

Building Instructions

Dassault Breguet
Rafale C 01

RC electric model
Order No. 1358/00

**aero-
naut**



Specification

Wingspan	940 mm
Length	1340 mm
Wing area	38 dm ²
Canard area	3 dm ²
Total surface area	41 dm ²
All-up weight	3200 g
Total surface area loading	78 g/dm ²

RC functions

Elevons, throttle

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Replacement parts

GRP fuselage, 3-part	Order No. 1358/02
Canopy and cockpit	Order No. 1358/04
Wing set	Order No. 1358/05

Undercarriage

Prepared for retract system:	Order No. 7358/52
Dummy pilot	Order No. 7335/03, in preparation

Power system

Turbo-Fan 4000 ducted fan unit	Order No. 7249/40
Other impeller units can be installed at the builder's discretion.	

We recommend the following motors:

Kontronik	Tango 45-08	9 Li-Po cells in series
	Tango 45-07	10 Li-Po cells in series
Plettenberg	HP 300/40/A2S	9 – 10 Li-Po cells in series
	HP 370/30/A2S	9 – 10 Li-Po cells in series
Lehner	2240-20	10 – 11 Li-Po cells in series

We recommend the use of epoxy laminating resin for all joints involving the GRP parts. This adhesive penetrates into the smallest gaps and ensures really strong joints. For certain joints the resin should be thickened by mixing in a thixotropic agent (thickener).



All joint areas on the fuselage must be thoroughly “keyed” (roughened) using abrasive paper before glue is applied. Where the surface is pigmented, the colour layer must be sanded away completely. Joints involving GRP parts must be made using slow-setting epoxy exclusively; do **not** use 5-minute epoxy.

If you wish, you can deviate from the sequence described in these building instructions, but any changes are at your own discretion and risk. The fuselage is of extremely lightweight construction and designed specifically for the retract system, Order No. 7358/52. The moulding can be reinforced with additional rovings, but this is not necessary if you install the specified undercarriage.

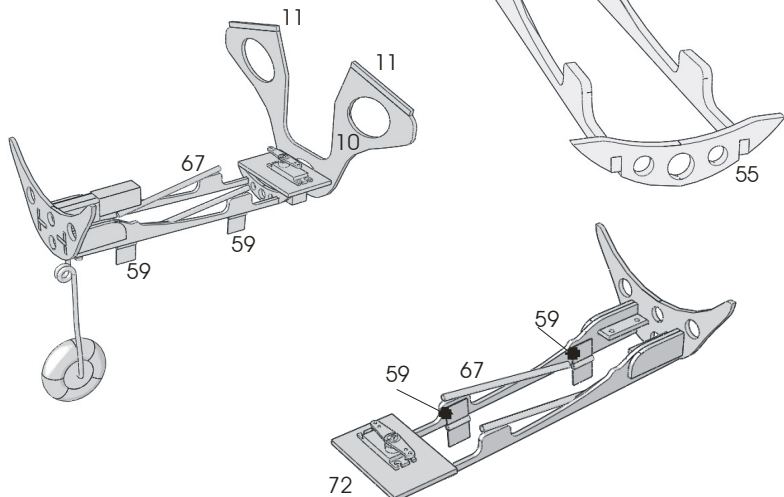
1) Fuselage cockpit cut-out

The front section of the fuselage (1) must be cut away to accept the cockpit: cut out the opening using a sharp knife, leaving a flange 7 mm wide all round, but only 4 mm wide at the pilot's seat position. Apply cyano to the projecting kevlar cloth strands, then slice them through with a knife.

2) Noseleg former set

The support for the noseleg is assembled from parts (54 - 58), as shown in the drawing. Allow the glued joints to cure fully, then glue the assembly to the fuselage, ensuring that the rear face of the former (54) is flush with the rear end of the *wheel door opening*. The wheel door is attached to the longitudinal members (56) using two hinges (59). Note that small notches must be cut in the fuselage and the wheel door, so that the axis of the hinge pivots lines up with the cut edge of the wheel door opening.

Glue the hinges (59) and the metal tubes (67) to the longitudinal members (56); later the steel steering cables for the nosewheel are routed through these tubes. Glue the 4 mm thick strips (11) to the top of the former (10). The servo plate (72) can now be glued to the former (55) and the fuselage. Glue the former (10) in the fuselage, butting up against the servo plate (72).

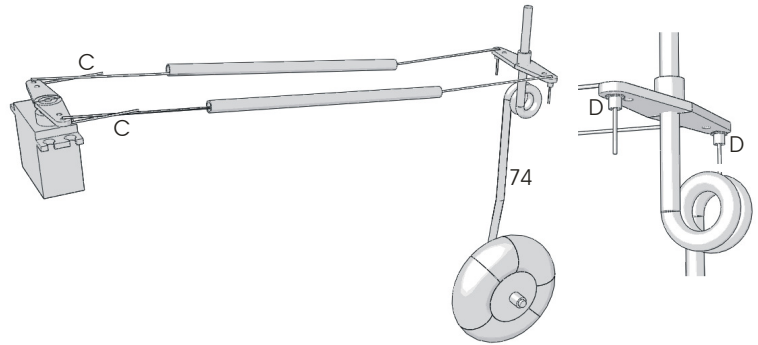
**3) Nosewheel steering system**

Thread the steel cables through the servo output arm, double them over and solder the ends to the cables (C). Slip the cables through the guide tubes, thread them

through the noseleg steering arm, then fit the tubular rivets on them (D). Pull the cables taut with a pair of pliers, and solder them to the tubular rivets.

4) Nosewheel door actuator

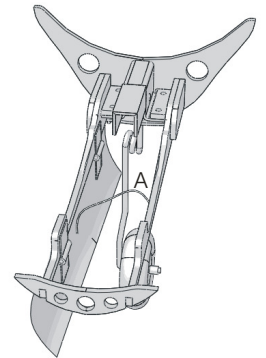
Glue one end of a length of steel cable (A) to the centre of the nosewheel door, and the other end to the inside of the fuselage on the opposite side. Set the cable length so that the wheel door is pulled up by the undercarriage leg when the nosewheel is retracted.



5) Main retract unit hinges

The main wheel doors are attached to the fuselage (1) using two hinges (59) each. Note that small notches must be cut in the fuselage and the wheel door, so that the axis of the hinge pivots lines up with the cut edge of the wheel door opening.

Glue the main (rear) undercarriage hinges (59) to the fuselage, then tape the wheel doors to the fuselage and glue the hinges to the doors from the inside. Allow the glue to set hard, then apply a patch of glass cloth over the top using epoxy. Please take care to avoid resin running into the hinges.

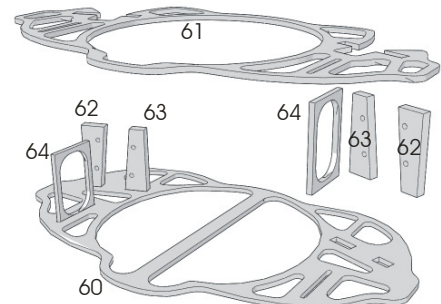


6) Main undercarriage former assembly

The support for the main undercarriage is assembled from parts (60 - 66) as shown in the drawing; tack the joints temporarily using cyano.

The holes for the retract unit retaining screws in parts (62 + 63) must be drilled accurately. Check the hole positions by offering up the retract units before gluing the parts in place.

The nuts for the retract unit retaining screws must be glued in place at this stage. Place the former assembly in the fuselage and align the rear face of the former (60) with the front edge of the wheel door opening. Check that the retract units work correctly, with proper clearance. When you are confident of this, apply more cyano to the former assembly to reinforce the joints. Allow the glue to cure fully, then glue the former assembly in the fuselage. Reinforce the joints between the formers and the fuselage with additional rovings.



7) Air ducts

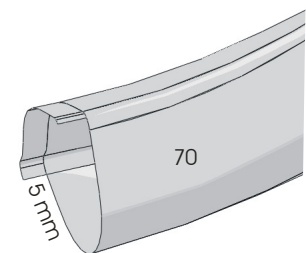
Remove 5 mm from the outer side of the front face of the air ducts (70), leaving a projecting flange which can be glued to the inside of the fuselage. At the rear end of the ducts, where the impeller unit fits, cut back the centre area as far as the shoulder, and cut a circular recess in the connecting walls to clear the rotor hub. This will ensure that the ducted fan unit can be slid into the two air ducts as far as it will go.

Fit the air intake ducts (70) in the fuselage through the main undercarriage support former assembly (60 + 61), and position them flush with the cut-outs in the air intake at the front. Glue the air ducts to the inside of the fuselage by means of the projecting 5 mm flange, and apply glass tape over the joint.

8) Ducted fan unit

Fit the motor bulkhead (68) in the fuselage, and fit the air ducts (70) through it. The air ducts (70) must end flush with the bulkhead (68).

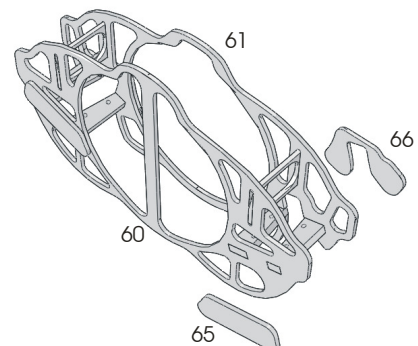
Slide the ducted fan unit into the air ducts (70) as far as it will go, push the GRP ring over the unit until it rests against the motor bulkhead, and tack it lightly to the ducted fan unit using cyano. Mark the retaining screw holes on the motor bulkhead (68). Withdraw the ducted fan unit from the air ducts, and reinforce the joint between the GRP ring and the ducted fan unit. Drill the holes in the motor bulkhead for the fan unit retaining screws, attach the impeller unit to the motor bulkhead (68) and glue the nuts securely to the bulkhead (68).



Glue the motor bulkhead (68) in the fuselage, flush with the end of the air ducts; reinforce the joints with additional rovings. The central connecting walls of the air ducts must now be glued together.

9) Air intake lips

Cut back the edge of the air intake lips (5) on both sides, as shown in the picture; they are supplied already trimmed to the correct width of 10 mm. The intake lips can now be glued to the outside recess in the fuselage (1) and the inside of the air duct (70).



10) Fuselage

Cut 12 pieces of scrap plywood to accept the connecting screws (50), space them out evenly on the inside of the fuselage (1) where it projects beyond the motor bulkhead (68), and glue them in place. Drill pilot-holes for the screws (50) when the glue has set hard. Place the two fuselage sections (1 + 2) together, and fit the connecting screws (50).

Trim the root facing ribs (14) to fit inside the root profile of the wing panels, and shorten them by about 10 mm towards the trailing edge. Trim the half-ribs (15) to the same shape and glue them to the ribs (14).

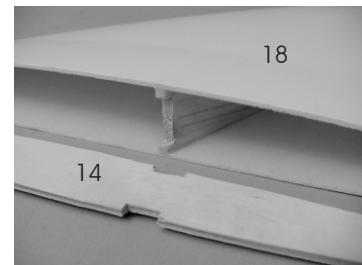
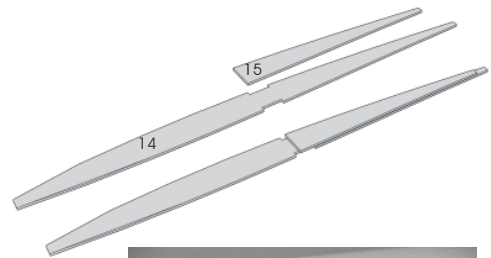
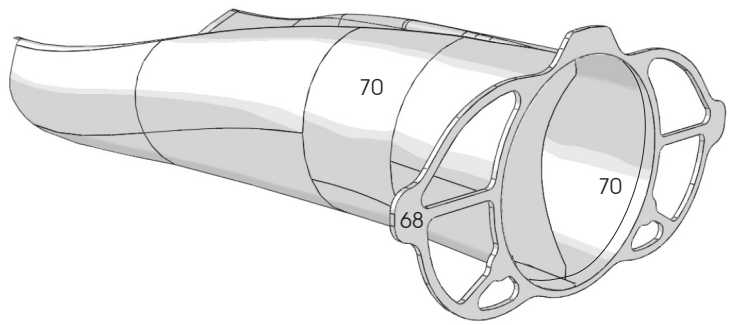
Tape the root facing ribs (14 + 15) to the front and rear fuselage sections (1 + 2) and fit the wing panels to check alignment. Note that the wing spars must be shortened by the thickness of the root facing ribs.

Glue the two root facing ribs (14) to the front fuselage section (1), allow the glue to set hard, then separate the fuselage sections again.

Printed film templates are supplied for locating the holes in the fuselage for the canard support tubes (22); drill the holes at the marked points. Glue the tubes (22) in the canard panels (21), and glue the canards and the tubes to the fuselage; they must be at the neutral angle of incidence dictated by the fuselage moulding; there should be a gap of 1 - 2 mm to the top surface of the profile, as shown in the full-size detail drawing.

Bend the wire bars (69) to shape and glue them to the inside of the main undercarriage wheel doors, ensuring that the doors (75) open when the undercarriage is extended.

The wheel doors are closed by means of a steel cable (A), which is fitted exactly as described for the noseleg unit. The maximum opening of the wheel door can be limited by a second steel cable (B), which is attached to a point on the wheel door in front of the wheel leg (75) and to the opposite side of the undercarriage opening. Finally glue the battery support (73) to the rear of the former (10) inside the fuselage.



11) Fin

Glue the balsa spar (4) in the fin (3). Cut out the opening for the fin spar (4) in the top of the rear fuselage section (2) and glue the fin in place.

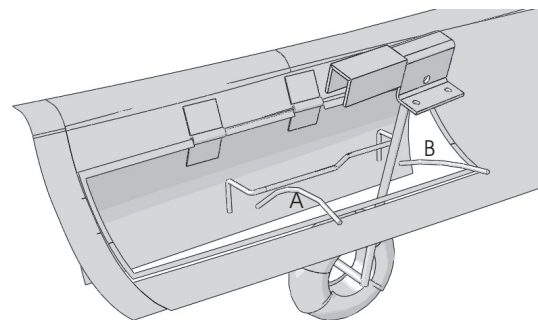
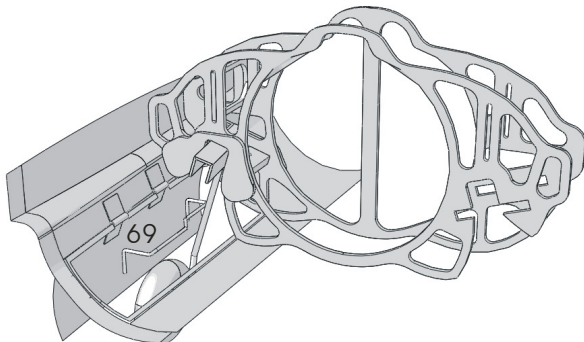
12) Wings

The first step here is to install the aileron servos in the wings (18). Glue each servo to a plywood plate (large oval cut-out from former 10), to act as a reinforcement. Cut slots in the wings for the servo output arms.

Glue the horns (20) to the underside of the ailerons.

The plastic aerial sleeve (76) is routed through the port wing and the rocket pylon (39 + 40), and glued in place. Drill a hole through the root rib (14) and the fuselage (1) so that the sleeve can be run into the fuselage.

Glue together the die-cut parts (39 + 40) to form the rocket pylons. Note that the hard plywood part must be the centre



layer. Glue pieces of scrap balsa (45) in the tip opening of the wings to act as reinforcements, and glue the pylons to them. Run the aerial tube right through the port rocket pylon.

The rockets (41) are made from the balsa dowel supplied. Cut out the tail and nose fins (42 + 43) from the printed film, cut slits in the balsa and glue them in place.

The wings can now be glued to the front fuselage section (1) and the root facing ribs (14 + 15). Apply two layers of 80 g glass cloth and resin to the joint area between the wing panels and the front fuselage section (1). Apply filler to the joint lines very carefully; these areas should not be sanded to avoid damaging the structural cloth.

13) Cockpit + canopy

Cut out the canopy frame (24) and the cockpit insert (25), and glue the insert to the underside of the frame. The pilot's seat (26) consists of two parts which have to be cut out and glued together; add a piece of scrap wood to complete the backrest. The cockpit insert (25) will need to be cut away under the seat to clear the nosewheel. Glue the seat in place, fit the (optional) pilot figure and glue him to the seat.

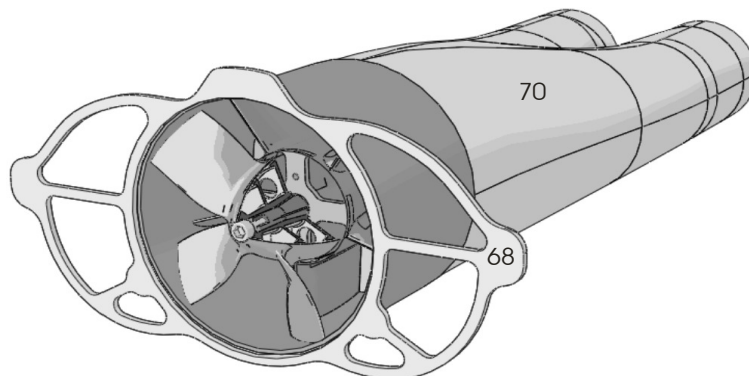
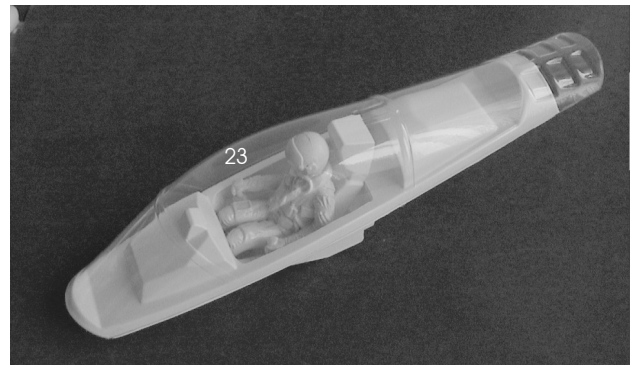
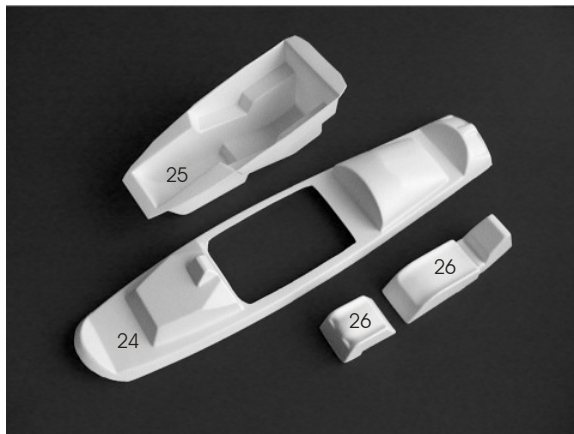
The canopy frame (24) is retained in the front of the fuselage (1) by the beech dowel (27). Glue two pieces of 3 mm scrap wood together and trim them to fit in the front of the canopy frame. Drill a hole through the wooden parts and the fuselage to accept the dowel (27). Glue the dowel to the wood block, then glue the dowel assembly to the canopy frame.

Cut out the canopy moulding (23), trial-fit the canopy latch (28) and glue it in place. Drill a hole in the fuselage to accept the canopy latch pin.

Glue the canopy (23) to the canopy frame (24).

14) Jet efflux

Screw the ducted fan unit to the motor bulkhead (68), and tape the efflux (71) to the rear of the unit before attaching the rear fuselage section (2).



Parts List		No. off		
1.	Front fuselage section	1	GRP	Ready made
2.	Rear fuselage section	1	GRP	Ready made
3.	Fin	1	GRP / Styrofoam	Ready made
4.	Fin spar	1	Balsa	Oversize, 9 x 9 x 160 mm
5.	Air duct intake lip	2	GRP, left + right	Ready made
6.	No part			
7.	No part			
8.	No part			
9.	No part			
10.	Former	1	Plywood	Die-cut, [4]
11.	Extension, former 10	1	Balsa	Strip, 4 x 4 x 55 mm
12.	No part			
13.	No part			
14.	Wing root facing rib	2	Balsa	Die-cut, [2]
15.	Root facing rib reinforcement	2	Balsa	Die-cut, [2]
16.	No part			
17.	No part			
18.	Wing panel	2	GRP, left + right	Ready made
19.	No part			
20.	Aileron horn	2	GRP	Machined parts
21.	Canard panel	2	GRP	Ready made
22.	Canard support tube	2	CFRP tube	6 Ø x 50 mm
23.	Canopy	1	ABS	Ready made
24.	Canopy frame	1	Plastic	Ready made
25.	Cockpit	1	Plastic	Ready made
26.	Pilot's seat, 2-part	1	Plastic	Ready made
27.	Dowel	1	Beech dowel	5 Ø x 25 mm
28.	Canopy latch	1	Metal	Ready made, 7329/00
29.	No part			
30.	No part			
31.	No part			
32.	No part			
33.	No part			
34.	No part			
35.	No part			
36.	No part			
37.	No part			
38.	No part			
39.	Rocket pylon	2	Plywood	Die-cut, [4]
40.	Rocket pylon	4	Balsa	Die-cut, [2]
41.	Rocket	2	Balsa	Dowel, 10 Ø x 280 mm
42.	Rocket tail fin	8	Film	Printed
43.	Rocket nose fin	16	Film	Printed
44.	No part			
45.	Reinforcement	2	Balsa	Make from scrap
46.	Decal sheet	1	Printed film	Water-slide transfers
47.	Woven tape	8	Glass cloth	30 x 500 mm
48.	M2 clevis + nut	2	Metal	Ready made, 7489/01 + 7774/01
49.	Threaded rod	2	Metal	Ready made, 7488/04
50.	Self-tapping screw	12	Metal	2.2 x 6.5 mm, 7768/21
51.	Screw	8	Metal	M3 x 10 mm, 7775/10
52.	Self-locking nut	8	Metal	M3, 7766/23
53.	No part			
54.	Main noseleg former	1	Plywood	Machined part
55.	Rear noseleg former	1	Plywood	Machined part
56.	Longitudinal member, noseleg	2	Plywood	Machined part
57.	Retract unit mount	2	Plywood	Machined part
58.	Reinforcement	2	Plywood	Machined part
59.	Wheel door hinge	6	Nylon	Order No. 7495/00
60.	Front main undercarriage former	1	Plywood	Machined part
61.	Rear main undercarriage former	1	Plywood	Machined part
62.	Outer retract bearer plate	4	Plywood	Machined part
63.	Inner retract bearer plate	4	Plywood	Machined part
64.	Former connecting piece	2	Plywood	Machined part
65.	Front former reinforcement	2	Plywood	Machined part
66.	Rear former reinforcement	2	Plywood	Machined part
67.	Steering cable guide tube	2	Aluminium tube	2 Ø x 100 mm
68.	Motor bulkhead	1	Plywood	Machined part

69.	Wire bar, wheel door actuator	2	Steel rod	1.2 Ø x 120 mm
70.	Air duct	2	GRP, left + right	Ready made
71.	Jet efflux (bifurcated tube)	1	GRP	Ready made
72.	Servo plate	1	Plywood	3 x 40 x 77 mm
73.	Battery support	1	Plywood	3 x 50 x 150 mm
74.	Noseleg	1	Steel	3.5 mm Ø, ready made
75.	Main undercarriage leg	2	Steel, left + right	4.0 mm Ø, ready made
76.	Aerial sleeve	1	Plastic	500 mm, Order No. 7498/01
77.	Nosewheel	1	Plastic	50 / 3.5 mm Ø
78.	Nosewheel collet	1	Metal	5 / 3.5 mm Ø
79.	Main wheel	2	Plastic	63 / 4 mm Ø, Nr. 7351/51
80.	Main undercarriage collet	2	Metal	5 / 4 mm Ø, Order No. 5842/40

A-D Included in retracts set

Operating instructions - Rafale

Installing the receiving system

The Rafale requires a minimum of three control functions: elevons (mixed aileron / elevator), speed controller and retractable undercarriage. It is also possible to fit an extra servo for the rudder, if you wish. The servo plate for the retract system servo and valve should be glued in the fuselage adjacent to the noseleg unit. The air reservoir is housed in the extreme fuselage nose.

If the model is to fly satisfactorily it is very important to set the control surface travels to the correct values.

The elevons should be set with a slight "up" offset at neutral, so that the rear of the trailing edge is flush with the wing root fairing on the fuselage; this gives the wing a slight reflex section.

On no account set excessive elevon travel for the first few flights, as this will make the model uncomfortably responsive around the roll axis. A travel of 5 - 6 mm up and down - measured at the root trailing edge - is quite sufficient.

If you fit a working rudder, the travel should be 10 mm either side of neutral.

Test-flying

Ducted-fan model aircraft are no more difficult to fly than conventional propeller-driven models. The power plant, concealed inside the fuselage, actually has a number of attractive advantages to offer. For example, a ducted fan is virtually torque-free (in contrast to a propeller system), has practically no influence on the machine's movements around the longitudinal (roll) axis, and generates absolutely no turbulence in the area around the fuselage. This is countered to some extent by the lack of control surface response when the model is launched. This means that the Rafale should never be hand-launched. The first flight should be carried out with slight up-trim.

Usually the Rafale will lift off after a ground-roll of just a few metres, and will make a smooth transition to a straight climb - provided that the Centre of Gravity is correct (it does no harm to offset it a few millimetres forward of the stated point for the first flight) and that the trim is correct. The angle of climb is determined largely by the thrust of the power system. We strongly recommend that you don't over-tax the power system's climb capacity over the first few metres of the flight - i.e. keep it straight and shallow - as ducted fans only achieve good efficiency when the aircraft is flying fast. Don't adjust the trims until you have brought the model up to a safe altitude by flying long straight passes and broad turns.

It is entirely normal for impeller-driven jets to build up to full flying speed relatively slowly, i.e. not until they are allowed to fly a long pass straight and level, followed by a reversal. Once the aeroplane has gained high speed, you should make every attempt to maintain it as far as possible. The secret of smooth, realistic jet flight is a fluent, wide-ranging flying style without slowing the model unnecessarily. This also helps to maximise flight times.

Of course, the Rafale is perfectly capable of straightforward aerobatic manoeuvres such as rolls and loops. If your selected motor provides relatively marginal power, you will need to build up plenty of speed beforehand.

When it comes to landing, we recommend that you fly a broad approach and keep the airspeed fairly high. For the first flight it does no harm to keep some "spare" energy in the flight battery so that you can go round again if necessary. However, do bear in mind that the ability of a ducted-fan model to accelerate from low speed, i.e. just before touch-down, is distinctly limited!

And please take care: when the model has landed, do not switch the motor on again until you have checked that there are no foreign bodies in the air intake!

All of us at "aero-naut" Modellbau hope you have many hours of pleasure flying this superb and beautiful model.

