

# User Guide

rev. 2019/03

# Fully 3d printable II-2 M3 Sturmovik scale 1:12, wingspan 1235mm (48.3in)

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# Il-2M3 Sturmovik

## - fully printable R/C plane for your desktop 3Dprinter

#### Future of flying - Print your own plane.

Fully 3D printable RC model of the most successfull soviet ground attack plane, specially designed to meet ACES aircombat reqirements, but also as a cheap and easy to build RC model for everyday flying. Many scale details such as armament, airframe plating or exhausts encourages to create realistic paint jobs. Huge wing area results in nice stall characteristics and easy landings. Get ready for battle with this great performing flying tank!

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 \$18

**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 assembly**, you don't need any extra tools or hardware, just glue printed parts together and make pushrods for control surfaces. 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'll get a superb performing airplane with highly efficient powerplant capable of flying 7+ minutes at full throtle and speeds exceeding 110 kph (HP setup). Low stall speed is achieved for easy landing on the other hand.







#### General specifications (HP setup):

Wingspan:
Lenght:
Height:
Wing area:
Wing loading:
Center of gravity:

Airfoil: Print weight: Empty weight (w/o battery): Takeoff weight (6s 2700 lipo): Max takeoff weight: Never exceed speed, VNE: Design maneuvering speed, VA: Stall speed, VS: 1235 mm / 48.2 inch 965 mm / 37.7 inch 240 mm / 9.4 inch 28 dm2 / 3.0 square foot 53 g/dm2 / 17.6 oz/square foot 120 mm / 4,6 inch from leading edge LHK508 modified by 3DLabPrint 887 g / 31.3 oz 1120 g / 39.5 oz 1500 g / 52.9 oz 1800 g / 63.5 oz 150 km/h / 93 mph 100 km/h / 62 mph 30 km/h / 18.6 mph





#### ACES performance setup

Motor:Leopard LC3542 600KV RED (for 6S setup)<br/>or similar parameters for 6S Li-PolESC:YEP 40A/6S or similarPropeller:two blade Aeronaut CAM Carbon Light 11 x 6 or APC 11 x 5,5Battery:LiPol 1800-2700mAh/6sPrinted (2 perimeter/shells setting) and annealed fuselage part (F1) and alluminium or<br/>carbon cross mount supplied with the motor.

#### Performance measurement

Max speed VH (level flight): Rate of climb: Flight time (6s 2400mAh/full): 105 km/h – 56.7kn – 65.2mph with APC 11x5,5 20 m/s (5 373 ft/min) with APC 11x5,5 7:30 with APC 11x5,5



ФАБ-100



# Il-2 Sturmovik, History Ил-2

The Ilyushin Il-2 Shturmovik was a ground-attack aircraft produced by the Soviet Union in large numbers during the Second World War. With 36,183 units of the Il-2 produced during the war, and in combination with its successor, the Ilyushin Il-10, a total of 42,330 were built, making it the single most produced military aircraft design in aviation history, as well as one of the most produced piloted aircraft in history along with the American postwar civilian Cessna 172 and the Soviet Union's own then-contemporary Polikarpov Po-2 Kukuruznik multipurpose biplane.

To II-2 pilots, the aircraft was simply the diminutive "Ilyusha". To the soldiers on the ground, it was the "Hunchback", the "Flying Tank" or the "Flying Infantryman". The II-2 aircraft played a crucial role on the Eastern Front. Joseph Stalin paid the II-2 a great tribute in his own inimitable manner: when a particular production factory fell behind on its deliveries, Stalin sent an angrily worded cable to the factory manager, stating "They are as essential to the Red Army as air and bread," and "I demand more machines. This is my final warning!"

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## Included:

#### 1. STL 3d files

Universal STL files designed to be used with desktop FMD 3d printers and slicer software as Simplify3D (recommended), CURA or MatterControl (these STLs are not compatible with Slic3r).



## 2. Factory files for Simplify3D slicer

contains all the necessary settings to slice the models along with suggested bed layout. We're using PRUSA i3 ORIGINAL printers so you may need to adjust the basic printing parameters to match your printer or use these files as a start point for you. Please check the <u>Simplify3D</u>

#### 3. Step By Step PDF/VIDEO userguides

Apart from this userguide, please see the Printing Guide to find some Tips and Advice for airplane printing (Thin Wall Printing).



## 4. Gcodes

Basic Gcodes prepared for direct use, as universal as possible. Should work on i3 style printers, Give it a try, but we can't guarantee it will work on your printer. You can also easily adjust the retractions if necessary using our <u>guide</u>. 100% compatible with PRUSA i3 ORIGINAL 3d printers.

#### 5. Prepared settings for CURA and MatterControl slicers

If you for any reason don't like Simplify3D, there is always option 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 PDF in scale on thin self tape advertisement foil and place it on the model as needed, violet cut lines included.









Lenght: 965 mm / 37.7 inch





Wing span: 1235 mm / 48.2 in)ch





## Step By Step PDF/VIDEO userguide

1. Choose airplane at <u>www.3Dlabprint.com</u>, visit our <u>Facebook</u> for latest info.



Basic requirments for II-2 M3 Sturmovik are 200/200/175mm volume, nozzle 0.4mm recommended (0.35 or 0.5mm alternativelly). Heated bed recommended. PLA filament (or PETG, APLA, htPLA, PC-max....) not ABS. If you want to try first, you can <u>download wing test part</u> from our websites or thingiverse, (the biggest part). Or contact support@3dlabprint.com

#### 2. Create account, download

You will receive download link to all the zipped files to your email (please check your spam folder if not) or you can log in to your account and download directly from our websites.



## 3. Gcodes preparing

#### option A Gcodes:

if your printer is i3 comptatible you can use prepared gcodes directly. Just save them to the SD card and let the 3d printer do it's job. HE temperature is set to 230°C so the layers fuse together well, you can adjust speed and temperature only through your printer's LCD. If these Gcodes does not work for you, please proceed to the next options.





#### option B Factory files Simplify3D (recommended)

We prepared all you need in these files (FFF process settings, parts layout on bed, etc...) You can use these settings as a start point. Adjust according to your need (adapt for your printer), print single parts and so on... Most 3d printers should work just with these settings, but please go through the settings and amend if necessary, we are not liable for any damage resulting from using our settings. If this still does not work for you, please proceed to the next option.



#### option C Simplify3D manual setting (watch and learn)

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



#### AND... please watch our VideoGuides:



video 2 Simplify3D setting



video about Thin Wall Printing



#### option D CURA or MatterControl

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 - see below (always adapt it for your printer, change build volume, filament diameter, etc... according to your printer!!!)



Please check our <u>CURA guide</u> on the website for the latest basic profile. Please visualise our presliced gcodes to see how the result should look like and try to achieve the same in your slicer.

OR (works only with older CURA/MC versions):



video MatterControl slicer setting







#### 4. Print it

Save the Gcodes to the SD card and insert into your printer. Prepare your printer and start printing, we prefer to use SD card rather than direct USB connection. Note: ABS filament is not suitable for thin wall printing. Scaling the model will lead to unusable result!

#### Video guide about printing

you will need: PLA filament - good quality and strong PLA (we need strong layer bonding) 3DLac, Strong hair spray, or your favorite adhesive bed surface Razor blade

AND... please watch our VideoGuides:

video printing guide



## **Basic Tips and Advice**

Please Experiment with your extrusion multiplier.

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

Turn OFF cooling fan for better layer adhesion (HE fan should be ON). We dont need it for thin wall printing. We tried many different materials and despite it's lower thermal resistance the PLA is still our best choice.

Feel free to experiment with PETG, PC-max by Polymaker looks promissing.

Heated bed is very recommended, 60-70° Celsius (to prevent warping ends).

Looks like any standard quality PLA is good for our planes, but the combination of PLA vs. Extruder vs. HotEnd is what matters the most.

We find some filament colors could have lower layer adhesion and lighter colors doesn't heat so much on the direct sunlight.

Many 3dprinters are on todays market, most of them are capable of printing our airplanes (specific thin wall printing...) suficient volume, heated bed, 0.4mm nozzle.

## Please see the Printing Guide:

Look at website or Included PDF file in your downloaded package.





## 5. Assembly of printed parts

## 5.1 Wing assembly II-2 M3 Sturmovik

Glue together wing parts L1-L2 perfectly aligned on the flat surface. Then glue the rest of the wing L3-L6 and continue with the right side as well. Glue both halves of the wing together. Use the CA glue, (position locks and pins will help you to align the parts), and use activator. On a flat surface glue the ailerons L1-L3 as well as the right side. Use a suitable 0,8mm - 1mm carbon rod or wire as a hinge for the ailerons. Just slide it in, there's no need to glue the hinge for easy aileron or servo replacement. Glue the optional Landing Gear Pods to the bottom of the wing to improve the scale look of the plane. Watch out for the left and right side.

#### See video quide #4

you will need:

CA Glue - medium or similar medium viscosity CA glue 0,8 - 1 mm carbon or steel wire for aileron hinge Scissors, Snap knife, Some cloth for wiping CA glue...





#### 5.2.1 Fuselage assembly II-2 M3 Sturmovik

Glue fuselage parts with CA glue together (position locks and pins will help you) use activator. You can use snap knife for clearing the shape of printed parts, but mostly it is not necessary. Glue F1-F6 fuselage parts. Do not glue part F7 before tail and elevator assembly.

Use any hot tool to remove the unnecessary material from bottom part of the fuselage and the upper rear gunner compartment. Make a hinge for the rear machine gun from a piece of 1.75 mm filament.

NOTE: Don't glue the F7 tailpart yet !!! (proceed to the next step for elevator and stabilizer assembly)

NOTE: fuselage part F1, must be printed with 2 perimeters (set in our Gcode) and <u>annealed</u> (boiled at least 30min in hot water) result - heat from motor is not issue anymore...

#### See video guide #5

you will need: <u>CA Glue - medium or similar medium viscosity CA glue</u> Scissors, Snap knife or Sandpaper, Soldering Iron or any hot tool

F7 21,8g/0,77oz



F2 55g/1,94oz

battery holder

25,8g/0,91oz

F1 22g/0,78oz



NOTE: fuselage part FI, must be printed with 2 perimeters (set in our Gcode) and annealed (boiled at least 30min in hot water) result - heat from motor is not issue anymore...









## 5.2.2 Fuselage tail - elevator pushrod

Glue together the L1 and L2 parts of the stabilizer and elevator. The profile is symmetric, so the left and right sides are identical. Glue the stabilizers to the fuselage perfectly aligned. Assemble both sides of the elevator with the control lever on a flat surface. Make a Z bend on the elevator pushrod wire. Using hot tool cut loose the hinge of the elevator on the F6 and F7 parts of the fuselage and mount the elevator assembly to the stabilizer using the 0.8 - 1 mm carbon rod or steel wire. Elevator should move freely controlled by the pushrod and servo. Check the functionality of the elevator assembly carefully and finally glue in the rear part F7.

you will need:

<u>CA Glue - medium or similar medium viscosity CA glue</u> 0,8 - 1 mm steel wire for elevator pushrod Scissors, Snap knife, Soldering Iron or any hot tool

See video guide #5





#### 6. Servo installation, pushrods

Extend the servo leads and install the prepared servos to wing servo bays. Use a 1mm steel wire with Z bends as a linkage between the servos and aileron control horns.

#### See video guide #6

you will need:

3x <u>Hitec HS-82MG</u> or <u>Corona CS-238MG</u> or any medium sized servos 30x12x30mm (1.17 x 0.47 x 1.16 inches) 2x <u>Servo Lead Extension or similar</u> Snap knife, Z pliers





## 7. Motor & ESC & battery holder, final

Mount the battery using zipper ties to the battery holder. Fix the battery to the front of the fuselage, ase the II-2 needs the weight on the nose to balance. Mount the motor assembly along with the ESC using the original aluminium cross or printed firewall. Insert the complete battery assembly into the fuselage. There are holes for the battery cables for easy connecting and recharging without the need of disassembling the wing and removing the battery assembly from the fuselage. Insert wing nuts and set with hot glue, add decals...

#### **Recommended motor setups**

Use any motor from <u>3542 line</u> with weight ~140g and sufficient thrust. Speed controller ~40A with LiPol pack around 400g weight.

#### ACES performance setup

Motor – Leopard LC3542 600KV RED <u>Speed controller (ESC) YEP 40A/6S</u> or similar <u>Battery LiPol 2700mAh/6s</u> propellers two blade Aeronout CAM Carbon Light 11 x 6 or APC 11 x 5,5 2xperimeters printed and anealed fuselage F1 part carbon or alluminium original cross mount

#### See video guide #7

you will need: 2x M5 nuts 2x M5 Nylon Screws









#### 8. Final assembly and setting

Refer to your R/C system userguide for setup information.

See video guide #8

you will need: Your own Rx/Tx system

Install your reciever, connect battery, setup servos and etc. with your trasmitter, check servo position, then install propeller.

Make sure that the battery is placed properly and secured with wing battery holder, if battery moves during flight it can shift the center of gravity backwards and aircraft will be uncontrollable! Never set ESC with propeller installed, this could be very dangerous!

#### aileron

elevator



## 9. Go flying

Pre-flight check center of gravity is very important (move it 5-10mm forward for the first flights), battery properly charged, ailerons and elevator deflection check, your own flying skills or RC simulator training ...

Basic to advanced ground handling take-off's and landing for warbirds

Flight video of Il-2 M3 Sturmovik





## 10. Pilots Please Attention!

For the first flights we recommend setting the center of gravity to around 5 mm forward of the CG tag - nose heavy, this increases the stability (you can use heavier battery). Increasing expo settings on your transmitter for elevator and ailerons to 80 % calms response from your stick inputs. Also you can decrease elevator and ailerons deflection to calm down the plane. Make sure the battery is well fixed in proper possition. If it moves during flight it will cause shifting of CoG aft and will result in uncontrolable flight behavior.

After gaining some confidence you can balance the plane to the Center of Gravity marks and set Expos to 60 % as shown in the video/instructions... this gains back extra maneuverability.

Never fly aft positioned Center of gravity.

Please, use these files only for your own purpose, do not redistribute or publish. Thank you very much. Enjoy your flight.





## Shopping list

Printing material:	1kg of PLA
RC:	4 channel receiver for your RC system
Motor:	any motor from <u>3542 line</u> with weight ~140g Leopard LC3542 600KV RED (for 6S setup) or similar for 3S - 6S Li-Pol
Controller:	Speed controller (ESC) YEP 40A/6S or similar
Battery:	6S Battery LiPol 2700mAh/6s
Servos:	3x <u>Hitec HS-82MG</u> or <u>Corona CS-238MG</u> or any medium sized servos 30x12x30mm (1.17 x 0.47 x 1.16 inches)
	2x servo extension cables 300mm / 12 inch
Glue:	<u>CA Glue - medium or similar medium viscosity CA glue</u> <u>Activator for CA Glue</u> or similar,
Other:	1 mm / 14 AWG pushrod wire or carbon rod 2x M5 fitting screws and nuts