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AIRCRAFT CIRCULARS

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

No. 144

THE "I.A.R." PURSUIT AIRPLANE (ROUMANIAN)

A One-Place Cantilever Low-Wing Monoplane

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THE "I.A.R." PURSUIT AIRPLANE (ROUMANIAN)*

A One-Place Cantilever Low-Wing Monoplane

By André Frachet

The remarkable performances of the Roumanian pursuit plane "I.A.R.," equipped with a 600 hp Lorraine "Courlis" engine, has aroused a general curiosity. Its performances put it among the best pursuit planes equipped with a compressorless engine.

The monoplane "I.A.R." was constructed in the Roumanian factories at Braşov under the direction of E. Carafoli and L. Virmoux, with the collaboration of the engineers Grossu, Urziceanu, Barbieri, Timochenco, Tchiobano and Cochéréano, as also of the French firms, Lorraine, Moulet and Lamblin.

The "I.A.R." has undergone static tests as severe as those required in France. These tests yielded high load factors for the three classic flight cases. The index 14.5 was obtained in the foremost position of the center of pressure; the index 11 for flight at maximum speed and 4.5 for the vertical dive. The latter coefficient corresponds to a diving speed of 600 km (373 miles) per hour. The strength of the airplane has thus been thoroughly established. Moreover, its pilot, Captain Illiescu, has put it through the whole gamut of acrobatic stunts. It responded perfectly to the controls in all positions and readily resumed normal flight at the end of each stunt.

The excellent centering of this airplane, the choice of its airfoils and the good aerodynamic conception of the whole assure very fine qualities of flight. Its fuselage closely resembles that of the Couzinet monoplane. This shape lessens the drag and increases the efficiency of the controls.

The "I.A.R." has a low cantilever wing with an aspect ratio of 6.7 (Figs. 1, 2, 3, 4 & 5). It is divided into three parts for convenience in transportation. The central part is integral with the fuselage. The tapering outer parts are joined to the central part by steel fittings and bolts. The wing profile varies along the span, having a relative thickness of 20% at the root and 10% at the tip.

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*From Les Ailes, March 5, 1931.

The unbalanced ailerons are long and narrow and extend to within a short distance of the wing tips (Fig. 1). Each one has an area of 0.825 m^2 (8.88 sq.ft.). They are operated by tubes and levers, each aileron having two horns. The wing structure (Fig. 7) consists of two duralumin box spars in the form of girders of uniform strength for the lateral sections. They are connected by two strong tubular crosspieces themselves braced by diagonal wires. The ribs, of spruce and plywood, have the form of lattice girders. Their leading edges are joined by an edge piece and covered with plywood. Their trailing edges are joined by a strip to which the ailerons are hinged. The surfaces are covered with strong doped fabric.

The fuselage (Fig. 6) is made almost entirely of native spruce and plywood back of the spacious cockpit. It consists of four spruce longerons with uprights and diagonals forming a lattice girder. The joints are secured by duralumin gussets attached to the wooden members by tubular rivets (Fig. 9). Torsional rigidity is afforded by two strong bulkheads in addition to the duralumin frame which supports the engine bearer. The fuselage is shaped by means of light intermediate frames, of duralumin in front and of spruce and plywood back of the cockpit, which is situated just aft of the rear wing spar. It is equipped with two Vickers machine guns firing through the propeller and can carry 700 cartridges. The sighting is done with an O.P.L. collimator.

The horizontal empennage (Figs. 1, 3 & 8) of 2.2 m^2 (23.7 sq.ft.), consists of a stabilizer and a two-part unbalanced elevator. The vertical empennage includes a fin which is joined by a fairing to the headrest of the pilot and integral with the fuselage (Figs. 3 & 4). This is followed by a rudder of 0.6 m^2 (6.46 sq.ft.). The rudder and elevator are both mounted on ball bearings. The tail surfaces are all made of spruce. The cantilever stabilizer has two spars with strong internal bracing (Fig. 8).

The "I.A.R." is equipped with a "Courlis" 48-5 Lorraine engine having a rated horsepower of 600 at 2000 r.p.m. It has 12 cylinders in W with a 145 mm (5.71 in.) bore and a 160 mm (6.3 in.) stroke. It has water cooling with a power equivalent of 660 hp. It operates, by direct drive, a two-bladed propeller of native beech adapted for use at 5000 m (16400 ft.) at normal engine speed. The duralumin engine bearer is attached at four points, by steel fittings, to the front metal bulkhead of the fuselage (Fig. 6).

The dumpable fuel tank is located in the center of gravity of the airplane so that the trim of the latter will not be af-

fected during flight. It forms the lower part of the fuselage and is extended into the wing. Due to its position, its capacity can be varied according to the desired range of the airplane. The oil tank is placed behind the engine, the oil being circulated by pumps. The oil is cooled by a Lamblin radiator. The water is likewise cooled by a Lamblin radiator mounted under the fuselage behind the fuel tank. The opening and closing of the fuel and oil pipes are synchronized. For the prevention of fire there is a fire wall and an automatic fire extinguisher and the fuel tank can be dumped.

The landing gear has independent wheels with a track of about 1.9 m (6.23 ft.). Each half consists of a vertical strut with inclosed sandow shock absorbers, a bent steel axle and a duralumin counterstrut (Fig. 5). These pieces are hinged to the spars of the central wing section. The oak skid can turn about a vertical axis so as to facilitate maneuvers on the ground. It is elastically attached to the fuselage by sandow loops.

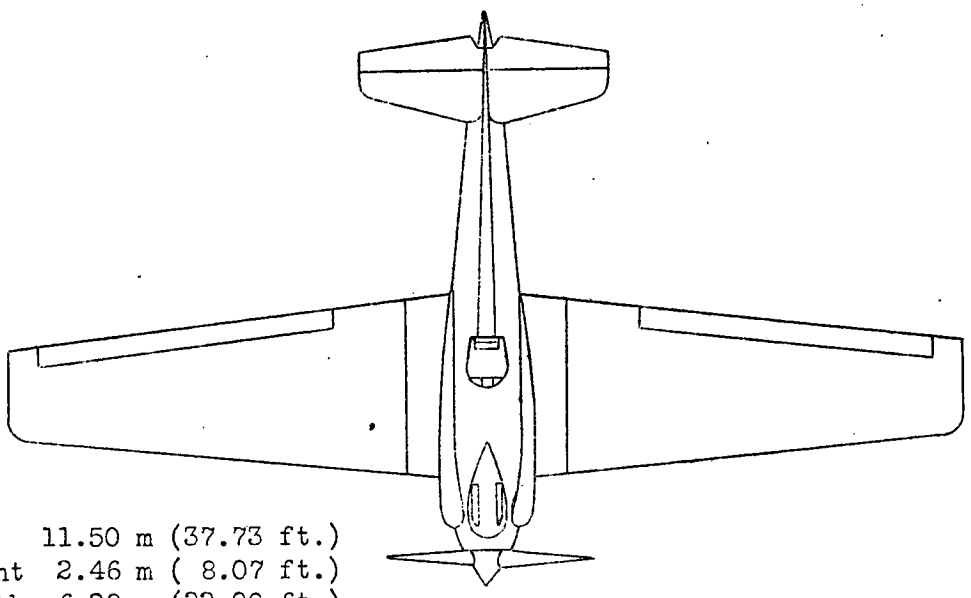
Characteristics

Span	11.5 m	37.73 ft.
Max. chord	2.25 "	7.38 "
Min. chord	1.125 "	3.69 "
Length	6.98 "	22.90 "
Height	2.46 "	8.07 "
Wing area	19.8 m^2	213.13 sq.ft.
Power	1 Lorraine "Courlis" engine of 600 hp	
Weight empty	1100 kg	2425.09 lb.
Fuel	230 "	507.06 "
Useful load	180 "	396.83 "
Total load	1510 "	3328.98 "
Wing loading	83 kg/m^2	17 lb./sq.ft.
Power loading	252 kg/hp	548 lb./hp
Power per unit area	30 hp/m^2	2.815 hp/sq.ft.

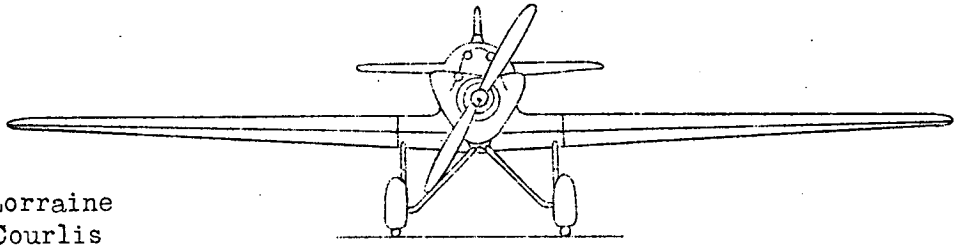
Official Performances

Max. speed near ground	325 km/h	202 mi./hr.
Speed at 4000 m (13120 ft.)	312 "	193.9 "
Speed at 5000 m (16400 ")	302 "	187.7 "
Climb to 5000 m (16400 ")		8 min. 30 sec.
Ceiling about	9000 m	29527 ft.

Translation by Dwight M. Miner,
National Advisory Committee
for Aeronautics.



Span 11.50 m (37.73 ft.)
Height 2.46 m (8.07 ft.)
Length 6.98 m (22.90 ft.)
Wing area 19.8 m^2 (213.13 sq.ft.)



1 Lorraine Courlis 600 hp engine.

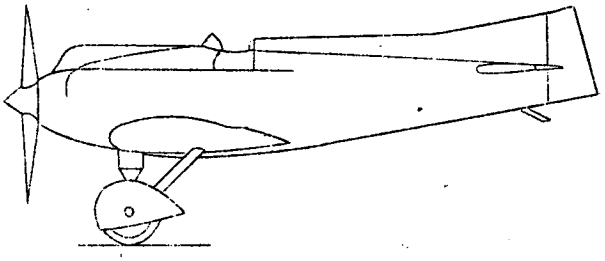


Fig.1 General arrangement drawings of the Roumanian pursuit I.A.R. airplane.

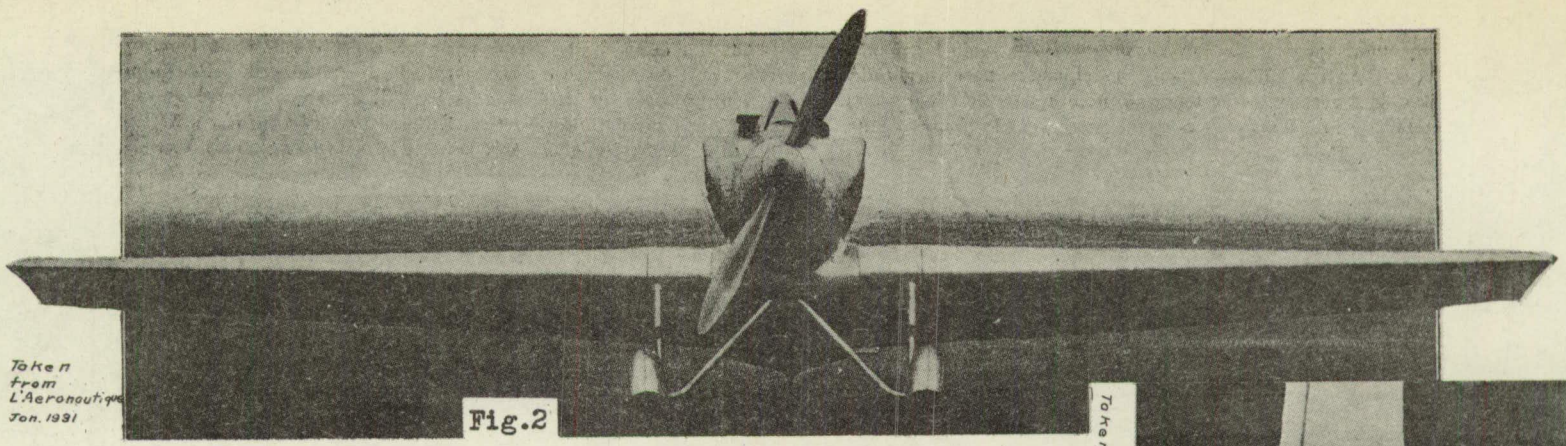
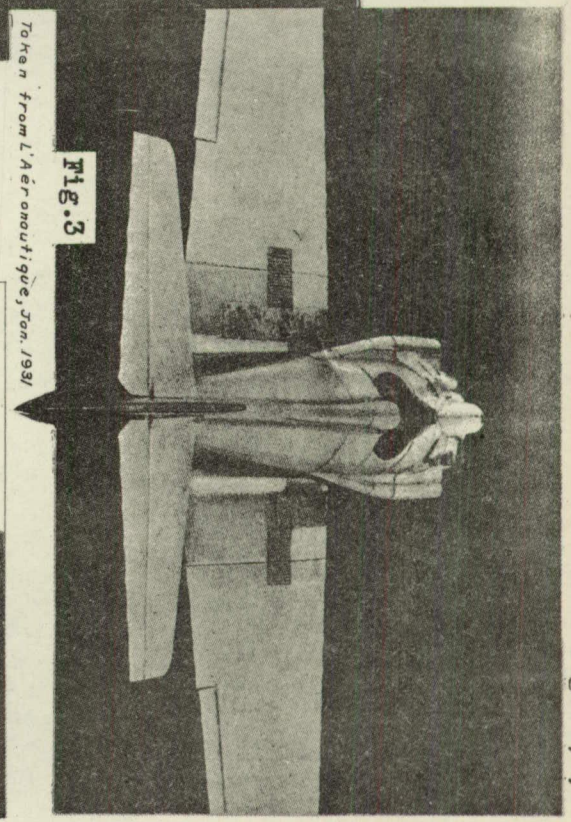


Fig.2

Figs.2,3,4 Roumanian pursuit plane "I.A.R."



Taken from L'Aéronautique, Jan. 1931

Fig.3

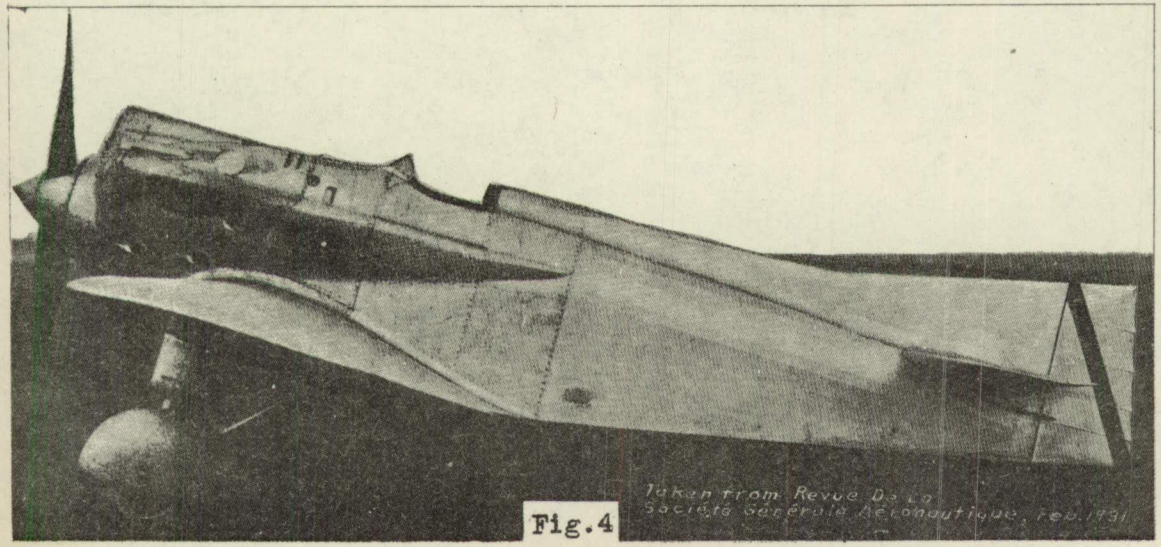


Fig.4

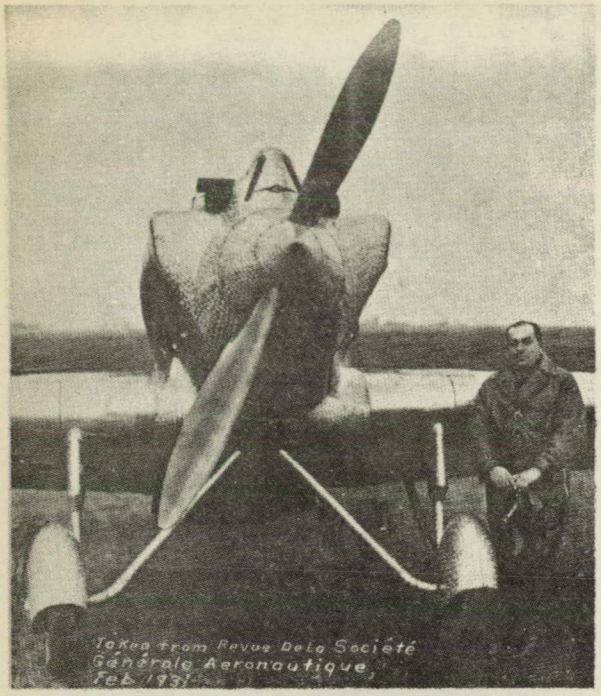


Fig.5 I.A.R. landing gear.

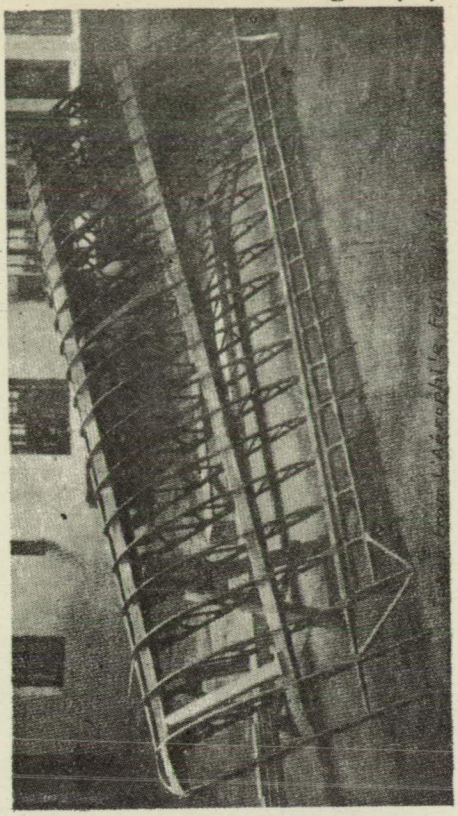


Fig.7 Half wing, duralumi num box spar with internal bracing wires.

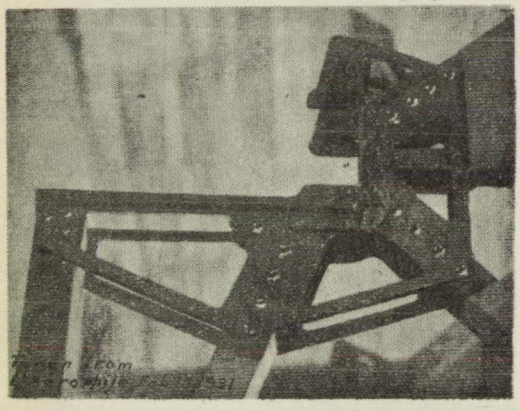


Fig.9 Fitting of fuselage and rear longeron, (assembled). Note the tubular rivets.

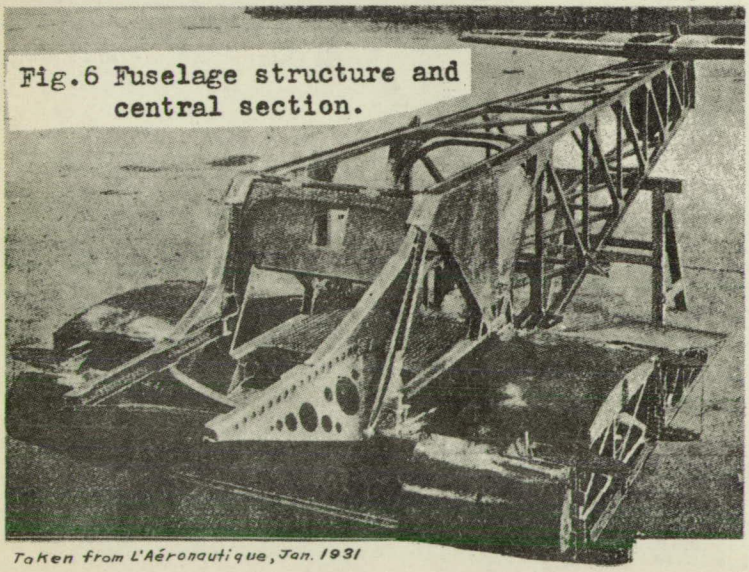
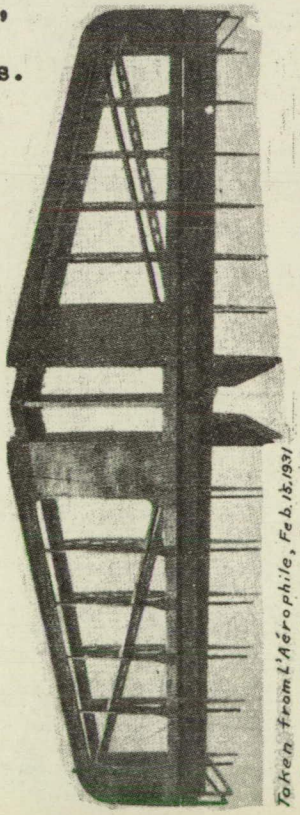


Fig.6 Fuselage structure and central section.

Taken from L'Aéronautique, Jan. 1931



Taken from L'Aérophile, Feb. 15, 1931

Fig.8 Horizontal tail surfaces in Roumanian spruce. Note box edges for supporting stresses of covering. Controls in ball bearings.