

SimHangar Team

# RWD-14b “Czapla”

for the Microsoft Flight Simulator X



Flight Manual

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RWD-14 manual pictures courtesy of [Polish Aviation Museum in Kraków](#).

## History of the construction

The RWD-14 design was a result of Polish Air Force response for a new close cooperation aircraft which would replace Lublin R.XIII. The first prototype was built in 1935 by the Doswiadczalne Zaklady Lotnicze (Experimental Aircraft Workshop) located at the Okecie aerodrome in Warsaw. However, the aircraft's performance did not meet the requirements. That is why, the designers reworked the prototype and between 1936-1937 they presented two new prototypes, called RWD-14a. The new version went to Technical Institute for tests. During dive tests both prototypes were crashed, because elevator wires jammed. Pilots were forced to jump from the plane in both times.

In the 1938, the DWL company presented reworked version: the RWD-14b, nicknamed "Czapla" (Heron). The engineers changed the fuselage and undercarriage. The new, more powerful Mors II engine was installed as well. During Summer 1938 the prototype passed the tests in the Technical Institute and short series was ordered by the Polish Air Force. The production was undertaken by the Lubelska Fabryka Samolotow (LWS, former Plage & Laskiewicz), which delivered 65 planes between Fall 1938 and early Spring 1939. The production batch was very short, because more advanced LWS-3 Mewa (Gull) was in the works.

35 RWD-14b "Czapla" were delivered to the five observation squadrons (Eskadra Obserwacyjna): No.'s 13, 23, 33, 53 and 63. The rest stayed as a operational reserve. They were marginal improvement over Lublin R.XIII and during German invasion of Poland, they were no match for the Luftwaffe planes. What is interesting, the development of the plane

was kept in secret and no photos were shown to public. That is why both Polish AA personnel and Luftwaffe pilots did not know about this design. Most of the planes were destroyed during the campaign. Over 10 planes flew to Romania and they were used there as auxiliary services. No RWD-14b survived the war.

The development of the plane took too much time and because of that, the RWD-14b was an obsolete design in the time when it was delivered to the units. The plane was designed to operate from a rough terrain and to be hauled by a truck. This is why, it received strong undercarriage, wing slats and wing folding system.



## Technical data and aircraft systems

The RWD-14b “Czapla” was parasol-type monoplane with mixed wooden and metal frame. The front fuselage part was metal covered, while the rest was covered with canvas. The wings were two-spar, covered with plywood and canvas. There was wing folding mechanism and automated wing slats. Both were taken from the previous DWL designs: RWD-9 and RWD-13. Also the IAW-192 airfoil was taken from that designs as well. Horizontal stabilizer could be trimmed. Vertical stabilizer turned 2 degrees to compensate engine torque. Two-blade, wooden “Szomanski” fixed pitch propeller.

The plane was equipped with conventional undercarriage and tail wheel with low-pressure Dunlop tires. Crew of two. Both cabins equipped with sticks and rudder pedals. Rear cabin occupied by the observer, who had access to photo camera, table, flare pistol and few aircraft instruments.

### **Armament:**

1 × fixed, forward-firing 7.92 mm wz.33 machine gun

1 × flexible, rearward-firing 7.7 mm Vickers K machine gun

1 x 35mm “Perkun” flare pistol with color flares

2 x Hoult’s flares used for landing, mounted on the right wing tip, operated by the pilot

1x Radio stack

1x Photo camera

## **Specifications:**

Crew: Two, pilot and observer

Length: 9.00 m (29 ft 6 in)

Wingspan: 11.90 m (39 ft 0 in)

Height: 3.00 m (9 ft 10 in)

Wing area: 22.00 m<sup>2</sup> (237 ft<sup>2</sup>)

Empty weight: 1,225 kg (2,701 lb)

Loaded weight: 1,700 kg (3,748 lb)

Useful load: 475 kg (1,045 lb)

## **Performance:**

Maximum speed: 247 km/h (133 knots, 153 mph)

Maximum speed at 2000m: 235 km/h (127 knots, 146 mph)

Cruise speed: 232 km/h (126 knots, 145 mph)

Stall speed: <80 km/h (43 knots, 50 mph)

Range: 675 km (364 nm, 421 miles)

Service ceiling 5,100 m (16,728 ft)

Rate of climb: 6.1 m/s (366 m/min) (1,200 ft/min)

Wing loading: 77 kg/m<sup>2</sup> (16 lb/ft<sup>2</sup>)

## **General engine data:**

1× PZL G-1620B Mors-II air-cooled 9-cylinder radial

Takeoff power: 380 HP

Nominal power: 430 HP at 2150 RPM at Sea Level

Maximum power: 470 HP at 2375 RPM at 0 Sea Level (5 minute duration)

Maximum allowed RPM's: 2475

Compression ratio: 6,0

Engine volume: 16,2 liters

Cycle: 4

Bore: 128mm

Stroke: 140mm

Propeller rotation: clockwise

Supercharger: one-stage

Carburetor: gravity, Claudel-Hobson AI-85E

Normal fuel pressure: 175 g/cm<sup>2</sup>

Normal oil pressure: 5,5 kg/cm<sup>2</sup>

Magneto: BTH CSE 9 S-3

Starter: Manual, Eclipse-Avia 6A

### **Fuel system:**

Two fuel tanks, with total capacity of 315 liters.

Main tank with 265 liters, located in front of pilot's cabin

Auxiliary tank with 50 liter capacity, located in the central wing section

Engine driven fuel pump

Three-stage fuel lever (main-aux-cutoff)

### **Oil system**

One oil tank with 31 liter capacity

### **Electrical system**

“Era” Alternator 24V, 300A

24V, 20A Battery for 10 minute operation

Pilot’s control panel

Navigation and cabin lights



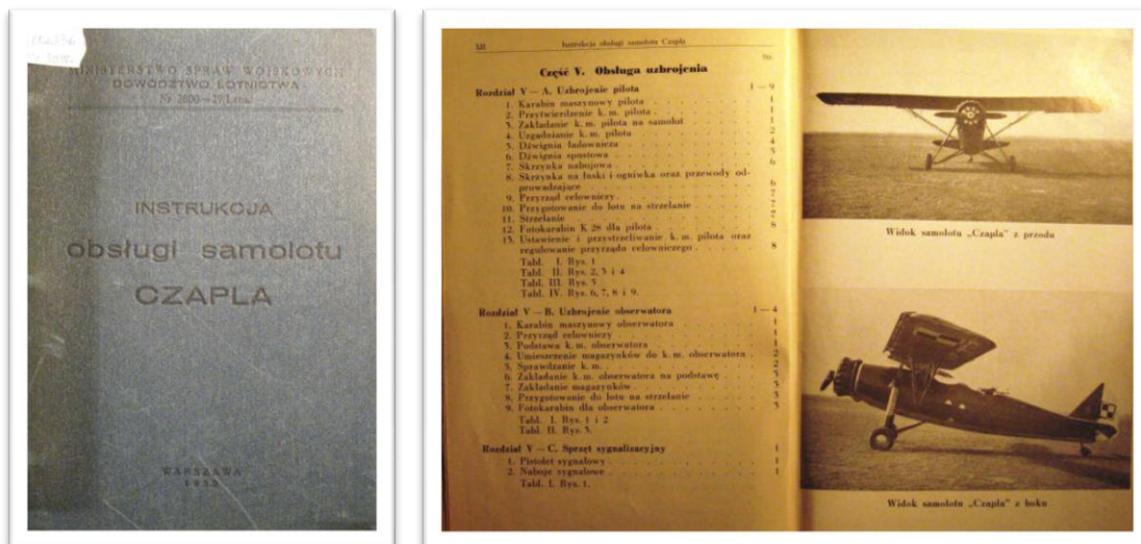
*RWD-14b in flight.*

## RWD-14b “Czapla” in the FSX

The original 3D model of the RWD-14b comes from “War over Poland” mod made on the Targetware Sim Environment<sup>1</sup>. The original 3D was exported to 3ds format and then imported into GMax to add FSX materials and animations.

The model has been compiled using FSX Acceleration SDK. It means that it is FSX native model, so it works in the DX10 Preview mode and there are no transparency issues. What is more, the plane should be very FPS friendly when compared to the default FSX planes. It also has specular and normal maps as well as self shadowing which enhance the overall look of the plane. We did not add self shadowing in the Virtual Cockpit, because the original 3D file should be reworked from scratch to achieve this effect.

This is not just simple conversion of the entire model. Few textures were repainted and the model received brand new 3D instruments. What is more, we got in touch with the Polish Aviation Museum in Kraków, where we were able to copy the original RWD-14b manual. The only manual which survived – just to be clear. This allowed us to model many aircraft systems and you can simply fly this small plane “by the book” using original procedures. The “realism” was the main key while making this FSX conversion.



Cover of the RWD-14b Manual with book contents. Courtesy of Polish Aviation Museum in Kraków.

<sup>1</sup> Another War over Poland’s model converted by the SimHangar Team is the RWD-8pws which is available on the major FS websites.



*Technical Institute Warsaw-Okecie, 1938*



*Kpt. obs. Feliks Misiewicz, 13.Eskadra Obserwacyjna, 1.Pułk Lotniczy, Warsaw-Okecie, 1939*



*Royal Romanian Air Force, Eastern Front, early 40's.*

## Virtual Cockpit

During building RWD-14b's virtual cockpit, we put extra detail on the aircraft's gauges. All of them, except of the pitch indicator were done in 3D technology. What does it mean? It means that they are very smooth and their refresh rate is equal to your global FPS setting. So, the standard gauges are not comparable with these. However, there are no tooltips available (you cannot pan the mouse cursor over the gauge to check the data), and you will have to get familiar with Polish pre- WW2 flight instrument system.

Polish instruments were manufactured by the G.Gerlach company, located in Warsaw. Gerlach started to make flight instruments at the beginning of 30's. At first, they were built under license of Badin Company located in France. Later, the designs evaluated, but still, Polish and French gauges looked very similar.

Each kind of gauges had its specific color:

Black – RPM, clock

Blue – HSI, altimeter

Red – manifold pressure, fuel pressure, fuel meter

Brown – oil pressure, oil temperature

Green – water temperature in the radiator



*Instrument panel of the RWD-14b*

1. Fuel pressure gauge. Units: gram/cm<sup>2</sup>, minimal 100 g/cm<sup>2</sup>, normal 175 g/cm<sup>2</sup>
2. Oil pressure gauge. Units: kilogram/cm<sup>2</sup>, minimal 2,5 kg/cm<sup>2</sup>, normal 5,5 kg/cm<sup>2</sup>
3. Oil temperature gauge. Units: Celcius degrees., min. 15C, normal 80C, max 120C
4. Compass deviation table
5. RPM gauge. Scale 0-2600, max 2475rpm, small needles not operable. They were showing engine usage time
6. Compass
7. Flight controller. HSI, Turn indicator, Slip indicator. Units: km/h
8. Variometer, Units: meters/second, Scale: -10 m/s ; 10 m/s
9. Clock
10. Pitch indicator. Units: Degrees
11. Altimeter with altitude calibration knob. Units: meters, Scale: 0-7000m. Note: The altimeter is mounted on the forward machinegun's inspection cover. The "Wzier. Wymian. Luf. K. M." means "Wziernik wymiany lufy karabinu maszynowego". It can be translated to "Machine gun Inspection Opening".
12. Fuel meter. Units: Liters, Scale: 0-300 liters. Note: The main fuel tank capacity was 265 liters. There was no gauge for the upper 50 liter tank, but only simple indicator. However, we don't know how it looked like.



*Left side of the RWD-14 cockpit.*

1. Fuel selector. 3-stage. Main-Aux-Cutoff, “Paliwo” is for “Fuel”
2. Cowl flaps lever “Przesłona silnika” is for „Engine cover”
3. Parking brake lever. “Hamulce” is for “Brakes”
4. H-Stab trim wheel
5. Magneto switch
6. Throttle lever. “G” is for “Gaz” which means “Power”
7. Mixture lever. “P” is for “Powietrze” which means “Air”
8. Engine disable lever
9. Map sack



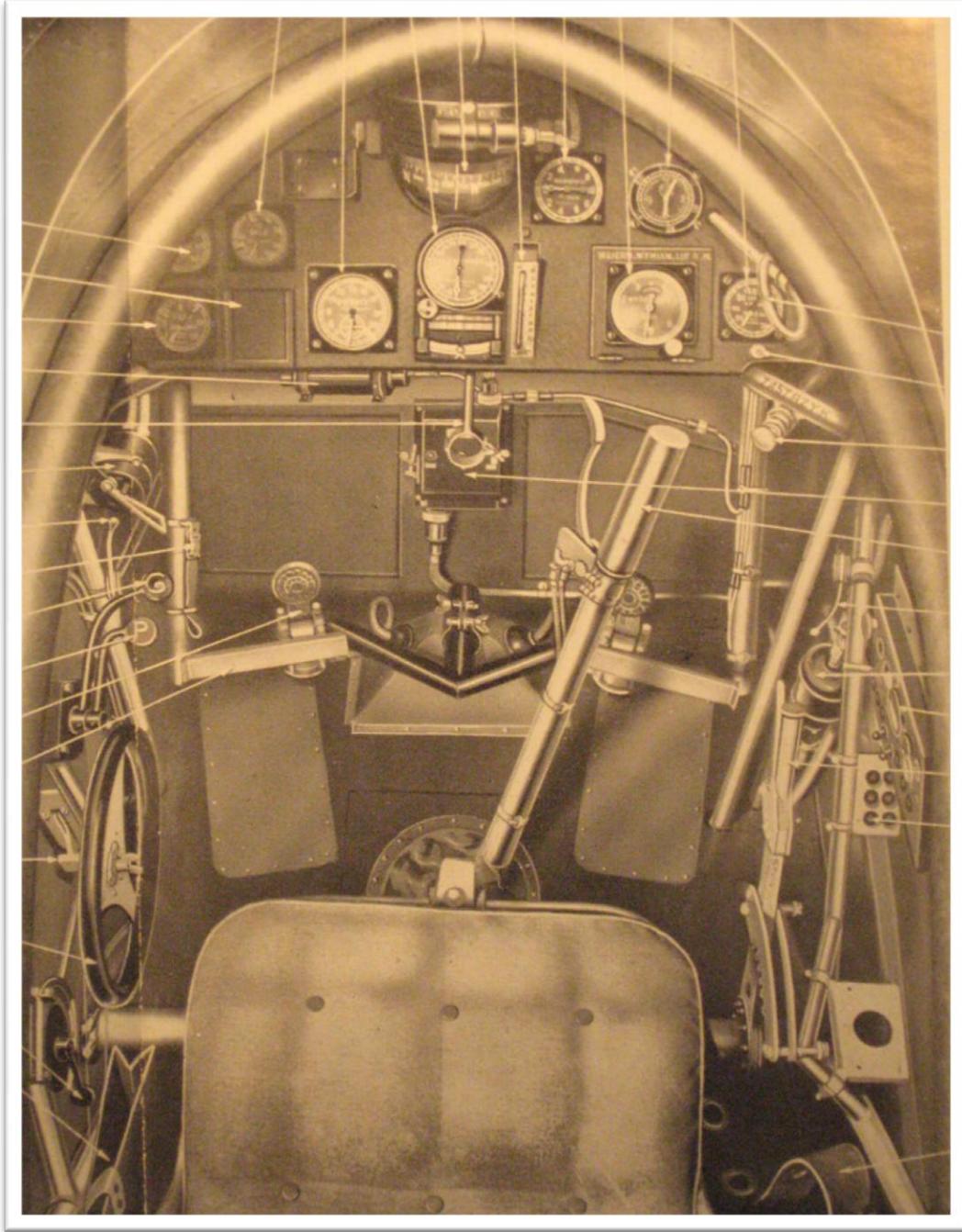
*Right side of the RWD-14b cockpit*

1. Engine primer. “Zastrzyk” is for “Injection”
2. Hoult’s flare release handle. Not operable
3. Fire extinguisher
4. Hoult’s flare switch. Not operable
5. Master switch
6. Cabin light switch. Originally this knob worked as a cabin light intensity knob
7. Navigation lights switch
8. Pitot heat switch
9. Seat adjust handle. Note: We prepared the animation, however, it will not have any impact on your sight position



*Observer section in the RWD-14b*

1. Cabin light
2. Cabin light switch
3. Throttle lever
4. Compass. Not operable since we don't know what kind of compass was used in the RWD-14b
5. Altimeter
6. Clock
7. Fire Extinguisher
8. Parachute belt



*Original photo from the RWD-14b Manual showing instrument displacement. Courtesy of Polish Aviation Museum in Kraków.*

## Flying the RWD-14b “Czapla”

The RWD-14b in the FSX is generally easy to fly. The plane has very short take off because of the wing slats and powerful engine. In fact, it was designed to operate from the rough terrain and small grass strips. That's why the plane has also very strong undercarriage.

While flying the RWD-14, please always remember about proper engine management. The plane has fixed prop and diving with full throttle is strictly prohibited. You can both overstress the plane or simply disable the engine by exceeding maximum RPM's (2475). Use your maximum power only during take offs and reduce it after getting airborne. Flying with maximum throttle will damage your engine and soon, your RPM's and power will start to drop. The original manual says that the full engine power was allowed only for the 5 minute duration.

Advanced aerobatics is forbidden in this plane because of the weak structure. Be very gently with the controls, as both rudder and elevator can be moved 30 degrees in both directions. That's a lot, so avoid sharp pulling on the stick and rudder pedals. The plane sideslips, too. During turns, please apply rudder, to keep the plane turning nicely. Because of the wing slats, the plane stalls gently and it is very easy to recover. It is suggested to use trim during the flight.

Make a use of aircraft systems. The RWD-14 has pitot heat, cabin and navigation lights.

## Checklists:

### Pre flight check

Parking brake	ON
Master switch	OFF
Fuel tank selector	Cutoff
Magnetos	OFF
Mixture lever	Cutoff
Throttle lever	0%

### Engine startup

Fuel tanks	Checked
Oil tank	Checked
Instruments	Checked
Parking brake	ON
Master switch	ON

Engine primer	Press 4-5 times
Fuel tank selector	Set to Upper Tank (50 liter)
Magnetos	ON
Mixture	Rich
Throttle	Set to 20%
Starter	Crank engine (ctrl-E)

### Engine warming

RPM	600, increase slowly to 800
Oil Pressure	5,5 kg/cm <sup>2</sup>
Oil Temperature	Minimum 15 C degrees
Fuel tank selector	Set to Main Tank (265 liter)
Length of engine warming	5-10 minutes

**Take off (with engine already running)**

Fuel tank	Set to Main Tank (265 liter)
Oil Pressure	Checked
Oil Temperature	Checked
Other instruments	Checked
H-Stab Trim	Set to -2 Deg.
Navigation lights	ON
Parking brake	OFF
Taxi to the headwind pos.	
Mixture	Rich
Throttle	Gently increase to full
Takeoff	120 km/h
RPM	2300
Climb	Initial 2 m/s, later 4m/s
Initial climb speed	160 km/h
Reduce throttle	2250 RPM

**Cruise flying**

Mixture	Lean, at 65%
Engine cowl lever	(depends on outside temp)
Speed 200-220 km/h IAS	200-220 km/h IAS
RPM	2150-2200 RPM
Oil Temp	85 C
Oil Pressure	5,5 kg/cm <sup>2</sup>
Fuel Pressure	175 g/cm <sup>2</sup>
Mixture	Rich

**Descent and landing**

Fuel tank	Upper Tank (50 liter)
Mixture	Rich
Speed	200 km/h
Landing speed	120 km/h

**After landing checklist**

Mixture lever	Cutoff
Throttle	0%
Magnetos	OFF
Parking brake	ON
Lights	OFF
Instruments	Checked

## Credits:

Piotr “Bociek” Mika – original 3D model, UV mapping, basic textures

Łukasz “Lucas” Kubacki – research, flight dynamics, textures, animations, manual

Michał “Empeck” Puto – 3D gauges, additional animations and textures

Michał “Some1” Krawczyk – additional animations

Robert “ROB” Rogalski – XML and aircraft system consultant

We would like to thank Mr. Jan Hoffmann from [Polish Aviation and Astronautics Museum in Kraków](#) for providing original RWD-14 manual, which was priceless to make all the things work and look right.

## Contact, support, links:

Since the product is Freeware, we don't provide real kind of support. However, if you would like to get in touch with the original authors, please visit Simhangar's Forum:

<http://simhangar.nets.pl/forum/index.php>

or send an email:

[lkubacki@o2.pl](mailto:lkubacki@o2.pl)

## Links:

<http://www.muzeumlottnictwa.pl> Polish Aviation Museum in Kraków

<http://www.simhangar.com> SimHangar Team's Website

<http://www.1pl.boo.pl> Virtual 1<sup>st</sup> Air Regiment Website, makers of the War over Poland

<http://www.il2forum.xt.pl> Polish Flight Simulation Forum

<http://www.aztec.pl> Polish VA Aztec Forum