USER'S MANUAL

Couzinet ARC71 "Arc-en-Ciel" for MSFS.

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Engine sounds by Jean-Michel RENAUX, Restauravia.
Flight controlers by Gilles FAULMEYER, Restauravia.
Bibliography and drawings from "Le Nouveau Souffle de l'Arc-En-Ciel" association.
Adaptation for MSFS by Jean LACANTE (D5turbi), Restauravia

SUMARY

1/ **Général informations:**

Presentation:

The Couzinet ARC71 "Arc-en-Ciel" is a French trimotor airplane from 1930 era, comming from several evolutions of the Couzinet 70, the very first having crossed the South Atlantic ocean in both directions in 1932, manned by the known French pilot Jean MERMOZ.

This kind of aircraft, conceived by the engineer René COUZINET as soon as 1928, had been realised for the long postal flights towards South America by the "Société Industrielle des Avions René Couzinet", and insured the line for 8 crossflights between France, Africa, Brasil, ang Argentina till 1934.
It was kind of a prototype intended to prove that it was possible to operate the line from airport-to-airport by plane, in competition against seaplanes.

Industrial life and financial difficulties of the Couzinet Company have finally led to disappearance of the ARC71, that prototype beeing at last sold at auction then destroyed in1942.

Bibliography:

There are few existing documentation and photos on the InternetI about this airplane, but thanks to the patient work of M. Claude FAIX and also from " Le Nouveau Souffle de l'Arc-En-Ciel" association, I have been able to modelise an aproximative model of the l'ARC 71, which I adapted to simulator XP12 for a single pilot (The real plane needed at least 3 people for beeing operated).
Lot of questions about functionning and flight model of the plane are still pending, but if by any chance i get complementary informations i'll try to implement model improvements.

If you wish to better discover this very special aircraft, you can consult teh following documents and sites:

-https://www.hydroretro.net/etudegh/arc-en-ciel_atlantique_vol1.pdf
-https://www.hydroretro.net/etudegh/arc-en-ciel_atlantique_vol2.pdf
-http://nvsouffle-aec.asso.fr/crbst_2.html
-https://alain-vassel.pagesperso-orange.fr/arc.htm
-https://youtu.be/QTOis9qY5ek
-https://youtu.be/xQ7c5b2Fc3A

I wish you good flights with this ARC71, conceived from the dreams of two pioneers of modern aviation, that alas no one believed in.

General charactéristics:

Aircraft fitted with 3 athmospheric Hispano-Suiza 650 Nb engines, 12 V cylinders, 36 liters, 650 Hp each.
Length 20.18 meters .
Wingspan 30 meters.
Wheight max about 15 tons, including 5 tons of fuel.
Max speed 280 Km/h, cruise 236 Km/h.
Ceiling 4000 metres at max wheight.
Wing area 90 m².
Classic fixed landing gear with shock absorbers.

2/ Installation:

- Paste the whole "ARC71_Arc-en-Ciel" directory in your MSFS "Community-Addons" library

3/ available functions :

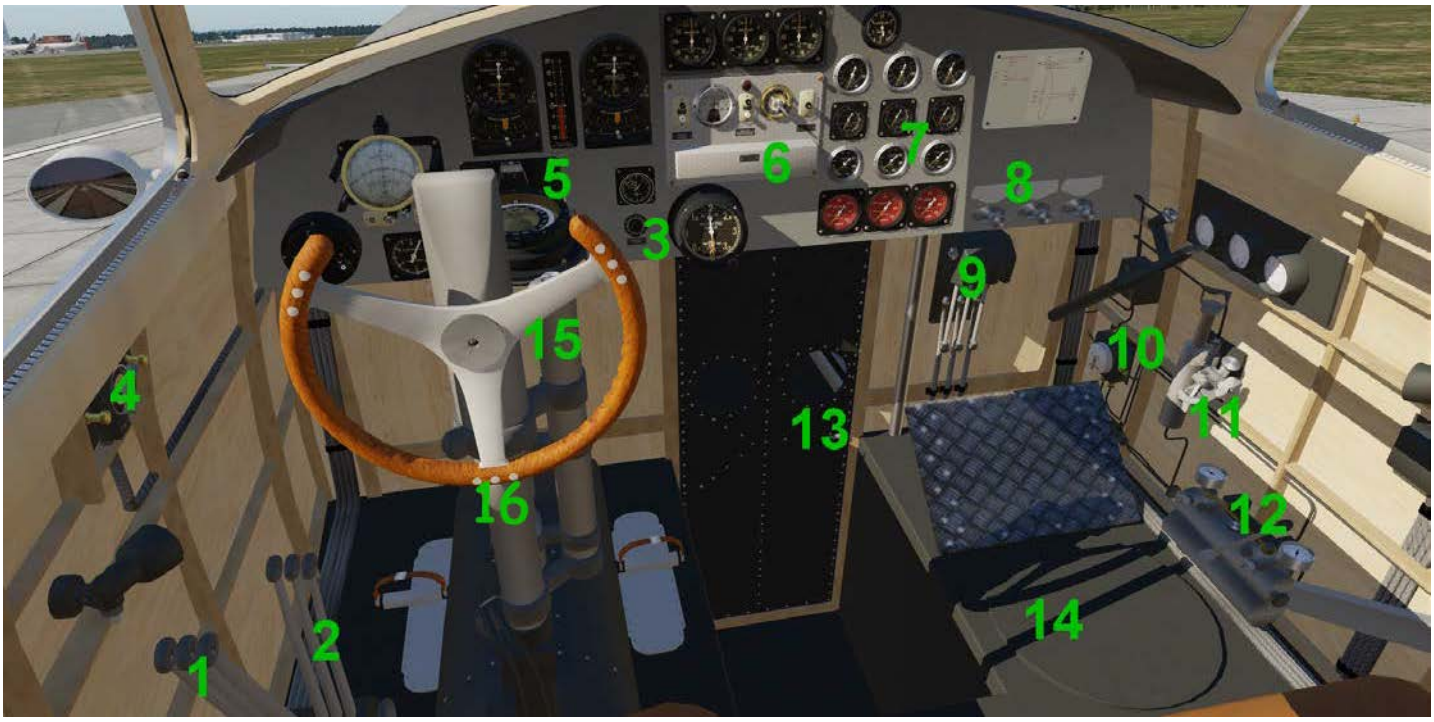
This model includes all classic MSFS accepted animations:

-control surfaces, yoke and pedals,
-buttons and switches,
-engine controls,
-MSFS lighting,
-doors and glasses openning,
etc...

Most of handles and controls fucntions are animated, and explained by the images attached to the texts of this manual.
The functions of each button or command are displayed by the MSFS tooltips

Because of this aircraft complexity and due to the lack of detailled documentation (and also due to my limited knowledge!!!), it was not possible to modelise all embedded systems from the actual plane.
Commands indicated in green color on joined pictures are active in the simulator. Those marked with a red cross are inop.

Virtual Cockpit:



1 – Engine throttles levers
2 – Fuel mixture and cutoff levers
3 – Instrument lights left and right
4 – Landing lights switch
5 – Flight instruments
6 – Electrical panel
7 – Engines Instruments
8 – Fire alarms and extinguishers
9 – Engines oil levers
10 – Engine start selector
11 – Fuel injection pump
12 – Engine air start pump
13 – Fore canin opener
14 – Side engines manhole (inoperative in MSFS)
15 – Pneumatic wheel brake
16 – Display/Removal yoke

Passengers cabine and radiotelegraphist workplace:

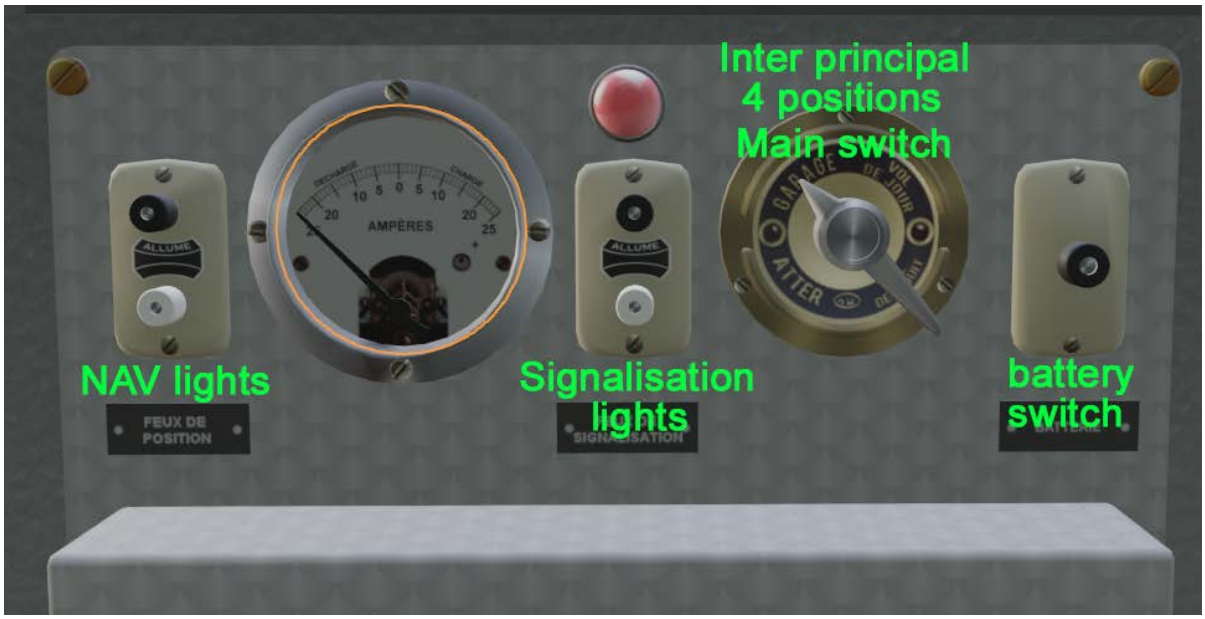
Aft luggage room and lavatory:

4/ Using the plane:

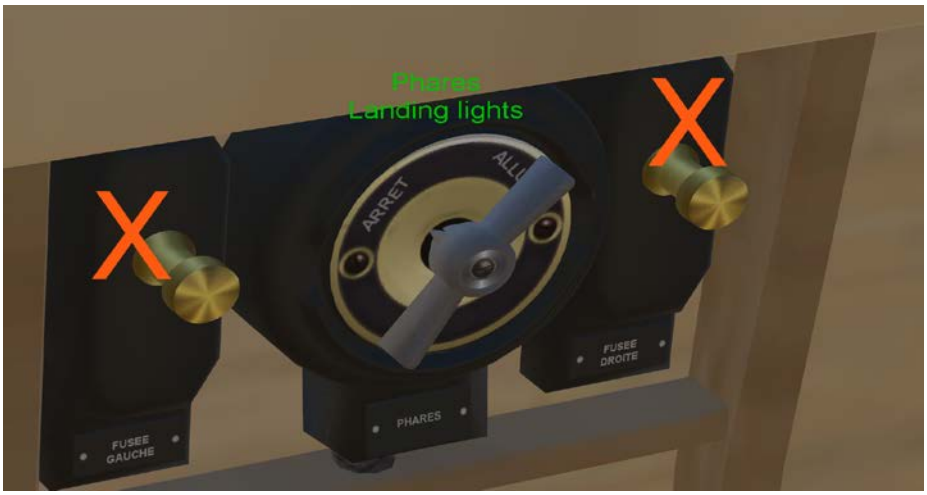
When launching the ARC71 in MSFS, the device is powered off (cold and dark) if it is in the hangar.
The **electrical power on** is done by means of the 4 position switch located on the electrical panel (6), at the center of the dashboard (see hereunder picture).

-position "GARAGE", out of power.
-position "Vol de jour", batteriy and generators connected. All lights are allowed.
-position "Vol de nuit", cockpit and cabin lights are actives. Nav lights are allowed.
-position "ATTER" (=Atterrissage), landing lights are allowed.

Nav lights and signal lights are commanded by two separate switches located on the electrical panel.



Landing lights are actuated by a switch near pilot's left hand.



Doors and windows opening :
Cockpit windows opening is done by click on the slides latches .
The cabin windows can be opened in the same way.
Inside doors are opened/closed by click on the relevant handles.
Good visit onboard!

Dashboard:

1- Magnétos switches
2- Gyroclinometre
3- Wheels brake pressure
4- "Morel" Compass
5- "Aera" flight controler
6- "Aera" landing controler
7- Clinometre
8- Watch
9- Cockpit lights rheostat
10- Altimeter
11- Engine RPM indicators
12- Cooling water thermometers
13- Engines oil pressure
14- Engines oil temperature
15- Fuel pressure
16- Engine fire alarms
17- Fire extinguishers handles
18- Total fuel indicator (fictional on this model)

Engines controls:

Attention!:
On this model, engines startup is not in conformity with the real plane!
Starting the engines was performed by 3 persons both from the pilot's place and from the mechanical engineer fore room. The starting device was VIET type with compressed air completed with manual fuel injection and manual starting magneto. Moste of those devices were located in the fore machanical room.

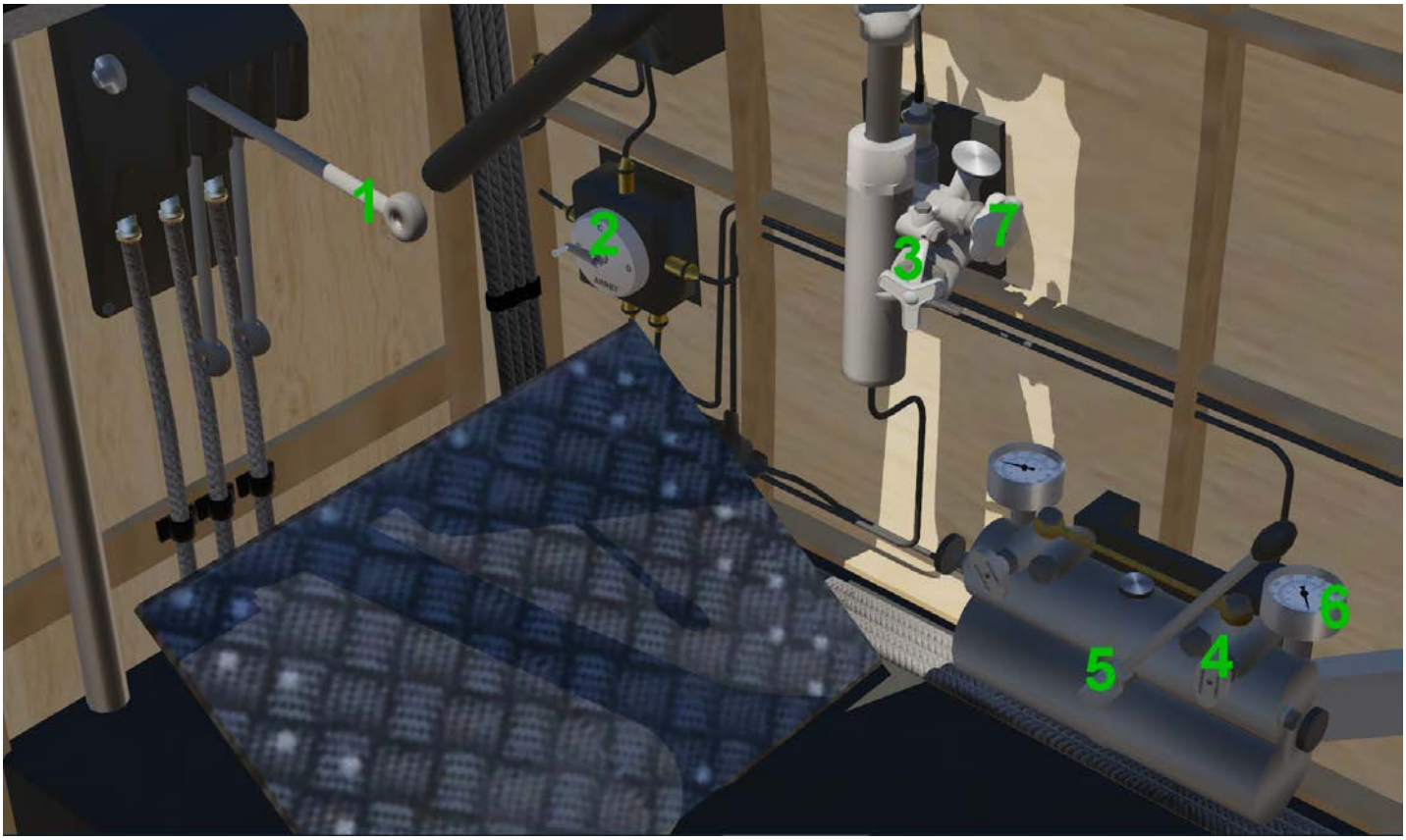
In order to simplify the use of this model by one single operator, starting controls have been grouped in the virtual cockpit.

Two starting modes:

A/ Simplified startup:
-Selected engine magneto on 1+2,
-open the relevant fuel control lever (levers 2 page 5) fully forward,
-type in CTRL+E+1 (or 2, or3),
-check engine indicators.

B/ Compressed air startup (refer to figure page 5):

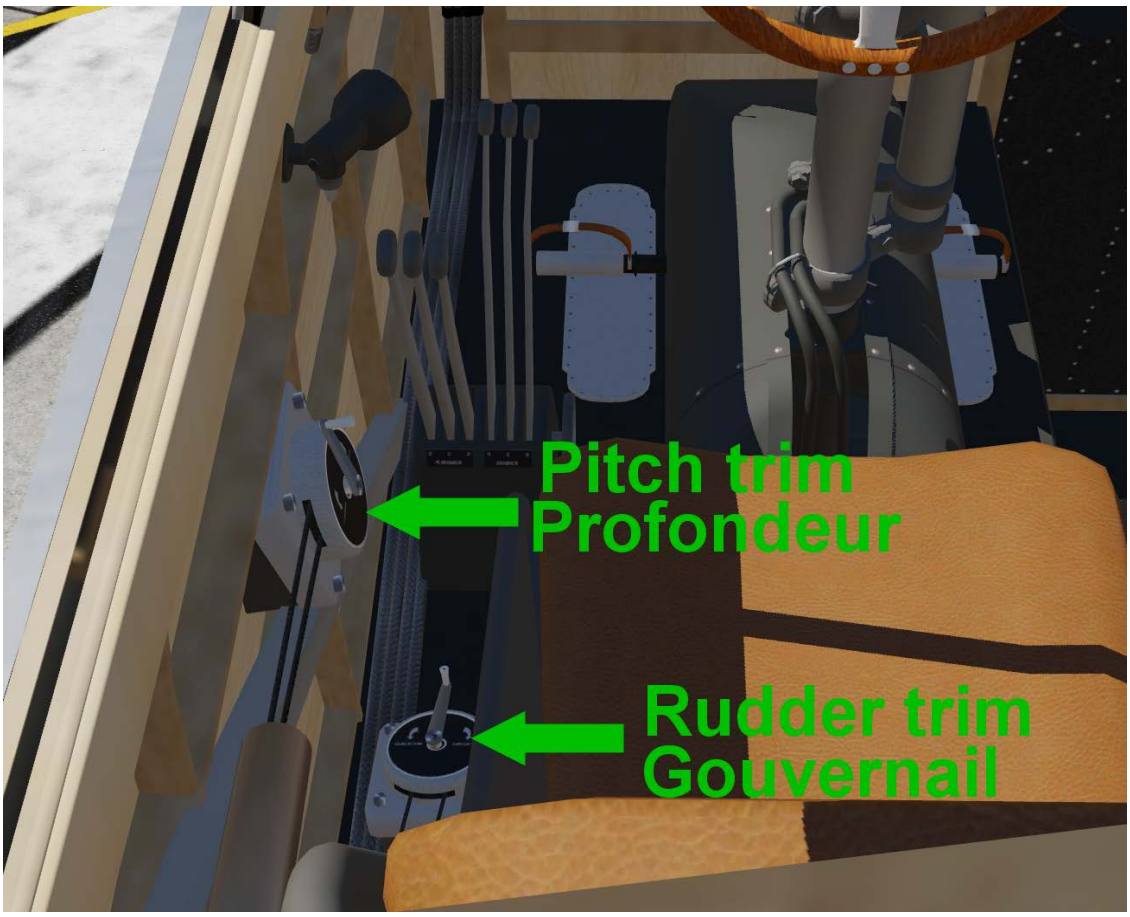
-Selected engine magneto on 1+2,
-Open the oil coolant lever 1 of the selected engine,
-Open the relevant fuel control lever (levers 2) fully forward,
-Select the engine to start on 3 way valve 2,
-Set the injection selector 3 on "démarrage",
-Open the compressor valve 4,
-activate the manual air pump 5 on the VIET device until at least 8 bars are reached on the manometer 6 (6 mouse clicks),
-Activate the injection valve 7 till engine starts,
-Check engine parameters on the instruments.



C/ Engines stop:

-cutoff fuel by pulling the mixture lever 2 fully backwards,
-Set the magneto selected on 0.
-In case of an emergency, it is possible to stop all three engines together by pulling the red button located on the magneto box.

Flight controls and instruments:



-The gyro-clinometer is a gyroscopic instruments that indicates the plane position in the air by means of a luminous dot projected on a white graduated screen .
In this model, it is not fully functionnal for the big roll angles. It displays a moving red dot when the electrical power is on.

-The clinometer is fitted with a glass tube filled with a coloured liquid. It displays the pitch position of the aircraft.

-Most dials from instruments are lit by night thanks to the letters fluorescence, except the Morel Compass, which is lit by an internel lamp.

-This aircraft is equipped with two "flight controlers": one for high speed when cruising, another dedicated to landing operations at slow speeds.

-Each "flight controler" has a slip-ball and a roll indicator needle that could be caged by means of a button in front face in case of strong roll movements.

-Morel compass indications are legible from the pilot's seat thanks to a prismatic device.

Miscellaneous:

Messier pneumatic brakes command button is located on the metallic wheel column at right hand .

In case of an engine fire, the relevant alarm flap opens and shows "FEU". The associated fire extinguisher lever can then be avtivated to stop the fire.

5/ Check list:	
Before start:	
-Park brake	Tight (low)
-Main switch	Day, or night (as needed)
-Red signal light	On
-Amperemeter	Discharge
-Cockpit lighting	As needed
-Total fuel	Check
-Position lights	As needed
-Signal light	Off
-Gyroclinometer	Red dot OK
-Chrono Watch	Set
-Mixture levers	Minimum
-Throttle levers	Minimum
-Oil coolant levers	Shut (down)
-Start selector	ARRET (off)
-Injection selector	Aspirer, then injection

Startup:	
-Signal light	ALLUMEZ (on)
-Mixture levers	Open, maximum
-Magnétos	1+2
-Oil coolant lever	Open (high)
-Start selector	On selected engine (1, 2, or 3)
-Injection selector	Injection then Demarrage
-VIET compressor valve	Shut
-VIET pump lever	Activate till 8 bars min on manometer VIET
-Injection valve	Open until complete engine starting
-Check tachymeter	600 RPM
-Oil pressure	Check pressure rise
-Engine instruments	Check normal temps and pressure
-Amperemeter	Charge

After startup:	
-Start selector	ARRET (0)
-Position lights	As needed
-Flight instruments	Check
-Altimeter	Set
-Engine parameters	Check (Pressures and temps).
-Magnetos	Test at 1000 RPM, Mag1 then Mag2, loss inferior to 100 RPM

Taxiing:	
-Park brake	Release
-Throttles	~800 RPM

Take off:	
-Trims	Neutral
-Park brake	Release
-Throttles	Maximum
-Take off	about 150 Km/h
After Take off:	
-Throttles	2000 RPM
-Climb	160 Km/h, clinometer 10 to 15 degrees
-Trims	Set for climbing
Cruise:	
-Throttles	1800 RPM
-Instruments	Check
-Attitude	Maintain
-Trims	Set
-Mixture levers	Reduce as needed

Descent:	
-Throttles	1000 RPM
-Instruments	Check
-Trims	Descent (piquer)

Approach:	
-Throttles	1300 RPM
-Trims	Neutral
Landing:	
-Throttles	1500 RPM
-Braking	Soft, without lock

6/ Références techniques:

Masse à vide/Empty wheight Combustible (fuel) 9400 litres Maximum (5 réservoirs dans chaque aile plus un réservoir central) Fuel capacity Masse maximum	**7310 Kg** **5200Kg** **14400 Kg**
Motorisation**:** 3 Moteurs athmosphériques	**Hipano-Suiza 650 Nb de 650 CV à 2000 RPM**
Surface Voilure **/** wing area	**90 m²**

V_{NE} - Vitesse à ne jamais dépasser	**320 Km/h**
VNO - Vitesse maximale de croisière autorisée par la structure	**280 Km/h**
Vitesse d'évolution à charge max.	**236 Km/h**
VSO - Vitesse de décrochage en configuration d'atterrissage	**100 Km/h**
VX - Vitesse d'angle de montée optimale (au niveau de la mer) Best climb angle speed	**150 Km/h**
Configuration atterrissage **/** landing configuration	**130 Km/h,**
Consommation moyenne **/** average consumption	**400 litres par heure**
Distance max franchissable sans vent **/** Max range	**6500 Km**
Plafond opérationnel (3 moteurs) **/** operating ceiling	**4150 m**
Roulement au décollage **/** take off distance	**870 m**

7/ Limitations:

This model as been adapted for use with MSFS and Windows 11. Not tested in any other condition.

The simulated plane includes some part of "invention" that I implemented due to the lack of precise documentation relative to certain aspects. But the goal is mainly to make this aircraft known, and to put in evidence 1930s aviation pioneers.

8/ Credits:
Thanks to:

-Jean-Michel RENAUX for the Engine sound.
-Gilles FAULMEYER for the flight controlers.
-Claude FAIX for his so nice documented texts about this aircraft,
-Claude LEFRANC and "Le Nouveau Souffle de l'ARC-en Ciel" association, for the precious informations they gave me. I wish success and long life to this association which has projected to reproduce an ARC71 in real size!
-Thanks to XPFR.org and to benead for the lend of the electric switch from the Simoun.

9/ Legal stuffs:

However it is allowed to publish modified textures on any site as long as they are free of charge and delivered as an addon to the main archive previously installed.

Good flights toward south America!