

Building instructions

Sukhoi SU 31M

Electric RC model aircraft
Order No. 1352/00



Specification

Wingspan	approx. 1410 mm
Length	approx. 1120 mm
Wing area	approx. 37 dm ²
Tailplane area	approx. 7.2 dm ²
Weight	approx. 2000 g

RC functions

- Elevator
- Ailerons
- Rudder
- Speed controller or motor switch

Recommended power system

actro CL 6 (Köhler) and actronic 40-18
12 cells 13 x 8" propeller

Fun 480/33/5,2 (Kontronik)
10 cells 14 x 8" propeller
12 cells 13 x 7" propeller

aero-naut Modellbau GmbH & Co. KG
Stuttgarterstr. 18-22
D-72766 Reutlingen
Germany

<http://www.aero-naut.com>

© aero-naut Modellbau GmbH & Co. KG

Preparation

Before starting construction connect the stand plates (1 + 2) using two lengths of hardwood dowel (pieces of broom handle), ensuring that the fuselage fits between the plates with the wing fitted.

Use 5-minute epoxy for all joints unless stated otherwise.

You will need four servos 30 mm long and 12 mm wide, with an output arm length of 15 - 18 mm. For painting Depron parts (bottom wing fairing) we recommend water-based acrylic paints. Photographs of the various stages of construction are printed on the sides of the kit box.

Fuselage

The first stage is to reinforce the fuselage (3) with several wooden parts. Glue part (8) across the fuselage at the front, and the two side doublers (9) on either side (*Figs. 8, 9 + 10*). Note that the lugs and notches of these three parts should slot together accurately. Slot the undercarriage support (10) into the notches in parts (9), and glue it to the doublers and the fuselage (*Figs. 10 + 11*). Glue the two captive nuts (39) to part (11) and glue this reinforcement in the fuselage over the undercarriage support (10), working from above (*Fig. 13*). Screw parts (10 + 11) together using the nylon screws (41). Glue the flight battery support (12) in the fuselage from the underside (*Fig. 12*). The stop-piece (13) for the battery should not be glued in place until the model's Centre of Gravity has been established, in case the battery needs to be shifted further forward.

Glue the balsa screw supports (14) on both sides of the fuselage (3) at the nose to accept the cowl screws (*Fig. 17*).

Glue the tailskid support plate (20) to the underside of the fuselage (*Figs. 19 + 20*), and glue the tailskid (21) to the plate once the glue has set hard. Cut out the tailskid fairing (22), paint it, and fix it in place using scrap decal sheet material.

The motor mount is assembled from parts (15 - 19). Sand the dark coloration from the cut edges and remove dust before gluing. The motor mount plate (15) must be positioned with the two slots on the left and the single slot on the right. Glue part (16) in place with the two lugs on the left, and part (17) with the single lug on the right (*Figs. 14, 15 + 16*). Glue parts (18 + 19) in place. Note that part (19) has one angled edge to allow for the 2.5° right-thrust; this edge must be glued to part (18).



Glue the motor mount to the front face of the fuselage, aligning the pointed part of the motor mount plate (15) with the fuselage moulding seam on both sides. This automatically sets the correct height, so all you have to do is centre the motor mount. Secure the motor mount carefully so that it cannot shift while the glue is setting.

Screw the two canopy retainer band hooks (49) in the balsa plates (50), and glue them on either side of the fuselage below the canopy, adjacent to the battery compartment (*Fig. 18*). One hook should be fitted to the balsa plate (51) and glued in the fuselage behind the canopy, between the vacant servo wells and the control "snakes" (*Fig. 18*).

Glue the four threaded plastic sleeves (42) for the wing retainer screws in the fuselage (3) and to the fuselage side doublers (9).

Tailplane and elevators

Apply the film strips (57) to the top surface of the tailplane to act as hinge reinforcements, with half their width (20 mm) on the tailplane, half on the elevator.

Position the GRP horn (32) half-way along the CFRP tube (6) and glue the CFRP tube to the two elevators (still attached to the tailplane (5)), with the GRP horn located in the circular recess (*Figs. 1, 2 + 3*); note the angle of the horn (*Fig. 3*). Take care that no glue runs into the second channel (hinge).

Separate the two elevator panels from the tailplane at both tips using a sharp knife (*Figs. 3 + 4*). Cut away the central area between the two elevators (*Fig. 3*); at a later stage this part is glued to the tail end of the fuselage.

Small servos weighing around 13 g are required for this model; they should fit in the servo wells in the fuselage from the underside (*Fig 5*). Fix the pushrod connectors (38) to the servo output arms using the self-locking nuts provided.

The tunnels in the fuselage for the snake outer sleeves (36) can be pierced using a length of stout wire. The exit slot for the rudder snake should be located about 50 mm forward of the tail end of the fuselage on one side (*Fig. 20*). The elevator snake outer (36) should be central at the tail end, lining up with the elevator horn (32) (*Figs. 5 + 6*). Please ensure that the snakes are as straight as possible to avoid stiffness in the linkage; any curves must be of large radius. Glue the snake outers (36) securely to the fuselage at several points. The pushrods (snake inners) are the steel rods (37). Form a Z-bend in one end of the elevator pushrod and connect it to the middle hole of the elevator horn. Slip the pushrod through the snake outer and thread it through the pushrod connector mounted on the elevator servo. Elevator travel should be 20 mm up and 20 mm down. Glue the tailplane to the fuselage. Secure the pushrod (37) in the pushrod connector (38) with a grub screw, then snip off excess rod length using side-cutters.

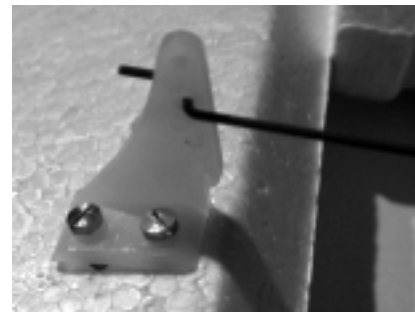


Fin and rudder

Apply the film strips (58) in the V-channels between the fin (7) and the rudder on both sides to strengthen the hinge line. Separate the fixed rudder from the fin at the top by cutting forward (*Fig. 7*) using a sharp balsa knife.

Form a Z-bend in one end of the rudder pushrod (37), slip it into the snake outer (36) and connect it to the pushrod connector (38) mounted on the rudder servo. Temporarily tape the fin (7) to the tailplane (5) and establish the correct position for the horn (33) on the rudder. Screw the horn (33) to the rudder using the spreader and M2 screws (48), and cut off excess screw length.

Cut a slot for the hinge (55) in the centre of the fuselage tail post using a balsa knife, and glue the hinge in it. Cut a matching slot in the rudder. Form a Z-bend in the pushrod (37) as for the elevator and connect it to the inner hole in the rudder horn. Slip the steel pushrod into the snake outer (36) and through the pushrod connector (38) mounted on the servo. The fin can now be glued to the tailplane, gluing the bottom hinge in the rudder at the same time. Secure the pushrod (37) to the pushrod connector (38) using a grub screw, and cut off excess rod length using side-cutters. The rudder should be capable of 50 mm travel to each side of centre.



Final assembly - fuselage

The servos can be glued to the fuselage once you have checked the control surface (servo) travels. Glue the fuselage turtle deck (4) to the fuselage (3).

The piece removed from the centre of the elevators can now be glued to the fuselage between the elevators. Take care not to glue it to the elevators, as that would prevent them deflecting. Attach the wheel axles (machine screws, part 45) to the GRP undercarriage unit (40) using the nuts (46) and shakeproof washers. Fit the wheels (44) followed by the self-locking nuts (47). Fix the undercarriage (40) to the fuselage using the nylon screws (41).

The next step is to cut three to five holes of around 10 mm \varnothing in the front face of the fuselage to provide a cooling airflow; the motor cables also pass through them. Screw the motor to the motor mount and run the cables back into the fuselage.

Attach the lower part of the cowl (23) to the fuselage with tape, followed by the top section (24). Drill four 1 mm \varnothing holes through the cowl sections into the balsa screw supports (14) on either side of the fuselage, and fix the cowl sections in place using the self-tapping screws (54). Remove the cowl, fill the holes in parts (14) with a drop of epoxy, then fit a self-tapping screw in each and remove it again immediately; the epoxy hardens the threaded holes. Tape the cowl sections together at the front using adhesive film (scrap decal sheet material).

Canopy

Don't cut out the canopy frame (25) yet.

Cut out the instrument panel from the decal sheet and apply it to the front of the canopy frame (25). The pilot's backrest can be painted a different colour if you wish. Cut out the canopy (26) leaving a flange about 20 mm wide. Glue the canopy to the canopy frame. When the glue has set hard trim the joined canopy parts leaving a flange 10 mm wide at the canopy recess. Glue the plywood support (27) to the underside of the canopy frame (25). Bend a hook (49) at right-angles and glue it in place, centred on the support (27); this hook must be set at right-angles to the fuselage centreline.

Tension a rubber band (53) from each of the two hooks (49) (in the front of the fuselage) to the rear hook in the fuselage. When the canopy is fitted the two rubber bands are then engaged in the hook on the bottom of the canopy.

Wing

Lay the two wing panels (29 + 29) upside down on a flat surface. Fit the carbon tube wing spar (30) into both wing panels from the centre and glue all three parts together (*Fig. 21*). Apply the film strips (56) to the top surface of the wing to act as hinge reinforcements; half the width (25 mm) should be on the wing, half on the aileron. Before gluing the servos in the wing set them to neutral from the transmitter (*Fig. 22*). The servo leads have to be extended as described in the RC system operating instructions. The wing ribs are already cut away to clear the servo leads. At the centre section a hole must be cut through the high-density foam in the direction of the centre of the wing, so that the servo leads exit the wing on the top surface.

Glue the balsa supports (52) in the slots in both ailerons. Please take care that no glue gets onto the aileron hinge. The spigot of the aileron horns (34) has to be shortened slightly; roughen the joint surfaces and file notches in the spigot to provide a "key" for the epoxy. Glue the horns in the balsa supports (52) (*Fig. 22*). The ailerons can now be cut through at the inboard end to separate them from the wing (*Fig. 24*). To check the aileron system connect the pushrods (35) to the servo output arms and the aileron horns, and secure them with the retainer clips (59) (*Fig. 23*). Aileron travel should be 30 mm to each side of neutral. When you are satisfied, remove the pushrods (35) again and glue the servos in place. Position the bottom wing fairing (31) in the recess in the wing, and push the servo output arms through the foam material. Remove the fairing and enlarge the slots slightly so that the output arms and aileron pushrods have proper clearance when they move. The fairing (31) can now be glued to the underside of the wing. This is best carried out in two stages: first glue the front edge (behind the leading edge) and allow the glue to set hard, then glue the remainder of the fairing in place. On the underside of the wing glue the four circular balsa reinforcements (60) for the nylon screws (42) in the recesses designed for them.

Centre of Gravity

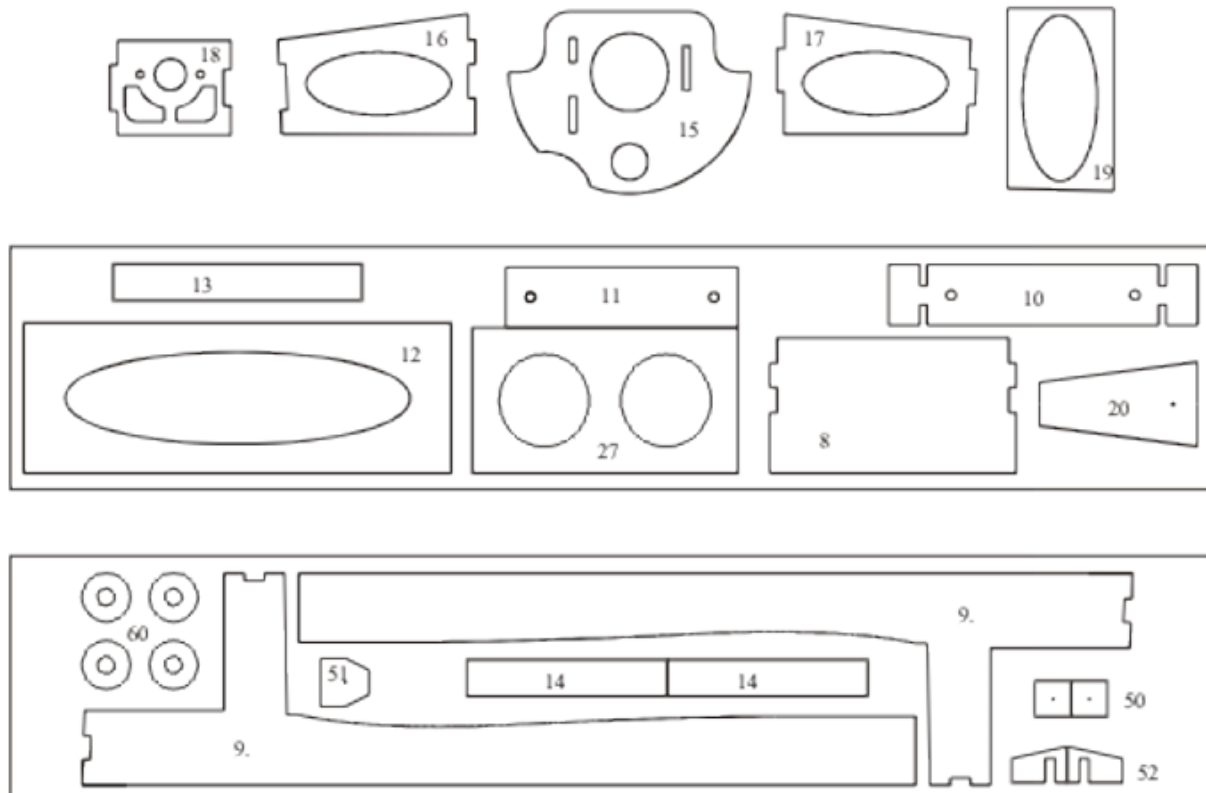
The model should balance at a point 85 mm aft of the wing root leading edge, measured directly adjacent to the fuselage. Adjust the position of the flight battery to obtain correct balance.

Decals

Cut out the individual decals and apply them to the model in the arrangement shown in the kit box illustration.

Control surface travels

Elevator: 20 mm each side
Rudder: 50 mm each side
Ailerons: 30 mm each side

Drawing of die-cut partsParts list

No.	Description	No. off	Material	Notes
1	Front stand plate	1	High-density foam	Moulded
2	Rear stand plate	1	High-density foam	Moulded
3	Fuselage	1	High-density foam	Moulded
4	Fuselage turtle deck	1	High-density foam	Moulded
5	Tailplane	1	High-density foam	Moulded
6	Tailplane spar, 5 x 415 mm	1	CFRP tube	Ready made
7	Fin	1	High-density foam	Moulded
8	Front fuselage reinforcement	1	Plywood 3 mm	Die-cut
9	Side fuselage doubler	2	Balsa 2.5 mm	Die-cut
10	Fuselage reinforcement, undercarriage	1	Plywood 3 mm	Die-cut
11	Fuselage reinforcement, captive nuts	1	Plywood 3 mm	Die-cut
12	Fuselage reinforcement, battery support	1	Plywood 3 mm	Die-cut
13	Flight battery stop	1	Plywood 3 mm	Die-cut
14	Fuselage reinforcement, cowl	2	Balsa 2.5 mm	Die-cut
15	Motor mount plate	1	Plywood 3 mm	Laser-cut
16	Motor mount, side piece	1	Plywood 3 mm	Laser-cut
17	Motor mount, side piece	1	Plywood 3 mm	Laser-cut
18	Motor mount, front	1	Plywood 3 mm	Laser-cut
19	Motor mount, bottom	1	Plywood 3 mm	Laser-cut

20	Tailskid reinforcement	1	Plywood 3 mm	Die-cut
21	Tailskid	1	Steel rod 2 mm	Ready made
22	Tailskid fairing	1	Plastic	Vac. moulded
23	Bottom cowl section	1	Plastic	Vac. moulded
24	Top cowl section	1	Plastic	Vac. moulded
25	Canopy frame	1	Plastic	Vac. moulded
26	Canopy	1	Plastic	Vac. moulded
27	Canopy support	1	Plywood	Die-cut
28	R.H. wing	1	High-density foam	Moulded
29	L.H. wing	1	High-density foam	Moulded
30	Wing spar, 5 x 970 mm	1	CFRP tube	Ready made
31	Bottom wing fairing	2	Depron	Die-cut
32	GRP elevator horn	1	GRP	Ready made
33	Rudder horn	1	Plastic	7491/03
34	Aileron horn	2	Plastic	7491/01
35	Aileron pushrod	2	Steel rod 1.5 mm	Ready made
36	"Snake" outer sleeve, 500 mm	2	Plastic	
37	"Snake" inner, 1 x 500 mm, one Z-bend	2	Steel rod	
38	Pushrod connector	2	Metal	7490/07
39	Captive nut, undercarriage	2	Metal	7766/04
40	Undercarriage unit	1	GRP	Ready made
41	Nylon undercarriage screw, M4 x 70	2	Nylon	Ready made
42	Nylon wing retainer sleeve, M6	4	Nylon	7329/66
43	Nylon wing retainer screw, M6 x 60/80	2 + 2	Nylon	
44	Wheel, 70 x 4 mm	2	Plastic	Ready made
45	Machine screw, M4 x 35 mm	2	Metal	7776/31
46	Nut, M4	2	Metal	7774/04
47	Self-locking nut, M4	2	Stahl	7766/24
48	Rudder horn screw, M2	2	Metal	7772/40
49	Canopy retainer hook	3	Metal	7800/00
50	Front hook plate	2	Balsa 2.5 mm	Die-cut
51	Rear hook plate	1	Balsa 2.5 mm	Die-cut
52	Aileron horn reinforcement	2	Balsa 2.5 mm	Die-cut
53	Canopy retainer rubber band	2	Rubber	Ready made
54	Self-tapping cowl retainer screw	10	Metal	7768/00
55	Hinge	1	Nylon	7495/00
56	Self-adhesive film strip, aileron	2	Plastic, 480 x 50 mm	Ready made
57	Self-adhesive film strip, elevator	2	Plastic, 190 x 40 mm	Ready made
58	Self-adhesive film strip, rudder	2	Plastic, 105 x 20 mm	Ready made
59	Pushrod retainer clip	2	Plastic	7489/07
60	Wing retainer screw reinforcement	4	Balsa 2.5 mm	Die-cut
61	Decal sheet	1	Self-adhesive film	
62	Building instructions	1		