

# A History of Aircraft Using Contra-Rotating Propellers

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# Why Contra-rotation?

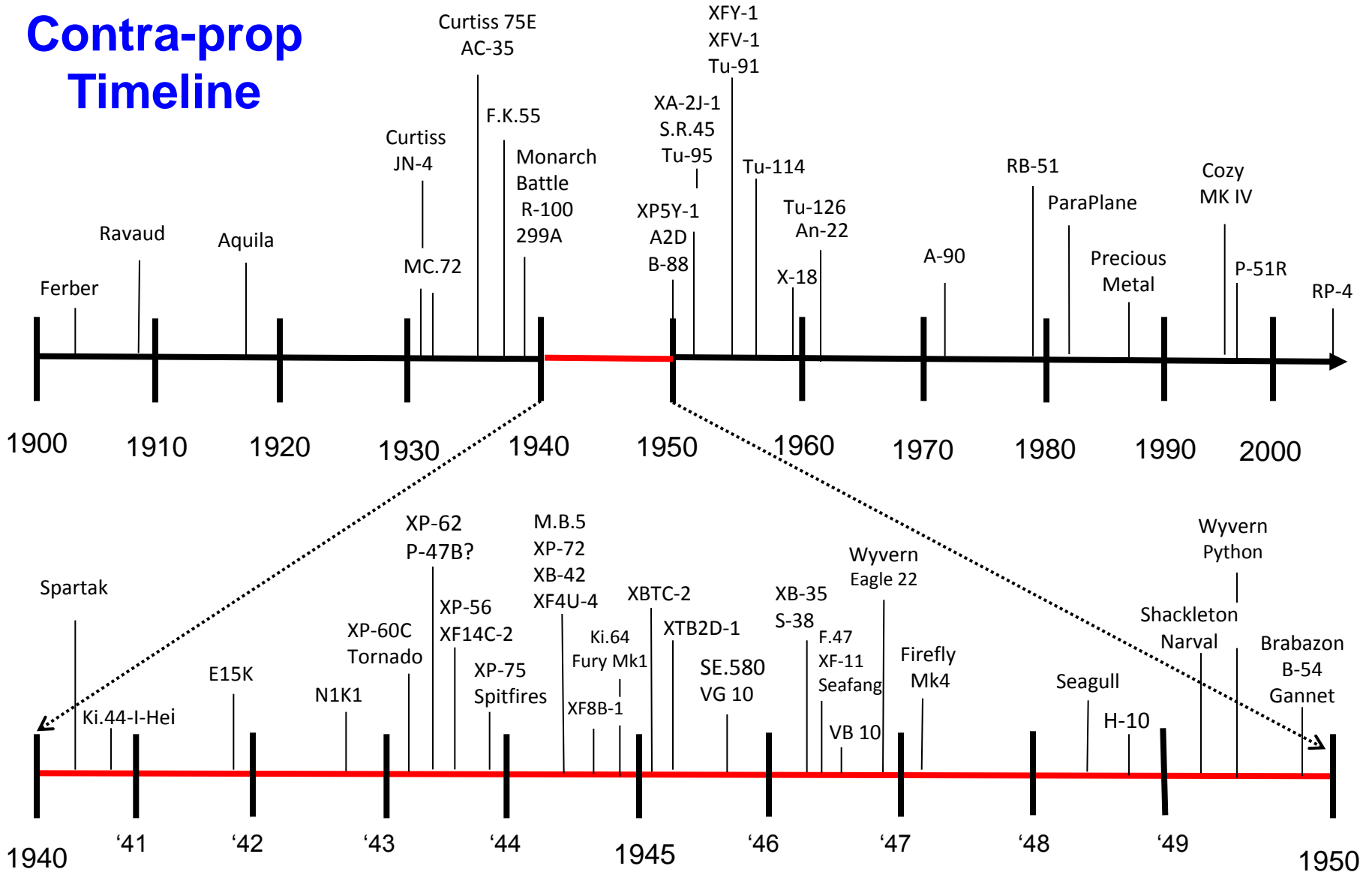
- **Eliminates torque:**  
Valuable for high powered aircraft, especially for naval applications during take-off and go-around
- **Provides high power absorption with a reasonably-sized propeller diameter**  
Reduces height, weight, and complexity of the landing gear necessary for prop clearance  
Keeps propeller tips below supersonic speeds
- **Efficiency:**  
Potential 3% to 5% gain due to energy recovery of the swirl flow from the forward propeller slipstream
- **The down side of contra-rotation:**  
Complexity of prop control mechanisms and reduction gearboxes, weight, noise, vibration, vision flicker vertigo, “discing” drag of one flat prop which also ruins airflow over the tail, manufacture of opposite-rotation propeller blades and specialized hubs

# How many types of aircraft were equipped with contra-props?

	Contra-Prop Aircraft		Contra-Prop Aircraft		Contra-Prop Aircraft
1	A-90 Orlyonok Ekranoplan	28	Fairey Gannet	55	Saro S.R.45 Princess
2	Antonov An-22	29	Ferber #5,#6,#8	56	Schindler Aquila
3	Arsenal VG 10, VB 10	30	Fisher XP-75, P-75A	57	Short S-38/S-39 Sturgeon
4	Atlas H-10/Mono Twin	31	Hawker Fury MK1 Tempest III	58	Sud Ouest SE.580 (Dewoitine)
5	Autogiro Company of America AC-35	32	Hawker Tornado	59	Sud Ouest SO 8000 Narval
6	Avro Shackleton	33	Hiller X-18	60	Supermarine Seafang F.32 Type 396
7	Blackburn B-54	34	Hughes XF-11	61	Supermarine Seagull
8	Blackburn B-88	35	Kawanishi E15K Shiun "Norm"	62	Supermarine Seafire F.47
9	Boeing XF8B-1	36	Kawanishi N1K1 Kyofu	63	Supermarine Spitfire Prototypes
10	Bolkhovitinov Spartak	37	Kawasaki Ki.64 "Rob"	64	Tupolev Tu-114 / Tu-126
11	Bristol Brabazon	38	Koolhoven FK-55	65	Tupolev Tu-20 / Tu-95 / Tu-116/ Tu-142
12	Bugatti R-100	39	Latecoere 299A	66	Tupolev Tu-91
13	Chance-Vought F4U-1, XF4U-4	40	Lockheed XFV-1 Pogo	67	Westland Wyvern Mk 1 to Mk 4
14	Convair R5Y, R3Y-1, R3Y-2 Tradewind	41	Macchi-Castoldi MC.72		
15	Convair XFY-1 Pogo	42	Martin-Baker MB-5		<b>Engine Test Bed Aircraft</b>
16	Cozy YV-22X	43	Nakajima Ki.44-I-Hei		Avro Lancaster: Armstrong-Siddeley Python
17	Curtiss JN-4	44	North American P-51 Precious Metal		Avro Lincoln: Napier Nomad
18	Curtiss Y1P-36 (Model 75E)	45	North American P-51R Miss Ashley II		Douglas B-23 w/ H-S Super Hydromatic
19	Curtiss XBTC-2	46	North American RB-51 Red Baron		Tupolev Tu-4: Russian TV-2 turboprop
20	Curtiss XF14C-2	47	North American XA2J-1		
21	Curtiss XP-60C / XP-60E	48	Northrop XB-35		
22	Curtiss XP-62	49	Northrop XP-56		<b>Prop Fans</b>
23	Douglas XTB2D-1 Sky Pirate	50	ParaPlane		Antonov-70
24	Douglas A2D	51	Ravaud Aeroscaphé		MD-80 578-DX
25	Douglas XB-42 / -42A	52	Republic P-47B		MD-81 UHB GE36
26	Fairey Battle w Monarch 24	53	Republic XP-72		Yak-42E-LL
27	Fairey Firefly 4	54	Rose RP-4		

**This list includes aircraft that were partially or fully constructed with the intention of flight, but not necessarily flown. Helicopters, propfans, lift fan, and test bed aircraft not included**

# Contra-prop Timeline



# Several approaches to drive and control coaxial propellers

**One engine driving two fixed-pitch coaxial propellers:**

**Ferber, Curtiss JN-4 & 75E, F.K.55, Shiun, Kyofu**

**One engine driving two coaxial, constant speed props:**

**Prop blades are slaved to each other**

**Seafire F.47, Avro Shackleton, Wyvern**

**Two engines, each engine driving its own fixed-pitch coaxial propeller:**

**MC.72, Bugatti R-100, Spartak, Atlas H-10, Cozy MK IV**

**Two engines driving two coaxial, constant speed props:**

**Gearbox clutches allowed one engine to drive both props, but actuation of blade pitch is mechanically slaved to each other**

**A2D, Tradewind, S.R.45 Princess, XFY-1, XFV-1, X-18**

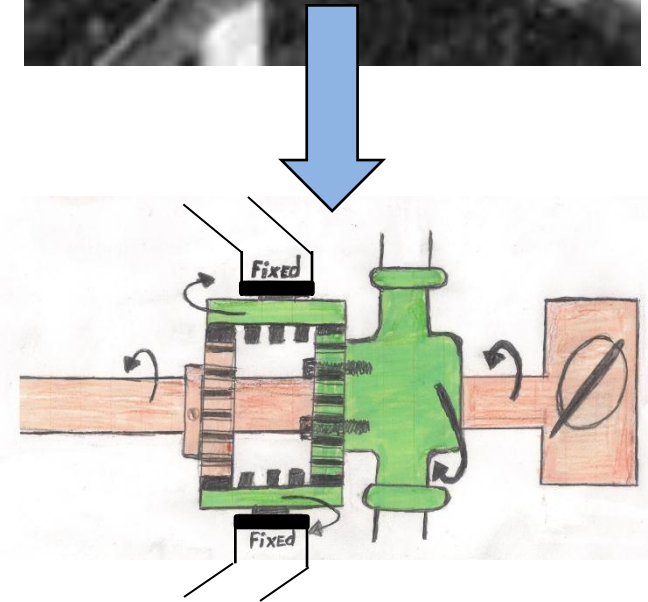
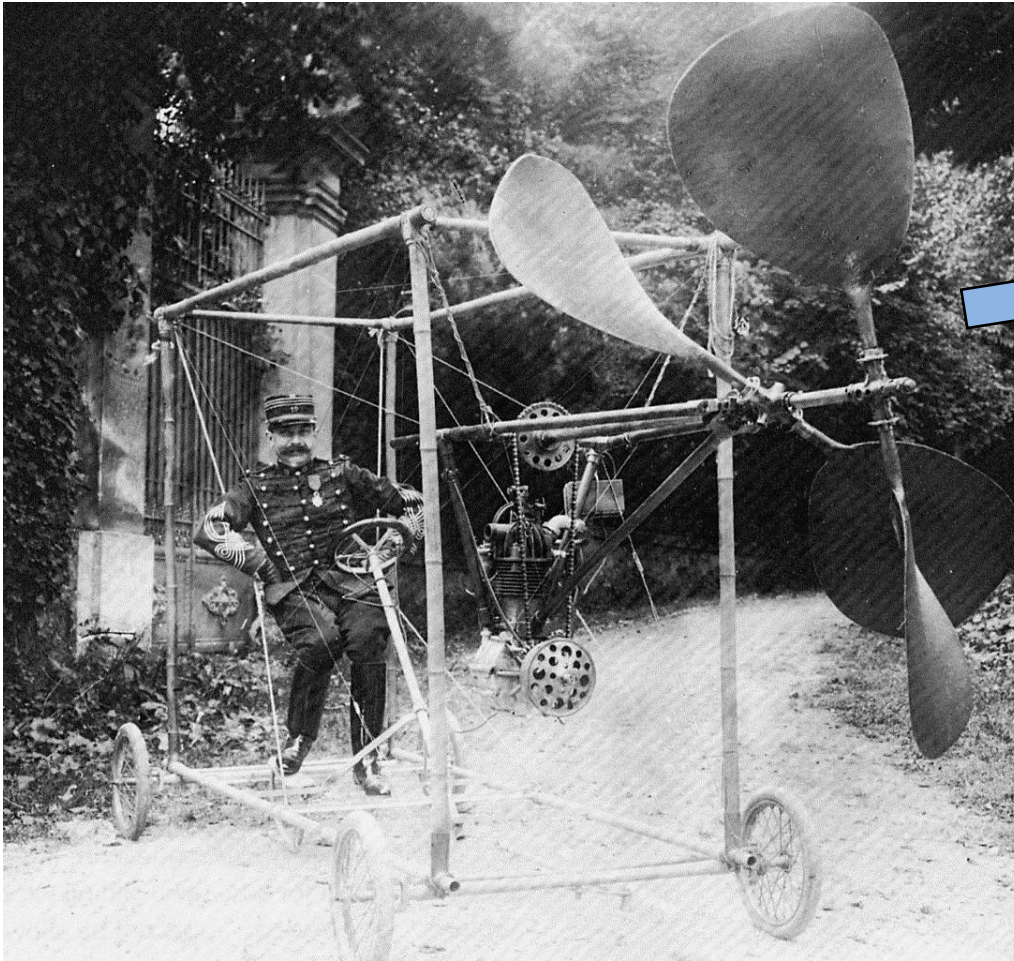
**Two engines driving two co-axial, constant speed props:**

**Independent control and actuation of each blade set**

**XB-42, Gannet, Brabazon**

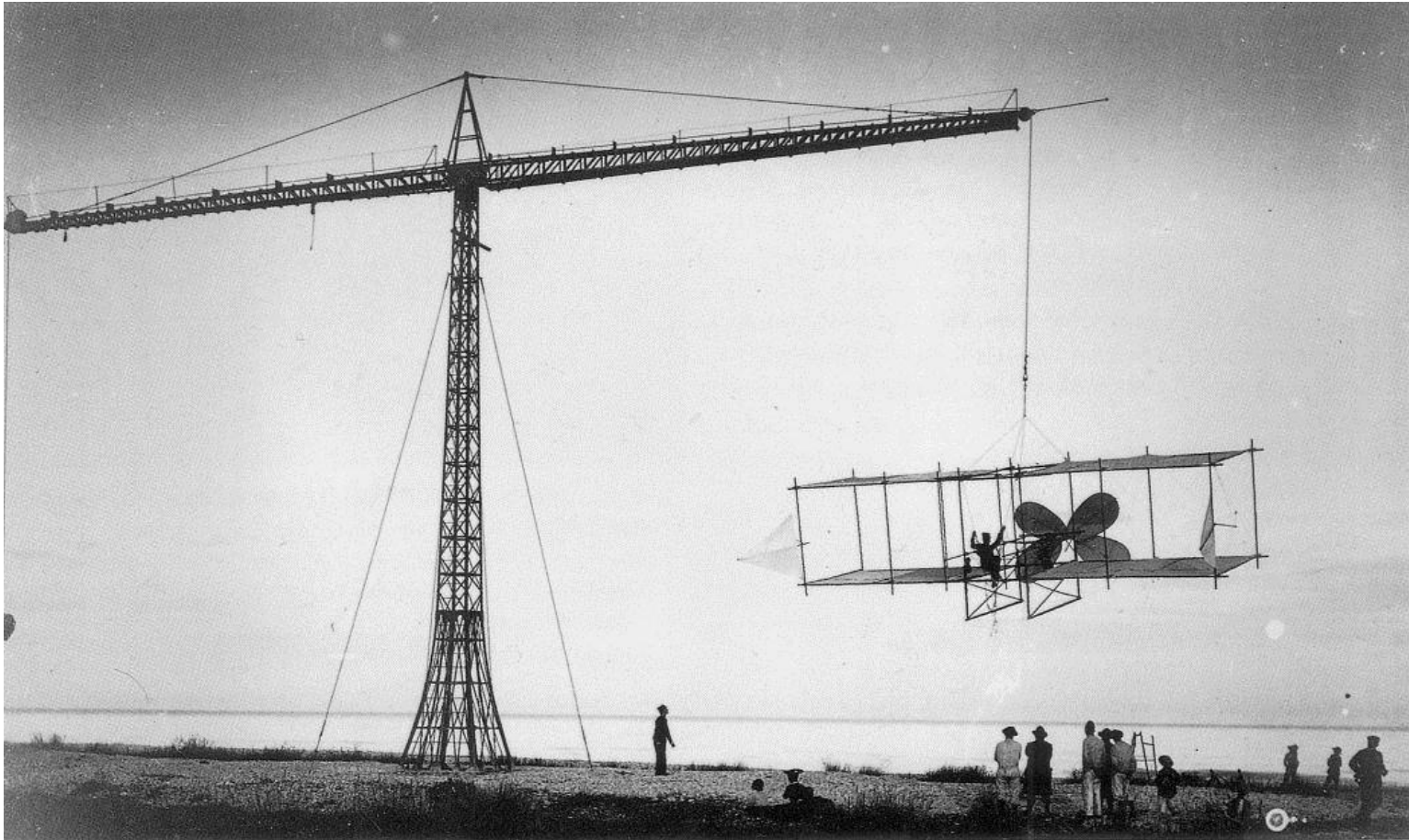
# Capt. (Louis) Ferdinand Ferber (1862-1909)

French artilleryman from wealthy family, graduated from the Paris Polytechnic Institute



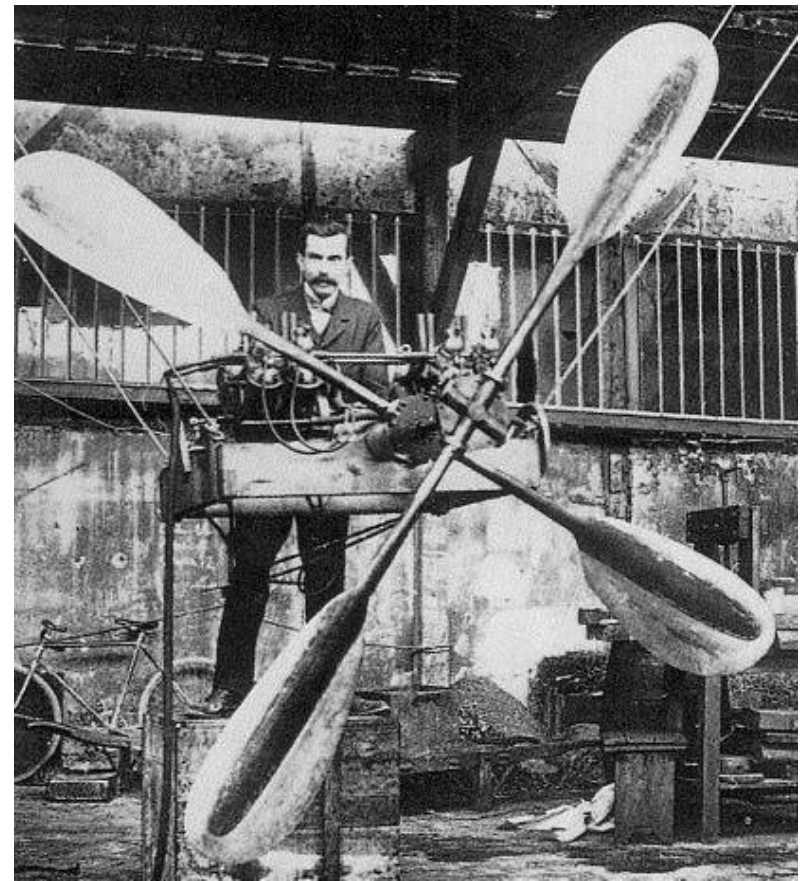
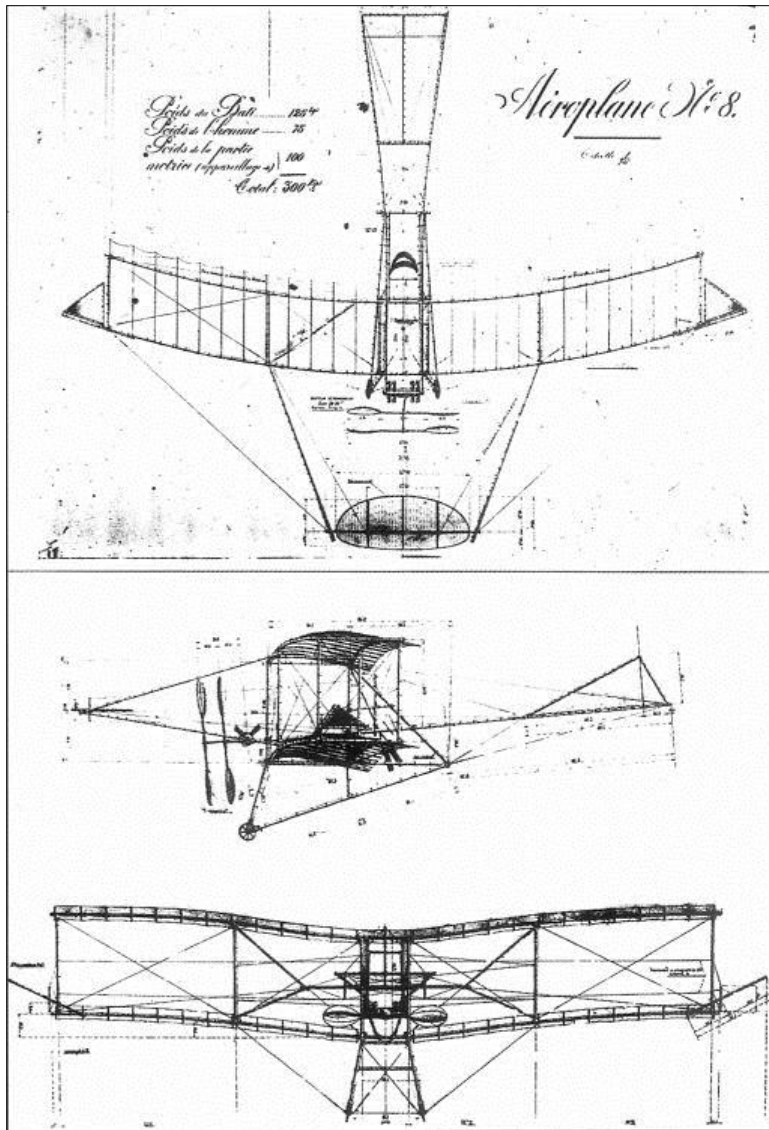
6 HP single cylinder Buchet engine; 79.2 lbs.

Umbrella gears used to achieve contra-rotation



**Ferber #5 bis on 60 foot tall, 100 ft. long counterweighted boom used to orient test aircraft into the wind to study thrust, lift, and control. Seaside estate “La Californie” near Nice, 1903**

**“... completely useless, but drew public attention to aviation” - Ferber**



**Ferber and a highly modified Antoinette V-8 driving contra-rotating props intended to power Ferber #8 (left)**

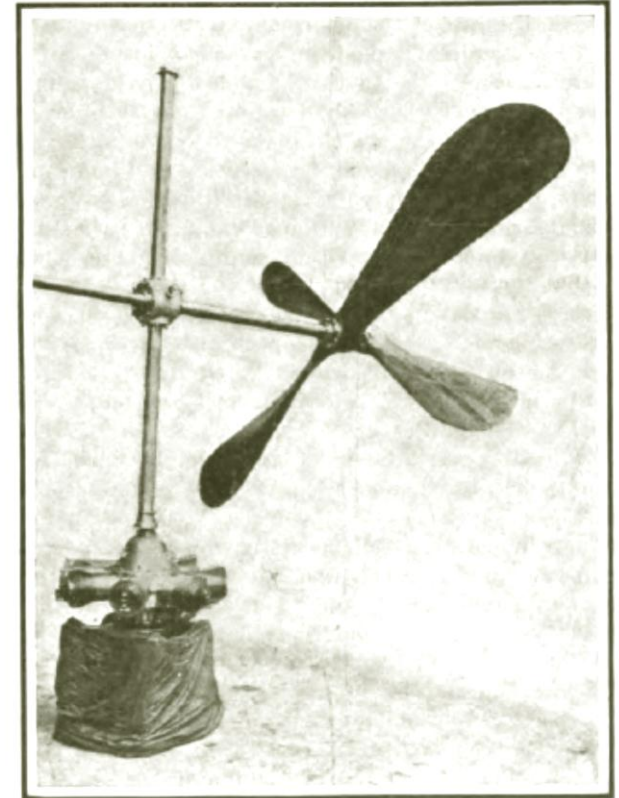
**Completed Airplane #8 was destroyed by a storm Nov., 1906. It never flew. Ferber was killed in 1909 piloting a Voisin biplane that overturned during taxi.**



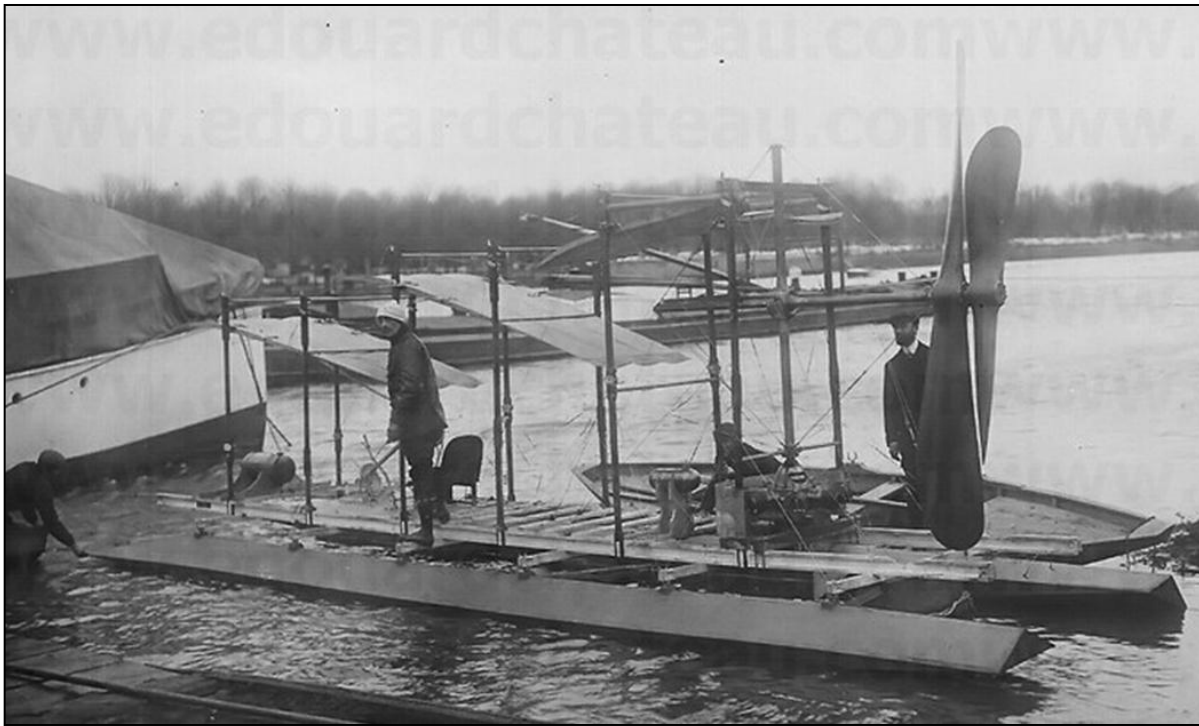
# M. Roger Ravaud “Aeroscaphe” circa 1909



- Intended to rise off of water
- 50 HP Gnome rotary engine with 2 to 1 reduction
- Engine weight: 176 lbs.
- Prop speed: 600 rpm
- Prop diameters: Fore: 10.5 ft.; Aft: 8.2 ft.
- Wingspan: 10 ft. 8 inches
- Only “airplane” that showed up to the 2 month long 1909 Monaco air and boat races



POWER PLANT AND PROPELLERS OF THE  
AEROSCAPHE.



## Ravaud Aeroscaphe

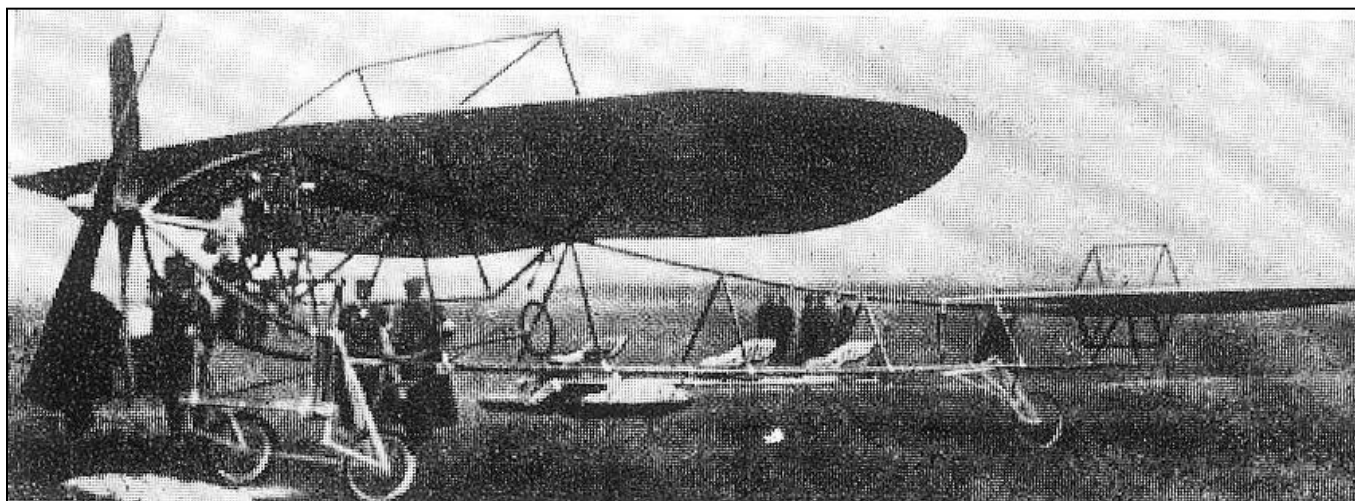
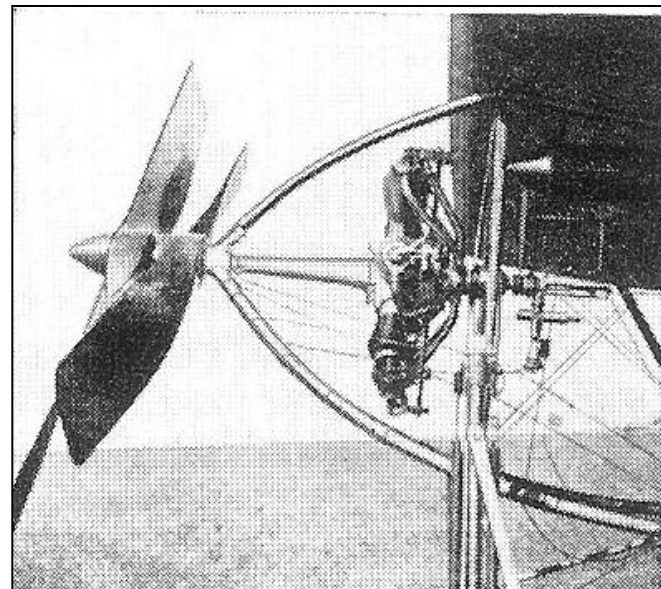
- Prop drive shaft(s) could be yawed  $10^\circ$  either side of neutral for steering.
- Notice significant difference in the diameters of the fore and aft props.
- Engine must have been extremely overloaded



# Schindler Aquila

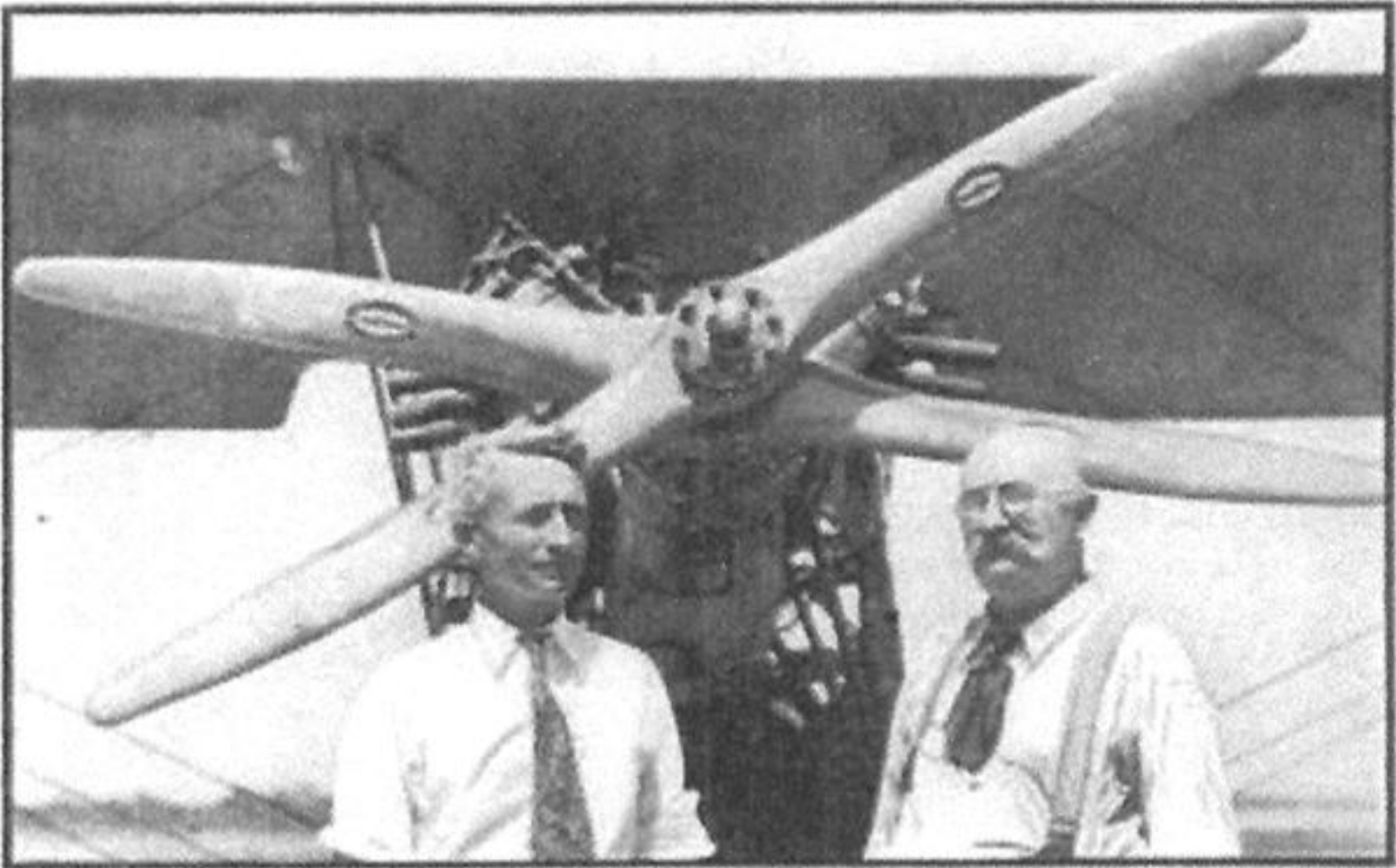
1910

The Aquila 3 place aircraft was designed & built by brothers Rudolph and Wincenty Schindler from Krakow, Poland. The remarkable engine was designed & built by fellow countryman Henryk Brzeski. The crankshaft was attached to one prop while the crankcase was attached to the other prop. It must have required two men to start and a careful matching of the thrust/drag between the fore and aft propellers. The elegant design and bamboo construction is outstanding, however controllability via wing and tail-warping, and perhaps an aft c.g., caused the loss of the airplane on its maiden flight in Vienna, Austria.



**Wingspan: 32 feet  
9.75 inches  
Weight (max):  
1,212 lbs.  
First and last  
flight: Sept. 1910  
Engine: Brzeski  
Iskra "bi-rotary",  
50 HP**

## Curtiss JN-4 with Egan-Evans Contra-Prop Assembly 1931



Popular Science, Nov. 1931

Most likely a Curtiss OX-5, 90 HP

# Egan-Evans Contra-Prop Assembly

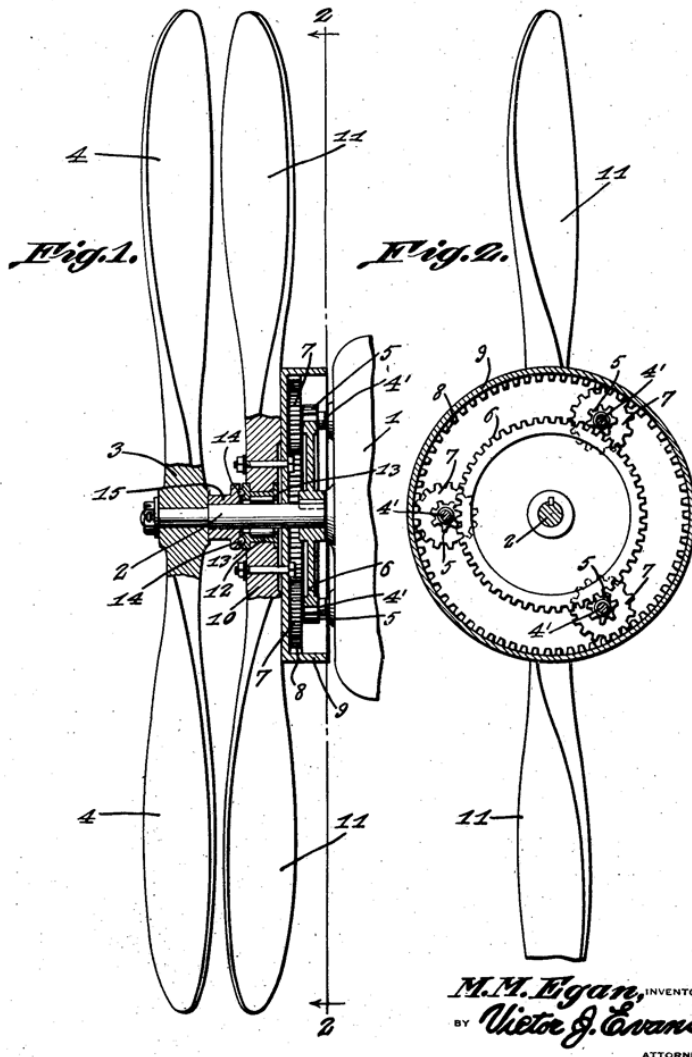
Sept. 27, 1932.

M. M. EGAN  
PROPELLER

1,879,142

Filed Feb. 17, 1930

2 Sheets-Sheet 1



- Front “Auxiliary” propeller spins at engine speed while the aft “Main” propeller spins at 1.5 fold the speed of the fore prop speed

“... wherein the auxiliary propeller will supply air to the main propeller, causing the air to become alive or become tangible to the opposite thrust of the blades of the main propeller..”

“Different pitches were used on the fore and aft props “... to handle the airstream at the best advantage...”

- Matthew M. Egan, inventor

No information on flight dates, time aloft, or performance.

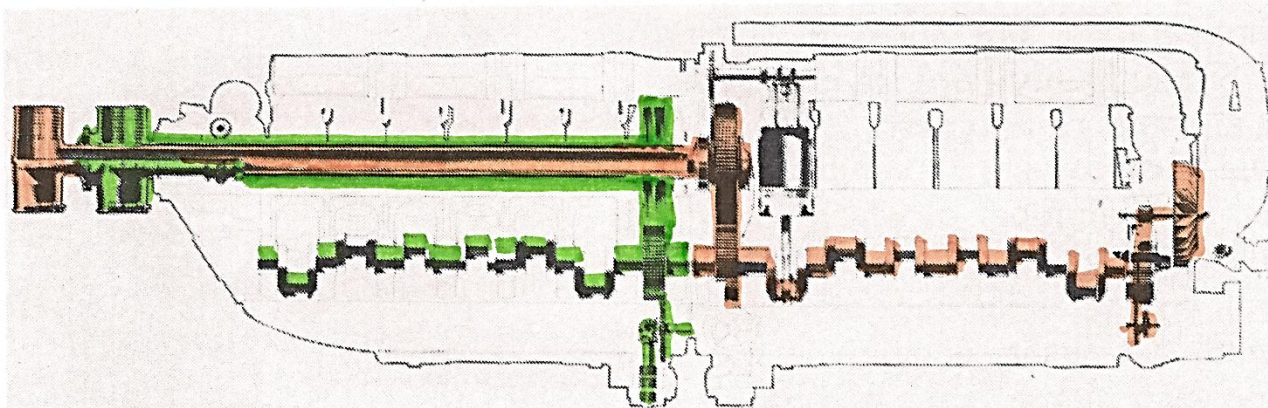
# Macchi-Castoldi MC.72

1931



**The Schneider Cup had been won in perpetuity by Britain before the MC.72 could participate. After many setbacks and two fatalities, the MC.72 broke the piston/propeller seaplane speed record of 440.681 MPH on Oct. 23, 1933. This 78 year old record still stands.**

The aircraft used an AS6 engine where each V-12 engine drove its own fixed pitch prop. Contra-props negated the powerful, float-submerging torque of the engine on takeoff. Fuel was in carried in the floats and brass surface oil and engine coolant radiators were used to reduce drag.



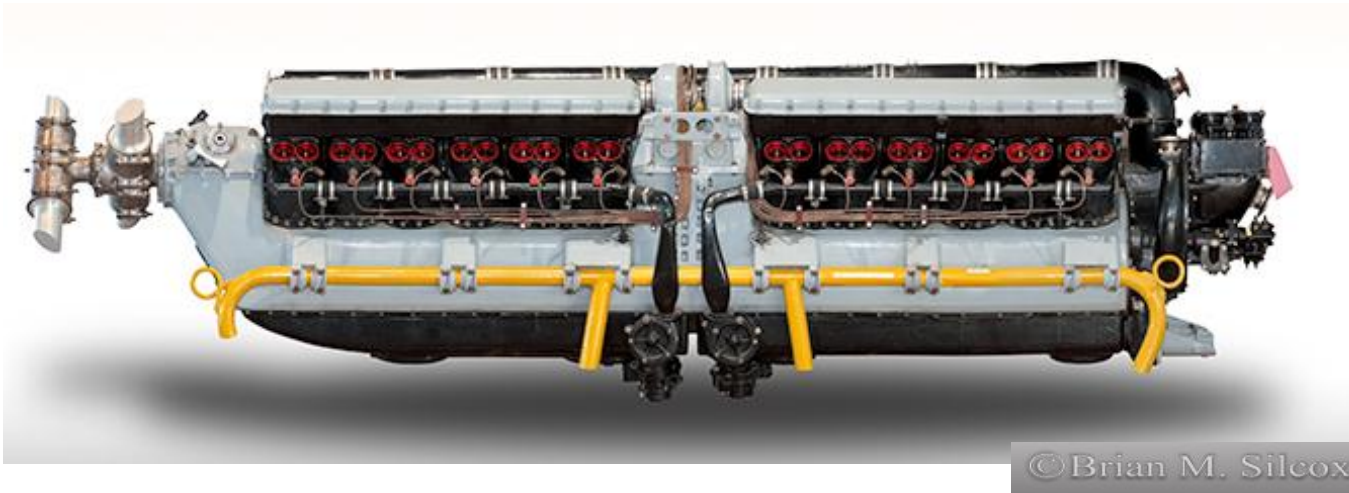
**Wingspan: 31 feet 9.25 inches**

**Weight (max): 6,669 lbs.**

**First flight: July 1931**

**Engine: Fiat AS6, double V-12 tandem engine, 3,063 cu. in., 3,000 HP**

**Props: Aluminum, fixed pitch, diameter approx. 9 feet 3.5 inches**



# Autogiro Company of America AC-35

# 1936

The AC-35 was a 2-place, roadable autogiro capable of 25 MPH on the ground and 75 MPH cruise in the air. The rear wheel was driven by the engine, the front wheels were steerable, and the main rotor folded. ACA was a subsidiary of the Pitcairn Autogiro Company, and the AC-35 was the only entry to meet all specifications of the 1936 US Bureau of Air Commerce roadable aircraft competition. After trying 12 sets of contra-props, it flew only briefly with them because "... the propellers set off a howl that would shatter glass". The lone AC-35 flew extensively thereafter with a single rotation propeller and survives in the collection of the NASM.

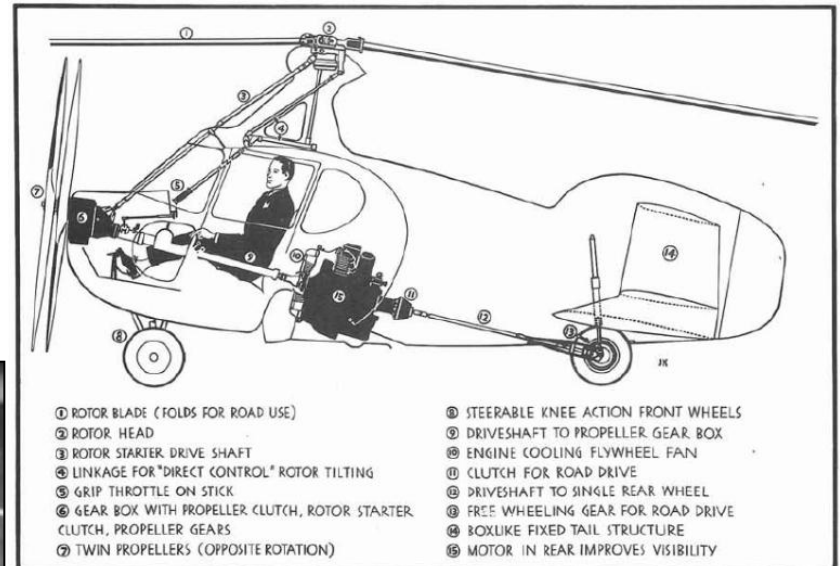
**Rotor span: 34 feet, 3 inches**

**Weight (takeoff): 1,329 lbs.**

**First flight: March 26, 1936**

**Engine: Pobjoy Cascade, 7-cylinder air-cooled radial, 173 cu. in, 90 HP**

**Props: Fixed pitch wood, approx. 54 in. dia.**





# Curtiss Y1P-36 (Model 75E)

1937

As a manufacturer of both aircraft and propellers, Curtiss was an early experimenter with contra-rotating propellers. Pratt & Whitney had developed a compact reduction gear set incorporating a Farman gear set between the planetary gears to achieve the contra-rotation. Not much is known about this aircraft beyond this picture, circa 1937.



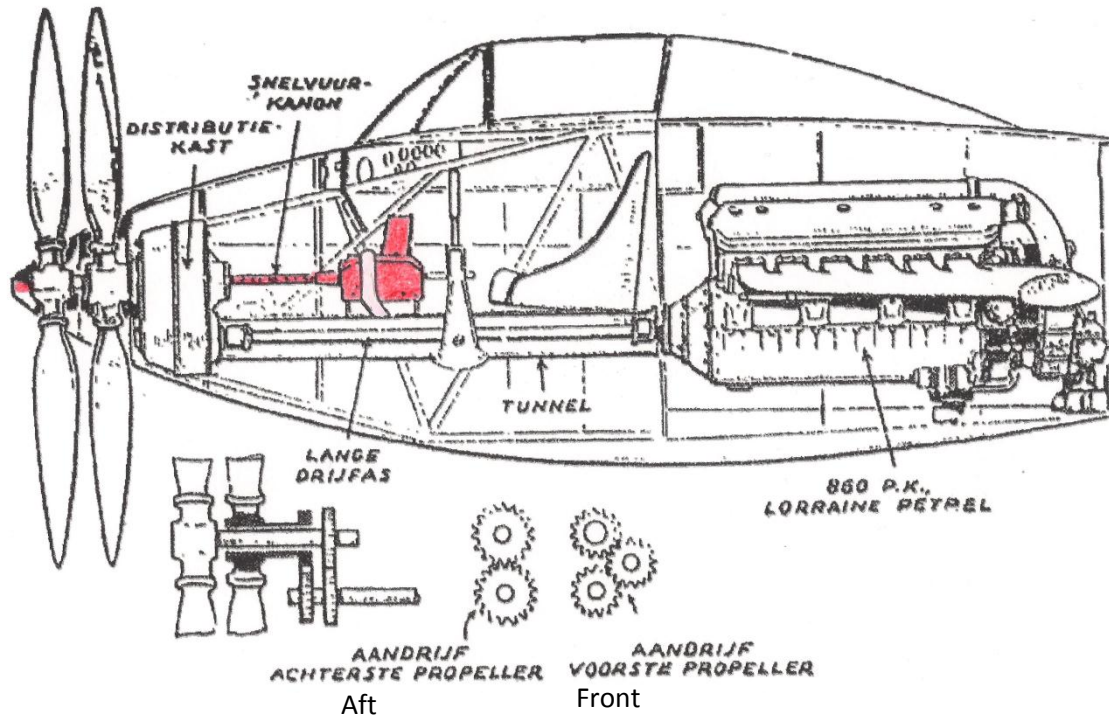
**Wingspan: 37 feet, 3.5 inches**  
**Weight (takeoff): 6,150 lbs.**  
**First flight: May 15, 1935**  
**Engine: Pratt & Whitney R-1830-13, 1,050 HP**  
**Props: Hamilton-Standard, aluminum, ground-adjustable, approx. 9.5 ft diameter**

# Koolhoven F.K. 55

1938

Dutchman Frederick “Frits” Koolhoven designed several aircraft and caused quite a stir at the 1936 Paris Salon show with his mock up of the F.K.55. The flying prototype differed significantly from the sleek, idealized mockup shown below. Difficulties with the engine, as well as stability and control, resulted in abandonment of the project after a single 2 minute flight.





Wingspan: 31 feet 6 inches  
 Weight (max): 5,026 lbs.  
 First flight: June 20, 1938  
 Engine: Lorraine 12 Hrs Petrel  
 V-12, 860 HP  
 Props: Ratier; aluminum,  
 approx. 7 feet 4 inches in  
 diameter, fixed pitch



# Bugatti R-100

1939

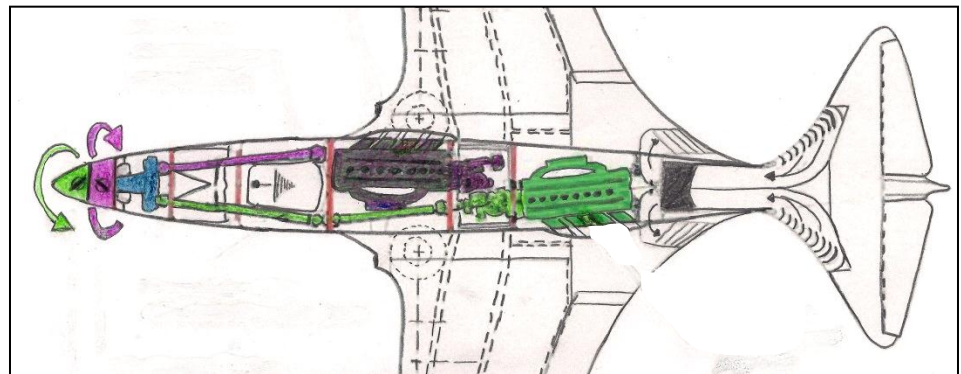
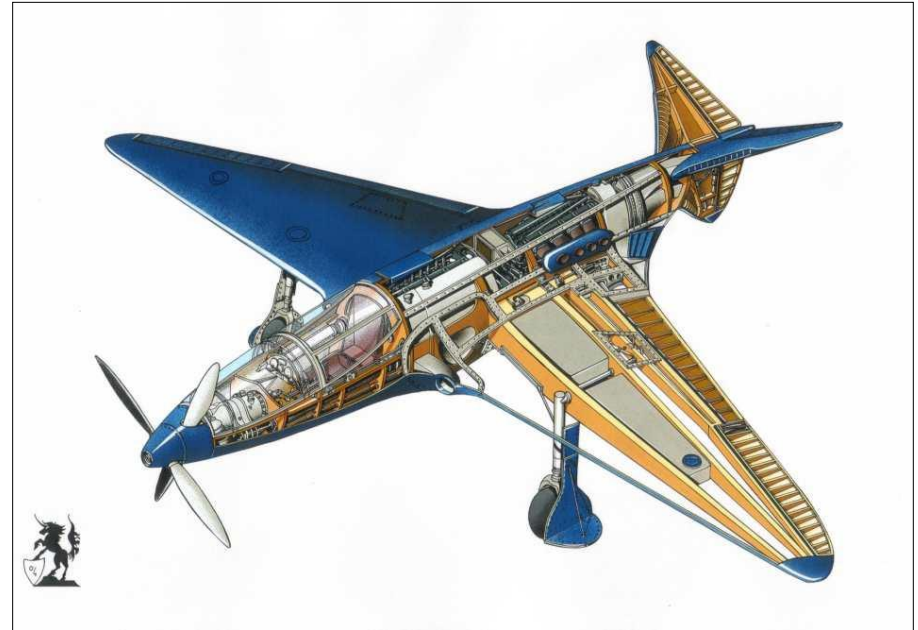
All wood French air racer completed just before WWII but never flown. Reduction gearbox (1.58 :1, props 2,850 rpm with engines @ 4,500 rpm) in nose, drive shaft aside each hip of semi-reclined pilot. Aircraft survives restored but engine-less in the EAA Museum Oshkosh, WI.

**Wingspan: 27 feet**

**Weight (takeoff): approx. 3,056 lbs.**

**First flight: Never flown**

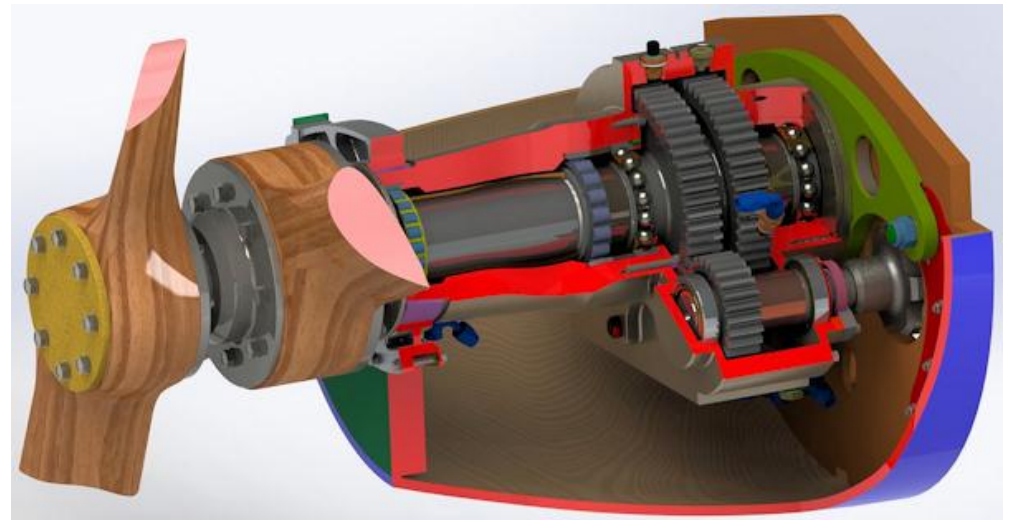
**Engine: Dual Bugatti T-50B, 287 cu. in., magnesium block, straight 8 cylinder, Roots-type supercharged engines, 450 HP, x2**  
**Props: Ratier ground-adjustable, fixed pitch, 5 foot 10 inches diameter (both sets)**



Bugatti 100P.com



Oshkosh 2011

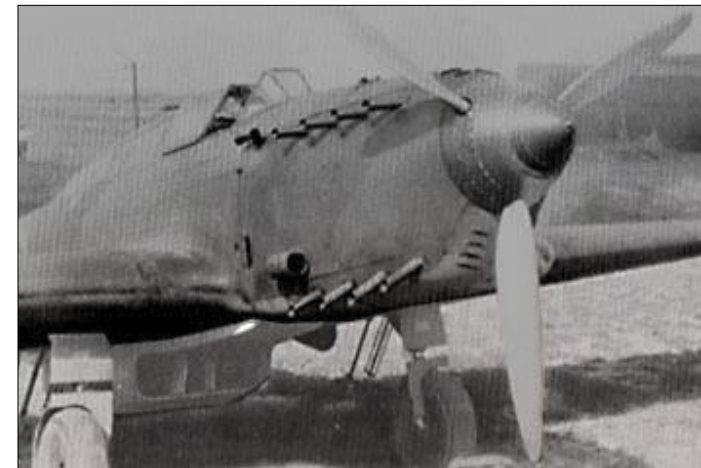
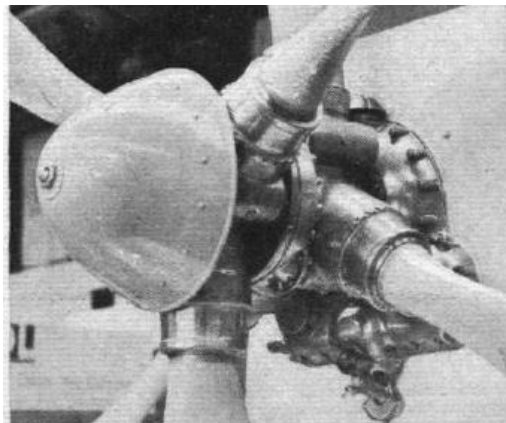
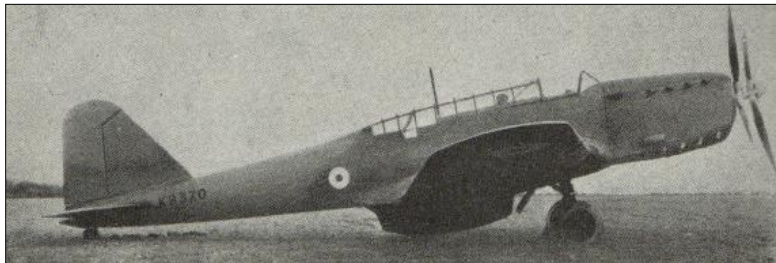


# Fairey Battle w/ Monarch 24

1939

The Battle light day bomber was used as test bed for the Fairey Monarch 24 cylinder engine. This engine was essentially two separate, flat 12 cylinder engines mounted aside each other. A special reduction gearbox had one 12 cylinder power unit driving each propeller. Independent control of the propellers allowed feathering of one or the other units. Fairey advertised extensively that this aircraft was the first to fly with constant speed contra-rotating propellers.

Wingspan: 42 feet, 4 inches      Weight (max): 10,792 lbs.  
First flight: June 30, 1939 (c-prop aircraft)  
Engine: Fairey Monarch P-24, liquid cooled, vertical H, 3,117 cu. in. (53 l), 2,000 HP  
Props: Fairey, electric actuation, independent propeller control



# Latecoere 299A

1939

This French 3 place torpedo bomber first flew with a single engine, then was further developed with two engines in tandem. The contra-prop version was not completed before the occupation of France by the Germans in 1940. Static and taxi testing was done during the German occupation, however it may have never actually flown. The aircraft was destroyed by Allied bombing of the Bron airfield on April 30, 1944.

Wingspan: 51 feet 4 inches

Weight (max): 10,252 lbs.

First flight: July 7, 1939 (single engine/prop)

Engine: Tandem Hispano-Suiza 12Y-31,

V-12, 860 HP each

Props: Ratier controllable pitch, aluminum,  
10 foot 6 inches diameter



# Bohkhovitinov S "Spartak"

1940

The Spartak (Sparta = speed) was an experimental Russian, two man, fast light bomber and reconnaissance aircraft. It was hoped that tandem centerline engines, a small wing area, and contra-rotating propellers would produce enhanced performance over existing aircraft. The aircraft flew well, but had a high take-off and landing speed.

Wingspan: 43 feet 4 inches

Weight (max.): 12,460 lbs.

First flight: Single engine S-1: Jan. 29, 1940

Dual engine S-2: March, 1940

Engines: Dual Mikulin M-103, 960 HP each

Props: Unknown. Fixed pitch

