Wing42
Blériot XI

Simulation manual

Last Revision: 27/11/2020

The Blériot XI project is dedicated to my Cynthia,
love of my life.

Contents

1 Preface

Thank you for your purchase! Your trust in the quality of our work is much appreciated. The Blériot XI is the first add-on Wing42 has published for the new Microsoft Flight Simulator platform and it has been a bumpy road to get her ready for it.

Microsoft Flight Simulator is a very new platform that comes with new technology, new methods and new hurdles. Some features are still in development, some things are missing, and a few things appear to be broken. For the past year, I have worked tirelessly to better understand the inner workings of the sim. I developed a new workflow to get even higher-fidelity 3D models and textures developed and I dug deep into the file structure of the software to uncover many yet undocumented features.

Meanwhile, Pamela Brooker took a deep dive into the new flight model, and while some aspects have been improved upon drastically in the new simulator, some other parts of the aerodynamics simulation seem to have been forgotten. The result is a flight model which needs extreme overdamping of the controls and still results in oversensitivity of rudder, elevator and ailerons. Despite those issues, Pamela managed to find a way to get the Blériot XI to conform to her numbers. From an aerodynamics point of view she has created a study-level representation of this iconic 1909 flying machine.

Despite her simplicity, you will undoubtedly find this aircraft very challenging to fly. You need to correct for every little gust, and you will *feel* the wind under your wings! You will become a better pilot after having flown the Blériot and will better understand the aerodynamic forces acting on an airframe.

I wish you good luck for your first flights and hope that you'll have as much fun flying the Wing42 Blériot XI as we have had developing this iconic aircraft!

Kind Regards,

Otmar Nitsche
Founder of Wing42

2 The Wing42 Blériot XI

The add-on installer will add three different variants of the Blériot XI to your Flight Simulator, each with a different focus. While all three variants feature a highly realistic flight model, some concessions were made to the first two, to allow for a better flyability in MSFS.

2.1 Blériot XI Gnome

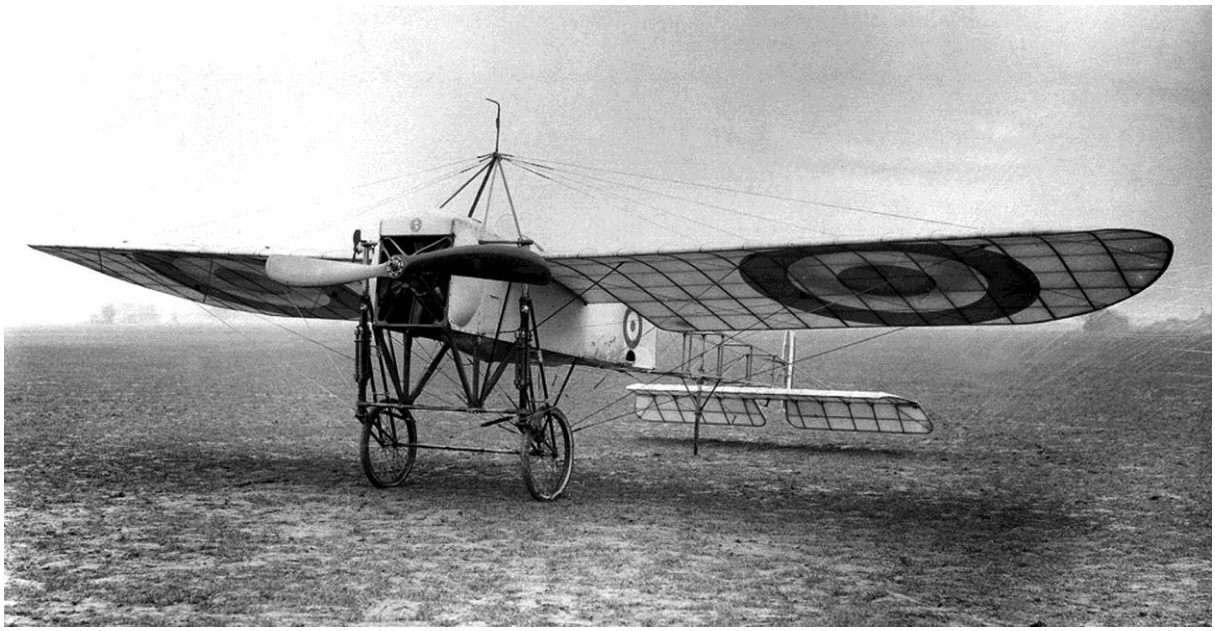


Figure 1: A Gnome-Omega powered Blériot XI of the RFC

The Gnome-powered Blériot XI represents the most widely used variant of this aircraft. Of the three, you will find her the easiest to fly and operate, simply due to the fact that the 50 HP rotary engine provides a satisfactory amount of thrust to keep the aircraft airborne.

The flight model differs from reality in overall stability and rudder authority. The enhanced stability allows for a more relaxed flying over longer distances with less active inputs required. The higher responsiveness of the rudder allows both for more controllability in the air, as well as a better ground handling – which is essentially nonexistent in the real-world counterpart.

It is recommended to start off with the Gnome variant so you become familiar with this very different and exciting way of flying. It is unlike any modern aircraft!

Difficulty: 

2.2 Blériot XI Anzani

Figure 2: Louis Blériots Anzani powered aeroplane.

The Anzani powered Blériot XI is representative of the aircraft that Louis Blériot flew across the English Channel and thus marks the very early variants of this magnificent flying machine. The 3-cylinder Anzani engine produces only half of the power of the Gnome variant and thus the aircraft is hopelessly underpowered.

The flight model is overall more challenging than that of the Gnome-powered Blériot and you will find her to be much more susceptible to winds.

Difficulty:

2.3 Blériot XI Anzani R.I.P. edition

Figure 3: Louis Blériot and his crash-landed aeroplane after the Channel crossing.

Lastly, the R.I.P. edition of the Anzani variant represents the most realistic, but also most challenging flight experience. The limited effectiveness of the rudder can be especially tricky on the ground during the take-off and landing roll.

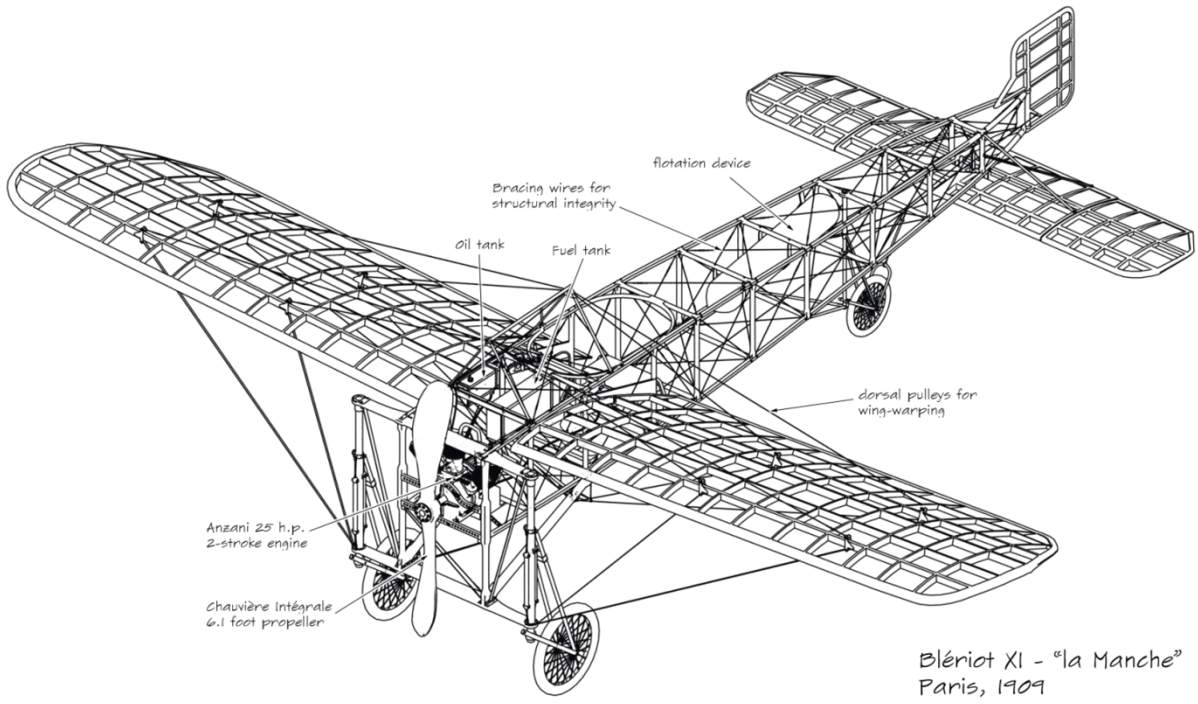
Are you brave enough to accept the challenge? A few seconds of flight without a crash is typical, and successful figure-8 is reason to rejoice.

Difficulty: ☠☠☠☠☠

3 Aircraft Specifications

CHARACTERISTICS	*Anzani*	*Gnome Omega*
Crew	1	1
Length	7.6 m (23.5 ft)	7.6 m (23.5 ft)
Wingspan	7.8 m (25.6 ft)	7.8 m (25.6 ft)
Height	2.7 m (8.8 ft)	2.7 m (8.8 ft)
Empty weight	230 kg (507 lbs)	330 kg (727 lbs)
MTOW	330 kg (727 lbs)	540 kg (1200 lbs)
Fuel tanks	1 x 40 l (11 gal)	2 x 40 l (11 gal)
Powerplant	Anzani "W" 2-stroke engine	Gnome Omega 7
Propeller	2-bladed Chauvière Intégrale 2m (6.1 ft)	2-bladed Chauvière Intégrale 2m (6.1 ft)

PERFORMANCE		
Max. Engine power	25 h.p. at 1,200 r.p.m.	50 h.p. at 1,200 r.p.m.
Cruise Speed	60 km/h (32 knots)	78 km/h (42 knots)
Max. Speed	68 km/h (37 knots)	90 km/h (49 knots)
Take-off speed	40 km/h (22 knots)	40 km/h (22 knots)
Stall speed	35 km/h (19 knots)	35 km/h (19 knots)
Climb rate	100 ft/min	250 ft/min
Max. Ceiling	600 m (2,000 ft)	4,800 m (16,000 ft)
Range	110 km (52 nmi)	250 km (134 nmi)
Endurance	1½ hours	3 hours



Blériot XI - "la Manche" Paris, 1909

4 Setting up Microsoft Flight Simulator

4.1 Flight Model

The Wing42 Blériot XI is a 100% native MSFS add-on and as such, it utilizes all the new technologies available with this new platform. This is noteworthy, because for the Blériot XI to fly right, you need to set the simulator's flight model to "MODERN" (**Error! Reference source not found.**)!

You can find the relevant parameter under: Settings->General ->Flight Model.

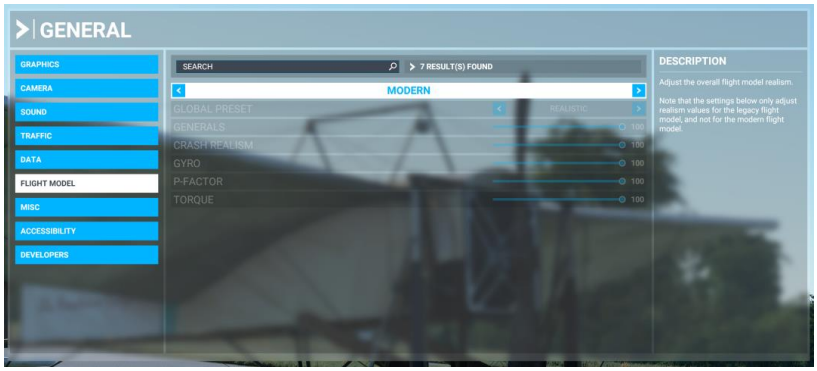


Figure 4: Flight model selection screen.

4.2 Instrument Overlay

Microsoft Flight Simulator shows some instruments in the exterior view by default. For a more immersive experience – and prettier screenshots - with the Blériot XI, we highly recommend you turn those overlays off.

To do that, go to settings->General->Cameras and scroll down to the section "Chase Camera". Turn off the setting labeled "Instrument Heads-Up Display (HUD)" (Figure 5).

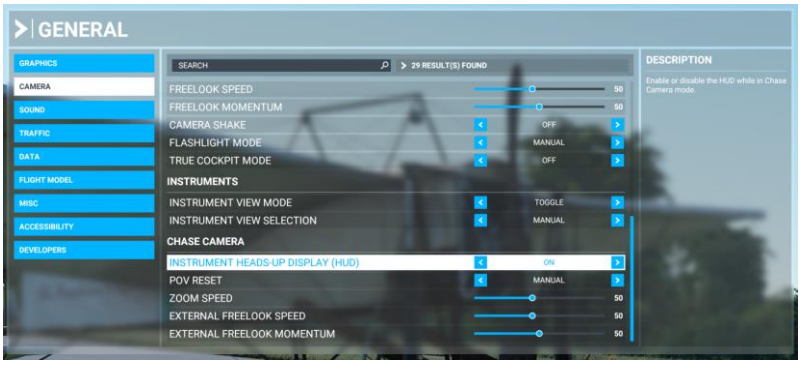


Figure 5: Camera settings to turn off the HUD in the external view.

4.3 Controller

The Wing42 Blériot XI is designed to be flown as closely to the original 1909 aircraft as possible. One aspect of operating an engine of that period is the usage of a blip switch to interrupt the ignition to control aircraft speed. We setup the ignition of the aircraft to be linked with the “master ignition switch” event of MSFS. This allows you to map the ignition to one of your joystick buttons, and we highly encourage you to do so!

Go to the “Controls” page of the settings menu and select your controller. Type: “master ignition switch” in the search box on the left, labeled “SEARCH BY NAME” and assign the “TOGGLE MASTER IGNITION SWITCH” event to a controller button convenient to you (Figure 6).

Keep in mind that you can save this assignment in a separate controller profile, to avoid conflicts with other aircraft addons you operate.

For more information on how to operate the different engines of the Blériot XI, please refer to chapter 5.3 of this manual.

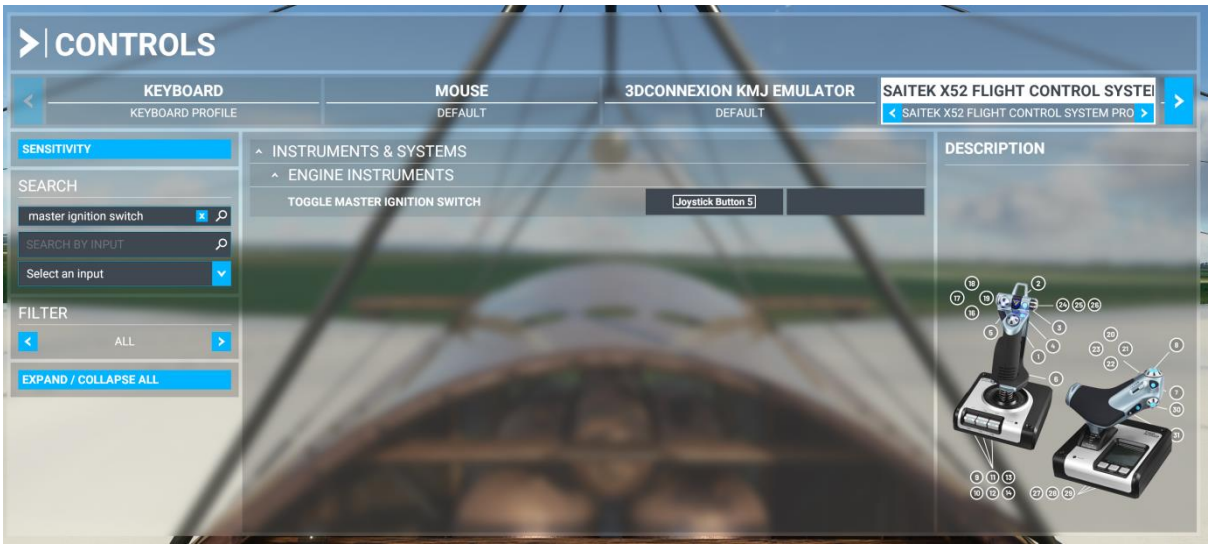


Figure 6: Controls set up screen of MSFS, showing the assignment of the ignition switch.

5 Getting started

5.1 Starting the Gnome Omega 7 engine

Make sure that the wheel chocks are installed by operating the input for the parking brake or by clicking on one of the wheels. Open either one or both of the fuel valves (Figure 7). Operate the fuel hand pump, mounted on the right side of the cockpit, to bring up the fuel pressure. Engage the magneto by flicking the switch upwards, and crack open the air flow and fuel flow (throttle and mixture). Switch to the propeller view and in a swift move pull the propeller by clicking and dragging it with your mouse. To ensure that the engine is well lubricated with oil, open the valve below the oil pressure bubble gauge on the left side of the cockpit.

The Gnome variant of the Blériot XI features a state-of-the-art Naudet altimeter, mounted between the dorsal bracing for the wings (Figure 8). Please note that the scale is in hundred meters and there is no ambient pressure adjustment and thus no option to calibrate the instrument.

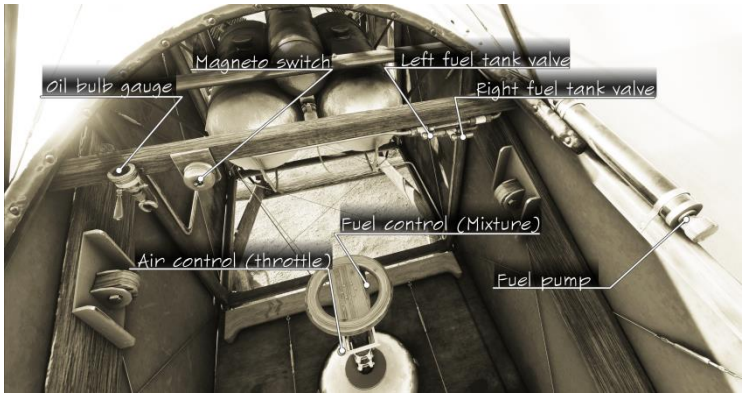


Figure 7: Controls in the cockpit of the Gnome variant.

Figure 8: Modern Instrumentation: the Naudet altimeter.

5.2 Starting the Anzani W-3 engine

To start the Anzani engine, first make sure that the fuel valve is fully open (Figure 10). Make sure that the wheel chocks are engaged by toggling the control for the parking brake, or clicking on one of the wheels. Switch on the magneto by pulling the magneto lever back to the "activé" position and open the throttle to ~50%. Switch to the propeller view and in a swift move pull the propeller by clicking and dragging it with your mouse. After the engine is running, make sure to open the valve of the oil pressure gauge to ensure that the engine is getting enough oil.

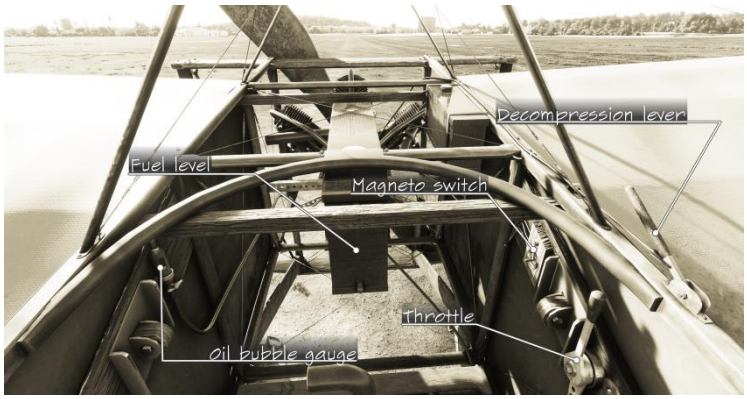


Figure 9: Cockpit controls of the Anzani variant.

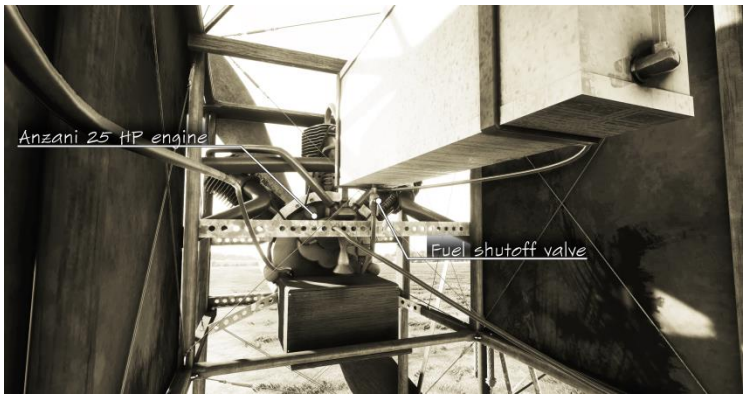


Figure 10: Position of the fuel shut-off valve below the main fuel tank.

Figure 11: Front view of the aircraft. Pull the propeller to start the engine.

5.3 Take-off

Figure 12: Harriet Quimby, the first American licensed woman pilot, in her brand-new Blériot XI.

After the engine is warmed up, make sure that the nose of the aircraft is pointing towards the wind. We made both the Anzani and Gnome variant of the Wing42 Blériot XI controllable on the ground, so you can actually taxi into position. However, in reality the rudder effectiveness is essentially nonexistent on the ground and the tail wheel doesn't steer, so you would always need a ground crew to move your aircraft around. For more realism, this is implemented in the R.I.P. edition of the Anzani-powered Blériot. Since there are no rampies pushing your aircraft in MSFS, it is recommended to use the slew-mode to put your flying machine in position for takeoff.

Once more, make sure that the wheel chocks are set (use parking brake or click on one of the wheels) and rev up the engine. When you reach maximum RPM, pull the wheel chocks to get your aircraft moving. Push forward on the stick to put a downward pressure on the elevator to reduced induced drag and relieve friction from the tailwheel. Make sure to warp the wings towards the wind direction if you have even a slight crosswind.

At around 15 knots, you should be able to lift the tailwheel off the ground completely. Hold a level attitude and gain more speed. When reaching around 19-22 knots, the aircraft will start to lift off the ground without any further input.

Keep accelerating by maintaining about 1 meter height above the ground to benefit from the ground effect. When reaching around 30 knots you will be able to climb at around 100 feet per minute for the Anzani-powered aircraft and around 200 feet per minute for the Gnome-powered variant.

5.4 Flying an aircraft from the 1910s

There are a few things you should keep in mind when flying the Blériot XI. The early aircraft of the 1910s were extremely lightweight and underpowered. As such, they are very susceptible to the elements in general and wind gusts in particular.

The Blériot XI does not like crosswind takeoffs and landings. Anything above 4 knots crosswind is generally avoided by pilots of the real world aircraft. Because of the lightweight build of the aircraft, any stronger crosswinds can put enough pressure under the upwind wing to flip the aircraft over – a fate that was shared by a number of pilots of the 1910s.

When flying the BlériotXI, you will quickly notice that the lateral control by means of wing warping is not great. In the real aircraft the physical strength required to twist the whole wing through pulleys mounted on top and bottom of the wing was a significant factor, too! It is therefore necessary to plan your turns carefully. Make sure you're going fast enough to deal with the additional drag and use the rudder to counteract the sideslip of the aircraft. It is generally advisable to make gentle and flat turns to limit the chances of a wing stall or spin.

Figure 13: The Blériot XI over the Cliffs of Dover.

5.5 Landing and Shutdown

Early aircraft engines of the 1910s were generally unreliable, underpowered and experimental in nature. Carburetors and throttle controls were in their early development and slow to react. Therefore, most pilots controlled the speed of the engine through the ignition. By switching the engine on and off intermittently, they were able to slow down the engine enough for an approach and landing.

Figure 14: Ready for touchdown!

In practice, you can use the air control (throttle) and for the Gnome engine the fuel control (mixture) to slow the engine down, however the effectiveness of those controls is limited, as it is in the real-world counterparts. So do what pilots from the 1910s did and use the ignition switch to slow down the engine! If you mapped the event on your controller as described in Chapter 4, you can achieve some control of your engine's RPM. However, be careful that your engine does not to lose too much momentum, otherwise you won't be able to start it up again!

Depending on the wind conditions, different techniques can be used to land the aircraft. If there is sufficient wind, make sure to land with the aircraft's nose pointing towards it. Prepare you engine for a low idle. In conditions with no wind, it might be advisable to turn off the engine completely just short of touching down.

When over the threshold of your chosen runway, don't force your aircraft on the ground. Instead, flare out so that you hover about half a meter above the ground and use the increased drag from this attitude to slow your flying machine down. Try to touchdown with the tailwheel first, lest the aircraft flips over.

There are no brakes on this aircraft and the controllability of the engine is limited. Taxiing is therefore not encouraged. Also, don't land on a runway that is sloped downwards or you'll have trouble coming to a stop altogether.

6 A word on Realism and Limitations of MSFS

Microsoft Flight Simulator is still awaiting a few iterations of updates, before some much-needed or much-wanted functions will see the light of day.

Effects

The technology currently used by the sim to produce any particle effects (dust, smoke, etc.) is still entirely based on the effects of Flight Simulator X. However, it was announced that an entirely new particle system is currently being developed for MSFS and will hopefully be deployed in a matter of months.

We therefore didn't spent any time developing particle effects for a technology that will become obsolete sooner rather than later. Once Asobo and Microsoft release the update for the new particle system, we will begin working on engine smoke effects and custom dirt and dust splatters.

Pilot Animations

Microsoft Flight Simulator introduced a new way to put a pilot-character into your aircraft. It is a very clever system; however the current state of it is incomplete. The character is currently not able to use the aircraft's controls and instead just uses a random idle animation to move his body and head. Furthermore, only modern attire and equipment is available for the existing models.

Our decision was therefore to develop a more classic approach by using the exterior model of the aircraft to display our 1910s pilot character. We hope that there will be improvements made to the animation system in MSFS and when there is, we will update our technology accordingly.

Systems

The aircraft systems simulation in Microsoft Flight Simulator is heavily focused on modern aviation and trying to implement technology as it was used in the 1910s has been difficult and we had to make some concessions to realism in some systems.

To simulate the inadequate engine controls of the time, we limit the effective range of both the throttle and mixture for the Gnome engine. This is to enable more complex adjustments that had to be made with those engine types.

The Decompression lever in the cockpit of the Anzani-powered Blériot would release the pressure on the valves of the engine, resulting in an idling of the engine without proper combustion. This could be used both to slow down the engine as well as stop it completely.

In the Wing42 Blériot XI, the lever is linked to the fuel control and will thus stall the engine when pulled.

7 Flights to challenge your piloting skills

7.1 Over the Channel!

The most famous flight of the Blériot XI was the one that gave her the commercial success in the first place – Louis Blériot's flight across the English Channel.

Select the Anzani variant of the Blériot. As a starting point, either take-off from Calais-Dunkerque airport (LFAC), or alternatively the smaller and more suitable airfield of Saint-Inglevert (LFIS)

If you want to make it even more realistic, take a short flight to the village of Sangatte, at the coast of the English Channel. Set the Bleriot down in one of the fields, create some weather settings with poor visibility and low ceilings, and takeoff just after sunrise.

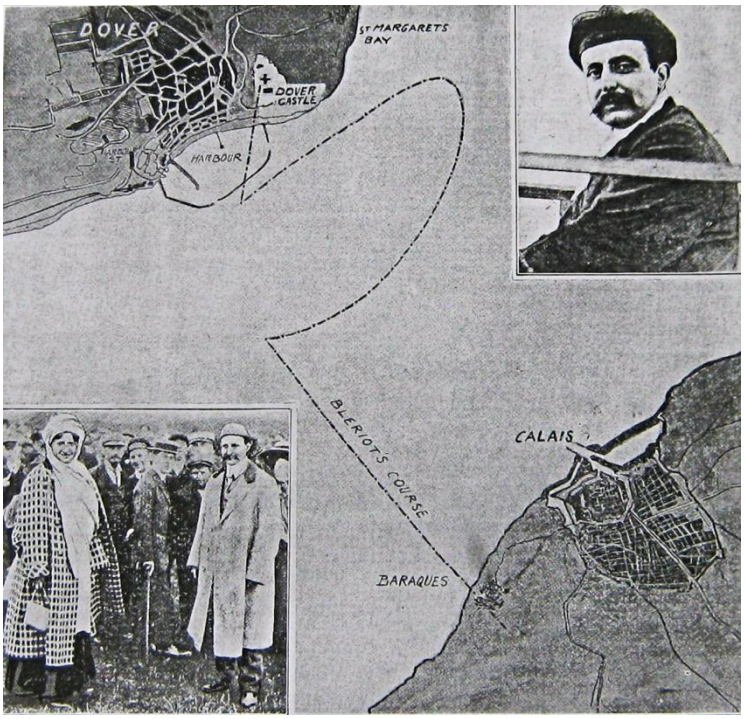


Figure 15: Louis Blériot's route across the English Channel.

Louis Blériot completed his famous flight in suboptimal weather conditions in 37 minutes. How long will you take? Don't cheat by using the VFR map, external view or HUD instruments!

7.2 Over the Alps!

Follow in Jorge Chávez' footsteps and fly across the Alps! Use the Gnome variant of the Blériot XI, take off at or around Brieg, Switzerland and circle to reach sufficient altitude. You need to reach at least 2,000 meters to make it over the peaks. Follow the mountain valleys to land at your destination in Domo d'Ossola, Italy.

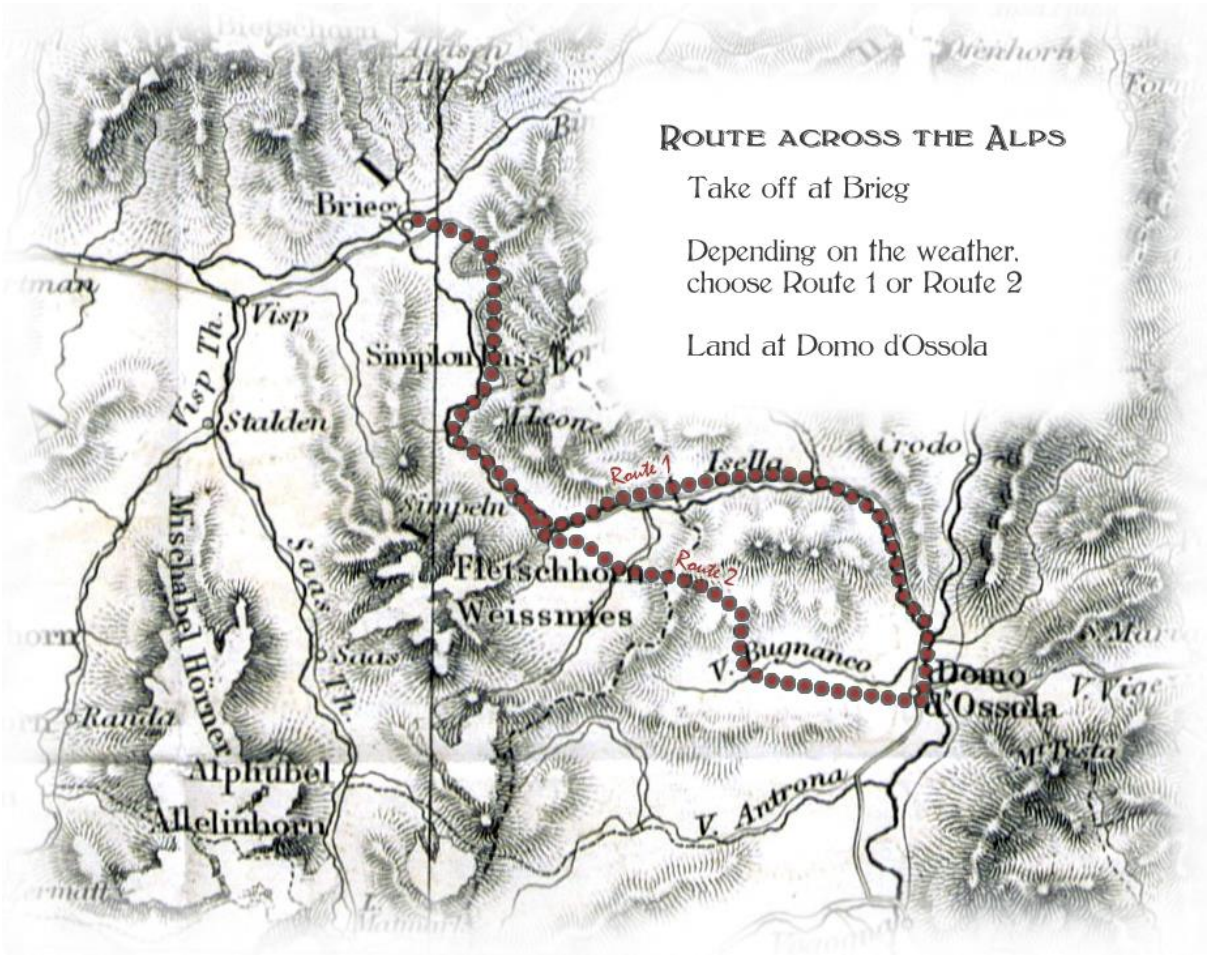


Figure 16: The proposed flight routes across the Alps. Chávez decided on Route 1.

Jorge Chávez completed his flight in 51 minutes, but tragically lost his life after a wind gust blew his aircraft over after touchdown.

7.3 Beat the Pyrenees

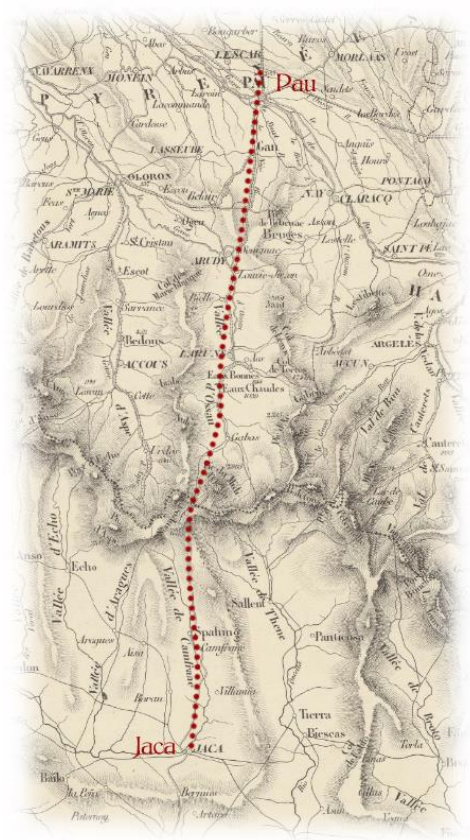


Figure 17: Suggested route across the Pyrenees. Leg 1 from Pau to Jaca.

On January 1913, Oskar Biden, a Swiss national, took off from Pau, France to be the first to cross the Pyrenees mountain range and natural boarder between Southern France and Spain. After flying a record distance of 500km, he stopped at the city of Guadalajara to refuel and then continued his flight to Spain's capital Madrid.

Since the Wing42 Blériot XI currently has a limited range of about 250 km, we recommend some adjustments to the route. Take off from around Pau, France (LFBP) climb to at least 8,000 ft and head south towards the Pyrenees mountain range.

Your first stop can be at around Jaca, Spain and from there it'll be an easy ride heading southwest towards Madrid.

This flight will take you an approximate 6 hours to complete – and that's provided you have favorable weather conditions.

Do you have the stamina to complete this monumental achievement?

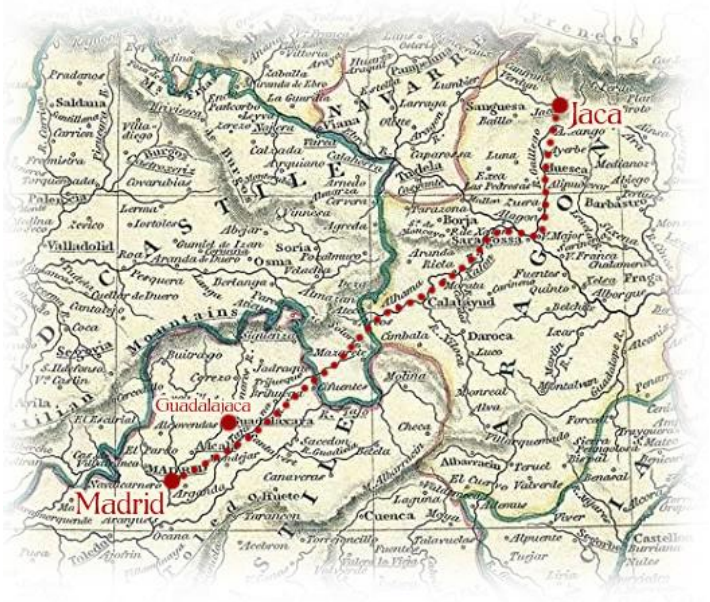


Figure 18: Leg 2 from Jaca to Madrid.

8 Credits

Lead Design, 3D modelling, texturing, programming and sound design	***Otmar Nitsche***
Flight model	***Pamela Brooker***
Research and documentation	***Tom Harnish and Otmar Nitsche***

ADDITIONAL LICENSING:

The Wing42 Blériot XI proudly uses the WWise sound engine to bring the aircraft to life.

WITH SPECIAL THANKS TO:

Dean Crawford of DC Designs for providing the base model for the pilot of the Blériot XI.

The group of "***All Stars***" that help me keep some sanity and are always willing to support me and my ludicrous ideas (you know who you are!).

Thanks to the ***Asobo*** team, for always having an ear for me.

9 References

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