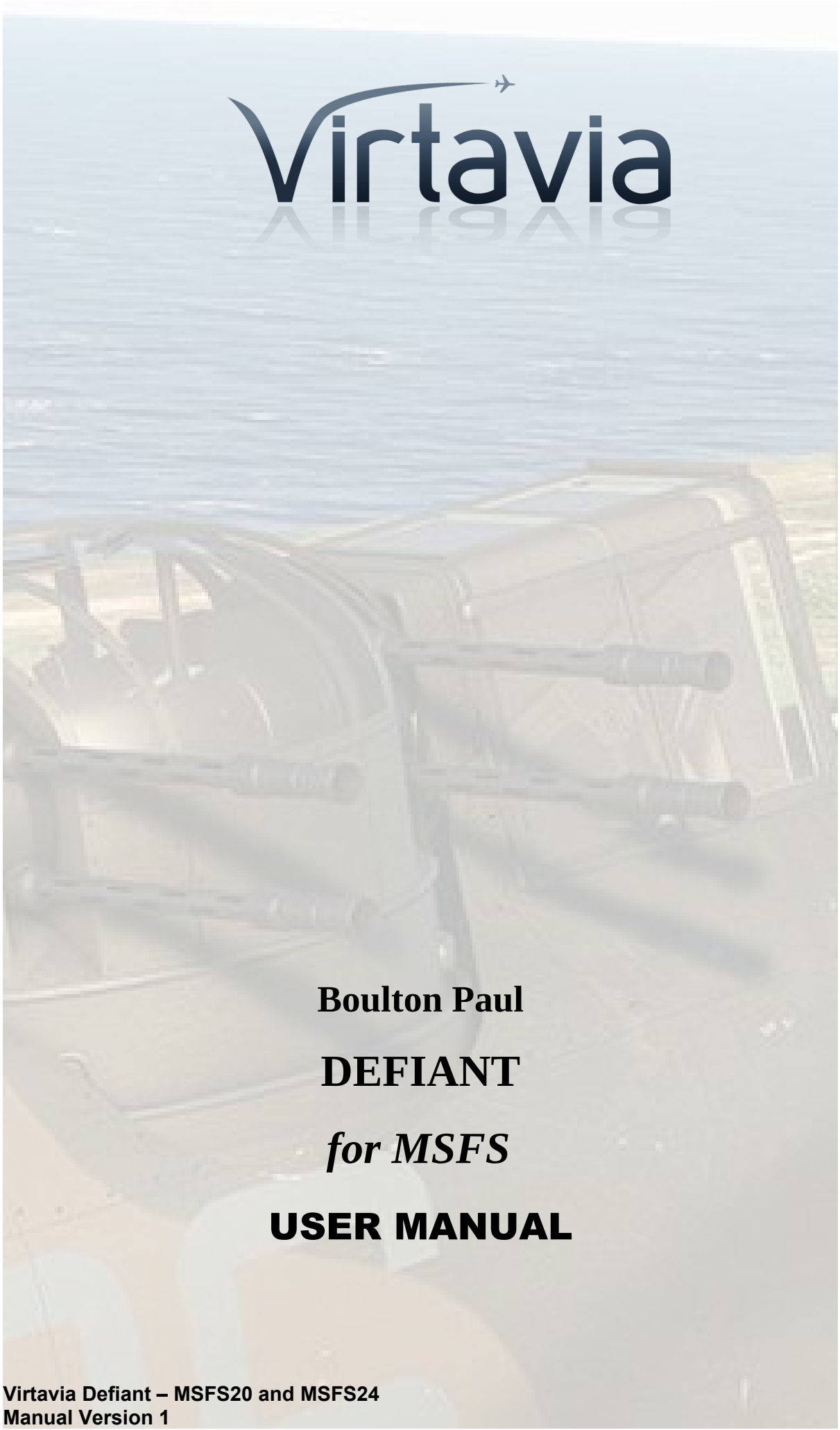

Boulton Paul

DEFIANT

for MSFS

USER MANUAL

Virtavia Defiant – MSFS20 and MSFS24
Manual Version 1

Introduction

The Defiant Mk1 is a British World War II-era two-seat, single-engine, day / night military interceptor developed by Boulton Paul Aircraft. The Defiant took its maiden flight on August 11, 1937, and it entered service in December of 1939. Boulton Paul Aircraft manufactured just over 1,000 of the design. Only one non-flying example remains in existence, as a static museum display.

In the mid-1930s, the Royal Air Force sought to procure a new type of aircraft that could defend against raids comprising masses of unescorted long-range German bombers. This concept culminated in the April 1935 Air Ministry release of Specification F.9/35. This outlined a two-seat, day/night interceptor aircraft comprising a powered, freely rotating turret with 360-degree field of fire that housed an array of machine guns. Such an aircraft would, as per the specification, engage bombers in formation from aside and from beneath them.

Called a “turret fighter,” the Boulton Paul Defiant was constructed with aluminum skin over a metal airframe. It has a low-wing cantilever monoplane design with a standard empennage and a retractable standard undercarriage. The electro-hydraulically turret is mounted just behind the cockpit on the dorsal aspect of aircraft. When operational, the turret comprised four parallel-mounted .303-caliber Browning machine guns and accommodated a single gunner. Upon its debut, the Boulton Paul Defiant proved successful against unescorted German bombers. However, the Germans quickly learned to counter the aircraft by attacking it head-on, as it did not possess any forward-firing armament.

The Royal Air Force withdrew the fighter from daytime use, focusing on nighttime missions, including missions that used onboard radar. These radar-equipped Defiants made critical defensive contributions to the effort against the German “Blitz” of 1940 to 1941. In the latter days of the war, the Defiant was used for gunnery training and search and rescue missions. The Defiant Mk1 measures 35 feet, 4 inches in length, stands 11 feet, 4 inches tall, and has a wingspan of 39 feet, 4 inches. When operational, it was powered by a single Rolls-Royce Merlin III V12 engine that produced up to 1,030 horsepower and turned a 3-blade, constant-speed propeller. The Defiant had a maximum range of 500 miles, a service ceiling of 31,000 feet above sea level, and a maximum climb rate of 2,000 feet per minute. It cruised at 175 miles per hour and had a top speed of 304 miles per hour.

Support

Should you experience difficulties or require extra information about the Virtavia Boulton Paul Defiant, please e-mail technical support on tech.support@virtavia.com

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Six liveries are included in this package :

Defiant F Mk1. PS-A, N1535

No. 264 Squadron, RAF Hornchurch, August 1940.

This Defiant bears the Commanding Officer pennant on the port side under the cockpit. It was flown by was flown by Sqn Ldr Philip Hunter, who played a major role in bringing the Defiant into operational service and developed the special defensive formation where a Defiant formation would, when attacked, fly together in a circle and use the combined turret guns to bring down enemy fighters. Sqn Ldr Hunter and his gunner, Sgt. F. King, were last seen chasing down a Ju88 over the English Channel on 24th August 1940, both presumed KIA.

Defiant F Mk1. PS-T, L6857

No. 264 Squadron, RAF Martlesham Heath, March 1940

Defiant F Mk1. AF-V, V1121

Air Fighting Development Unit, RAF Duxford, April 1941

Defiant NF Mk1. DZ-Z, N3328

No. 151 Squadron, RAF Wittering, January 1941

Defiant NF Mk1. JT-T , T4037

No. 256 Squadron, RAF Squires Gate, October 1941

Defiant NF Mk1. EW-D, N1671

No. 307 (Polish) Squadron, RAF Kirton-in-Lindsey, September 1941

This Defiant is the only airframe ever preserved and is on display at the RAF Museum in London. Struck off charge in June 1942, N1671 was selected for preservation in 1944 and underwent a full restoration in 2012.

Exterior Model

The exterior model has most of the usual animations such as landing gear, control surfaces and a sliding canopy. There are also some additional animations on the model:

Gun Turret (automatic)

In this model, the gun turret is animated automatically to follow the position of the landing gear. When the Defiant was taking off or landing, the usual procedure was to have the guns facing forwards so that the gunner's access doors were not obstructed in case of a forced landing. So to simulate this procedure in MSFS, when the landing gear is retracted, the turret, guns and associated fairings will operate automatically and traverse the turret from the guns-facing-forward position to the guns-facing-aft position, which is the normal defensive state in flight.

Gun Turret (manual)

Once on the ground and stationary, the turret can be rotated 90 degrees by means of a dedicated switch on the right side of the cockpit (refer to the cockpit section of this manual for its location). The gunner's access doors will open automatically at the end of the turret animation. Putting the switch to OFF will simply reverse the animation. This function is only available when the aircraft is on the ground and not moving, if there is any movement the turret will return to the normal parked state (guns forward) and the switch will move back to OFF.

Radiator Shutter

The ventrally-mounted engine cooling radiator has a shutter at the rear to control airflow. This can be set open or closed using a rotary handle on the right upper side of the cockpit. A small drop in coolant temperature will register on the RAD TEMP indicator.

Crew figures

The pilot's head will move left/right with roll input and the pilot figure can be toggled using a cockpit switch (refer to Pilot's Instrument Panel section of this manual for the location of the switch).

Exterior Lighting

Pressing the L key will turn on the navigation lights only. You may however wish to turn them on using the switch on the right side of the cockpit. The landing lights are operated using a switch on the top of the the throttle console on the left side of the cockpit.

Please refer to the cockpit section of this manual for information regarding light switch location.

Quick Tips

Starting from cold – Assuming the aircraft was left in the fully shut down state and all switches and levers are in their usual OFF position, you can follow the quick start procedure below or alternatively follow the in-game checklist.

Preliminaries -

Check the park brake is on (the lever is in the centre of the pilot's control column). On the right-side console, set the Master Battery and Navigation Switches to ON. If required, the Pitot Heat Switch can be found on this same console.

Set the landing gear position indicator to ON by means of the sliding switch on the top left of the main panel. This was a safety feature used to prevent the magneto switches from being placed ON before the landing gear indicator was activated. The two green (gear down) lamps will illuminate, assuming the Master Battery is ON.

The Defiant was not fitted with any radio navigation instruments, merely a basic communication set, the location and appearance of its controls is not apparent from available documents and images. It is advised therefore to use the MSFS AI assistant to tune into in-range COMM frequencies, if desired.

For authenticity, the radiator shutter can be set OPEN if desired.

Engine Start – Set the star-shaped fuel cock knob so the red pointer is straight UP and points to 'ALL ON'. On the lower right side of the main panel, prime the engine using the brass 'Ki-Gass' primer pump first (primes the induction system), then use the smaller, lower primer which affects only the fuel pump. One click is all that is needed.

Now set both the magneto switches (main panel, top left) to ON. Assuming there is fuel in the tanks (check the two gauges, main panel botton right), the engine can now be started. Press the starter button on the right side of the main panel. The booster coil switch next to the starter will engage simultaneously. In the real Defiant the pilot would press both switches in, then release starter first, then the booster afterwards once the engine was running evenly. In this sim, they operate together. Now release the parking brake and taxy/take-off.

Taxi - It is advised, but not strictly necessary, to set the Propeller Pitch Lever on the throttle console to about 70% when taxying. Taxying at fully fine pitch (100%, lever fully forward) can lead to the aircraft moving too fast and so a lower pitch setting prevents frequent use of the brakes.

Trim – In the real Defiant Pilot's Notes, it is stated that the Defiant does not require any nose-up trim or flap extension when taking off, this is also true of the Virtavia model.

Take-Off – To get airborne, check the Propeller Pitch Lever is at fully fine (lever is fully forward). Advance the throttle to full. Once moving, the aircraft will tend to wander slightly due the torque reaction of the propeller, care is needed with rudder input to maintain directional stability. The tail will rise at around 70 mph, but DO NOT under any circumstances attempt to lift off under 90 mph on the Airspeed Indicator, this will cause a sudden left wing drop (authentic Defiant stall behaviour) and most likely a crash. A small triangle marker is placed at that speed on the dial to aid the pilot. The aircraft will lift off nicely at 90-95 mph.

Retract the landing gear immediately and apply rudder control to counter the low-speed yaw, this will diminish as speed increases and the aircraft gains directional stability. Reduce power, apply pitch trim as needed and maintain 160 mph in the climbout.

Autopilot - The Defiant did not have an autopilot but for ease of use a basic system has been added in this simulation. A simple on/off toggle switch for ALT hold is provided at the front of the right-side console, an amber warning lamp below the switch will illuminate when the AP is ON. The autopilot function will just level the wings and hold the present altitude, no directional facility is provided.

Landing and Engine Shutdown

The landing procedure is detailed in the in-game checklist and is very straightforward with no special procedures required.

Reduce speed by reducing power and making turns, if necessary. At 160 mph lower the landing gear. First flaps extension (15 deg.) at 140 mph. Continue deccelerating to 120 mph when the flaps can be extended to 30 deg.

Aim to cross the runway threshold at 100 mph. The last flaps extension (45 deg.) is not normally necessary but can be used to help slow down some more if required.

The airspeed indicator has a cautionary triangle indicator at 90 mph - the aircraft will STALL at this speed, excercise caution ! Touchdown at 95 mph, higher speed touchdown is possible but bouncing is likely.

The engine is shut down simply by either setting the Magneto Switches to OFF and turning the Fuel Cock Knob to ALL OFF (red pointer straight down). Full shutdown requires only that the Navigation/Landing Lights and Pitot Heater switches are set OFF, the Landing Gear Indicator switch (under the magneto switches) is set to the OFF position and the Radiator Shutter set to SHUT, then the Master Battery switch can be turned off.

If desired, the pilot figures can be hidden and the turret set to the exit position using the rearmost two switches on the right side console.

Instrument Panels

It is expected the user will recognize the usual altimeter, airspeed, vertical speed, directional indicator, turn/slip instrument and engine/fuel indicators, the other items of interest are detailed below.

1. Landing Gear Indicator - The lamps go OFF when the gear is in transit between locked UP or locked DOWN positions. The small rotary knob controls the lamp dimmer, used at night.

2. Landing Gear Indicator Isolator - In the shut down state, this safety switch is moved to the right where it turns the Landing Gear Indicator

OFF and also prevents the two Magneto switches from being used. When starting the engine, the pilot is thereby forced to move the switch to the left, thereby switching the Landing Gear Indicator to ON.

3. Magneto Switches - The Defiant does not have a separate ignition switch, the Magneto switches are the typical left/right type, the engine requires at least one to be ON to run.

4. Cockpit Illumination Switch (left) - This switch has three positions, OFF, DIM and ON, it controls the illumination of the instruments and some general red flood.

5. Pitch Trim Lever - click and drag to adjust nose up/down trim.

6. Left Side Indicator Cluster - Indicators for Brake Pressure, Hydraulic Pressure and Flaps Position.

7. Fuel Cock - Use left and right mouse click to advance or return this knob to select the fuel tanks. Normal position for the red pointer is straight up, 'ALL ON'. Set down to 'ALL OFF' to shut down the engine.

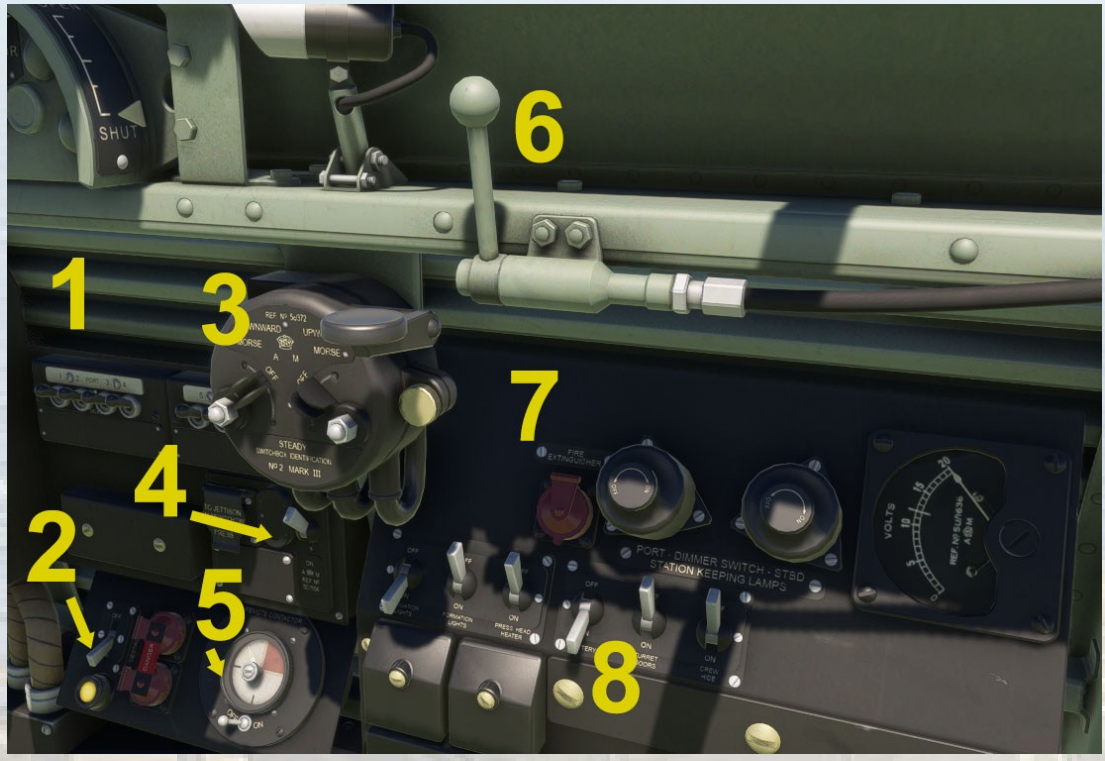
Just for information, the red knob next to the Fuel Cock is the Emergency Boost Cut-Out and was used in the Defiant to override the automatic supercharger boost control and stop the system. It was meant for emergencies only. The knob is retained by a spring wire structure to prevent accidental use and this would prevent it returning once it had been pulled out, meaning that it would be visible to the ground crew and would require re-setting. It is not operable in MSFS.

1. Cockpit Illumination Switch (right) - This switch has three positions, OFF, DIM and ON, it controls the illumination of the panel text and some general red flood.

2. Radiator Shutter Lever - Use a single mouse click to open or close the ventral radiator pod rear flap.

3. Starter Switch - The booster coil switch next to the starter will engage simultaneously. In the real Defiant the pilot would press both switches in, then release starter first, then the booster afterwards once the engine was running evenly. In this sim, they operate together.

4. Primer Pumps - The upper pump is used to prime the Merlin engine's induction manifold with fuel, aiding cold starts. The lower pump primes the engine's fuel pump. A single mouse click will operate the pumps.



1. Bomb Selector Switches - The Defiant was able to carry a light bomb load but this feature was never used other than on the ASR Mk1 variant which could carry two inflatable dinghies.

2. Autopilot Switch - No autopilot was actually fitted to the Defiant, this feature is just for ease of use in MSFS, it controls altitude hold only and is not settable to a specific altitude. In the real Defiant, this switch and the adjacent red switchcovers would be for the IFF radio self-destruct, to be used only when the aircraft is abandoned after a forced landing in hostile territory and there is not time to destroy the airframe.

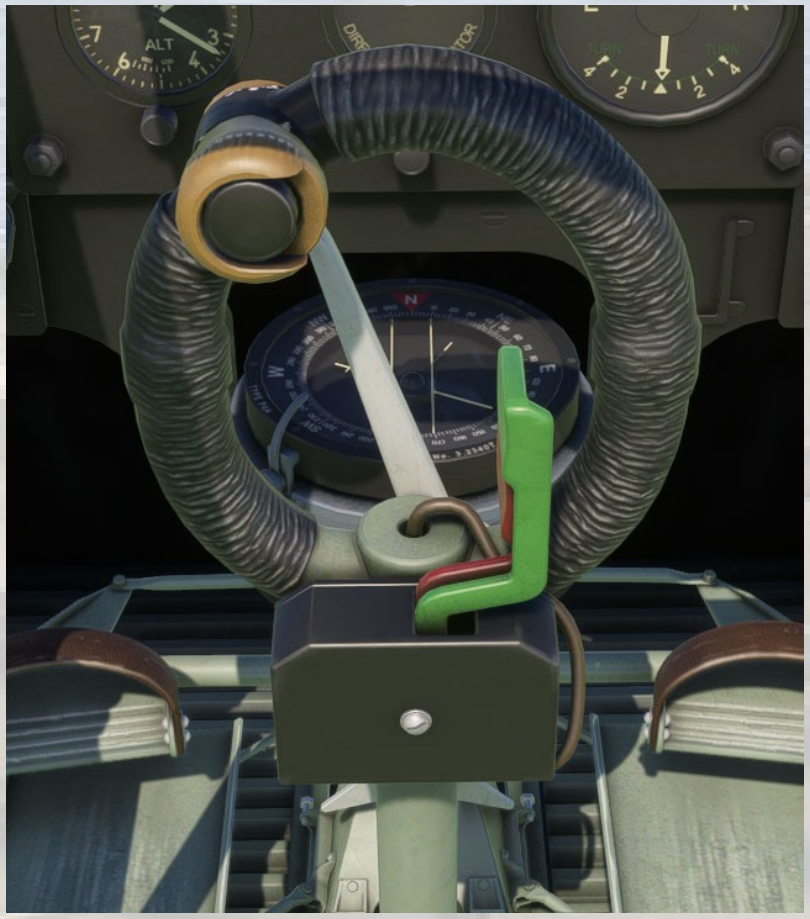
3. Signalling Switches Box - Found in almost all RAF aircraft of the period, this unit allows various combinations of lamp signalling, including a Morse Code key. This unit is not operational in MSFS.

4. Bomb Jettison Switches - The bombs would be selected first using the switches in (1) above, then the master toggle switch set ON. The flap is then raised and the pushbutton switch used to release the bomb(s).

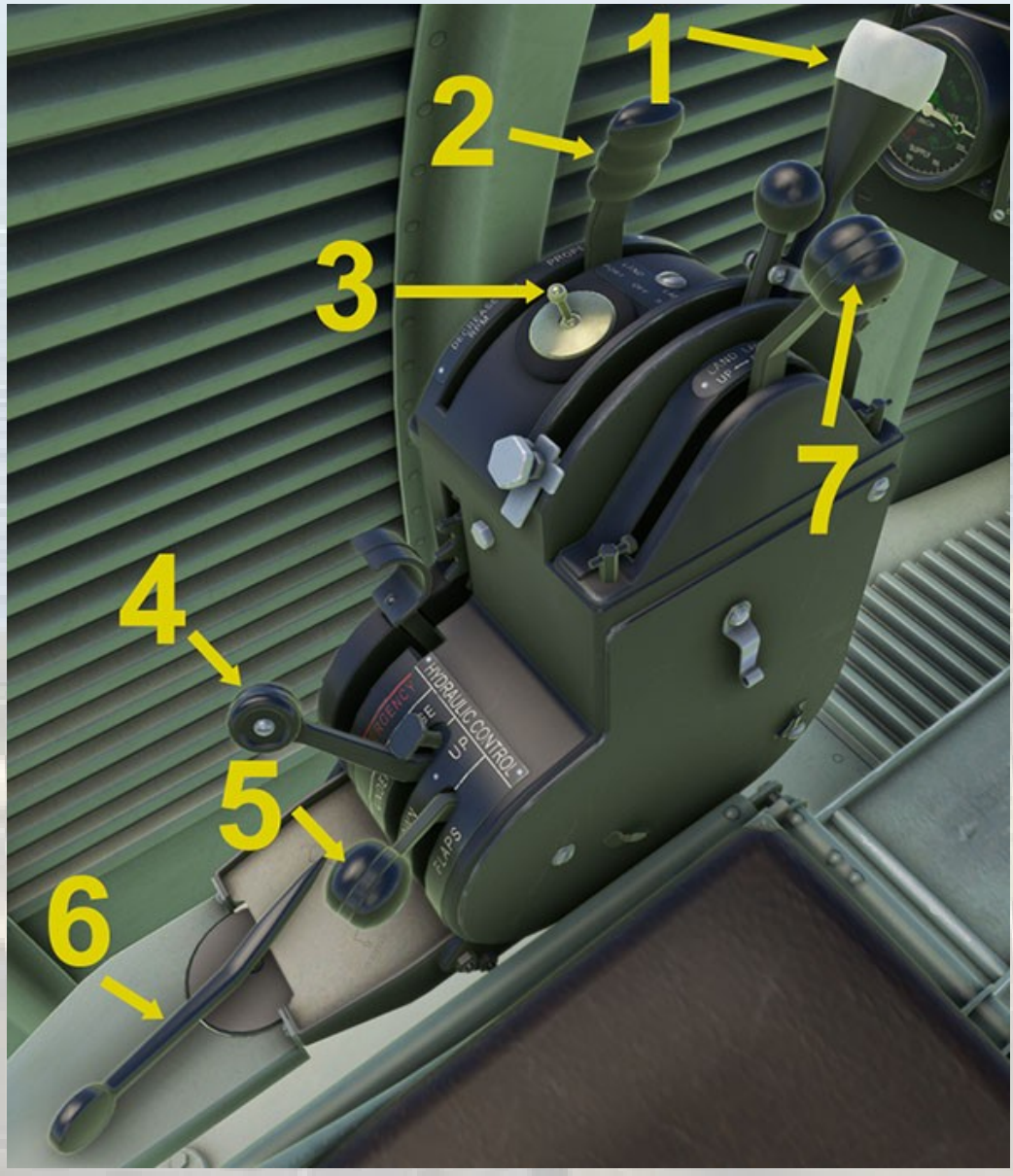
5. Remote Contactor - Also called the 'IFF Master Contactor Type 2', this was a spring-driven clockwork unit used as part of the Identify Friend or Foe (IFF) system, also known as 'Pipsqueak'.

6. Harness Release - this small lever was used to lock the pilot's harness, which when unlocked allowed for some fore and aft movement, like a modern car seat belt.

7. Right Side Console - here the pilot has access to the Gravinder Fire Extinguisher (the red switch cover) and two dimmer controls for the signalling lights (not supported in the sim). The indicator at the end of the panel is a standard Voltmeter.



Control Column - The Parking Brake Lever is in the centre, the red and green levers operate the gunner's signal lights. These were used as a quick and clear way for the pilot to inform the gunner of the direction of an enemy aircraft he had spotted. Repeater lamps are fitted in a pod on top of the main instrument panel. As the Defiant did not have any forward-firing guns, the gun firing button would be used as a bomb release, had bombs been carried by the aircraft.



1. Throttle Lever - The throttle lever has the Mixture Control Lever linked to it as and such they move together, so in other words mixture control is fully automatic. In the real Defiant they could be unlinked and operated independently, however this is not practical in MSFS.

2. Propeller Pitch Control Lever - Fully forward is maximum fine pitch and provides maximum thrust. Fully aft is maximum coarse pitch and is useful for engine testing as little or no thrust is generated. It is advisable to set the lever at around 70% when taxying as the default fully forward position generates too much speed for safe taxying.

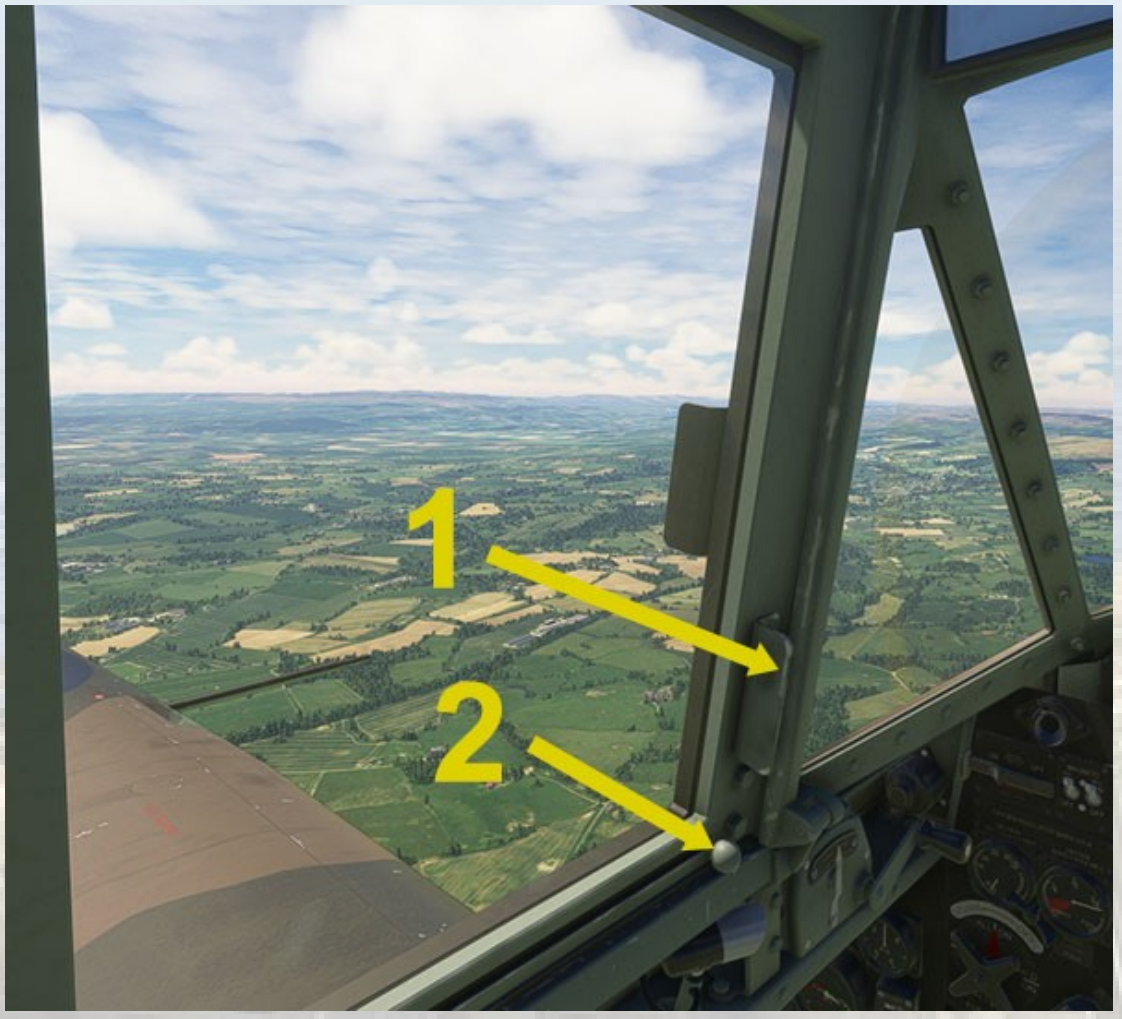
3. Landing Lights Switch - Use left mouse click for ON and right mouse click for OFF, or vice-versa as it operates both to the left and the right.

4. Landing Gear Lever - Self explanatory. The C-shaped knob and lever next to the landing gear lever is the emergency gear extender, it is not supported in this simulation.

5. Landing Flaps Lever - The lever has three positions for the 15, 30 and 45 degree flap angles.

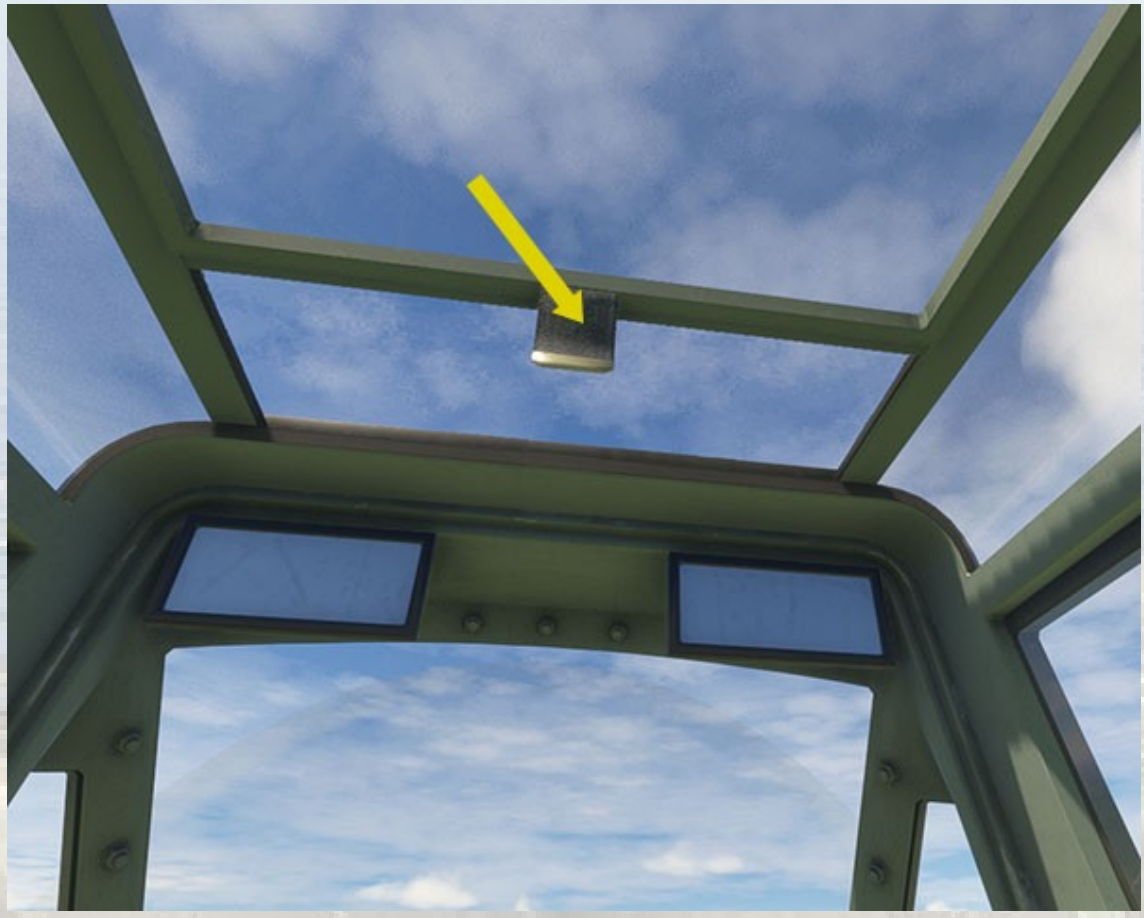
6. Rudder Trim Lever - The lever mounting is marked with degrees of trim, 1 degree to port and 6 degrees to starboard. Trim to port is not as important as starboard as the rotational force of the engine and propeller provide natural yaw to port, so starboard trim is needed more.

7. Landing Light Elevation Adjuster - The Defiant's landing lights (one in each wing) could be rotated up or down a small amount using this lever. Although the lever can be used in this simulation, the MSFS landing light splashes are fixed in the vertical plane so it could not be implemented.



1. Sliding Canopy - A single mouse click on the tab handle will open or close the canopy. There are handles on both sides of the cockpit. Dragging with the mouse is not supported.

2. Sliding Window - A single mouse click on the ball handle will open or close the sliding window. Each side window can be operated independently of the other. Dragging with the mouse is not supported.



Sunroof - A single mouse click on the hanging tab will open or close the sunroof. Dragging with the mouse is not supported.

Defiant F Mk.1 Specs

Specifications :

Empty Weight: 6,078 lbs.
Normal Aircraft Weight, full fuel: 8,318 lbs.
Crew: 2
Maximum fuel load: 104 Gal. / 697 lbs.
Powerplant : Rolls-Royce Merlin III, 1,030 hp.

Reference speeds :

gear down, full flaps stall speed : 90 mph

gear up, flaps up stall speed : 90 mph

cruise speed : 200 mph

claimed maximum speed : 390 mph in a dive

max flaps extended : 140 mph

max gear extended : 160 mph

rotation speed min : 95 mph

economical climb speed : 160 mph

service ceiling : 31,000 ft

range : 465 miles