

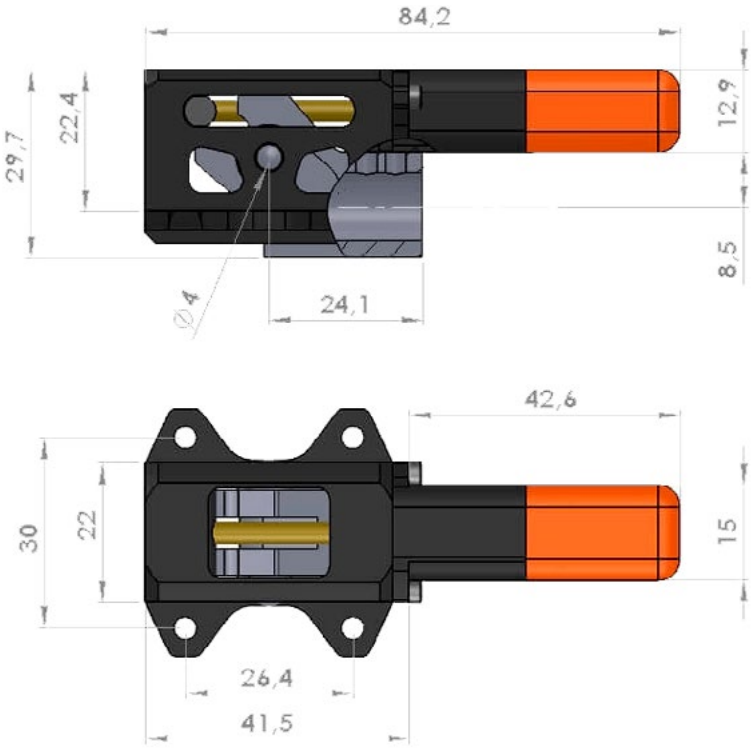
You will need:
CA Glue - medium viscosity CA glue
Activator for CA Glue or similar, but gas presurized aerosol is better
3x Hitec HS-65 MG or HobbyKing™ HK15178 Analog Servo or similar
1 mm /14AWG pushrod wire or carbon rod
1,5 mm / 16 AWG pushrod wires
Wire cutter, Z bend pliers or pliers.
Snap knife
Soldering Iron or any hot tool



6.1 Landing gear - nose, main retracts

Top Quality Retracts

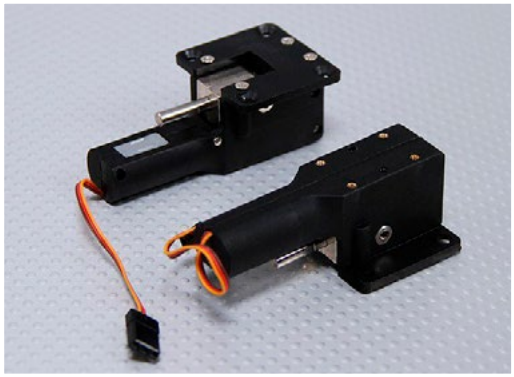
The best retracts set you can buy for your Mig-15BIS are Electron retracts ER-30eVo with Electron steering system and 4mm leg pins. Great quality, perfect nose leg steering. Great retracts suitable for any plane. The best on the market.



Standard Retracts

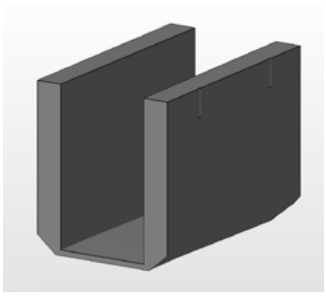
Use standard 33mm x 35mm Servoless Retract with 4mm metal pins for main legs. For the nose leg use 33mm x 35mm Servoless Nose Wheel Retract with 4mm metal pin. In this case you need to use pull-pull string system for steering the nose wheel.

NOTE: You can also use other retract with similar size.



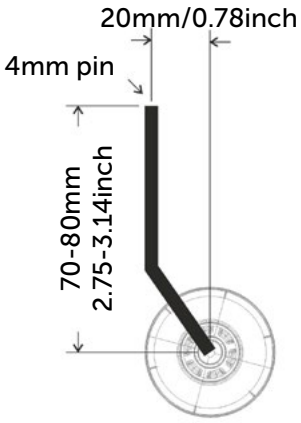
Budget retracts

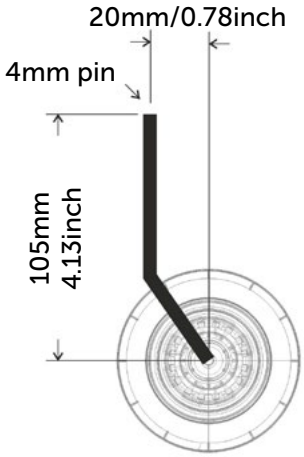
Slim retracts from Full Metal Servoless Retract with Oleo Legs (Tricycle, Mig 17 type), that are part of the set suitable for Mig-15BIS. Unfortunatelly a nose side metal plate holders are not suitable and you need the one from Turnigy MCR All Metal Retract System (Small) main gear. We experienced several failures during our test flights however so these retracts fits, but are not 100% reliable.
To mount slim retracts se printed insert glued into the bays.

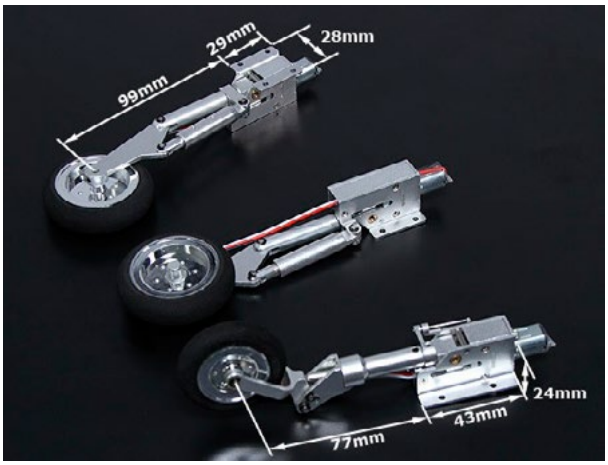


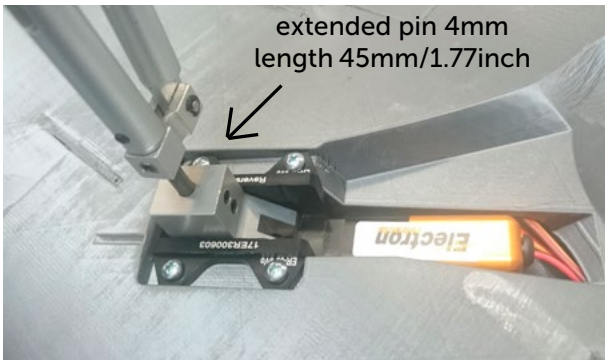
6.2.1 Landing gear - direct nose and main legs

Oleo legs with perfect geometry are in set Full Metal Servoless Retract with Oleo Legs (Tricycle, Mig 17 type) from Hobbyking. In case of using Electron retracts ER-30eVo electron steering system is the nose leg steered directly by the retract system. The lenght of main legs is increased by using 45mm/1.77inch pin.







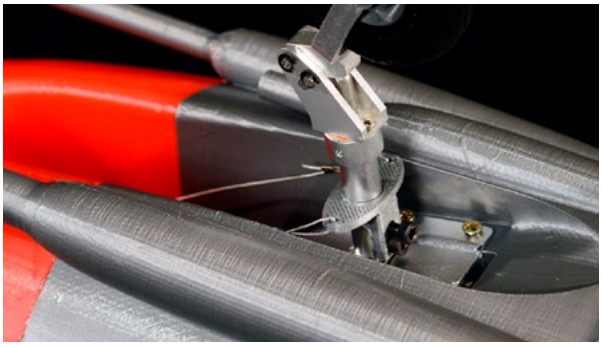


6.2.2 Landing gear - Pull-Pull front leg, wired legs etc.

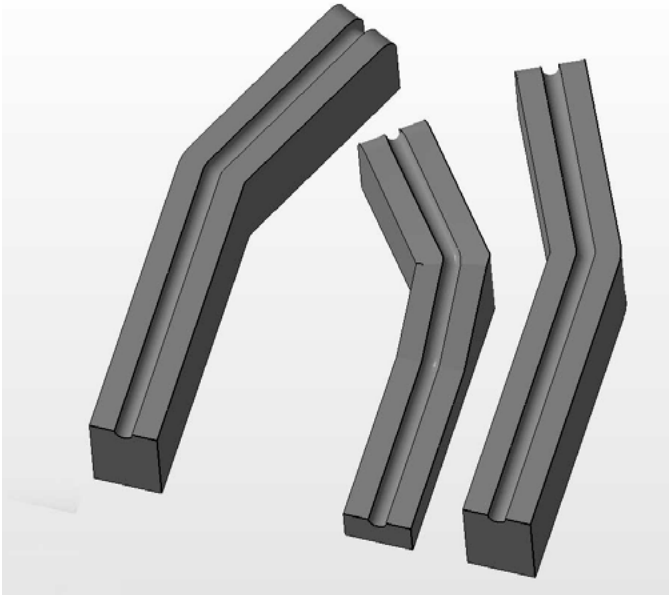
Assemble the printed lever of the front wheel and use the strings of pull-pull system.

See video guide #8

You will need: fitting screws
1x Hitec HS-65 MG or HobbyKing™ HK15178 Analog Servo or similar
Coated Steel Wire 0.6mm (5m/Bag)
Coated Copper Crimping Tube for Pull/Pull Wire (10pc)



If you're unable to find suitable oleo legs and are manually skilled, you can try to make your own legs using spring wire of 3-4 mm diameter. You'll find the bending templates in accessories.



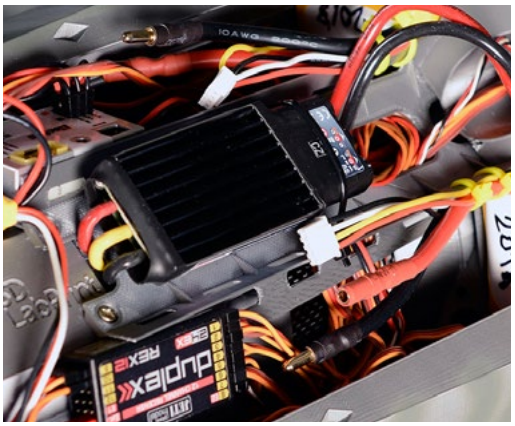
Print the rims and tires. There are rims for 3 or 4mm axle. To print tire we like Treed Flexmark No. 7 but it's very hard to print. Slow down to very low speeds.

7.1 Electro Ducted Fan propulsion system

Our Mig-15 was designed for 90mm EDF. We tested it with 6S Li-Pol and 2-3,5kg thrust. The use of more powerful drives has not been tested or designed for. We do not take responsibility for using too powerful EDFs. Be careful with power.
Glue 10mm ring at intake channel in fuselage T3. You can use hot wire or dremel to prepare EDF holder in fuselage. Mount your EDF, push it to output channel tightly and use screws for perfect and strong fitting. Measure distance betwen intake channel and EDF. Print correct length of cover ring. Cut off it and use cabel binder to cover the ring mounting. Test your power.

Top Power

VASAFAN 90mm with HET motor - excellent quality and sound, with 90A ESC Jeti Mezon for perfect telemetry tuned setup.



High Power

12 Blade High-Performance 90mm EDF Unit - high quality thrust and sound with Turnigy 3553-1800 90mm EDF Brushless Fan Motor and 100A ESC.

Standard Power

Dr Mad Thrust 11-Blade Alloy 90mm - standard quality, not so nice sound.
Mount strap for 90mm Alloy DPS Fan

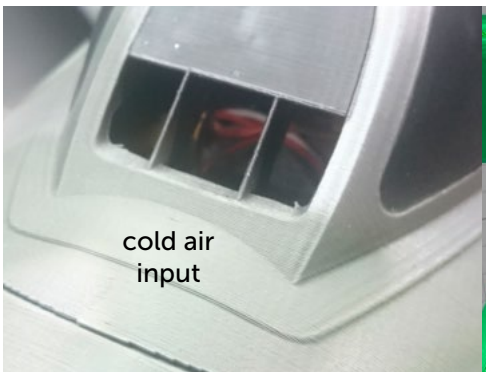
NOTE: Our Dr Mad Thrust arrived without holder and maybe you will need order it separatelly Mount strap for 90mm Alloy DPS Fan.

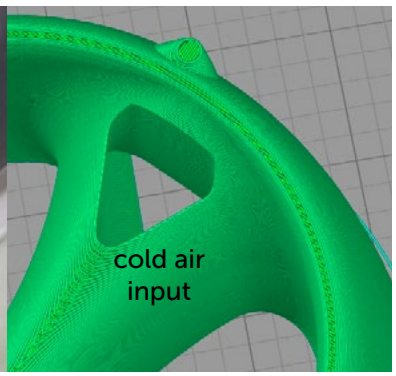
See video guide #9

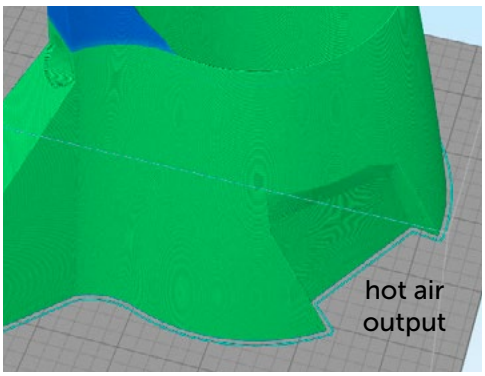
You will need: 90mm EDF for 6s Li-Pol, 2-3,5kg thrust, not so long body...
Dr Mad Thrust 11-Blade Alloy 90mm
EDF unit with 1750kv Motor - 90mm
or similar
fitting screws

7.2. Cooling system

Keep your controller cold! Use well dimensed for 90 - 150 Ampers. Try to fly shortly and test controller temperature after landing. There are cooling holes in canopy for better air input.





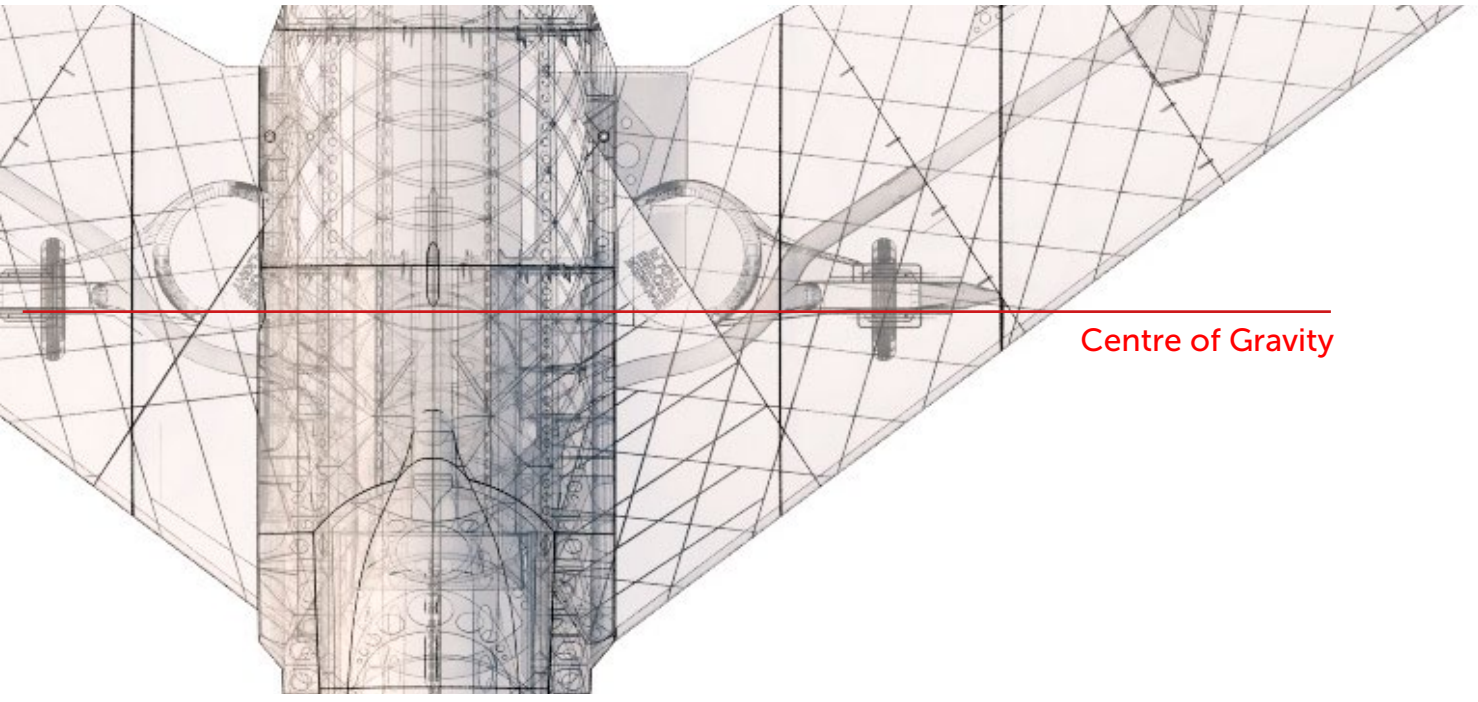


8. RC equipment and final assembly

Glue controller holder and mount it to the fuselage. Install your receiver, connect battery, setup servos and etc. with your trasmitter, check servo position. Set recommended deflection from videoguide. Check CoG point (see CG- tags on wings). Use 740mm/29inch of 8mm carbon tube for wings reinforcement. Carbon tube marks CoG.
Make sure the battery is placed properly and secured. If battery moves during flight it can shift the center of gravity backwards and aircraft will be uncontrollable!

You will need:
Your own Rx/Tx system
2x 3S Li-Pol 4000mAh used as serial for 6S
80-100A Electronic Speed Controller
Adhesive velcro strip for Li-Pol battery and ESC
Scale markings printed on adhesive foil
Battery bays fits 2900 - 6000mAh with 32x45mm profile.

battery maximal profile:
32 x 45 mm
1.25 x 1.77 inch



8.2. Flying setup

Setup flight modes at your RC system.

Start mode

Flaps down at 20°, lower the undercarriage, 30% expo.

Normal mode

all in neutral, lower the undercarriage, 30% expo

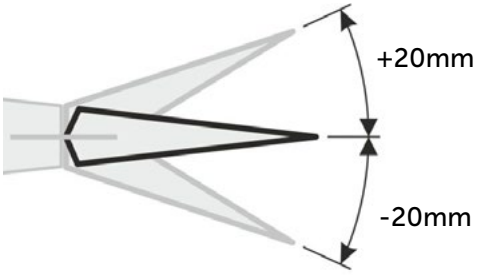
Fast Fly mode

all in neutral, retract the undercarriage, 40% expo, 70% elevator, rudder, ailerons throws

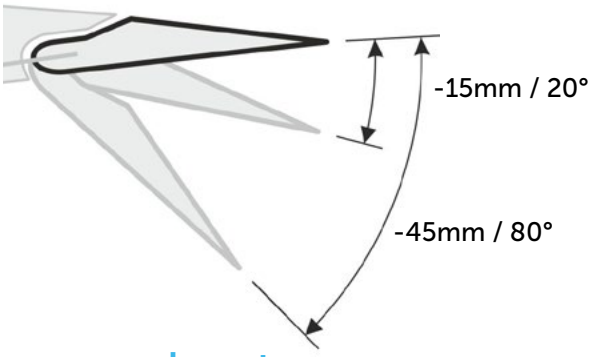
Landing (butterfly) mode

lower the undercarriage, flaps full down 80°, ailerons full UP +20mm, elevator little bit down -5mm. 30% expo. You will need about half of power of EDF for perfect speed.

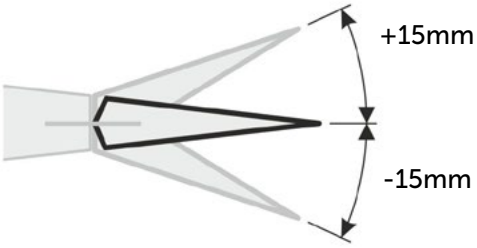
aileron



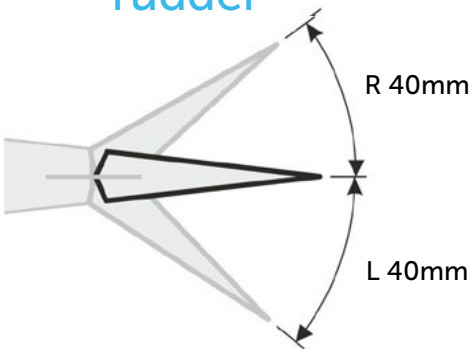
flap



elevator



rudder



10. Pilots Please Attention!

For the first flights we recommend to set the center of gravity of the airplane by about 5 mm forward of the CG tag - nose heavy, this increases the stability (you can use heavier battery). Also is good to increase expo settings on your transmitter for elevator and aileron to 60 % (this calms response from your stick inputs). Also you can decrease elevator and ailerons deflection.
Make sure the battery is well fixed in proper position. If it moves during flight it will cause the CoG move aft and can lead to uncontrollable flight behavior.

You can then return to the proper center of gravity (balance aircraft). Set expo to 30-50 % ... this will gain back extra maneuverability when you are confident with flying your airplane.
Spent at leats 10 hours with RC flight simulator before you go out for the first time.

Flite test: RC Planes for beginners (but note: we use primary ailerons for turn, not only rudder)

See your Mig-15BIS flight video!

Please, use these files only for your own purpose, do not send it further. Thank you very much. Enjoy your flight.

Shopping list

Printing material:	2kg of PLA
RC:	8 chanell receiver by your RC system
EDF:	Use any 90mm EDF by your choice. We tested: VASAFAN 90mm with HET motor - top quality 12 Blade High-Performance 90mm EDF Unit - high quality Dr Mad Thrust 11-Blade Alloy 90mm - standard quality Mount strap for 90mm Alloy DPS Fan or similar for 6S Li-Pol with not so long body...
Controller:	80-100A Electronic Speed Controller
Battery:	2x 3S Li-Pol 4000-6000mAh used as serial for 6S
Servos:	2x Hitec HS-81/82 or similar servos 3x Hitec HS-65 MG or HobbyKing™ HK15178 Analog Servo or similar 4x servo extension cables 300mm / 12 inch 2x servo extension cables 500mm / 20 inch 3x servo extension cables 800mm / 32 inch
Retracts:	Full Metal Servoless Retract with Oleo Legs (Tricycle, Mig 17 type) Turnigy MCR All Metal Retract System (Small) Coated Steel Wire 0.6mm (5m/Bag) Coated Copper Crimping Tube for Pull/Pull Wire (10pc)
Glue:	CA Glue - medium or similar medium viscosity CA glue Activator for CA Glue or similar,
Other:	8mm carbon tube 1 mm / 14 AWG pushrod wire or carbon rod 1,5 mm / 16 AWG pushrod wire fitting screws