A.P. 1565Y. - P.N.

PILOT'S NOTES

FOR

SPITFIRE I & II

MERLIN ENGINES
MkIII & MkXII

PREPARED BY DIRECTION OF THE MINISTER OF SUPPLY

A. Rowlands.

PROMULGATED BY ORDER OF THE AIR COUNCIL

J. H. Barnes.

A2A simulations

"Passion for Flight"

Wings of POWER 3

"We put you in the cockpit of some of the worlds most exciting aircraft."

Spitfire Mk I & II

Pilot's Handbook

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Chapter 1: Introduction

DESIGNER'S NOTES:

Welcome to the Wings of POWER Supermarine Spitfire Mk I / II. Our mantra over the years has been, "nothing looks, sounds, or flies like a Wings of Power aircraft." Before we even start building a Wings of Power aircraft, we embark on a long fact-gathering and research mission. We almost always visit the aircraft wherever it may be, when possible fly it to capture first-hand data, take high resolution photos and videos, capture sounds, research, and interview those who flew them then and now.

The result, we hope, is the very finest reproduction possible in Lockheed Martin's Prepar3D.

The Spitfire is quite a remarkable plane when you consider how far ahead of it's time it was when it was first flown into combat. However, before the Spitfire was a combat aircraft, it was born into a family of racers. If it is nothing else, it is a beautiful airplane with almost no vices. It handles well at very slow speeds, yet can reach high speeds due to it's low-drag wing and fuselage.

The separate Accu-Sim expansion pack is included in this single installer, and it to another level of authenticity. Accu-Sim opens up a brand new world, taking you beyond what is possible with Prepar3D. It places you inside the most believable cockpit imaginable as it recreates every sound, nuance and characteristic of the airplane.

However, if you just like to step in, fire up the engine, throw the throttle forward and fly away while admiring a beautiful airplane, then Wings of Power is for you. The Spitfire can be flown by the book and delivers performance based on measured flight tests of the actual aircraft.

A2A simulations

The Air to Air Simulations Team

Wings of Power 3: Supermarine Spitfire Features

Lightweight, powerful and maneuverable.

As with every A2A aircraft, it is **gorgeously constructed**, inside and out, down to the last rivet.

Designed and built to be flown "**By The Book**".

Custom Cockpit Systems and Gauges.

Visual **Real-Time Load Manager**, with the ability to load fuel and stores in real-time.

Naturally animated pilot.

3D Lights 'M' (built directly into the model) with under-wing landing light than can be turned on, deployed, and retracted and fully functional recognition lights.

Pure3D Instrumentation now with natural 3D appearance with exceptional performance.

Sound **engineered by A2A sound professionals**.

Oil pressure system models **oil viscosity** (oil thickness).

Authentically modeled **pneumatic system**.

In cockpit **pilot's map** for handy in-flight navigation.

Auto-Mixture that actually performs as intended. Now you can set for “auto-rich” or "auto-lean" and the aircraft fuel-to-air ratio will be automatically determined and set by the carburetor based upon various factors, such as altitude.

Three different models, Mk Ia, Mk IIa (machine guns), and Mk IIb (cannons).

Internal **Supercharger** modeled with accurate behavior.

Fuel delivery system simulated.

All models include A2A **specialized materials with authentic metal**.

Pilot's Notes pop-up 2D panel keeps important information easily available.

Wings of Power Overview

General Operational Information and Guidelines

The following information is provided to help pilots become familiar with the Wings of Power series of aircraft. These aircraft are materially different in terms of the flight modeling than what is commonly available. Be aware that what is generally accepted as standard performance or aircraft behavior, in many cases will not apply to these aircraft.

Why? Because Wings of Power aircraft are flight tested and tuned until they reflect the proper results throughout their entire performance envelope.

Flight simulation that goes beyond maximum performance figures

Many times, an aircraft is considered to fly accurately if it reproduces a handful of specific performance figures (top speed, max climb rate, stall speeds, etc.). These figures really only represent how an aircraft is performing at a single point in time. We push through these numbers and authentically simulate all flight through an almost unlimited amount of conditions.

As the pilot in command, you can take a Wings of Power aircraft to any given altitude, choose your own power setting (adjust the throttle and watch the manifold pressure / boost gauge), adjust your prop speed and witness your aircraft climb and cruise exactly as it did in real life. You will even experience accurate fuel consumption rates, engine temps, and stall characteristics. You can plan realistic and even historic flights based on your aircraft weight, and calculate cruise speeds, distances traveled, and even authentic figures like "distance-to-altitude" shown in the manuals. These figures are not just estimated, they are finely tuned and put through a rigorous and exhaustive testing process by pilots.

Every Wings of Power aircraft is test flown by the book with hand-drawn charts and passes a rigorous testing procedure before it is released to our beta testers. Among our testers are **highly experienced real-world pilots** who continue to push the aircraft through its paces. We encourage people to go out and buy the actual pilot training manuals for these aircraft and use them. When it comes to unique stall characteristics and other aspects not documented in the manuals, we refer to actual pilot flight-test reports and our own pilot interviews. The end result comes from a hard-working team effort. The bottom line is, for the first time ever, you can experience these thoroughbred aircraft today like it truly was and still is.

FULL POWER does not mean FULL THROTTLE

It is common in the flight simulation industry to accept that the maximum throttle setting (100 percent throttle) should reflect the published takeoff power of piston-engined aircraft. For example, the published takeoff power setting for the B-24D Liberator is 49" of manifold pressure and 2700 RPM. A standard P3D model of a B-24 would expect the pilot to simply shove the throttles and propeller controls to the stop and head for the wild blue yonder. This is just not the way things are in real life or with Wings of Power.

In reality, a real pilot would never under any circumstances shove the throttle all the way to the stop unless war emergency power was required and even in this case it would almost never mean throwing both boost and throttle to the extreme forward position. On takeoff, a pilot "walks" the throttle carefully but briskly forward until the proper takeoff power setting is reached. This setting is read on the manifold pressure gauges. Use the boost lever with extreme care, especially at low altitudes.

How long does it take to get airborne?

The takeoff distances are tested and compared against the performance tables for that airplane's respective pilot's training manual. However, to achieve these figures, the airplane must be flown exactly according to the procedure in the checklist. Using full throttle, incorrect flap positions, incorrect takeoff weights, erroneous trim settings, or improper liftoff technique will materially affect the takeoff distance.

The distances provided are the distances it takes to clear a 50' obstacle, which is a common pilot training procedure. These can be reduced by about 1/3 by using full war emergency power and up to 1/2 flaps on most airplanes. See the aircraft's checklist for details.

The climb is a carefully executed process

The rate of climb for piston aircraft is normally greatest at sea level and falls steadily as the aircraft gains altitude. The weight of the aircraft, the power setting, and the climbing speed are absolutely critical in obtaining proper and accurate climb performance and if any of these parameters change, the time and distance to climb will also change. For most aircraft, there are two climb power settings: rated power and desired climbing power. The lower power setting is usually reserved for lower aircraft weights and in some cases the higher power settings are not desirable due to fuel economy or engine cooling reasons. It can easily be seen that a simple figure published in a book cannot begin to accurately indicate an aircraft's actual ability to climb.

An engine can run out of breath

Engines, like people, need air to breathe. The higher the altitude, the thinner the air. The solution is supercharging or turbocharging, which is basically a fan in the induction system that forces more air into the engine when needed, so it can get the air it needs to breathe.

Superchargers are geared directly to the engine crankshaft, moving as one with the engine. Higher RPM = Higher boost. Turbochargers do essentially the same thing as superchargers with the primary difference being the turbocharger is powered by exhaust air pressure and not by internal, direct gearing.

The critical altitude, for supercharged or turbocharged aircraft, is the altitude at which maximum power can no longer be maintained. For example, if your maximum power is achieved at 50” manifold pressure, then the altitude at which you can no longer achieve 50” manifold pressure is called your critical altitude.

Flaps improve slow flight characteristics

It is common that simulated aircraft are built with drastically exaggerated flap drag values, including the stock aircraft. Therefore, many virtual pilots habitually fly the landing approach far too high and have a much greater rate of descent than is actually specified for a particular aircraft. These very high flap drag values allow pilots to get away with unrealistically steep, high approaches. This is not the case with Wings of Power aircraft.

This can easily be demonstrated by setting the aircraft up on a simulated final approach at a specified landing weight. Thrust, drag and weight are in the proper equilibrium as specified. The same is true for all Wings of Power aircraft, which can be tested in the same way. The bottom line is that flaps are not air brakes; these aircraft need to be flown at the proper speeds and power settings or landings are going to be very challenging!

To obtain ultimate realism, fly the Wings of Power aircraft by the numbers using the information given in each aircraft's checklist. Even better, go out and buy a copy of the aircraft's actual flight manual and use that to fly the plane. That’s what we did.

Spitfire History

The Supermarine Spitfire is one of the truly legendary aircraft, not just of World War II, but of all time. A brilliant design, the basic Spitfire wing and fuselage were able to be refined and improved over and over again into many different configurations during the course of World War II, and each excelled in its own right.

The Spitfire was designed by R. J. Mitchell, an aeronautical engineer of stellar talent who had previously designed such aircraft as the Supermarine S6B, which won the Schneider Trophy in 1931. Borrowing from the developments of others, including the low-wing, monocoque design which came from the United States, Mitchell crafted a superb basic design which stands to this day as one of the greatest piston fighters in aviation history. Mitchell envisioned a light, maneuverable craft with low drag, elliptical wings, and a broad performance envelope. The result was the Spitfire, a capable, lethal, yet forgiving aircraft that ultimately proved more than equal to anything the Germans could throw at it, including the vaunted Focke-Wulf 190.

The Spitfire had a number of design characteristics which set it apart from other contemporary fighter aircraft. The Merlin engine, the elliptical wing, the well-harmonized controls, and the versatile wing platform all worked together to create a package that was perhaps unmatched in terms of its immediate effectiveness and its potential to be developed further. Unlike the Japanese Zero, which was obsolete by 1943, the Spitfire was just coming to its prime. Chief among the features that set the Spit apart from other aircraft was its wing, which served multiple purposes. The elliptical platform and relatively broad root chord allowed a thinner airfoil section, reducing drag while preserving lift, which led to a very low wing loading. This increased top speed, preserved a low stalling speed, increased the service ceiling, and provided excellent low-speed agility. But the broad wing chord also allowed the convenient fitting of formidable armament such as multiple 20mm cannon and heavy machine guns.

The Spitfire last saw combat in 1948 during the Arab-Israeli war, where Spitfires from both sides were pitted against one another. But the honor which will always distinguish this singular aircraft is its superb service during the Battle of Britain, where it -- along with the Hawker Hurricane -- helped to fend off German designs for invasion of Great Britain. For that, it will always be remembered.

Chapter 2: Quick Start Guide

Chances are, if you are reading this manual, you have properly installed the A2A Wings of Power Supermarine Spitfire. However, in the interest of customer support, here is a brief description of the setup process, system requirements, and a quick start guide to get you up quickly and efficiently in your new aircraft.

System Requirements

The A2A Simulations Wings of Power Spitfire requires the following to run:

REQUIRES LICENSED COPY OF Lockheed Martin Prepar3Dv4

OPERATING SYSTEM:

Windows XP SP2

Windows Vista, 7, 10

PROCESSOR:

2.0 GHz single core processor (3.0GHz and/or multiple core processor or better recommended)

HARD DRIVE:

250MB of hard drive space or better

VIDEO CARD:

DirectX 9 compliant video card with at least 128 MB video ram (512 MB or more recommended)

OTHER:

DirectX 9 hardware compatibility and audio card with speakers and/or headphones

Installation

Included in your downloaded zipped (.zip) file, which you should have been given a link to download after purchase, is an executable (.exe) file which, when accessed, contains the automatic installer for the software.

To install, double click on the executable and follow the steps provided in the installer software. Once complete, you will be prompted that installation is finished.

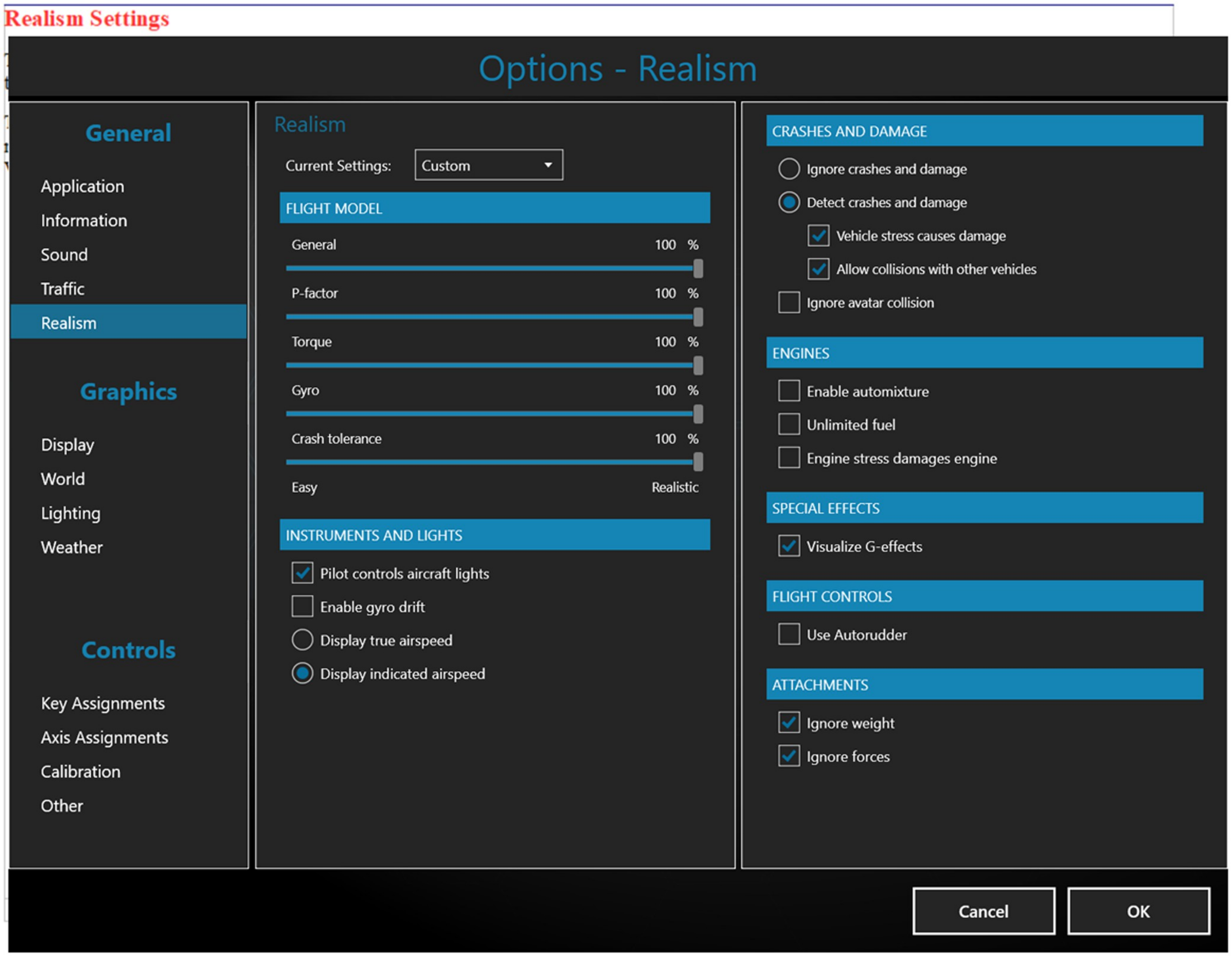
IMPORTANT:

If you have **Microsoft Security Essentials** or other virus protection installed, make sure you make an exception for Prepar3D

Realism Settings

The A2A Simulations Wings of Power Spitfire was built to a very high degree of realism and accuracy. Because of this, it was developed using the highest realism settings available in Lockheed Martin P3Dv4.

The following settings are recommended to provide the most accurate depiction of the flight model. Without these settings, certain features may not work correctly and the flight model will not perform accurately. The figure below depicts the recommended realism settings for the A2A Wings of Power Supermarine Spitfire.



FLIGHT MODEL

To achieve the highest degree of realism, move all sliders to the right. The model was developed in this manner, thus we cannot attest to the accuracy of the model if these sliders are not set as shown above. The only exception would be “Crash tolerance.”

INSTRUMENTS AND LIGHTS

Enable “Pilot controls aircraft lights” as the name implies for proper control of lighting. Check “Enable gyro drift” to provide realistic inaccuracies which occur in gyro compasses over time.

“Display indicated airspeed” should be checked to provide a more realistic simulation of the airspeed instruments.

ENGINES

Ensure “Enable auto mixture” is **NOT** checked. The Spitfire has a fully working automatic mixture control and this will interfere with our extensively documented and modeled mixture system.

FLIGHT CONTROLS

It is recommended you have “Auto-rudder” turned off if you have a means of controlling the rudder input, either via side swivel/twist on your specific joystick or rudder pedals.

ENGINE STRESS DAMAGES ENGINE

(Acceleration Only). It is recommended you have this **UNCHECKED**.

Quick Flying Tips

- To **Change Views** Press A or SHIFT + A.
- Left-click the **primer** to screw it out, left-click to prime, right-click to screw it back in.
- **Get airborne fast.** With it's right gear strut blocking it's small, single radiator, the Spitfire will overheat in 7-8 minutes idle time on the ground. Plan your flight, start your engine, do a quick run-up, and get off the ground.
- **Keep the engine at or above 800 RPM**. Failure to do so may cause spark plug fouling. If your plugs do foul (the engine will sound rough), try running the engine at a higher RPM. You have a good chance of blowing them clear within a few seconds by doing so. If that doesn't work, you may have to shut down and visit the maintenance hangar. *(Accu-sim required)*
- **REDUCE POWER** after takeoff. This is standard procedure with high performance aircraft.
- Use AUTO-RICH mixture for TAKEOFF / CLIMB and AUTO-LEAN (Weak) mixture for CRUISE.
- **DO NOT lower gear** when going over 160mph IAS.
- On landing, raise your flaps once you touch down to **settle the aircraft**, pull back on the stick for additional elevator braking while you use your wheel brakes.
- Be careful with high-speed dives, as you can lose control of your aircraft if you exceed the max allowable speed.
- For landings, take the time to line up and plan your approach. Don't use the landing gear or flaps as brakes. Keep your eye on the speed at all times.
- Using a **Simulation Rate** higher than 4X may cause odd system behavior.
- On the Mk I, the "G" key selects GEAR UP or GEAR DOWN, and repeatedly pressing the **CTRL-G key pumps the gear** in that direction.
- Keep throttle above 1/3 when flying at high RPM to **avoid fouling plugs**. *(Accu-sim required)*
- A quick way to warm your engines is to re-load your aircraft while running.
- The spitfire uses a single finger latch for braking and the rudder pedals both turn the aircraft and perform differential braking.

Chapter 3: Supermarine Spitfire Variants

Mark I

The Spitfire Mk I was the initial production version of the Spitfire. The first seventy-seven came with the Merlin II engine, which utilized a fixed-pitch, wooden propeller. From then on, the Merlin III engine was installed which allowed for the installation of more advanced, variable-pitch propellers.

92 Squadron May 1940

During the frenetic activity of the Dunkirk evacuation, Robert Stanford Tuck used Spitfire N3249 to gain the first of his aerial victories, a Messerschmitt Bf-109, on the morning of May 23rd and added two Bf-110s during the afternoon. However, his final victim of the day had also scored, with Tuck being forced to “dead stick” his battle-damaged Spitfire on to the grass verge in front of the Hornchurch control tower.

603 Squadron Aug 1940

Undoubtedly one of the most successful pilot/aircraft combinations during the Battle of Britain, Flying Officer Brian Carbury used Spitfire R6835 to shoot down eight Bf109E's between August 29 and September 2. On 31st August 1940 Carbury became an 'ace in a day' by downing five Me109E's during three sorties. Unfortunately on the final sortie, his aircraft was shot up by cannon shells wounding him and damaging his aircraft. Despite his wounds and the damage caused he managed to return to RAF Hornchurch.

Mark II

The Spitfire Mk II utilized the Merlin XII engine designed to use the higher, 100 octane fuel for higher boost pressures. Additionally, the electric starter was replaced with a Coffman cartridge starter, which used something similar to a shotgun shell to crank the engine for starting. The Merlin XII had a slightly higher ratio supercharger and stronger components, which resulted in higher power and better high altitude performance. Fitted with the latest constant-speed Rotol propeller, the performance over the prior fixed pitch wooden propeller was enormous, including half the takeoff run distance, faster climbs, and better high altitude performance.

The Mk IIa was fitted with eight browning .303 machine guns while the Mk IIb was fitted with two 20mm cannons and four browning .303 machine guns.

71st 'Eagle' Squadron Mk IIa

Spitfire Mk II P7308 of Plt Off Bill Dunn, No 71 'Eagle' squadron, North Weald, August 1941. Dunn was flying this aircraft on 27th August 1941 while flying as part of a 100 strong Spitfire escort for nine Blenheims attacking the steelworks at Lille. He shot down two Bf 109Fs during this sortie making him the first Eagle squadron pilot to achieve ace status and thus the first American ace of the war.

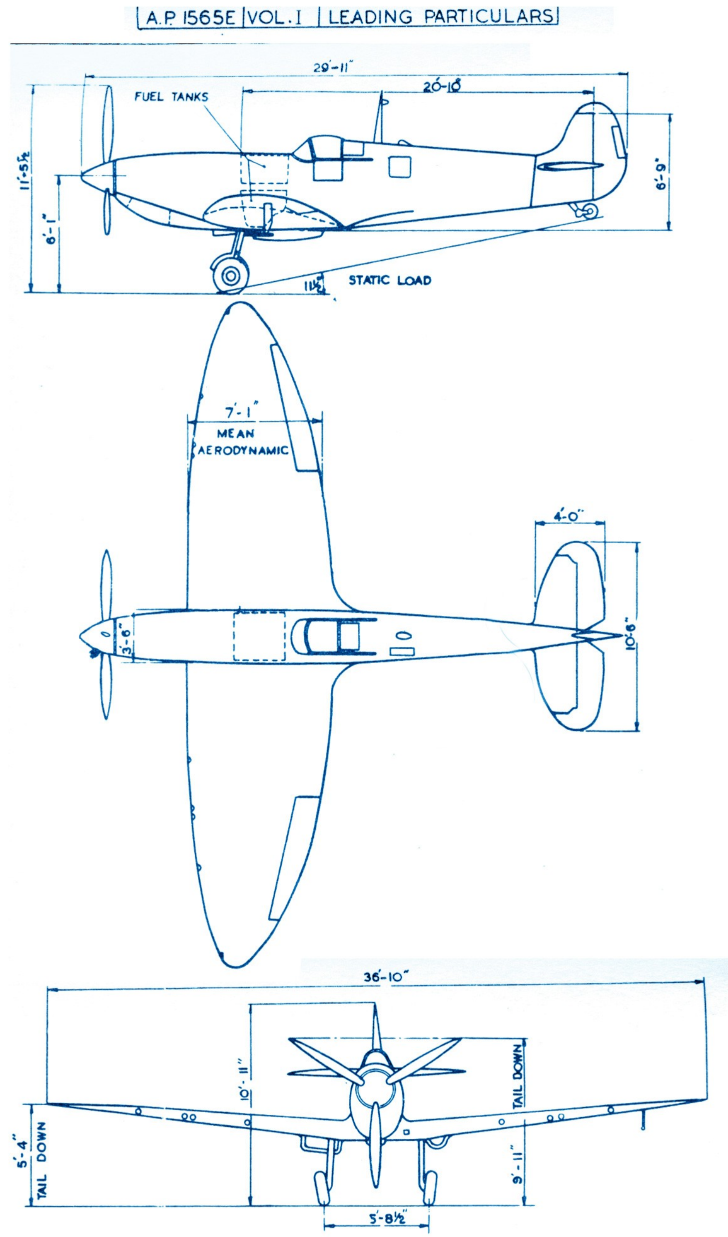
During the same engagement his own aircraft was hit and Dunn suffered wounds to his right leg and head. He managed to nurse the damaged aircraft back to Hawkinge airfield in Folkstone despite his injuries.

303 (Polish) Squadron Mk IIb

Spitfire IIb P8385. Built at Castle Bromwich. Named IMPREGNABLE after the Trade Name of John White, Northamptonshire boot and shoe manufacturers, who raised the sponsorship. It was delivered to No 303 'Kosciuszko' Squadron (RF-A) at Northolt on 12-05-41. A variety of pilots flew in her, Pilot Officer Miroslaw Feric destroyed a Bf109 on 22- 06-41 and the next day Sergeant Jan Szlagowski claimed another. Its last victory with this squadron was on 02-07-41 when Pilot Officer Jan Zumbach shot down one Bf109 and damaged another.

Model Spitfire Mark IIb Specifications

Wing Span	36 feet, 10 inches
Length	29 feet, 11 inches
Height	11 feet, 5 inches
Powerplant	1,310 horsepower Rolls Royce Merlin
	V-12 Mk XII Liquid-cooled engine.
Weights	6,275 lbs takeoff weight
Service Ceiling	37,600 feet
Top Speed	354 mph @ 18,000 feet
Climb	5 min to 15,000 feet
Fuel	85 gal (49 gal upper, 37 gal lower)
Takeoff run	230 yards
Combat Range	395 miles



Chapter 4: Pilot's Handbook

The following is a fictional “pamphlet” which we imagine might have been issued to new members of R.A.F. squadrons on the eve of the Battle of Britain in June 1940. In it you will find what we hope are useful and interesting facts about the Spitfire Mk I and Mk II, its history as well as factual descriptions of its handing and operational characteristics.

By Mitchell Glicksman

On behalf of our Squadron - a hearty welcome to you all. In addition to you British lads, many of you have come here to help us in our struggle against the Nazis from countries within the Commonwealth as far away as Australia, New Zealand, the Union of South Africa and Canada; many of you have come here from Poland, Ireland, Norway, the United States and elsewhere. Your aid and service at this desperate time is most greatly appreciated. If you are reading this little pamphlet that we have prepared for all new incoming squadron members, you have just recently graduated from various OTUs (Operational Training Units) and are now certified pilots in the Royal Air Force or in the various Commonwealth Air Forces. We here at Squadron all had a similar course of training as you have just completed, and we appreciate all of your hard work and the diligence that it took for you to get through it and to have arrived here at last. Congratulations. We appreciate that many of you have come here with somewhat limited time in front line fighters, particularly the Spitfire, as there are just not enough of them, as of yet, to go around in the OTUs. Well, we've got plenty of them, and that which you still may need to learn, we will teach you.

The recent events in France, particularly the air combat over Dunkirk in which this squadron participated, and the occasional combat over the Channel as of late, has taught us a great deal about our enemy and how to fight him. Some of our pilots have a good deal of experience in Hurricanes and Spitfires against the Luftwaffe, and they will have a lot to tell you about that just may save your bacon one day when you are up there with a Jerry snapper or two on your tail.

One of the first things that we will expect of you before you commence further training here at Squadron and are posted for duty will be to memorize the location and function of every control, switch, indicator, gauge, instrument and lever in the Spitfire's cockpit. You will be expected to be able to touch and name everything in the cockpit correctly whilst blindfolded. Practice this drill with a mate until you have mastered it. Additionally, you will be expected to demonstrate your knowledge concerning the operation of the engine, aircraft systems and mechanisms as well as the operational air-speeds and engine settings of the aeroplane. When you think that you are ready, report to your assigned individual Squadron Aide who will then put you to a thorough test. Upon your passing this test, he will report you fit for the next phase of your training and for posting for duty. All new Squadron pilots will have six (6) days from the date of their arrival to prepare for and to pass the test. You may take the test up to three times, after which, if you have not passed, your case will be reported to the Squadron Adjutant for consideration of appropriate remedy.

Before discussing in detail the flying characteristics and operation of the Spitfire Mk Ia and Mk IIa and b, which are the latest and the current operational aircraft being flown by this squadron, a short history of this remarkable aircraft and a description of it is, perhaps, in order.

The Vickers/Supermarine Spitfire is a thoroughbred whose sires are some of aviation's most illustrious examples. The Supermarine Company began in 1913, just before the Great War, and was known then as "Pemberton-Billing Ltd.", after its owner and founder Noel Pemberton-Billing. Mr. Pemberton-Billing holds British Pilot's Certificate No. 683 and it is said that he won his certificate within 24 hours of his having sat in an aeroplane for the first time in his life. When the Great War began, the new aircraft manufacturer began to design and produce a number of military aircraft, notably, in 1915, the P.B. 25 single-seat scout, and in 1916, the AD Flying Boat patrol seaplane. After his election to Parliament in 1916, Mr. Pemberton-Billing sold his fledgling company to his friend and factory manager, Hubert Scott-Paine, who renamed the company "Supermarine Aviation Works, Ltd."

The newly named factory submitted a few aircraft types during the war, most of them, as the company name implies, designed to operate from the sea; but during the War, none of these were produced beyond the prototype. After the War, a more conventional aircraft, the Supermarine Sea Lion I, was built as a modification of another failed Supermarine wartime aircraft, the Baby, a single-seat flying boat fighter. The Sea Lion I is notable for having been the first Supermarine aircraft to be entered and flown in the 1919 Schneider Trophy race, the first in a long and fabulously successful line of Supermarine racing seaplanes. The "Lion" in the name of this aeroplane and the other Supermarine "Lions" comes from the Napier "Lion" engines which powered these and many Supermarine aeroplanes until 1929.

The Sea Lion I didn't win the race that year; however, the Sea Lion II, a completely different design, powered by a 450 hp (336 kW) Napier Lion engine won the 1922 Schneider, thwarting Italy, who won the race in 1920 and 1921, from chalking up its third consecutive Schneider win, and thereby, by the rules of the Schneider Trophy contest, becoming the permanent owner of the Trophy. This feat of two consecutive Italian Schneider wins was not as remarkable as it may outwardly seem. In 1920 no other nation entered the race, and in 1921 the only non-Italian entry did not actually compete. The Sea Lion II was but the first of many illustrious Supermarine racing aircraft to win the Schneider.

This is as good a time as any, I think, to mention the man who designed these racing aircraft and, most importantly, the Spitfire, and who is responsible for many of its notable aerodynamic advances: the late Reginald J. Mitchell. Having joined Supermarine as an aeronautical engineer and designer in 1916, his prodigious talent was soon recognized, and he quickly moved up in status to Chief Designer the following year. R.J. Mitchell designed the Sea Lion II and most of the Supermarine aircraft thereafter, including the Spitfire, his greatest triumph, until his recent untimely death at the age of 42 on 11 June, 1937.

The Mitchell-designed Supermarine seaplane, the 1925 S.4, is perhaps the first aircraft which might be considered to be a progenitor of the Spitfire. This ultra-clean, streamlined beauty, powered by the 680 hp (507 kW) Napier Lion VII engine, established a new world's seaplane speed record on 13 September 1925, flying at the then blistering speed of 226.752 mph (365.071 km/h). It was later destroyed in an accident involving wing vibration and/or inadvertent side-slipping, which upset the aeroplane during testing before the 1925 Schneider race. American Army pilot, Jimmy Doolittle won the 1925 Schneider in a Curtiss RC3 biplane which flew the race at an average speed of 232.573 mph (374.443 km/h) which broke the speed record set by the S.4 only a month before.

There was no British entry in the 1926 Schneider race; however, in the 1927 race, 2 Mitchell-designed Supermarine S.5s took first and second place, the winner powered by the 900hp (671kW) Napier Lion VIIA engine, and the second placer powered with 875 hp (652 kW) Napier Lion VIIB engine. The S.5 was of a composite wood and metal construction with the semi-monocoque fuselage made of duralumin and the wings made primarily of wood. In this aircraft we can begin to see a hint of the coming Spitfire.

After the 1927 race, The Schneider Trophy board decided to run the race every two years to allow designers to have more time to develop their aircraft. The 1929 Schneider race was won by one of the 2 Mitchell-designed Supermarine S.6s which were entered. The S.6 was a larger, more powerful, and more refined version of the S.5., and is also notable because it was the first Supermarine aircraft of many to come to be powered by a Rolls-Royce engine; the 1,900 horsepower (1,417 kW) "R", a great leap forward in power and in engine design.

In 1928 Vickers-Armstrong took over the management of Supermarine which thereafter has been known as "Supermarine Aviation Works (Vickers) Ltd." Reginald Mitchell continued as Chief Designer.

The last Supermarine racing seaplane was the S.6B which was essentially an S.6 with an even more powerful 2,300 hp (1,715 kW) Rolls-Royce "R" engine. The 1931 Schneider race had no non-British competitors, accordingly, when the S.6B crossed the finish line, this third consecutive "win", permanently secured the Schneider Trophy for Great Britain. It averaged 340.08 mph (547.19 km/h), which in 1931 was a remarkable achievement for any type of aeroplane, less a float/seaplane. Even more remarkably, seventeen days later, an S.6B broke the world air speed record flying at 407.5 mph (655.67 km/h), the first aircraft known to reach (and exceed) 400 mph. The incredible performance of this aircraft and its engine caused the British Air Ministry to request that Supermarine design a fighter for the R.A.F. The direct path to both the Spitfire and the Rolls-Royce "Merlin" engine begins here.

As is clear, the Schneider Trophy competition for seaplanes looms large in the Spitfire legend as it is perhaps the single most important crucible in which the elements of its airframe design and engine were created and tested. While there is no commonality between the airframe components of the Schneider racers and those of the Spitfire, the spirit and design philosophy that R.J. Mitchell evolved during the Schneider years clearly set the course for his last and greatest achievement.

While R.J. Mitchell was developing the S.6B, he was already working on the design of a fighter to meet Air Ministry Specification F/7 30 which resulted in the Supermarine Type 224. This was not a success, as Mitchell had to adhere to many restrictive requirements in that specification; it lost to the Gloster Gladiator. In July, 1934 Mitchell submitted another fighter design, Type 300, which again was not accepted.

Frustrated, Mitchell decided to forgo trying to accommodate the Air Ministries ideas of what a fighter aircraft should be like, and Supermarine commenced developing an all-new and original design, incorporating a closed cockpit, thin wings, and the new Rolls-Royce PV-XII V-12 inline engine, which was later named "Merlin". This aircraft, also called Type 300, was accepted by the Air Ministry 1 December, 1934, who named it "Spitfire", a name Mitchell thought little of (he preferred "The Shrew"). The A.M.'s original specification, requiring four .303 Vickers machine guns, two in each wing, was changed to eight .303 Browning machine guns, four in each wing, before the first Spitfires were delivered.

On 5 March, 1935, eight months after the first flight of the Hurricane prototype, Spitfire prototype (K5054), flown by Supermarine test pilot Joseph "Mutt" Summers in the presence of R. J. Mitchell, took its maiden flight. After further necessary development of the aircraft for military use, the first operational Spitfires were delivered in June, 1938. Reginald Mitchell did not, tragically, live to see his brilliant creation fly in R.A.F. colours; however, his undaunted spirit and extraordinary vision lives in every Spitfire that presently so intrepidly defends our Nation.

The following are some guidelines for flying and operating the Spitfire Mks I and II which we hope will speed your transition along. While we are aware that you have already had some experience flying Spitfires while in your OTU, we are equally aware that most of you have not had extensive time in this aeroplane. These notes and comments are intended to supplement the information contained in other official documents and manuals on the subject, some of which we include herein. It is our wish and hope that through the agency of what we have prepared for you that your transition towards becoming a fully-fledged Spitfire pilot will be eased.

You will note that this pamphlet does not include content or comment regarding combat techniques, methods, etc. We leave that to your assigned individual Squadron Aide, who will be an experienced hand in the serious game of aerial combat, and who will be better able to demonstrate and impart this complex and crucial body of knowledge to you whilst you are actually flying the aeroplane. *Kyrie Eleison*

The Spitfire Mks I and II are single seat, single engine, all metal, low wing monoplanes. Here are the basic specifications and dimensions of the Spitfire Mk I:

Empty Weight: 4,999 lbs.
Wingspan: 36.8 feet
Wing Area: 242 square feet
Normal Takeoff Weight: 6,050 lbs.
Maximum Takeoff Weight: 6,250 lbs.
Top Speed @ sea level: 289 m.p.h. TAS
Top Speed @ sea level: 340 m.p.h. TAS (War Emergency)
Top Speed: 354 m.p.h. TAS @ 20,000 feet MSL
Top Speed: 410 m.p.h. TAS @ 20,000 feet MSL (War Emergency)
Stalling Speed, clean (6,000 lbs.): 69 m.p.h. IAS_
Stalling Speed, landing (6,000 lbs.): 63 m.p.h. IAS
Service Ceiling: 34,700 feet
Powerplant: Rolls-Royce Merlin III, 1,310 HP War Emergency, 1,025 HP for takeoff.
Armament: (8) .303in. caliber machine guns with 300 rounds per gun.

Please take note of this aeroplane's very low wing-loading - 24.79 lbs/sq. ft. This is one of the reasons why the Spit is such a nimble and excellent turning machine. Now please note the power-loading; only 6lbs./hp. or .164hp/lb. This is what makes the Spit climb and accelerate so well. The Spitfire is a thoroughbred which, when handled correctly, will perform as well or better than any aeroplane you will encounter in combat. However, unlike a thoroughbred, it is not at all touchy, skittish or in any way unpredictable. Once you have mastered the many ways of the Spit, she will become your most faithful friend and dependable mount. She will always come through for you and will never let you down.

Here is a brief description of the aeroplane's systems and controls:

Fuel System - Fuel is carried in two tanks, one above the other, the lower being self-sealing in later Mk Is and in all Mk IIs. They are located forward of the cockpit and fuel is delivered to the engine by an engine driven pump. Tank capacities are: upper - 48 Imperial gallons; lower - 37 Imperial gallons.

The lower tank sends fuel to the engine and the top tank feeds into the lower tank. There are two fuel cocks, one for each tank, located starboard-of-centre below the instrument panel.

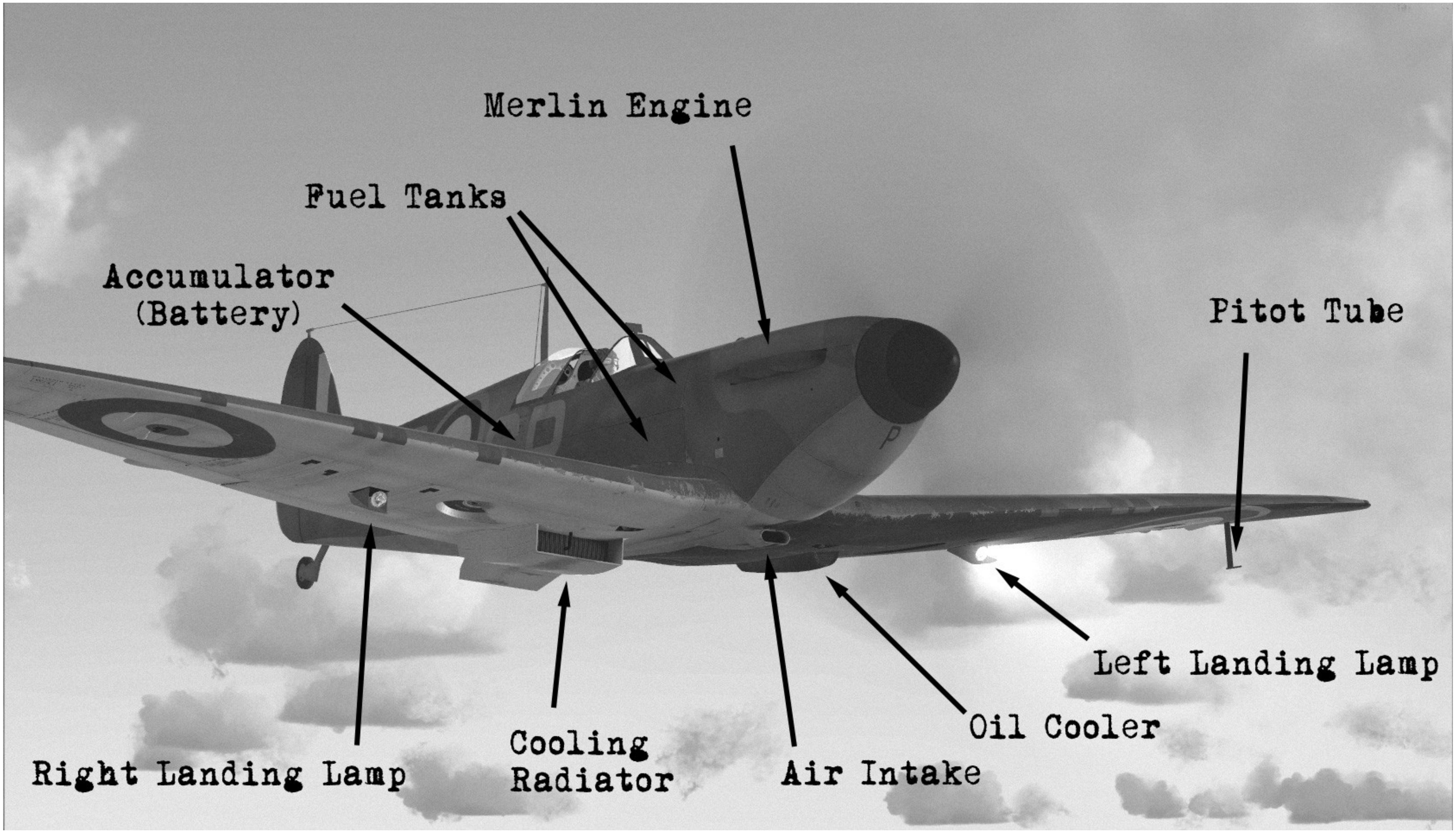
Oil System - Oil is supplied to the engine by a tank located below the engine mounting. Its actual capacity is 7.5 Imperial gallons; its usable capacity is approximately 5.8 Imperial gallons. Two oil coolers in tandem are fitted in a fairing on the underside of the port wing. The total oil cooler area is .2 sq. ft. in both the Mk I and Mk II.

Hydraulic System - In the Mk II, an engine-driven hydraulic pump (non-switchable) supplies hydraulic fluid to operate the undercarriage raising and lowering mechanism. In early Mk Is this is not engine-driven.

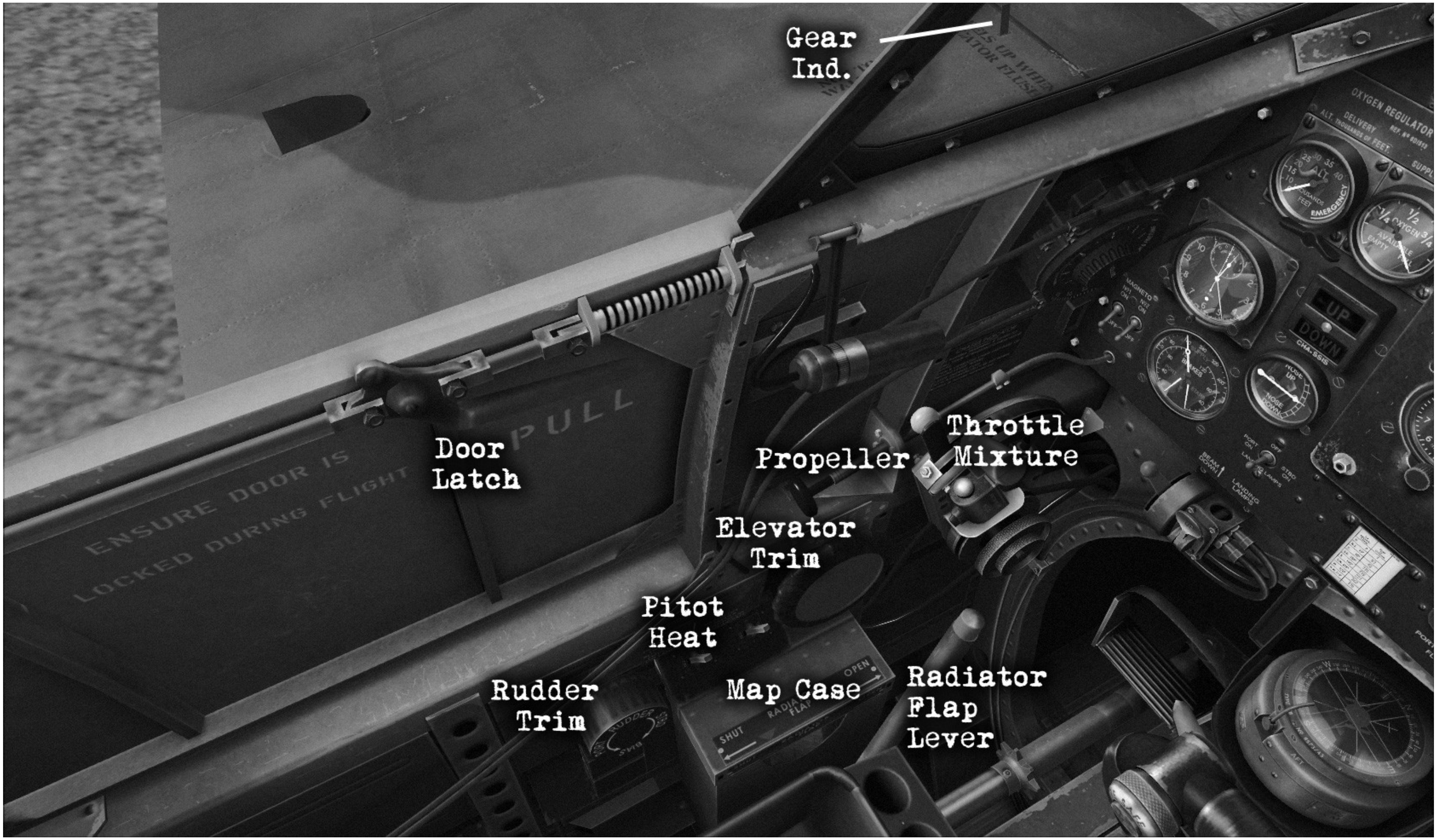
Pneumatic System- An engine driven air-compressor (non-switchable) supplies two storage cylinders containing compressed air to operate the flaps, brakes, guns and landing lamps. These cylinders are connected in series and contain compressed air at 200 lbs. /sq. in. of pressure.

Electrical System - Mk I - A 12 volt generator controlled by a switch located on the upper instrument panel, starboard-of-centre, supplies an accumulator which in turn supplies the entire electrical system of the aeroplane. A voltmeter is located immediately to the port side of the generator switch. A direct drive starter motor is used for starting the engine when the aeroplane is connected to an external ground Accumulator trolley (Trolly Acc)which supplies the electrical power for starting.

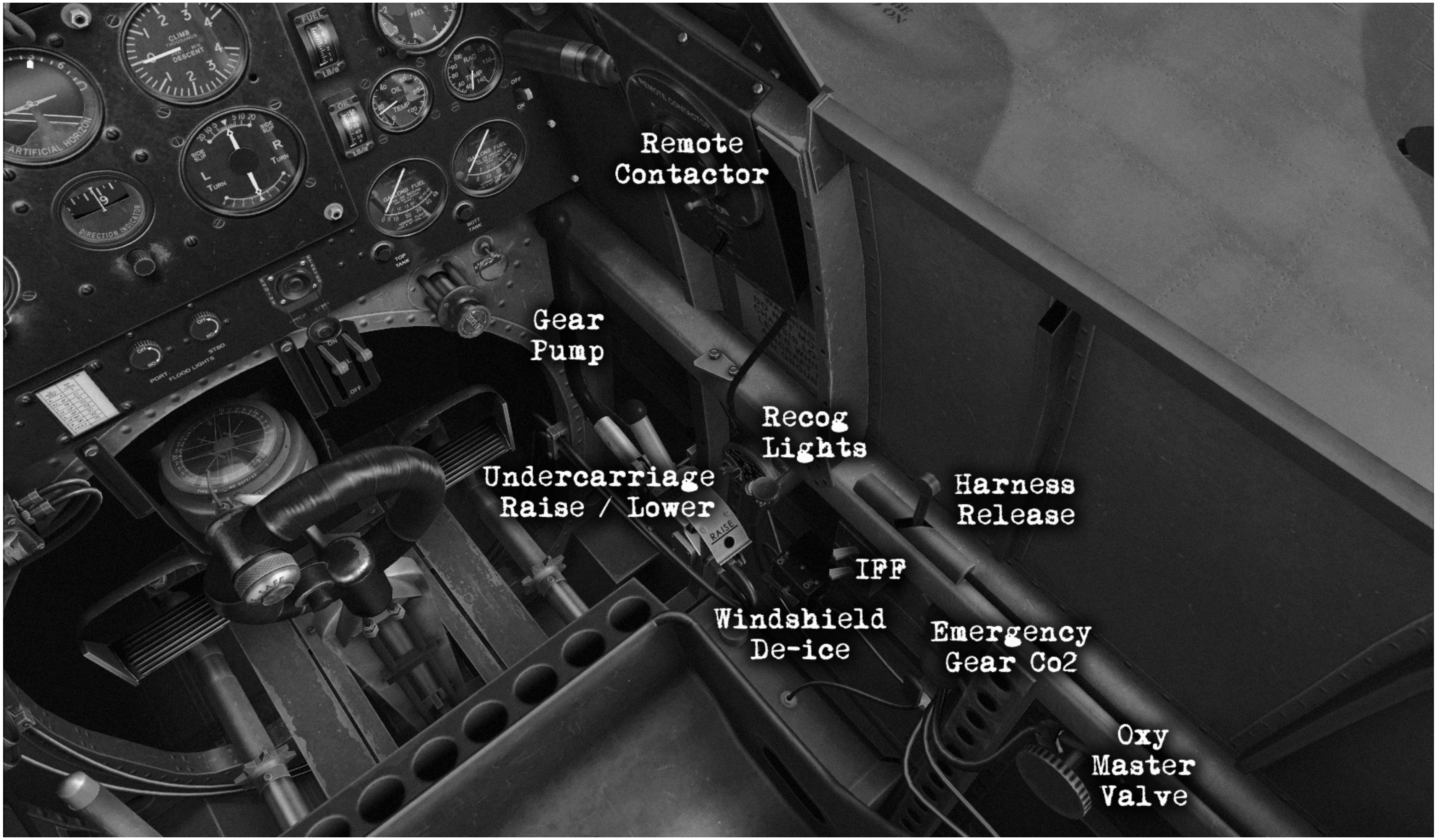
Mk II - The same electrical system is installed as in the Mk I, except that the engine is started by the use of an L.4 Coffman starter which uses a special explosive cartridge, similar to a shotgun shell, which is loaded into the breech by pulling a ring grip which, when fired, supplies pneumatic force necessary and sufficient to turn the engine over for starting.


Merlin Engine
Fuel Tanks
Accumulator
(Battery)
Pitot Tube
Left Landing Lamp
Oil Cooler
Right Landing Lamp
Cooling
Radiator
Air Intake

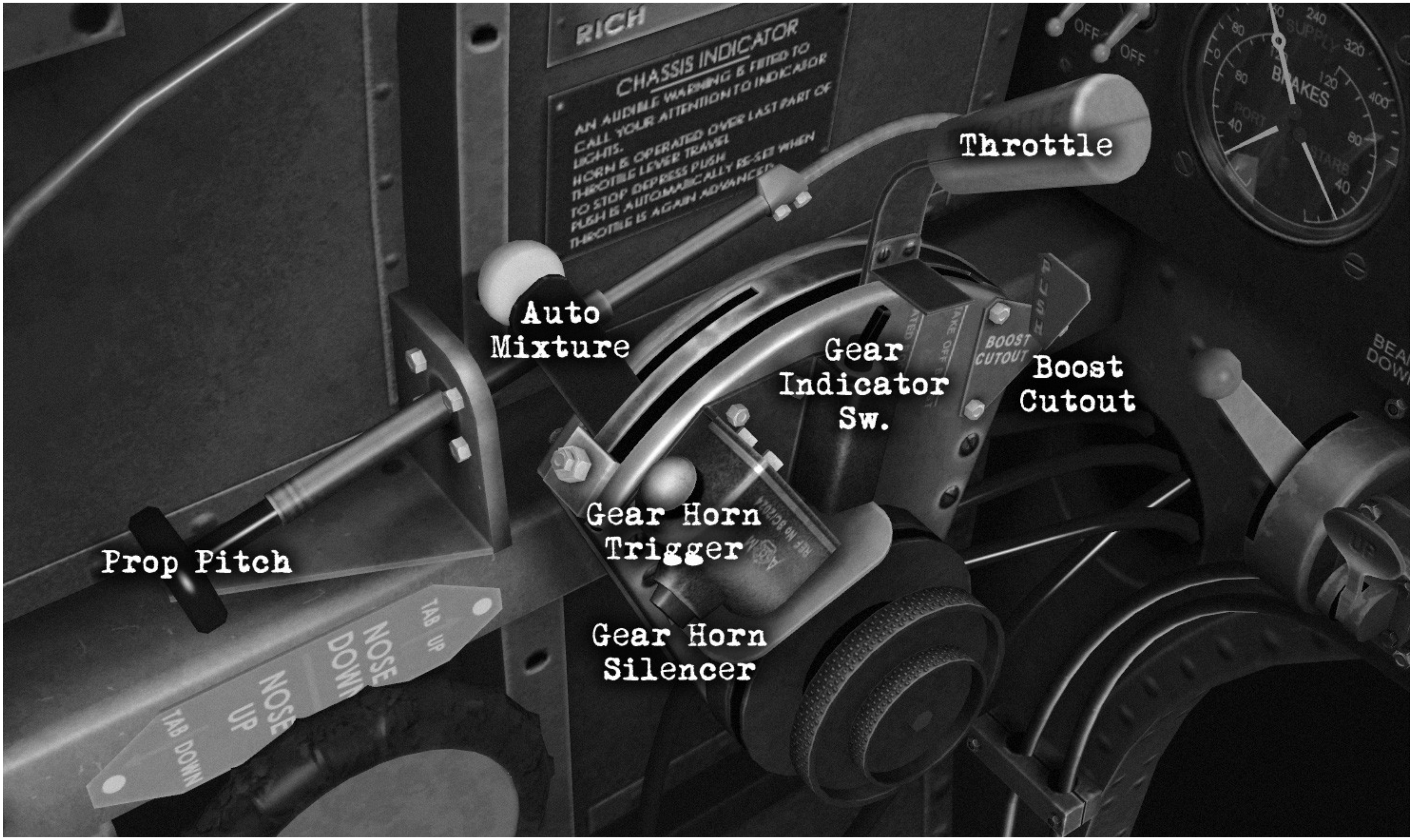
Mk Ia Cockpit Front


Gear Ind.
Door Latch
Propeller
Throttle Mixture
Elevator Trim
Pitot Heat
Rudder Trim
Map Case
Radiator Flap Lever
PULL
ENSURE DOOR IS LOCKED DURING FLIGHT
OXYGEN REGULATOR
UP
DOWN
SHUT
OPEN

<u>Mk Ia Cockpit Right</u>

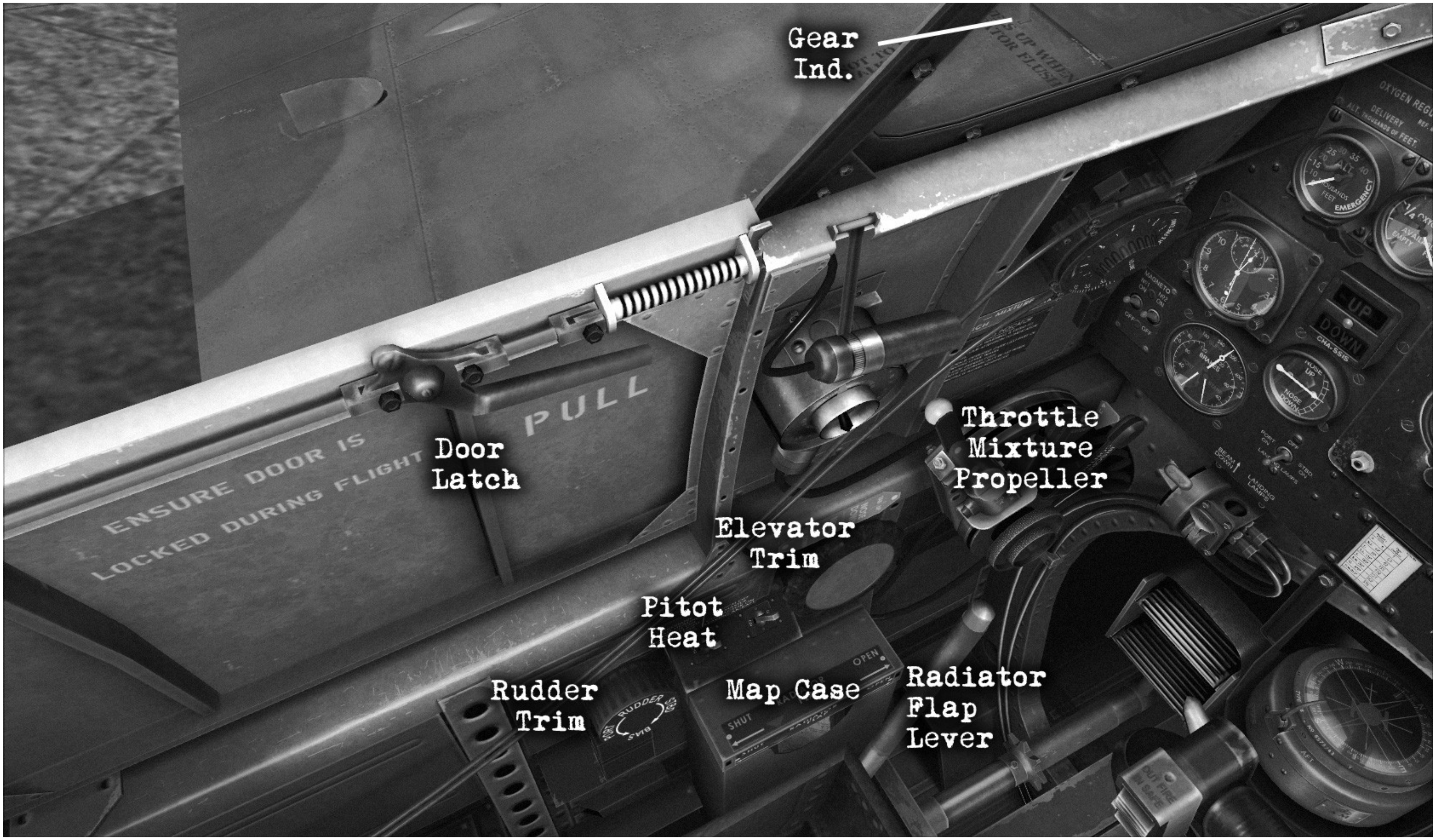


<ins>Mk Ia Engine Controls</ins>

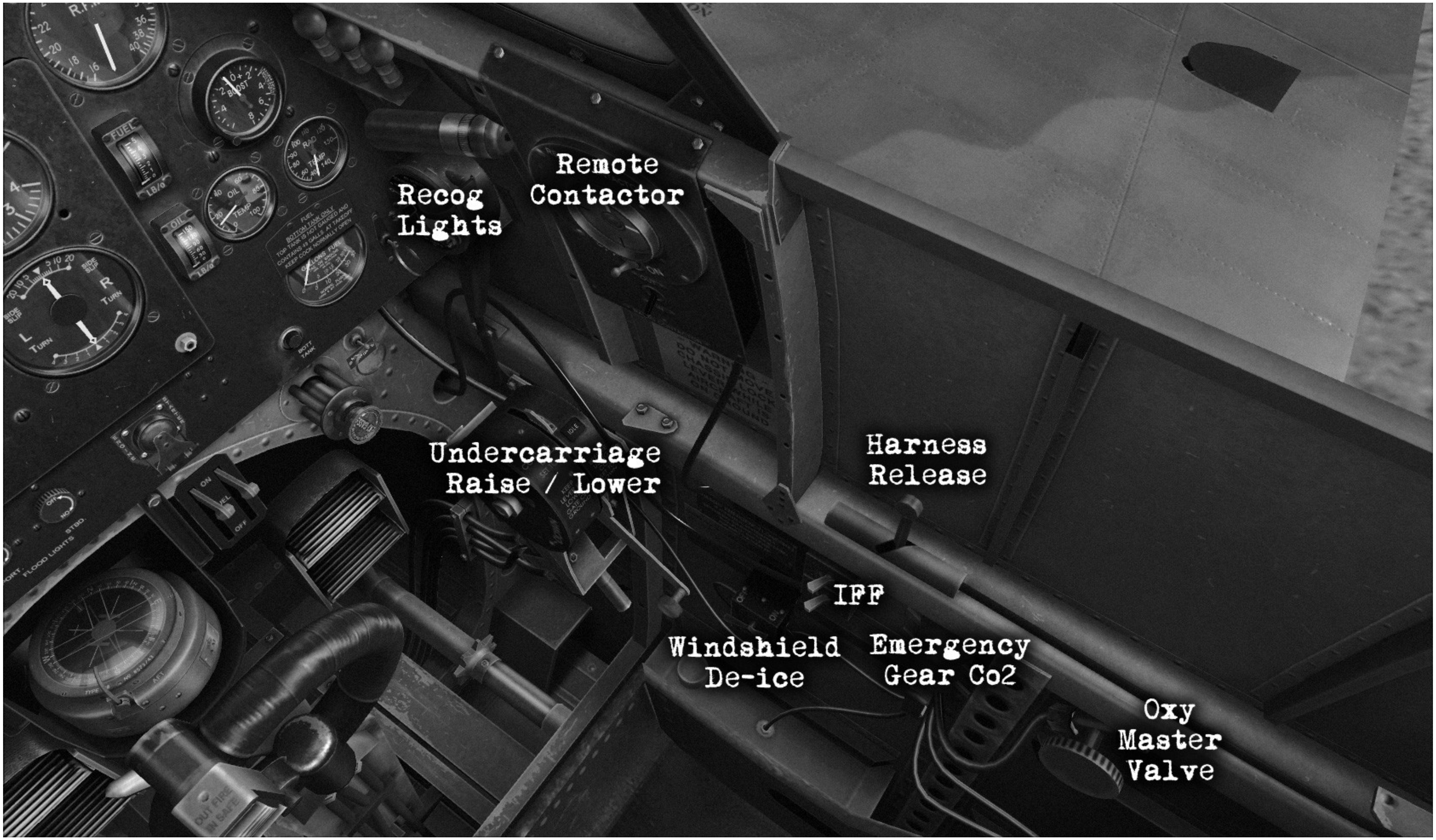


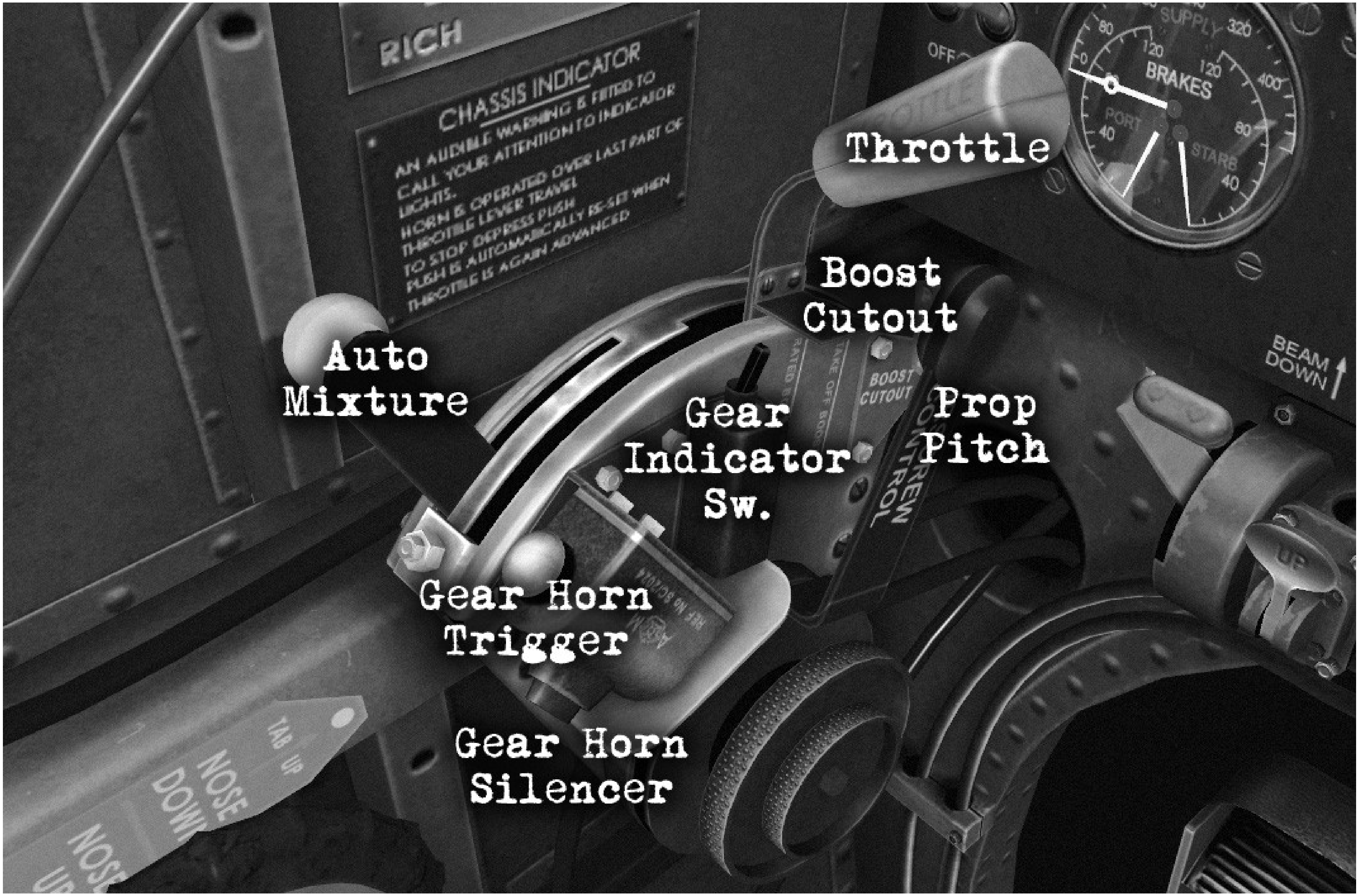
Mk IIa/b Cockpit Front

Mk IIa/b Cockpit Left



<u>Mk IIa/b Cockpit Right</u>




RICH
CHASSIS INDICATOR
AN AUDIBLE WARNING IS FITTED TO CALL YOUR ATTENTION TO INDICATOR LIGHTS.
HORN IS OPERATED OVER LAST PART OF THROTTLE LEVER TRAVEL
TO STOP DEPRESS PUSH
PUSH IS AUTOMATICALLY RE-SET WHEN THROTTLE IS AGAIN ADVANCED
Throttle
BRAKES
SUPPLY
PORT
STARB
Boost
Cutout
BOOST
CUTOUT
Auto
Mixture
Gear
Indicator
Sw.
Prop
Pitch
BEAM
DOWN
Gear Horn
Trigger
Gear Horn
Silencer
TAB UP
NOSE
DOWN

AEROPLANE CONTROLS

Main controls -
The Elevator is controlled by fore and aft movement of the control column.

The Ailerons are controlled by the side-to-side movement of the spade grip.

The Rudder is controlled by the two rudder pedals. Each pedal has two places where the feet may rest. The upper position is for longer periods of cruising flight as it promotes comfort over long periods of time. The distance of the rudder pedals from the pilot can be adjusted by turning the “stars” on the rudder control shafts located just above the cockpit floor.

Trimming tabs - The elevator trim tab is controlled by a wheel on the port cockpit wall. There is an elevator trim tab position indicator located port-of-centre on the instrument panel. For nose-down elevator trim, turn the elevator trim wheel clock-wise (forward). For nose-up elevator trim, turn the elevator trim wheel counter-clockwise (aft).

The rudder trim tab is controlled by a smaller wheel located to the rear of the elevator trim tab wheel, on the port cockpit wall. There is no indicator for the position of the rudder trim tab. For starboard trim, turn the rudder trim tab wheel clockwise (forward), and for port rudder trim, turn the rudder trim wheel counter-clockwise (aft).

Undercarriage control and indicators -

To raise the undercarriage:

MK I - move the undercarriage control lever, located on the starboard side of the cockpit, out of the cut-out gate and fully aft to RAISE. Then pump the pump handle 15 strokes until UP is illuminated in the undercarriage position indicator on the instrument panel (see below) .

MK II - move the undercarriage control lever, located on the starboard side of the cockpit, out of the cut-out gate and fully forward to UP.

To lower the undercarriage:

MK I - move the undercarriage control lever, located on the starboard side of the cockpit, out of the cut-out gate and fully forward to LOWER. Then pump the pump handle 30 strokes until DOWN is illuminated in the undercarriage position indicator on the instrument panel (see below).

MK II - move the undercarriage control lever, located on the starboard side of the cockpit, out of the cut-out gate and fully aft to DOWN.

Undercarriage position indicator - The electrically illuminated undercarriage position indicator is located port-of-centre on the instrument panel and has two semi-transparent windows. The upper window, when illuminated, shows the word “UP” on a red background. The lower window, when illuminated, shows the word “DOWN” on a green background. The illuminated undercarriage position indicator is switched on when on the ground by advancing the throttle lever until it strikes the switching lever on the inboard side of the throttle quadrant. This switch should be turned off when the aircraft is left standing with the engine not running for any extended length of time to conserve the battery.

Mechanical undercarriage position indicator - On the forward part of each inner main plane a red-painted rod connected to the undercarriage mechanism will rise and protrude above the surface of the main plane when the undercarriage is down, and retract and become flush with the surface of the main plane when the undercarriage is up.

In the Mk II a warning horn is provided and will sound if the undercarriage is up when throttled back. The warning horn button is located on the throttle quadrant. The warning horn may be silenced by pushing the warning horn button. When the throttle is advanced to around its one-quarter position, the warning horn will be enabled again and will sound if the throttle is pulled back when the undercarriage is up.

Flaps - The flaps are split-type and are pneumatically operated. A splayed finger control is located at the upper, port side of the instrument panel. When this control is pulled out and down, the flaps will be lowered. The flaps have one lowered position only: 85°. DO NOT use lowered flaps to assist take off.

On both Mk I and Mk II: On the aft part of each inner main plane a door will rise above the surface of the main plane when the flaps are lowered and will close flush with the upper surface of the main plane when the flaps are up.

On the MK I only: An additional flap position indicator is located on the upper instrument panel, port-of-centre.

ENGINE CONTROLS

Throttle and Mixture Controls - The throttle and mixture control levers are fitted in a quadrant on the forward, port side of the cockpit. Friction adjusters are located at the starboard side of the quadrant.

Automatic boost cut-out - On the Mk II, the engine is provided with an automatic maximum boost control. To cut-out the automatic boost control, push the small red-painted lever located at the forward end of the throttle quadrant.

Airscrew controls - The control for the de HAVILLAND 20 DEGREE POSITIVE COARSE PITCH AIRSCREW is a plunger-type control located on the port side of the cockpit near the throttle quadrant.

The control lever for the ROTOL 35 DEGREE CONSTANT-SPEED AIRSCREW is located on the throttle quadrant.

Radiator shutter control lever - The position of the shutter at the rear of the radiator duct located beneath the starboard plane is controlled by a ratcheted lever located to the port side of the pilot's seat. To open the shutter, release the ratchet by depressing the button located at the top of the lever and push the lever forward; to close the radiator shutter, release the ratchet by depressing the button located at the top of the lever, and pull the lever aft. The radiator shutter's normal minimum drag position in level flight is indicated by a red triangle located on the top of the map case located on the port side of the pilot's seat. Moving the radiator control lever a notch beyond the normal, aft position enables warm air to be diverted from the engine compartment to heat the guns when at high altitudes or when the outside air temperature is cold. The fully aft position closes the radiator shutter.

Slow-running cut-out – This control cuts the engine when it is running slowly, and it is to be used to shut the engine down. It is operated by pulling the ring grip located on the lower, starboard side of the instrument panel.

Fuel cock controls and contents gauges - The fuel cock controls, one for each tank are located side-by-side on the lower starboard-of-centre instrument panel. When the levers are up they are in the ON position.

On the Mk I there are two fuel contents gauges (top and bottom tanks), each of which may be read when the button adjacent to it is pushed. They are located near the bottom, starboard side of the instrument panel.

On the Mk II there is only one fuel contents gauge (for the top tank) which may be read by pushing the button adjacent to it. It is located near the bottom, starboard side of the instrument panel.

Fuel priming pump – A hand priming pump is provided and is located starboard-of-centre and below the instrument panel. To unlock for use, unscrew it counter-clockwise. To lock after use, screw it clock-wise.

Ignition (Magneto) switches – There is one switch for each of the engine's magnetos (left and right) located at the bottom-port corner of the instrument panel. When the switch is up the magneto is on. When down, the magneto is off. DO NOT stop the engine by cutting these switches. Observe proper engine stopping procedure below.

Starter - On the Mk I, a direct-drive electrical starter system is provided and is powered by an external ground Accumulator trolley (Trolly acc). The starter button is located at the bottom-centre of the instrument panel. A separate starter magneto is also provided, located at the bottom, starboard side of the instrument panel.

On the Mk II, an L.4 Coffman cartridge starter system is provided. Starter cartridges are held in a magazine at the breech containing three cartridges. A cartridge may be loaded and re-loaded by slowly pulling a ring located below the bottom-starboard side of the instrument panel until a click is heard, indicating that a new cartridge has been loaded into the breech. The L.4 Coffman starter system is operated by pushing the starter/boost coil button located at the bottom-centre of the instrument panel.

COCKPIT ACCOMODATION AND EQUIPMENT

(a) Pilot’s seat – A lever for adjusting the height of the seat is located on the starboard side of the seat. The seat cannot be adjusted fore and aft.

(b) Safety harness release – In order to facilitate the pilot leaning forward without undoing his harness, a harness release catch is fitted to the starboard side of the cockpit.

(c Hood locking control - The sliding hood is provided with spring catches for holding it either open or shut. The catches are released by two finger levers at the upper, forward end of the hood. From the outside the catches can be released by depressing a knob at the top of the windscreen. Provision is made to prevent the hood from sliding shut in the event that the aeroplane overturns upon landing.

(d) Direct Vision Panel - A small knock-out panel is provided on the port side of the hood for use in the event that the windscreen becomes obscured.

(e) Cockpit Lighting – Two floodlights are located at either side of the cockpit and are controlled and dimmed by switches located at the bottom of the instrument panel.

(f) Cockpit ventilation - A small, adjustable flap on the starboard coaming above the instrument panel is provided for the ventilation of the cockpit. The flap is opened and closed by turning a knurled nut underneath the flap.

(g) Map case - A metal case is located to the port side of the pilot’s seat for the stowage of maps, papers, writing pads, etc.

(h) Oxygen - A standard regulator unit and gauge is fitted on the port side of the instrument panel. A bayonet-type socket located on the starboard side of the cockpit is provided for attaching your oxygen mask. A rotary control for manually adjusting oxygen flow is located next to the socket. (See instructions below regarding high altitude flying).

(i) Rear-view mirror - Mk II - a mirror providing a rearward view is located at the top of the windscreen. USE IT! (our Mk I aircraft did not come from the factory with rear-view mirrors, although most pilots in this Squadron have since affixed an automobile mirror above the windscreen on most of our Mk I aeroplanes)

NAVIGATIONAL, SIGNALLING AND LIGHTING EQUIPMENT

Wireless - The aeroplane is equipped with a combined transmitter-receiver type TR-9D and R-3002 set.

A Type C mechanical controller is fitted on the port side of the cockpit above the throttle lever and a remote contactor and contactor master switch are located on the starboard side of the cockpit. The microphone/telephone socket is fitted on the starboard side of the pilot's seat.

A high frequency IFF (Identification Friend or Foe, which we call "Pipsqueak") control is installed on the starboard side of the cockpit. It contains a clockwork mechanism that transmits a discrete high frequency signal for fourteen seconds in every minute that it is turned on. IFF signals are received at Sector Stations. The IFF receiving radio gear is a part of the High Frequency Direction Finding (HF/DF or "Huff Duff") system.

Note: To prevent undue alarm at Sector, pilots will turn the IFF transmitter on during ALL flights, for which Sector will be grateful and will therefore not send aeroplanes up to shoot you down, for which you will be grateful.

(a) Navigation and identification lamps - A switch located on the upper instrument panel, port-of-centre turns on and off the navigation lamps. The upper and lower identification lamps are controlled from the signaling switchbox located on the starboard side of the cockpit. The switchbox has a switch for each of the two identification lamps and a Morse key. A control located on the instrument panel provides for steady illumination or signaling by Morse code from each lamp or both. The switch lever has three positions: MORSE, OFF, and STEADY.

(b) Landing Lamps - Two landing lamps are provided. One is located under each main plane and they are lowered and raised by a finger lever located below the instrument panel port-of-centre. Each landing lamp has an independent electrical circuit and is controlled by a switch. With the switch in the central position, both lamps are off, when the switch is moved to port, the port lamp is illuminated, when the switch is moved to starboard, the starboard lamp is illuminated. The vertical azimuth of the landing lamps may be controlled by a lever next to the aforementioned switch, which when pulled upwards, lowers the landing lamps' vertical azimuth, and when pushed downwards, raises it.

OPERATIONAL EQUIPMENT AND CONTROLS

(NOTE:The machine guns and cannon on the A2A Spitfire do not operate. The following is presented for historical information only.)

Machine Guns - The eight machine guns in the Mk Ia and Mk IIa are simultaneously fired pneumatically by pushing a button located on the control column spade grip. The compressed air is taken from the same source as that which is utilized by the brakes, the available pneumatic pressure being shown on the pressure gauge. The guns' firing button is surrounded by a milled sleeve which may be rotated one-quarter turn to the SAFE position which prevents the operation of the firing button. The SAFE and FIRE positions of the sleeve are marked and can also be identified by touch as the sleeve has an indentation which is at the bottom when the button is in the SAFE position and to the side when the button is in the FIRE position.

Cannon - The two cannon as well as the machine guns on the Mk IIb are fired pneumatically by a triple button located on the control column spade grip. A milled finger lever extending from the bottom of the push-button casing provides the means for locking the button in the SAFE position. The SAFE and FIRE positions are engraved on the adjacent casing. These positions can also be identified by touch. When the lever is in the FIRE position, a pip extends from the top of the casing which can be felt by the pilot.

To prevent accidental firing of the cannon when on the ground, a safety valve is fitted to the firing system. This is mounted below the undercarriage control unit and is coupled to the undercarriage locking-pin cable in such a manner that the cannon firing system is inoperable when the wheels are locked down. For practice firing and sighting in at the butts, however, a finger lever on the safety valve can be operated to permit the use of the firing system.

The cannon are cocked by pulling a cocking valve located on the starboard side of the cockpit.

Reflector gunsight - For sighting the guns and cannon a reflector sight is mounted on a bracket above the centre of the instrument panel. A main switch and a dimmer control are mounted below the mounting bracket. The dimmer control is marked OFF, NIGHT and DAY. Three spare lamps for the reflector sight are stowed in holders located on the upper, starboard side of the cockpit.

Day operations - The dimmer should be switched to DAY in bright daylight conditions. If necessary, a sunscreen may be slid behind the windscreen by pulling on the ring at the top of the instrument panel.

Night Operations - At night or in dark daylight conditions switch the dimmer to NIGHT. A low-wattage lamp will be brought into the circuit which may be adjusted for brightness by rotating the dimmer control.

DE-ICING EQUIPMENT

(a) Windscreen De-Icing – A tank containing de-icing solution is located on the port side of the cockpit directly above the bottom longeron. A control cock is mounted above the tank. A control to switch it on is located on the starboard side of the cockpit below the undercarriage emergency lowering control. When engaged, de-icing liquid is pumped to the base of the windscreen and upwards over the front panel of the windscreen.

(b) Pressure Head (Pitot tube) heater – An electrical heating element in the pressure head is turned on and off by a switch located on the port side of the cockpit just below the trimming wheels. Switch the heater off after landing to conserve the battery.

EMERGENCY EQUIPMENT

(a) Hood Jettisoning – The hood may be jettisoned in an emergency by pulling the lever mounted at the top of the hood in a forward and downward movement, pushing the lower sides of the hood upwards with the elbows.

(b) Forced landing flare – A flare for use in signaling that you are about to make a forced landing is located in a tube in the fuselage. The flare may be released by pulling a ring grip located to the port side of the pilot’s seat.

ENTERING AND CHECKING THE COCKPIT BEFORE STARTING

You enter a Spit by climbing up on the innermost part of the port wing, pressing the button at the top of the windscreen and sliding the canopy back if it is closed, and opening the side door by pulling down and aft the handle located on the inside of the door, on the port side of the cockpit, letting the door swing down and out. Your parachute is your seat cushion. The seat is adjustable up and down, but not fore and aft. Once seated, you may adjust the distance of the rudder pedals to even length by turning the stars on each of the rudder pedal rods with your feet. When you are well-settled in the cockpit, you may now fasten your flight harness. You will usually have an Aircraftman present to help you with this, as the cockpit is a bit snug for most people, which will limit your ability to maneouver about in it. Once your harness is fastened and snugged up tight, pull up and secure the side door, making sure that the handle is at half-cock before takeoff.

Once you are properly fastened in, you may now proceed. Perform each item on the following checklists at all times that you are not scrambling. Refer to the notes below regarding the procedure for scrambles.

OPERATING DETAILS REGARDING THE SPITFIRE MK I and II AEROPLANES

AIR PUBLICATION 1565A

SPITFIRE MK Ia AEROPLANE

MERLIN III ENGINE / WATTS OR WEYBRIDGE 20 DEGREE FIXED-PITCH AIRSCREW; or
de HAVILLAND 20 DEGREE PCP 2-POSITION, ADJUSTABLE AIRSCREW;

SPITFIRE MK IIa and IIb AEROPLANES

MERLIN XII ENGINE / WATTS OR WEYBRIDGE 20 DEGREE FIXED-PITCH AIRSCREW or ROTOL 35 DEGREE CONSTANT-SPEED AIRSCREW.

NOTE: All of the following comments and tips apply to both Marks I and II unless specifically

noted.

CHECKLISTS FOR MKS I AND II- ALL AIRSCREWS, UNLESS OTHERWISE NOTED

ON ENTERING THE COCKPIT:

1. ALL magneto switches are OFF
2. Mk I - Undercarriage Pump Valve set to LOWER

   Mk II- Undercarriage lever set DOWN

(A2A Note: press "g'' on keyboard to toggle undercarriage lever to raise or lower position)

3. The Flaps are UP (CONFIRM INDICATORS)
4. The Landing Lamps are UP
5. The Wheel Brakes (parking) are ON
6. The Chassis Indicator Lights show DOWN
7. Check Contents of BOTH Fuel Tanks
   - Top (not gauged in the Mk II) 48 Gal.
   - Bottom 37 Gal.
8. Check flying controls full and free and in the correct sense

Airspeed Indicator Correction

There is a substantial error between the indicated airspeed shown on the pilot's airspeed indicator and the actual, calibrated airspeed. Use the following table to obtain calibrated airspeed. The upper row shows the gauge reading, and the lower row shows the actual, calibrated airspeed.

(A2A note: You can see this difference by holding the mouse over the gauge and comparing the tool tip reading with the indicated speed on the gauge.)

IAS, mph	100	110	120	130	140	150	175	200	250	300
CAS, mph	109	117	125	133	141	150	171	193	240	290

Pre-Engine Start and Engine Starting

Just as you did when training, you will use your checklist and perform each operation except during "scrambles". During "scrambles" when getting into the air and to altitude in the shortest time is imperative, you will not have time to perform and check every item. In this situation, we have arranged for an Aircraftman to have your aeroplane ready for flight with the engine previously warmed up and checked for you. When "scrambled", all pilots will start engines as soon as they are properly belted in, and will takeoff as soon as is practicable.

On flights other than "scrambles" you will go through the checklist thoroughly and slowly. Remember, once the engine has been started you have only a short time, depending upon the outside air temperature, to get into the air before your engine overheats and has to be shut down and cooled. Because of this, all aircraft will be parked and waiting in such a location as to minimize the need for taxiing for take off, ready to start the engine and take off. On days when a "scramble" is expected to be likely, all pilots will wait sufficiently near their aircraft so that when the scramble bell rings, the least amount of time will be expended before takeoff.

STARTING THE ENGINE AND WARMING UP:

1. Set mixture control fully rearward to	NORMAL (RICH)
2a. If de HAVILLAND 2-POSITION ADJ AIRSCREW	COARSE PITCH (plunger in) then, immediately after start to FINE PITCH (plunger out)
2b. If ROTOL CONSTANT-SPEED AIRSCREW	FINE PITCH (lever forward)

NOTE:
<u>In Mk I</u> - Check that the ground Accumulator trolley (Trolly acc) has been properly connected.

<u>In Mk II</u> - With L.4 Coffman cartridge starter:	Using the ring to LOAD a fresh cartridge into the breech.
3. Set radiator shutter lever full forward	FULLY OPEN
4. Raise both fuel cock levers to	ON
5. Open throttle slightly on quadrant	OPEN ¼”
6. Unscrew primer (counter clockwise)	
7. Inject petrol shots 5 AT NORMAL TEMPERATURE	
8. Ensure everyone is clear of the airscrew	“CLEAR”
9. Switch both magnetos (in Mk I, also the starting magneto) to ON	
10. Switch Generator to:	ON
11. Throttle	CRACKED
12. Hold START button and prime until engine catches	
13. Throttle OPEN only as far as avoids rough running 800 – 1,000R.P.M. (BY EAR)	

In Mk I - Switch starting magneto OFF

14. Screw down priming pump (clockwise) LOCKED

15. See that the oil pressure is satisfactory AT LEAST 45 lb./ sq. in.

If not, SHUT DOWN ENGINE IMMEDIATELY and report condition to maintenance officer.

16. Warm up at fast tick over (1,200 R.P.M.) until oil temp is 15C

Mk I - radiator temp is - 70C

Mk II - " - 60C

17. IFF transmitter switch ON

NOTE:

Mk I - Starting engine turning periods should not exceed 20 seconds with 30 second rest between attempts.

DO NOT oscillate the throttle lever, but open slowly to get the engine running at a fast tick-over.

If the engine begins to fade or backfire excessively, close throttle quickly and open it up again very slowly.

Particularly in cold weather you may find that the engine does not want to "catch" without very vigorous priming, so don't be afraid to really lay into it.

In Mk I - ensure that after the engine has started that the ground Accumulator trolley's (Trolly acc's) electrical lead has been detached from the aeroplane, and that it and it's crew are clear of the aeroplane's wheels and airscrew before testing the engine or taxiing.

In Mk II – with L.4 Coffman cartridge starter: If the engine does not start, change to a new cartridge by pulling and then releasing the ring grip. The revolving cartridge magazine at the breech has a capacity of three cartridges.

TESTING ENGINE AND INSTALLATIONS:

NOTE: Warming up should not be unduly prolonged as the temperatures rise quickly and some margin must be kept in hand for taxiing. The aeroplane MUST be airborne before temperatures reach the prescribed maximum. The engine should not be run at full power for more than a few seconds - just long enough to test magnetos and to observe oil pressure, boost and R.P.M. TWO men MUST hold down the tail at all times during testing.

NOTE: Before testing the engine: RELEASE PARKING BRAKE AND APPLY THE BRAKES WITH THE BRAKE LEVER PULLED FULLY TO STARBOARD (ON) POSITION MANUALLY.

1.	Check fuel pressure	2 ½ to 3 lb./sq. in.
2.	Check brake pressure	RESERVOIR AT LEAST 120 lb./ sq. in.
3.	Pneumatic system	FLAPS DOWN THEN UP AGAIN
4.	Set altimeter	AERODROME HEIGHT
5.	Set directional gyro	TO COMPASS OR RUNWAY HDG
6.	If required, turn pressure head heat	ON
7.	Harness release to	FIXED
8.	Other general preparations for flight	PERFORMED
9a.	If De HAVILLAND 20 DEGREE PCP 2-POSITION ADJUSTABLE AIRSCREW:	
	Set airscrew to	FINE (Plunger back/out)
9b.	If ROTOL 35 DEGREE CONSTANT-SPEED AIRSCREW:	
	Set airscrew to	FULLY FINE (lever forward)
10.	Running up, open to full throttle and check boost at +6 ¼ lb./sq./in.	
11a.	If WEYBRIDGE FIXED PITCH AIRSCREW:	no R.P.M. check is necessary. Open up to full throttle momentarily and check boost is as expected.

11b. If de HAVILLAND 2-POSITION AIRSCREW:	Check R.P.M. 2,500 – 2,600 at FINE PITCH and check for positive R.P.M. drop at COARSE PITCH
11c. If ROTOL CONSTANT-SPEED AIRSCREW:	Slowly reduce airscrew control to 2400 R.P.M. Throttle down a little and observe R.P.M. to be CONSTANT at 2,400 R.P.M. Then, set airscrew control lever fully forward to: FULL FINE PITCH
12. Check oil pressure is at least	80lb./sq. in.
13. Check magnetos for R.P.M. drop	NOT TO EXCEED 150 R.P.M.
14. Reset throttle to smooth idle.	
15. Wave away chocks.	

NOTE: Never attempt to do a run up without two Aircraftmen sitting on the tail. Without their weight on the tail, you will certainly tip up when you open the throttle. Remember to let them know when you are ready to taxi away so that they can remove themselves from the tail.

Taxiing tips:

For those of you who have not flown the Spit before or who have limited experience in her and are coming directly from flying Harvards (AT-6s for you Yanks), a few words about the Spitfire's handling characteristics will be useful:

The first thing you will be likely to notice upon sitting in a Spitfire for the first time is that it is rather snug and that there is little shoulder or head room even for the slightest pilots. Make sure you belt in tightly to avoid your head colliding with the canopy in turbulence. You can adjust the distance of the rudder pedals by turning the metal "stars" located on each rudder control rod with your feet.

The next thing you are likely to notice is that you have absolutely no forward vision at all on the ground. Fortunately, the engine's cowling is rather narrow and will provide a reasonably good view to each side of it. In any event, you <u>must always</u> s-turn when taxiing so that you don't chew up the tail of the aircraft ahead of you or smack into something hard. You have all probably been required to fly a few circuits in the Harvard from the rear seat before graduating from OTU.

This was not merely an exercise designed by your flight instructor to terrify and torture you; this was to prepare and train you for flying aircraft like the Spit which have such a long nose and poor forward vision on the ground.

The brakes in the Spit are typical of most current British fighter aircraft (the American made Tomahawk being an exception) and consist of a laterally-moving lever at the top of the control handle. The brakes in the Spit are engaged when the lever just behind the control column spade grip is pulled to starboard and disengaged when released and is at the port position. When the lever is pulled to its extreme starboard position engaging a small clip at the bottom of the control handle will lock the brakes for parking. To engage either of the individual wheel brakes for tight turning on the ground, the rudder pedal is first depressed in the direction of the desired turn and then the aforesaid brake lever is pulled towards the starboard until the brake engages. For those of you who have previously only flown aircraft like the Harvard which has individual toe brakes, it will require some practice until you get the knack of operating the Spit's brakes properly. We strongly suggest that you do your brake practice in an area on the field where there is adequate room for mistakes and where there are no objects or other aircraft nearby with which you are likely to collide and prang the kite.

NOTE: When not on a "scramble", engine starting, run-ups, magneto checks and other engine checks with the power past idle when standing still require that a least two Aircraftmen hold the tail down to prevent a tip-up and a ground strike of the airscrew. Should you at any time even slightly touch the ground with your airscrew, you must immediately shut the engine down and report the incident to the Maintenance Officer. Do not engage the brakes' locking catch during run-up or at any time that you are standing stationary with the engine past idle. If the aircraft begins to tip up, you will not have time to release the brakes if they are locked. Hold the brake lever so that the aircraft cannot move, and be prepared to release it immediately and close the throttle if the tail begins to rise. On the ground, the Spit is a nose heavy aircraft and particularly so when the petrol tanks are full, as they will be before every scramble - so be very careful. To prevent tip-ups, easy does it on the brakes. Never apply the brakes suddenly or powerfully when slowing or coming to a stop. Hold the control column FULL BACK at all times when taxiing.

<u>ALL</u> ground operations in the Spit require that the radiator shutter be fully opened (shutter control handle fully forward) at all times, this includes when sitting still or taxiing before takeoff, and immediately after landing. Once the engine has started, you must takeoff as soon as possible (within 5-10 minutes after engine start under most usual conditions depending upon the OAT)to avoid boiling over, as previously mentioned. The single radiator under the starboard plane is adequate to cool the aircraft during all in-flight operations; however, it is barely adequate for ground operations and not at all adequate should such be prolonged.

BE FORWARNED- If your engine should boil over, immediately shut down and let the engine cool before you permit your Aircraftman to refill the aeroplane with cooling fluids - only then may you re-start the engine and give it another go.

AT ALL TIMES when on the ground, the door-opening handle is to be at the half-cocked position to enable you to quickly leave the aircraft in the event of an emergency, and to prevent the door mechanism from jamming shut in the event of a mishap.

AT ALL TIMES when on the ground, the canopy is to be opened and locked and is to be opened and locked when in the circuit before landing for the same reason. <u>There are no exceptions to this, regardless of the weather.</u> This rule is for your own good and is intended to promote safe operations and to provide a way to for you to exit your aircraft quickly and/or to aid those who may be helping you to do so in the event that such should become necessary. The bulkhead immediately behind your seat is designed to protect you from head injuries should your aircraft turn turtle. Always ensure that your harness is pulled tight!

The Spitfire handles fairly easily on the ground but has a very narrow undercarriage. Be cautious about making fast and/or sharp turns or you may tip over onto a wing tip. If you do tip over at any time, pull over, shut down and inspect the wing tip. If any damage is apparent, return the aircraft to the maintenance hanger and report the damage to the Maintenance Officer. DO NOT AT ANY TIME try to take off with a damaged wing tip, the damage may be more extensive than you realize or can easily see. Take no chances; we cannot afford to lose a good pilot and/or a good machine.

TAXIING OUT:

1.	Parking brake	RELEASE
2.	Check radiator shutter	FULLY OPEN
3.	Ample brake pressure	80lb./sq. in. MINIMUM
4.	Throttle Friction	ENSURE FIRM
5.	If takeoff is delayed for any reason	CLEAR ENGINE - MODERATE R.P.M.

Ensure maximum temperature limits are not exceeded

CHECK (SHUT DOWN IF EXCEEDED)

FINAL PREPARATION FOR TAKEOFF:

Drill of Vital Actions – catchphrase ***T.M.P. FLAPS***

T	Trimming tabs for elevator	1 DIVISION NOSE DOWN
M	Mixture control	RICH
P	Pitch control	FULL FINE
Flaps		UP

Should, by serious omission of drill, the flaps be down, the aeroplane may still take off, if so ON NO ACCOUNT must the flaps be raised until A.S.I. is 120 m.p.h. and the aeroplane is at a safe height. DO NOT exceed 140 m.p.h. with the flaps down.

Engine operating tips:

A word or two about the remarkable Rolls-Royce "Merlin" engine that powers the Spitfire is perhaps appropriate here:

The "Merlin" is a liquid-cooled, V-12 piston engine. Its capacity is 1,650 cubic inches. It was called the PV-12 before becoming named for the bird of prey. It was developed and initially built at the Rolls-Royce Osmaston, Derby factory. Additional newer factories for manufacturing this engine have recently been established at Crewe and at Hillington, near Glasgow, Scotland.

The Spitfire Mk I has a Merlin III installed. This engine produces 1,030 hp at 3,000 R.P.M. at 5,500 ft. using + 6 ½ psi boost and may be operated at up to +12 psi boost for short periods of time by pressing the automatic boost cut-out override control located at the forward end of the throttle quadrant. This engine has an electrical starter powered by a ground accumulator trolley (Trolly acc). Merlin IIIs which are fitted with a "universal" airscrew shaft are able to mount a WATTS OR WEYBRIDGE wooden fixed-pitch, a de HAVILLAND 2-position adjustable, or a ROTOL constant-speed airscrew.

The Spitfire Mk IIs, fresh from Castle Bromwich, have the new Merlin XII installed. This engine produces 1,150 hp at 3,000 R.P.M. at 5,500 ft. and may be operated at up to +12 psi boost for short periods of time by pressing the automatic boost cut-out override control located at the forward end of the throttle quadrant. This engine does not have a direct electrical starter and instead is fitted with an L.4 Coffman cartridge starter. The Merlin XII uses a 70/30% water/glycol coolant mixture rather than 100% glycol as used by the Merlin III installed in the Mk I. Merlin XIIs are able to mount either a WATTS OR WEYBRIDGE 20 DEGREE FIXED-PITCH AIRSCREW or a ROTOL constant-speed airscrew.

The throttle and mixture controls of both the Spitfire Mark I and II operate as usual and are to be handled as you have been trained. There is an automatic boost cut-out override control located at the forward end of the throttle quadrant. Pressing this tab forward permits the throttle to deliver maximum boost up to 12 lbs.

Sudden or rapid throttle advancement may cause a temporary over-speed of the constant-speed airscrew governor. This is normal and the pilot should not be alarmed when it occurs; R.P.M. will settle down shortly.

The Merlin engine will cut out when at negative "g" and will pick up again when at positive "g".

Mixture Controls - The Mk I and II have an automatic mixture control which will weaken (lean) the mixture as height is increased, regardless of whether the mixture control handle is set rearward to RICH, or set forward to WEAK (lean). If the mixture control handle is set to WEAK an extra-weak mixture will be provided with a 3% drop in R.P.M. DO NOT use the extra-weak mixture at more than +2 ¼ lbs./sq. in. Boost.

The following power settings assume 100 octane petrol is in the tanks. Lower octane requires more conservative power settings.

Spitfire	Mk I -	12 lbs. Boost.
"	Mk II - (when necessary)	12 lbs.** Boost

**The Spitfire does not ordinarily require this much power to accomplish a reasonably short takeoff run. It is strongly suggested that 12 lbs. maximum Boost be used judiciously and sparingly, and only when absolutely necessary, as may occur in a tight situation in combat. The use of maximum Boost shortens your engine's life. You will be expected to note the frequency and length of time that you opened the throttle to 12 lbs. boost after each flight so that the maintenance mechanics can check your engine for undue stress.

DO NOT ordinarily use the boost cut-out override (throttle override gate control switched) on takeoff. If you do, you might blow up your engine before you can be of any use against the enemy.

TAKING OFF:

Takeoff tips:

Turn into wind and move slightly forward to straighten the tail wheel. Open up to full throttle and take off by holding the aeroplane to a constant attitude with the tail well up, ALMOST in a flying position until it leaves the ground. You will find the Spit does not to want to turn or swerve to the port very much on takeoff and that the rudder is effective to counter any portward swing at all times that there is airscrew blast over it, and/or when you are moving at 30 m.p.h. or faster. You will always easily be able to keep the Spit going straight down the runway with the rudder during takeoff. It is not necessary to use starboard trim to counter the portward swerve.

The aeroplane must NOT be lifted off too soon by dropping the tail, but ON NO ACCOUNT push forward on the control column spade grip to lift the tail. At the beginning of the take off run hold the control column spade grip fully back until the aeroplane has attained sufficient speed for the control surfaces to operate, around 30 m.p.h.; then ease the control column spade grip to or near neutral, applying such starboard rudder at all times as may be necessary to prevent the nose from swerving to the port. Maintain a straight line during the take off run. After liftoff hold the nose down to almost level until airspeed is at 140 m.p.h. then commence climb, lifting the undercarriage during the climb.

Even fully loaded the Spit will get into the air and accelerate rather quickly at the stated lbs. of boost and you will be able to commence your climb almost immediately. Remember to retract your undercarriage as soon as you see a positive rate of climb indicated. There have been instances where, in the excitement of a "scramble", pilots have forgotten to raise their undercarriage and wondered why their aircraft's performance was so dodgy.

The Spit's elevator is <u>very</u> sensitive. Do not under any circumstance try to hurry the tail up - you will risk an airscrew strike if you do. Once the tail rises, hold the aircraft with the tail wheel off the ground, but in a slightly tail down attitude during the takeoff run. This will facilitate the shortest possible takeoff run. Do not horse the aircraft off the ground, let it rise by itself. Once you are positively climbing out, close the canopy, raise the undercarriage, and set the climb power and airspeed. Refer to this manual for power settings and operating temperature parameters.

NOTE: If your machine is a Mk I equipped with a WATTS OR WEYBRIDGE fixed-pitch wooden airscrew, the takeoff run will be rather longer, and the rate of climb somewhat reduced as compared to machines equipped with the de HAVILLAND two-position or the ROTOL constant-speed airscrews.

When possible and in keeping with reasonable safety considerations, when scrambled for an interception, formation, random group, and multiple simultaneous takeoffs will be permitted and expected so that the entire squadron can be in the air as soon as possible.

ACTIONS AFTER TAKING OFF:

Drill of Vital Actions – catchphrase “UP”: **U**- undercarriage is up. **P**- Power reduced to climb setting. As soon as clear of the ground, wait a few seconds (but not more than five) to ensure that the aeroplane is gathering speed and is several feet clear.

When pumping up the undercarriage, take care to continue to fly the aeroplane as smoothly and steadily as possible, particularly when in a formation takeoff or if any other aircraft is nearby.

1a. In Mk I - Undercarriage Pump Valve	BACK to RAISE
Raise undercarriage by means of hand pump	15 STROKES OF PUMP HANDLE

(A2A Note: Press “g” on keyboard to toggle undercarriage lever to raise or lower position.
Press control + “g” to move the undercarriage pump)

Counter tendency to “porpoise” by ensuring column is	STEADY
1b. In Mk II - select undercarriage lever	FORWARD to UP
2. Ensure undercarriage indicator light shows	UP
3. When the undercarriage is confirmed to be “UP” start a gradual climb; throttle reduced to	NORMAL CLIMB SETTNGS
4. High power climb:	
De HAVILLAND 2-POSITION ADJUSTABLE AIRSCREW: up to +6 ¼ lb. (+4 lb. - 87 octane petrol) BOOST Pitch-	FINE (approx. 2600 R.P.M.)
ROTOL 35 DEGREE CONSTANT-SPEED AIRSCREW: up to +9 lb. (+7lbs.-87 octane petrol) Boost	Adjust airscrew control to 2850 R.P.M.

NOTE: The maximum high power climbing time for Mks I and II with all airscrews is 1 HOUR
However, always monitor the engine temperature gauges and reduce power if necessary.

5. Accelerate to best climb speed then adjust attitude to	MAINTAIN 185 M.P.H.
6. At leisure (but not unduly delayed) check oil pressure	AROUND 60 lb./sq. in.
7. Door and hood	CLOSE AND LOCK
8. Radiator shutter (unless high power climb)	NORMAL (RED TRIANGLE) OR AS REQUIRED TO MAINTAIN NORMAL TEMERATURES
9. Any further engine, airscrew, mixture adjustments	AS REQUIRED
10. Note radiator and oil temperatures	WITHIN ALLOWABLE MAXIM
11. Cockpit check	SYSTEMATICALLY SCAN
12. Feet may be taken off rudders during normal flight	USE FOOT RESTS
13. Particularly when flying on instruments, keep off rudder pedals	USE FOOT RESTS
14. Always run engine at the lowest speed practical	MONITOR RPM

CLIMBING:

The charts below assume 100 octane petrol (87 octane petrol in brackets) and appropriate oil grade for the season.

1a. Mk I may be climbed at any engine power to a maximum of:	+ 6 ¼ lb./sq. in. (+4 lb./sq. in.) BOOST at 2600 R.P.M. maximum.
1b. Mk II may be climbed at any engine power to a maximum of:	+9 lb./sq. in. (+7 lb./sq. in) BOOST at 2850 R.P.M. maximum.

2. In both Mk I and Mk II, at maximum permissible power the best climbing speed:

up to 12,000ft is	185 M.P.H.	A.S.I
up to 15,000ft is	179 M.P.H.	A.S.I
up to 20,000ft is	169 M.P.H	A.S.I
up to 25,000ft is	160 M.P.H	A.S.I

3. Watch radiator and oil temperatures	RAD 120C, OIL 90C MAXIMUM
4. Radiator shutter to control temperatures	ADJUST AS NECESSARY
5. The aeroplane climbs very steeply, periodically	CLEAR NOSE OCCASIONALLY

Always monitor oil pressure in particular, the engine can seize in as little as ONE MINUTE should the oil system fail. Maximum engines limits are exactly that, DO NOT EXCEED. The engine should normally be operated well WITHIN and not exceed these limits.

Do not start to climb before a speed of 140 mph is attained. Climbing too steeply will not get you to altitude faster. As with all aeroplanes, there is a best rate of climb speed and a best angle of climb speed.

The airspeeds indicated above are the best rate of climb speeds for the Spitfire. The best angle of climb speeds are considerably lower, equal, in fact, to what the best angle of glide speeds are (least rate of descent–best lift to drag ratio)at whatever altitude you might be.

Also, climbing too steeply at a too slow an airspeed will overheat the engine quickly, even with radiator shutter opened fully. If you find that the engine temperatures are rising and approaching the maximum allowable temperature, ensure that the radiator shutter is full opened, level off, and reduce throttle to cruise until the engine cools off.

NORMAL CRUISE:

Check your engine power charts for appropriate settings. The greatest range may be accomplished when flying at approximately 200 m.p.h. indicated airspeed at any altitude. Cruising at higher altitudes at this indicated airspeed will, of course produce higher true airspeeds. The Spitfire will trim out for level flight easily and hands-off flying is practical. Put your feet upon the upper rudder pedal stirrups when cruising long distances to promote better circulation in your legs for extended periods of time. All normal flying should be done with only the elevator and aileron controls. The rudder control is rarely needed during flight, except in certain aerobatics, to hasten the rate of roll, when flying at slow airspeeds, or when landing. The pilot’s feet should be off the rudder pedals entirely when flying by sole reference to the instruments.

Remember, the elevator control is sensitive. Inadvertent movement of the pilots arm due to the aircraft’s sudden bumping in turbulence are liable to cause large and sudden fluctuations in “g”, which should be avoided in order to not unduly stress the pilot or the airframe. To avoid this it is advisable for the pilot to press his elbows against the side walls of the cockpit to steady and brace himself.

Use Climb power settings and Normal (Rich) mixture until level at the desired altitude; then, after the aeroplane has accelerated to at or near its cruising speed, reduction to cruising power may be set.

NOTE: Remember, when <u>increasing</u> power with the TWO-POSITION or CONSTANT-SPEED airscrew, first raise the airscrew’s R.P.M., and then open the throttle to desired Boost.

When <u>reducing</u> power with the TWO-POSITION or CONSTANT-SPEED airscrew, first lower throttle, and then reduce the airscrew’s R.P.M.

When the cruise settings have been set, then adjust mixture to WEAK (Lean). Never try to climb or use high power settings when the mixture is WEAK (Lean).

When cruising, set the Radiator shutter control so that it lines up with the red triangle located on the top of the map case. This is the most efficient aerodynamic/cooling setting for the shutter. Monitor your Radiator and Oil temperatures at all times, opening or closing the Radiator shutter accordingly to maintain proper operating temperatures.

Flying at high altitudes:

You will find that the Spitfire handles well at all heights, right up to its service ceiling. Of course, as you climb your indicated airspeed (A.S.I.) will become lower than your true airspeed (TAS), the difference being proportional to your density altitude (height and the outside air temperature (OAT), determined by consulting a DENALT chart). An easy rule of thumb for determining true airspeed is to increase your indicated airspeed by 2% per thousand feet of altitude. Another easy one is to divide your altitude by 1000, multiply by five and add the result to your indicated airspeed.

The most important thing to remember about flying at heights at or above 12,000 feet is that you MUST wear your oxygen mask with the oxygen flow valve, located on the starboard wall the cockpit, be turned FULL ON. Hypoxia (oxygen deprivation) is no joke, and you usually cannot tell when it has begun. Headache, fatigue, shortness of breath, a feeling of euphoria and nausea, followed by blacking out are the main symptoms. There are many cases on record of pilots blacking out from hypoxia and not recovering before a fatal crash. To avoid this be diligent about wearing your oxygen mask at all times that you expect to fly above 10,000 feet.

Navigation by reading charts when at great heights is made more difficult by the fact that ground objects, except for very large ones like lakes, rivers and the like, become more and more difficult to see the higher you fly. Clouds, haze and generally reduced visibility when looking down through so much atmosphere may obscure the ground, even on an otherwise clear day. Call in to a local Sector Control Centre, if you can, to get a radar fix on your position when in doubt.

Flying in bad weather or conditions of low visibility:

When flying when visibility is poor when the ground is in sight or in formation, open the cockpit hood if visibility becomes obscured. If the hood cannot be opened for any reason such as icing or combat damage, a break-out panel is fitted to the hood which, when pushed out with the elbow or flat of the hand may improve visibility.

In all low visibility conditions, it is advisable to slow down. In extreme conditions the flaps may be lowered to aid in keeping the airspeed down and the aeroplane flown at airspeeds as low as 120 m.p.h. indicated airspeed. Do not exceed 140 m.p.h. with flaps down. At this airspeed the airscrew pitch should be FINE and the radiator shutter fully opened. Radiator temperature should stabilize at 100C. Note that FINE airscrew pitch greatly increases fuel consumption. If conditions permit, the flaps may be raised and the TWO-POSITION airscrew set at COARSE, or the CONSTANT-SPEED airscrew set to produce 1,600 R.P.M. This will give an airspeed of approximately 180 m.p.h. An intermediary airspeed of approximately 160 m.p.h. can be accomplished by raising the flaps and lowering the undercarriage using the same engine settings.

A USEFUL THING TO REMEMBER: When in the appropriate circumstance, flying with the undercarriage down indicates that you are a non-hostile aircraft.

DESCENT:

Plan the descent well ahead when leading or flying solo. AVOID high airspeed, low-power descents for extended periods of time, particularly when the aeroplane has been at high altitudes for an extended time as this cools the engine too fast and can damage it. Monitor your Radiator and Oil temperature gauges and open or close the radiator shutter as needed. Raise the nose to reduce speed and open the throttle slightly if the engine is cooling off too rapidly. Never let the airflow rather than the engine turn the airscrew at low power settings as this can damage the engine's internal bearings. Advance the throttle slightly so that the engine is turning the airscrew when you feel that this is occurring. Be aware of this possible condition and take the same steps to correct it particularly when in circuit in preparation for landing.

DIVING:

In both the Mk I and II the maximum permissible diving speed is 450 m.p.h. A.S.I. (indicated air speed), provided that the engine limits are not exceeded.

At less than 1/3 throttle the maximum continuous R.P.M. permitted is 3,000. If the throttle is at least 1/3 open, 3,600 R.P.M. is permitted momentarily until it settles down to 3,000 R.P.M. or less. At no time must the throttle be closed if R.P.M. becomes excessive in an attempt to reduce R.P.M. With the ROTOL 35° constant-speed airscrew, the R.P.M. will remain constant in the dive within governor limits (1,700-3,600 R.P.M.). However with the WATTS OR WEYBRIDGE fixed-pitch or de HAVILLAND TWO-POSITION airscrews, R.P.M. limits can be reached and exceeded rather quickly. When the TWO-POSITION airscrew is installed, the plunger control must be set fully forward in the COARSE position. When the ROTOL 35° CONSTANT-SPEED airscrew is installed the airscrew control should be set back in the POSITIVE COARSE position before starting the dive to prevent the airscrew from jamming in fine pitch.

The minimum R.P.M. permissible at maximum Boost is: Mk I - 2080 R.P.M.
Mk II - 2270 R.P.M.

At all times the flaps must be up before exceeding 140 m.p.h.

The Spitfire has a marked tendency to become quite tail heavy (nose up) at high airspeeds. The elevator trim must be trimmed into the dive (nose down) in order to avoid the danger of excessive "g" when recovering. In the dive the elevator trim tab control wheel should be set so that there is no load on the elevator. This will lessen the possibility of excessive "g" and stress on the airframe being induced when easing out of the dive, particularly if the pilot should release his hold on the column owing to having "blacked out", or for any other reason. After recovery forward trim should be wound back as speed is lost. The Spitfire has a tendency to yaw to the starboard in a dive. This may be corrected by use of the rudder trim control. All trim tabs in the Spitfire are sensitive and must be used conservatively and carefully.

If the aeroplane is trimmed as stated above, no difficulty should be experienced when pulling out of the dive as the elevator is light, sensitive and effective at all airspeeds. Recovery from a dive will not be restricted by excessive pitch stability. The elevator trim tab control may be used to aid in pulling out of a dive, but it must be used gently, carefully and with caution. The pilot should always have his hand on the elevator trim wheel when using it to recover from a dive as if it is not held still, the tremendous forces on the elevator trim tabs in a dive could cause it move on its own, creating too great a force on the elevator.

The Spitfire will lose a great deal of altitude very rapidly in a dive, so do not commence a dive unless sufficient altitude had been attained to allow for a safe recovery.

MANEUVREING AND AEROBATICS:

The Spitfire is stable in all axes during normal maneouvers; however it begins to become somewhat unstable in pitch during steep turns. As the turn becomes steeper, the elevator becomes lighter in feel and an accelerated stall may be easily produced if caution is not taken.

Note: the Spit will tend to tighten into steep turns during ordinary turns unless care is taken to hold this tendency in check.

While the Spitfire is exceptionally good for acrobatics, owing to its high performance and sensitive elevator control, care must be taken not to impose excessive loads either on the aeroplane or on the pilot or to induce a high-speed (accelerated) stall. Many aerobatics may be done at less than full throttle; however, at least normal cruising boost and R.P.M. should be used during aerobatics. If boost and/or R.P.M. is reduced below this, detonation which may damage the engine may occur if the throttle is quickly opened up to climbing boost for any reason.

The following is recommended for aerobatics:

Loop - about 300 m.p.h., but may be commenced at 200-250 m.p.h. with care and when the pilot is fully proficient.

Roll - between 180 and 300 m.p.h. The nose should be brought up about 30 degrees above the horizon at the start of the roll, and the roll should be somewhat barrel shaped (maintain constant positive "g" to keep the engine running throughout).

Half roll off loop (Immelmann turn) - 320-350 m.p.h., but may be commenced at 225-250 m.p.h. with care and when the pilot is fully proficient.

Split S *(A2A note: reverse Immelmann turn)* - Commence at lowest practical indicated airspeed. Throttle fully off (back), airscrew fully fine, gear and flaps up. During this and all vertical maneouvers, take care not to pull the control column spade grip back too quickly or with too much force as this is likely to produce a high-speed (accelerated) stall.

Flick maneouvers (snap rolls) - not permitted.

NOTE: Mixture should be set to NORMAL (rich) before performing all aerobatics.

SLOW FLIGHT, STALLING AND SPINNING:

Slow Flight:

Because of its generous wing area for a high performance, modern fighter aeroplane, the Spitfire demonstrates very forgiving and stable slow speed flight characteristics. Even with the flaps and undercarriage up, the aeroplane is fairly stable around all axes down to around the stall speed + 10%. During any prolonged period of slow flight below 100 m.p.h. care must be taken to closely monitor the engine temperature gauges and to open the radiator shutter if necessary to maintain proper operational temperatures. If, during slow flight engine temperatures begin and continue to rise, lower the nose and increase airspeed to force cooling air into the radiator.

As the aeroplane approaches the stalling angle of attack, it will begin to shudder and shake. This will increase until the stall break. When slow flying, should the aeroplane begin to exhibit such shuddering, etc, immediately lower the nose by moving the control column spade grip forward gently until the shuddering, etc. stops.

Turning while slow flying should be performed at shallow angle of bank and the turn coordinated with the rudder. The aeroplane wants to increase bank when in a slow turn. Do not permit bank to become excessive. A slight increase of throttle may be required to maintain height in a slow turn. Monitor engine temperature if the throttle is opened during slow flight and open the radiator shutter if necessary. All non-aerobatic maneouvers, including maneouvers during slow flight may be performed with the undercarriage down. DO NOT attempt maneouvers except shallow, gradual turns with the flaps down.

Stalls:

At the stall, one wing will usually drop whether the flaps are up or down and the aeroplane may spin if the control column spade grip is persistently held back.

If the control column spade grip is brought back too rapidly in a maneouver such as a loop or steep turn, stalling angle of attack may be quickly reached or exceeded, and a high-speed (accelerated) stall may be induced. When this occurs there is a violent shudder and clattering noise throughout the aeroplane, which tends to flick over laterally, and unless the control column spade grip is brought forward instantly, reducing the angle of attack, a rapid spin may result.

Approximate stall speeds when loaded to 6,250 lbs are:

Flaps and undercarriage UP:	Mk I- 69 m.p.h.	Mk II- 79 m.p.h.
Flaps and undercarriage DOWN:	Mk I- 63 m.p.h.	Mk II – 71 m.p.h.

NOTE: Due to position error when the aeroplane is at high angles of attack, the airspeed indicator may not read the correct airspeed.

The above stall speeds are correct only for stalls when the aeroplane is at one "g" and when the stall has been approached gradually. Pilots should remember that a stall may occur at **any airspeed** if the angle of attack of the wing reaches its critical stall angle (the angle at which it can no longer produce lift). This may occur during a steep turn, or in a pull-up from a dive, or at any time that the control column spade grip is pulled back too far or too sharply.

DO NOT commence recovery after a stall until the airspeed is at least 160 m.p.h. A.S.I.

Spins:

Intentional spins except during authorized training exercises are ABSOLUTELY PROHIBITED. The Spitfire will spin violently and will loose a great deal of altitude in the spin before recovery. Before entering into a spin ensure that you are at a high enough altitude for a safe recovery. If practicing spins with proper authorization to do so, be sure not to commence the spin below 10,000 feet.

Practice spins should be performed with undercarriage and flaps up, with the airscrew at FULL FINE pitch, the mixture RICH, and with the throttle fully closed. DO NOT enter a practice spin out of a steep turn or with the throttle opened. In the former instance, a sudden and violent spin could occur which could cause the pilot's head to strike the canopy so violently as to cause unconsciousness. In the latter instance, power on at the commencement of or during a spin could cause the spin to be flat; that is, the nose to be near or to the horizon. Flat spins are treacherous and very difficult, or, in some instances, impossible to recover from. Occasionally a quick blast of power will pull you out of a flat spin; however this is not always an effective solution. If you find that you are in an unrecoverable flat spin, immediately prepare to leave the aeroplane and execute a bale-out according to the techniques for same which were taught to you at OTU. *Kyrie*, etc.

Always be sure that your harness is snugged up tight before commencing any potentially violent maneouvers.

Spin Recovery: For normal nose-low spins, check that the throttle is fully closed, the airscrew pitch is fully fine, and the mixture is RICH.

First push the rudder opposite to the direction of the spin until the rotation stops.
Then push the control column spade grip forward to un-stall the wing.
Then, when un-stalled with no rotation and when the airspeed is at least 160 m.p.h., gently pull the control column spade grip back to raise the nose until it is level.
Then open the throttle to normal cruise settings.

Note: If, when you push the rudder pedal to stop the rotation, the rotation rate increases, you have pushed the wrong pedal; push the other one until the rotation stops and proceed as above.

When in a spin, DO NOT un-stall the wing (forward control column spade grip) while the aeroplane is still rotating. Doing this will cause the aeroplane to enter an extremely violent nose-low, extremely rapid spiral dive, the "g" forces resulting from which will likely prevent you from being able exit the aeroplane, will quickly overstress the aeroplane and/or will cause it to be difficult to recover from before striking the ground.

PRELIMINARY APPROACH TO LANDING:

1.	Ensure hood is locked open and door latch to	HALF-COCK
2.	Harness release to	FIXED
3.	Mixture control ensure back to	NORMAL (RICH)
4.	Maps and other equipment not required for landing	STOW
5.	Radiator, shutter unless approach will be prolonged	NORMAL (RED TRIANGLE)

ON DOWNWIND, ACTIONS TO BE PERFORMED QUICKLY AND DECISIVELY:

1.	Reduce speed to allowable limit for undercarriage	160 M.P.H.
2a.	In Mk I	
	Operate undercarriage hand pump to take weight off "pins"	ONE STROKE
	then undercarriage Pump Valve set to	LOWER
	Lower undercarriage by means of hand pump	30 FULL STROKES OF HANDLE
2b.	In Mk II - Undercarriage lever set to	DOWN
3.	Ensure undercarriage indicator shows	DOWN
4a.	If de HAVILLAND 2-POSITION ADJUSTABLE AIRSCREW:	Airscrew control plunger BACK/OUT to FINE PITCH
4b.	If ROTOL 35 DEGREE CONSTANT-SPEED AIRSCREW:	Airscrew control lever forward to FULL FINE
5.	Adjust speed to about	120 M.P.H.
6.	Upon finally turning in to land put	FLAPS DOWN (INDICATORS)
7.	Aim to cross fence at	80-90 M.P.H. DEPENDING UPON THE WINDS
8.	At threshold close throttle and adopt 3 point attitude	HOLD
9.	DO NOT attempt to force aeroplane onto ground	HOLD ATTITUDE UNTIL TOUCHDOWN

Landing tips:

The landing of any aircraft is as much an art as it is a science. It is this phase of the flight most often judged, rightly or wrongly, to indicate the level of competence of a pilot. As it is with most artistic, skill-based endeavours, consistently good landings are the product of constant practice and attention at all times to what the aircraft is doing.

The Spitfire is a responsive but gentle aeroplane. With practice and due diligence, you will not find it difficult to make safe and acceptable landings in it. We suggest that when you can, take your machine to altitude and practice slow flight, stalls and landings with gear and flaps down at a specific altitude until you are fully familiar with the slow speed handling and characteristics of the aeroplane. On days when the squadron has stood down from combat, it is a good idea to practice circuits and bump-and-goes.

Lowering the undercarriage: In the Mk I, this is accomplished by first pumping the actuating handle one stroke while the gear position handle is in the "RAISE" position. This will lift the gear off the locking pins and will enable you to proceed further without difficulty. Now, move the gear position handle to "LOWER" and pump 30 full strokes of the pump handle until the illuminated undercarriage indicator on the port side of the instrument panel reads "DOWN" and the undercarriage position indicating pins on both wings, located towards the front of the inboard part of each wing and visible from the cockpit are sticking up from the wings' surfaces. The position pins on the wings are the most reliable indicator of the undercarriage's position.

Emergency lowering of the undercarriage: Both Mks I and II - In the event that the undercarriage will not lower using the usual techniques and methods as described herein, an emergency undercarriage lowering system has been provided. A sealed, 90 gram, high-pressure cylinder containing carbon dioxide - Co2, which is connected to the undercarriage operating jacks is provided for use when the undercarriage will not lower using normal techniques and/or the hydraulic system has failed. This cylinder is located on the starboard wall of the cockpit and its seal can be punctured by operating a dark red-painted lever marked "EMERGENCY ONLY" located beside the cylinder. A thin copper wire prevents the inadvertent use of this lever and acts as a safety. Firm and definite operation of the lever will break the wire and enact the emergency undercarriage lowering system.

In the event that it is necessary to operate the emergency undercarriage system described above, it is essential to first ensure that the undercarriage selector lever is in the "DOWN" position before pushing the emergency lowering lever forward and down. The emergency lowering lever must be pushed to its limit (100° of travel) and thereafter permitted to swing downwards. After this procedure is completed, this lever must not be placed in its original position unless and until a new Co2 cylinder has been installed.

Note: When contemplating landing, if you are in doubt about whether the undercarriage is locked down and if terrain permits, it is best to land wheels up. If you have any doubts about being able to negotiate a safe wheels-up landing under the circumstance you may find yourself in, bale out at an appropriate height.

DO NOT attempt a wheels-up landing if the fuel tanks are more than 1/3 filled. If the fuel tanks are more than 1/3 filled, a wheels-up landing is extremely hazardous and a fire is likely to ensue upon contact with the ground. In such circumstance, bale out at an appropriate height.

If the undercarriage will not completely raise or lower, land with the undercarriage selector in the UP position. In this way the undercarriage will be likely to collapse upon alighting. In these kinds of situations it is far safer to have both wheels up upon landing than to have one wheel down and the other wheel semi-down or up. An asymmetrical undercarriage when landing can be deadly. The Spit lands very nicely with the undercarriage up. There have been instances, after a gentle wheels-up landing on grass, where the kite was jacked up, the damaged undercarriage mechanism repaired or replaced, and the aeroplane then put back in rotation as operational without any further repair required.

If it becomes necessary to ditch in the water, if possible, contact the nearest Sector Station on your TR-9D on any frequency and inform them of your position so that rescue services maybe provided. Sector may already be tracking you on HF/DF-"Huff-Duff". Ensure that your IFF "Pipsqueak" is switched on as well. Approach the water with the radiator shutter closed, your harness as snug as possible, flaps and undercarriage up, the nose well above level (three-point landing attitude), and at the lowest possible speed. Of course, the canopy should be opened and locked, and the port door should be at half-cock before contacting the water in order to facilitate a quick evacuation from the aeroplane. If you can, also cut the engine immediately before contact with the water so that the spinning airscrew will not upset your machine. Attempt to contact the water with the wings level. The radiator beneath the starboard plane, the oil cooler beneath the port plane, and the carburetor air intake under the fuselage will cause some sudden drag when contacting the water. Be prepared for this. Once settled in the water, leave the aeroplane at once, it will not float for very long under the best of circumstances. Inflate your life-vest immediately <u>after</u> leaving the aeroplane as an inflated life-vest may interfere with your evacuation.

Flaps: The flaps are lowered by pulling the splayed flap control lever located on the instrument panel at the top, port-of-centre, out and down. They are raised by returning the lever to its former position. On both the Mk I and II the flaps have only two positions - up and down (85°). The maximum speed at which the flaps may be down is 120 m.p.h. DO NOT lower the flaps above 140 m.p.h., and lower them at a reduced speed if you can in order to reduce stress on the flap operating mechanism. DO NOT lower flaps until the landing is assured. The flaps on the Spitfire are very powerful and will cause a severe nose down trim. Be ready to catch this with up elevator and anticipate it by raising the elevator trim just before or simultaneously with lowering the flaps. Under ordinary circumstances and when the flaps are operating normally DO NOT attempt to land unless they are down.

In the Mk I only, the flaps' position is displayed on an indicator, starboard of the flap control lever on the instrument panel at the top, port-of-centre. In both the Mk I and Mk II the flaps' position is also indicated by a small door on each wing located towards the rear of the inboard part of the wing and visible from the cockpit. This door will open when the flaps are down and locked and close when they are up. The doors on each wing are the most reliable references for flap position.

In the event that the flaps will not go down when the flap control is lowered, ensure that you are at or below 140 m.p.h. and check that there is sufficient pneumatic pressure to operate the flaps. If this is confirmed, slow down a bit more and retry a few times. If you cannot get the flaps to lower, be prepared to make a flaps-up approach and landing. Such approaches and landings require higher airspeed than normal until you have alighted on the runway. It is recommended that in such a circumstance that you do not permit the indicated airspeed to become lower than 100 m.p.h. at any time during the approach until just over the fence, when the airspeed may be reduced to 90 m.p.h. This is a good margin of safety against an inadvertent stall. Round out and land as usual but be prepared to use a judicious amount of throttle to soften the landing if required. It is not recommended that you practice flaps-up landings except at altitude as the chance of a mishap is greater than with normal flaps-down landings.

When you return from a sortie or a mission you will usually have little fuel in your tanks and the aircraft will be at or near its lowest possible wing loading. In this light condition, the Spitfire will tend to float for a long time before alighting if it is brought over the fence at anything substantially more than the recommended airspeed - 80-90 m.p.h. depending upon the winds. If you should experience a long float-off, do not try to push the aeroplane to the ground with forward control column spade grip. Set up for a normal landing and use power as needed to soften any drop. If you find that you are running out of runway, go around immediately. It is better to lose a little face than to lose your machine or yourself.

Normal landings in the Spitfire are three-point, or when conditions are gusty and/or when high winds are present, perform a tail low wheel landing. Fully level wheel landings are not recommended as the aeroplane tends to tip up easily, even with little fuel on board, and airscrew ground clearance is only 7 ½ inches when level.

Raise the flaps after alighting to reduce lift thereby allowing the full weight of the aeroplane to settle on the tyres.

After alighting, DO NOT apply the brakes until the tail is firmly on the ground. Apply the brakes gently and sparingly with the control column spade grip held fully back until the aeroplane has slowed. Be ever vigilant against a tip up. In the event that the tail begins to rise, release the brakes immediately. A short blast of the airscrew with control column spade grip fully back will lower the tail in most circumstances.

PROCEDURE AFTER LANDING:

1. When clear of landing area then	RAISE FLAPS (CONFIRM INDICATORS) OPEN RADIATOR SHUTTER
If de HAVILLAND TWO-POSITION ADJUSTABLE AIRSCREW:	AIRSCREW TO COARSE PITCH (plunger fully in) - A blast of power may be necessary to move the airscrew blades to COARSE
If ROTOL CONSTANT-SPEED AIRSCREW:	AIRSCREW TO FINE PITCH (lever fully forward)
2. Taxi in, do not delay as temps will become excessive:	PRESSURE HEAD HEAT OFF WATCH TEMPERATURES
3. Throttle set to just above rough running by ear	800 - 1000 R.P.M.
4. Move both fuel cocks down to	OFF
5. Allow to run for approximately	1 MINUTE

6.	Immediately rough running begins	LOW CUT SWITCH - PULL ON
7.	Indicator lights	OFF
8.	Wheel brakes	ON

Bump-and-Goes - When specifically permitted to do them by the Squadron air-traffic control authority, you may practice multiple landings in the shortest time by doing "bump-and-goes", that is, where you land and immediately takeoff again without stopping or taxiing back to the beginning of the runway to takeoff.

Please note: When doing bump-and-goes in a Spitfire there are few things to think about:

2. The Spitfire Mk I and II are lightly wing-loaded aeroplanes. When practicing landings with less than full petrol and no ammunition, they are lighter still. Accordingly, your Spit will easily float-off for a long distance before alighting if the wind should fall off, or if you should make your approach and round out with even a small amount of excess airspeed. What this means is that you must be vigilant and cautious about how far down the runway you are when you have actually alighted before deciding to takeoff from that point. DO NOT continue the takeoff if you have less than 2,000 feet of runway ahead, even if you still are rolling quite fast after the landing.

3. Remember to open the radiator shutter to FULL OPEN upon alighting and before taking off again. You may have closed the radiator shutter to its most efficient aerodynamic position (red triangle) or to some other closed position during your approach to landing in order to clean the aeroplane up for best glide performance. DO NOT takeoff with it in any other position than FULLY OPEN or you will surely boil the radiator coolant fluids.

4. Where appropriate, remember to set the airscrew to FULL FINE PITCH before taking off.

5. Upon approach you will have likely trimmed the elevator up to counter the nose-down pitching upon lowering your undercarriage, and even more so upon lowering your flaps. Accordingly, elevator trim will be near its full UP position on approach. Upon alighting you must immediately return the elevator trim to at least neutral, or best, to one division down before taking off again. Failure to do this may cause the aeroplane to lift off too early and before adequate flying speed has been achieved. Also, with the elevator trim in or near its full UP position, the nose will rise dramatically upon lifting off which might not be easily corrected with the control column.

6. DO NOT open the throttle quickly after alighting to takeoff again. The resulting sudden increase in p-factor and torque will tend to pull the aeroplane hard to port and severely depress the port wing, possibly before you can correct it, and to an extent that rudder/aileron authority may be inadequate to handle. Open the throttle slowly with starboard rudder applied to counter any swing to port.

7. Be vigilant as to traffic ahead. Maintain a safe distance at all times from other traffic. If a slower flying aeroplane is ahead of you and is not far enough away from you when you alight, DO NOT continue the takeoff. Slow the aeroplane and taxi back to the beginning of the runway for the takeoff.

8. DO NOT practice bump-and-goes in inclement weather, when the runway or grass is slippery, or when visibility and/or ceiling height is marginal or low. Good judgment must always precede action.

Note: Always wear your goggles and gloves when flying the Spitfire. They will give you the best protection against fire in the cockpit which may be caused by a number of things, including, but not limited to the ignition of your fuel and/or glycol tanks when in combat. Regardless how uncomfortable you may be when wearing them, your goggles and gloves have been issued to you to protect you. They are not optional dress, wear them at all times when in the cockpit and the engine is operating.

We here at Squadron hope that this pamphlet will be of use to you as you become familiar with the Spitfire and take her into combat. Good luck, Tally Ho, and good hunting!

STUDY AND TRAINING MATERIALS FOR FLYING MODERN-DAY RESTORED SPITIFRE MK IIa and IIb AEROPLANES

The preceding checklists and notes are historically accurate and represent those which were used for operating and flying the Spitfire in the summer of 1940. The aeroplanes and engines which were flown at that time were new, in excellent condition, and able to be safely pushed to limits to which it would not necessarily be wise to push a 70 year-old aeroplane and/or engine. Also, the exigencies of war provided little room for conservative operations regarding these aeroplanes and engines. Unlike today, spare parts were plentiful as were replacement aeroplanes and engines. Wringing the maximum possible performance out of these Spitfires without thought or regard for preserving them for posterity was the rule, and was necessary in order for their pilots to succeed in and survive the desperate combat in which they were daily engaged.

As time has passed, flyable examples of the venerable Spitfire, particularly of the earlier Marks, continue to become fewer and fewer. Those that are still flown are treated, as they ought to be, with tender care so that they might be well-preserved and so that they will continue to be able to be flown for many years to come. Accordingly, surviving modern-day Spitfires are no longer flown with anything like the same abandon that they were in the days when they were the bright spear-point of a Nation's first-line of defense.

The following is based in part upon the checklists and notes which the Battle of Britain Memorial Flight (BBMF) uses as study and training material for pilots who today fly the few remaining Spitfires and other aircraft of which they have most respectful custody. It is the BBMF's mission to nurture and protect these aircraft which represent unique and precious living examples of an important part of classic British Aviation History. Thus, the BBMF continues to fly and display them in order that each new generation may be educated and informed as to their history and heritage, and to thereby honour in an appropriate and respectful manner those who fought and died in them.

In these materials you will notice many differences from the 1940 era checklists and notes, particularly with regard to airspeeds and engine operating numbers. Merely flying 70 year-old, irreplaceable and precious aircraft is daunting enough; that they are flown particularly gently, and with great care and respect is no more than they so richly deserve.

SPITFIRE MK IIA and IIB AEROPLANES

MERLIN XII ENGINE / ROTOL 35 DEGREE CONSTANT SPEED AIRSCREW

EXTERNAL CHECKS:

In addition to normal "Walk Around" Special attention is to be directed to:

1. Engine Cowlings, Vent Pipes, Fluids	Security, NO abnormal leaks apparent
2. Control Surfaces and Trimming Tabs	Condition, Fit and Travel
3. Wings level, Undercarriage Struts, Tires	Check for wear, integrity chocks in place.
4. Hood and Cockpit Door	Operation and Cleanliness
5. Oil Cooler and Radiators	Intake and Matrix unobstructed
6. Ground Fire Extinguisher / Fire Marshall	Available

ON ENTERING THE COCKPIT:

1. The magneto switches are	OFF	
2. The undercarriage lever set to	DOWN (in gate, IDLE indicated)	
3. Emergency Undercarriage Bottle	Lever Vertical and wire locked.	
4. The flaps are	UP	
5. The landing lamps are	UP	
6. The wheel brakes (parking) are	ON, Pressure 80 psi MIN to each brake	
7. The chassis indicator lights show	DOWN	
8. Check contents of fuel tank –	Bottom	37 GALL

		Top (NOT GAUGED) 48 GALL AT TAKEOFF
9. Check flying controls		FULL, FREE AND CORRECT SENSE
10. Automatic Boost Cut-out Override		Confirm OFF (Red Thumb Lever "back")

STARTING THE ENGINE AND WARMING UP:

1. Set mixture control back to		NORMAL (RICH)
2. Set "Airscrew Control" fully forward to		FULL FINE
3. Set radiator shutter lever full forward		FULLY OPEN
4. Raise both fuel cock levers to		ON
5. Open throttle slightly		OPEN 1/4 "
6. Unscrew primer pump and operate until		SUDDEN INCREASE IN PRESSURE
7. Inject appropriate number of effective shots		5 AT NORMAL TEMP
8. Ensure everyone is clear of the propeller		"CLEAR PROP"
9. Switch both main magnetos to		ON
10. Switch Generator to		ON
11. Hold START button and prime until engine catches		3 OR 4 BLADES Normal before firing.
12. Engine turns freely but does not fire :	Check	Ignition Switches ON Throttle ¼" open Excessive Fuel?
13. Engine does not turn:	Check	Cartridge Starter Breech Loaded? Cartridges remaining?

	Ring on right of panel RELOADS Cartridge Breech
15. Hold START button until engine catches	DO NOT USE PRIMING PUMP
16. When Engine running smoothly Priming Pump	SCREWED DOWN, LOCKED
17. Throttle OPEN only as far as avoids rough running	800 – 1,000R.P.M. (BY EAR)
18. See that the oil pressure is satisfactory	AT LEAST 45psi , MAXIMUM 120psi for SHORT period only then as pressure drops:
19. Warm up at fast tick over (1200r.p.m.) until oil temp	40C
Radiator temp	60C

NOTES:
Do NOT oscillate the throttle lever, but open slowly to get the engine running at a fast tick over. If the engine begins to fade or backfire, close throttle quickly and open it up again very slowly. Maximum of 120psi Oil Pressure MUST NEVER be exceeded. 90-100psi is preferable on start-up but not always possible.

TESTING ENGINE AND INSTALLATIONS:

NOTE Warming up should not be unduly prolonged as the temperatures rise quickly and some margin must be kept in hand for taxiing. Aeroplane MUST be airborne before temperatures reach prescribed maximum. The engine should not be run at high power for more than a few seconds- just long enough to test Magnetos and observe oil pressure, boost and r.p.m. TWO men MUST hold down tail.

1. Check fuel pressure	2 ½ to 3 psi
2. Check brake pressure	RESERVOIR AT LEAST 80 psi.
3. Pneumatic system	FLAPS DOWN THEN UP AGAIN
4. Set altimeter	AERODROME HEIGHT
5. Set directional gyro	TO COMPASS OR RUNWAY HEADING
6. Turn pressure head heat (Pitot Heat)	ON
7. Harness release to	FIXED

8. Parking brakes released	HOLD BRAKES MANUALLY
9. Open throttle to boost	+2 psi
10 Exercise airscrew control a few times then set to	2,400 rpm
11. Reduce throttle slightly and confirm that	R.P.M. CONSTANT SPEED
12. Set Airscrew Control to	FULL FINE (FULL FORWARD)
12. Open throttle to boost	+4
13. Check each of the magnetos in turn r.p.m. drop	NOT TO EXCEED 80
14. Check oil pressure	60-80 psi
15. Ensure hood is locked open and door latch to	HALF-COCK
16. Wave away chocks.	TEMPERATURE NOT TO EXCEED 115C

TAXIING OUT:

1. Check radiator shutter	FULLY OPEN
2. Ample brake pressure	80 psi. MINIMUM
3. Throttle friction do not loosen to make taxiing easier	ENSURE FIRM
4. If takeoff is delayed for any reason	CLEAR ENGINE - MODERATE R.P.M.
5. Ensure maximum temperature limits are not exceeded	CHECK (SHUT DOWN BEFORE BOILING BOILS AT 124C) IF RADIATOR BOILS FLIGHT IS TO BE SCRUBBED.

FINAL PREPARATION FOR TAKEOFF:

Drill of Vital Actions – catchphrase ***T.M.P. FLAPS***

1. **T -** Trimming tabs for Elevator	1 DIVISION NOSE DOWN
Rudder	FULLY RIGHT
2. **M -** Mixture control	BACK TO NORMAL (RICH)
3. **P -** Pitch control lever fully forward	FULL FINE
4. **Flaps -** Flaps must NEVER be down (85º)	UP

If the flaps are left down, the aeroplane may still take off. If so on NO account must the flaps be raised until A.S.I. is at least 120 m.p.h. at a safe height.

TAKING OFF:

Take off power is limited to +7 Boost in ALL cases

Turn into wind and move slightly forward to straighten tail wheel. Open up to full throttle and take off by holding the aeroplane to a constant attitude with the tail well up ALMOST in a flying position until it leaves the ground. It must NOT be lifted off too soon by dropping the tail but on NO account push forward on the controls to lift the tail. Any tendency to swing to the left can easily be counteracted by use of coarse rudder but Right trimming SHOULD be used. Hold down to almost level flight.

ACTIONS AFTER TAKING OFF:

Drill of Vital Actions – catchphrase ***UP***. As soon as finally clear of the ground, wait a few seconds (but not more than five) to ensure that the aeroplane is gathering speed and is several feet clear:

1. **U** Undercarriage lever set to	UP
2. Ensure undercarriage indicator light shows	UP
3. When "UP" confirm A.S.I. reads at least	140 M.P.H.

4. **P**__Power: Start a gradual climb and throttle down to	+4 psi Boost
5. Adjust airscrew control to	2400 R.P.M.
6. Note maximum high power climbing time	30 MINUTES
7. Accelerate to best climb speed then adjust attitude to	MAINTAIN 185 M.P.H.
8. At leisure (but not unduly delayed) check oil press	AROUND 60 lb./sq. in.
9. Door and hood	CLOSE AND LOCK
10. Radiator shutter (unless high power climb)	NORMAL (RED TRIANGLE)
11. Any further engine, airscrew, mixture adjustments	AS REQUIRED
12. Note radiator and oil temperatures	WITHIN ALLOWABLE MAXIMA
13. Further radiator shutter adjustments	AS REQUIRED
14. Cockpit check	SYSTEMATICALLY SCAN
15. Particularly when flying on instruments	USE FOOT RESTS FEET OFF RUDDERS
16. Always run engine at the lowest speed practical	MONITOR RPM
17. Operating Limitations	READ, LEARN OBSERVE. ***NO EXCEPTIONS***

NOTE: Operating Limitations of the Airframe and engine are listed as an appendix hereto. They are not suggestions, advice, theories, guidelines or guesses. They are hard and fast rules, They are the maximum limits at which the aircraft is permitted to be operated and therefore any breaching of these limitations MUST be reported on the maintenance sheet and such breeches will be THOROUGHLY investigated and appropriate disciplinary action taken.

CLIMBING:

1. This aeroplane may be climbed at any engine power to	+7lb./sq.in. BOOST 2850 R.P.M	
2. At full throttle best climbing speed up to	13,000ft is	185 M.P.H. A.S.I
	15,000ft is	180 M.P.H. A.S.I
	20,000ft is	160 M.P.H A.S.I
	25,000ft is	140 M.P.H A.S.I
	30,000ft is	125 M.P.H A.S.I
	35,000ft is	110 M.P.H A.S.I
3. Watch radiator and oil temperatures	RAD 120C, OIL 90C MAXIMUM	
4. Radiator shutter to control temperatures	ADJUST AS NECESSARY	
5. The aeroplane climbs very steeply, periodically	CLEAR NOSE	

NOTE
Always monitor oil pressure in particular, the engine can seize in as little as ONE MINUTE should the oil system fail. Maximum engines limits are exactly that, DO NOT EXCEED. The engine should normally be operated well WITHIN these limits. Radiator temperature may be controlled directly and oil temperature indirectly, with the radiator shutter lever. Best economy and engine life is achieved when only the minimum necessary boost and r.p.m are used to obtain the desired performance.

PRELIMINARY APPROACH TO LAND:

1. Ensure hood is locked open and door latch to	HALF-COCK
2. Harness release to	FIXED
3. Mixture control ensure back to	NORMAL (RICH)
4. Maps and other equipment not required for landing	STOW
5. Radiator, shutter unless approach will be prolonged	NORMAL (RED TRIANGLE)

ON DOWNWIND, TO BE PERFORMED QUICKLY AND DECISIVELY:

1. Reduce speed to allowable limit for undercarriage	160 M.P.H.
2. Undercarriage lever set to	DOWN
3. Ensure undercarriage indicator shows	DOWN
4. Airscrew control forward to	FULL FINE
5. Adjust speed to about	120 M.P.H.
6. Upon finally turning in to land put	FLAPS DOWN
7. Aim to cross fence at	85 M.P.H.
8. At threshold close throttle and adopt 3 point attitude	HOLD
9. DO NOT attempt to force aeroplane onto ground	HOLD ATTITUDE

NOTE: Landings should ALWAYS be made in a "3 Point" attitude as Airscrew Clearance is only 7 ½ " at flying attitude with Gear fully extended and tyres at maximum operating pressures!!

PROCEDURE AFTER LANDING:

1. As soon as positive directional control is established	RAISE FLAPS OPEN RADIATOR SHUTTER PRESSURE HEAD HEAT OFF
2. Taxi in; do not delay as temps become excessive	WATCH TEMPERATURES
3. Throttle set to just above rough running	800 - 1,000 R.P.M.
4. Move both fuel cocks down to	OFF
5. Allow to run for approximately	1 MINUTE
6. Immediately rough running begins	SWITCH OFF AND PULL S.R.C-O
7. Generator switch to	OFF
8. Indicator lights	OFF
9. Wheel brakes (parking)	ON

APPENDIX "A"

OPERATING AND ENGINE LIMITATIONS

REMEMBER This is an Historic Aircraft. It is your duty to ensure that it is flown to the highest standards and that operating and engine limitations are strictly adhered to. This is the only way in which you can ensure that the aircraft will be preserved for future generations. In addition to debt that we all owe to the men and women who flew these aircraft during Britain's and the Commonwealth's darkest hours, in flying this aircraft you owe a personal debt to those men and women who, by their sacrifice, afforded you the honour and priviledge of being able to do so.

Always fly this aircraft with those facts firmly in mind. You may be assured that the people who keep these aircraft flying now perform their duties whilst holding themselves to the highest standards and the hold the above firmly in their minds. We trust that you will do the same.

Maximum IAS (cruise OR dive)	310mph
Max Gear Extension /retraction IAS	160mph
Max IAS for Flaps lowering or down	120mph
Maximum G	Positive +4
Maximum G Negative	NO REDUCED OR NEGATIVE G
Maximum Takeoff Boost Setting	+7lbs
Maximum "normal" Boost Setting	+4lbs
Maximum Display Boost Setting	+6lbs
Maximum/Normal/Minimum Oil Pressure	110/60/45 psi
EMERGENCY MINIMUM Oil Pressure	30 psi
Normal Fuel Pressure	2 ½ - 3 psi
Maximum Allowable Oil Temperature	90C

Maximum Allowable Radiator Temperatures:

Before Take Off	115C
In flight	120C
On Landing/Taxi In	120C

IF EXCEEDED ON GROUND SCRUB FLIGHT

IF EXCEEDED IN FLIGHT DIAGNOSE PROBLEM ..REDUCE POWER AND OPEN RADIATOR SHUTTER TO FULL.

IF EXCEEDED ON LANDING/TAXY HALT AND SHUT DOWN

Recommended Settings for Cruise:

RPM	1800
Boost sufficient to maintain	180-200mph (but +4psi MAXIMUM)
Radiator set to	Normal Flight (Red triangle)
Altitude IDEAL	6,000 - 8,000 (subject to ATC) T

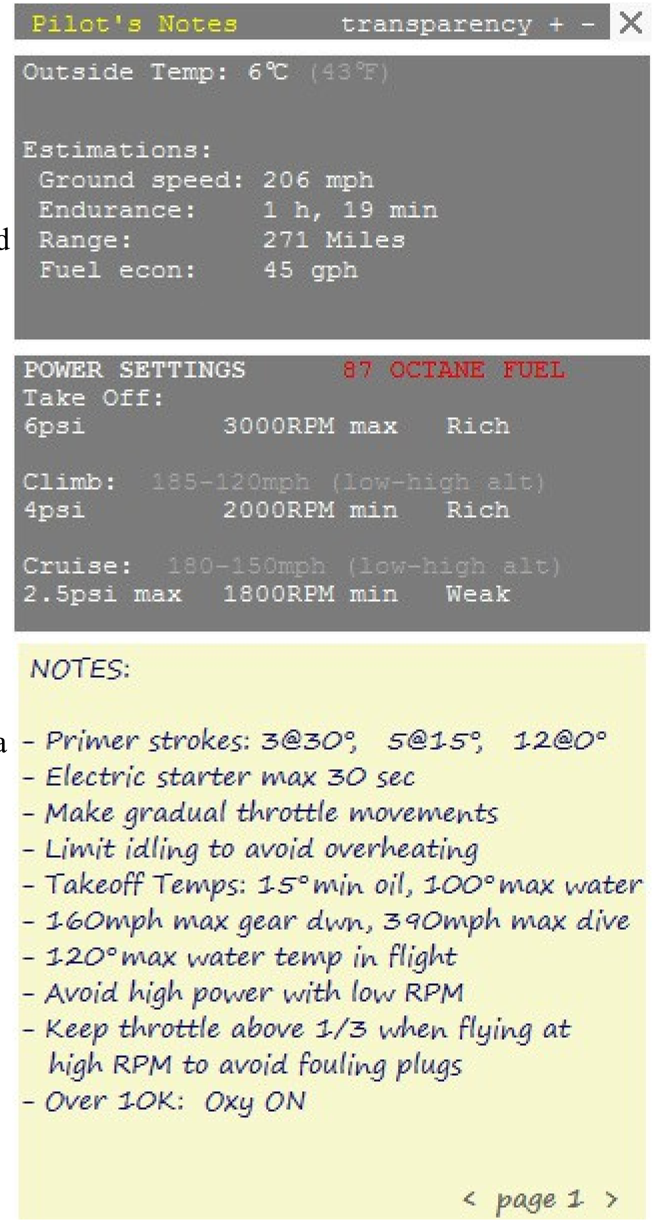
To counter Plug Fouling (at less than 2150rpm for an extended time) CLEAR engine at 2600rpm for a period of 1 minute every 20 minutes.

Special thanks to Darryl Hackett, for his unstinting aid and help with getting all of this right, for his technical expertise which he always generously shared with me and with all of us, and for his unwavering mateship, which I personally appreciate. Cheers.

Mitchell Glicksman

PILOT'S NOTES

PILOT'S NOTES (SHIFT-2). Important information is readily available with the Pilot's Notes screen.



Ground Speed is the actual speed your aircraft is moving over the ground surface.

Endurance is the amount of time your aircraft can fly at the current rate of fuel consumption. Take into account, as you are climbing to your cruise altitude, this estimated endurance will be less than once you level off, throttle back, and settle into a cruise.

Range is the distance your aircraft will fly at the current speed and rate of fuel consumption. Again, take into account this will change based on climb, cruise, and descent operations.

Fuel Economy is the current rate of fuel consumption in gallons per hour (gph).

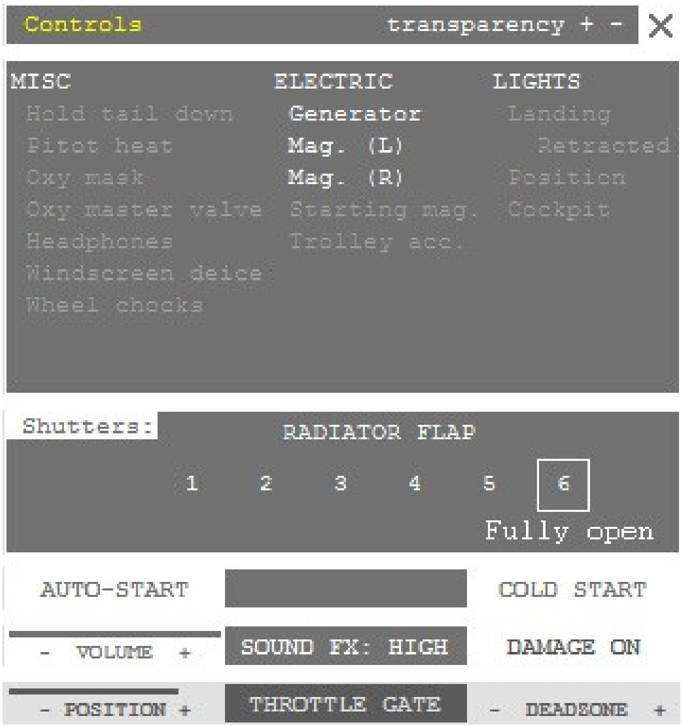
High Temp Warning will display if your engine temperatures get close to maximum allowed. This becomes vital information if you install the Accu-Sim Spitfire Expansion Pack as high temperatures can damage your engine.

Power Settings represent your clipboard showing you important info to quickly establish a proper takeoff, climb, and cruise.

NOTES appear below along with abbreviated checklists for takeoffs, landings, etc. Click the arrows at the bottom to browse through the available pages.

CONTROLS

CONTROLS (SHIFT-3). This control panel was initially created to allow you to operate and watch systems like lights and engine flaps while in the external view. It soon became a nice little place where we could put anything we wanted to have quick access to.



You can:

- Attach your battery cart trolley accessory for extra power for startups (Mk I)
- Order ground crew to hold down your tail for high power run-ups
- Adjust various switches and levers including your radiator flap, lights, etc.
- Set the aircraft to a cold-start state
- Set throttle gate to match your joystick detent
- Set sound effects HIGH or LOW (Low is recommended for an Intel Core2 or slower CPU's)

Additionally, Accu-Sim users can:

- Enable or disable damage modeling
- Adjust the volume of the Accu-Sim sound system
- Use headphones

PAYLOAD and FUEL MANAGER (Real-time)

PAYLOAD AND FUEL MANAGER (SHIFT-4)

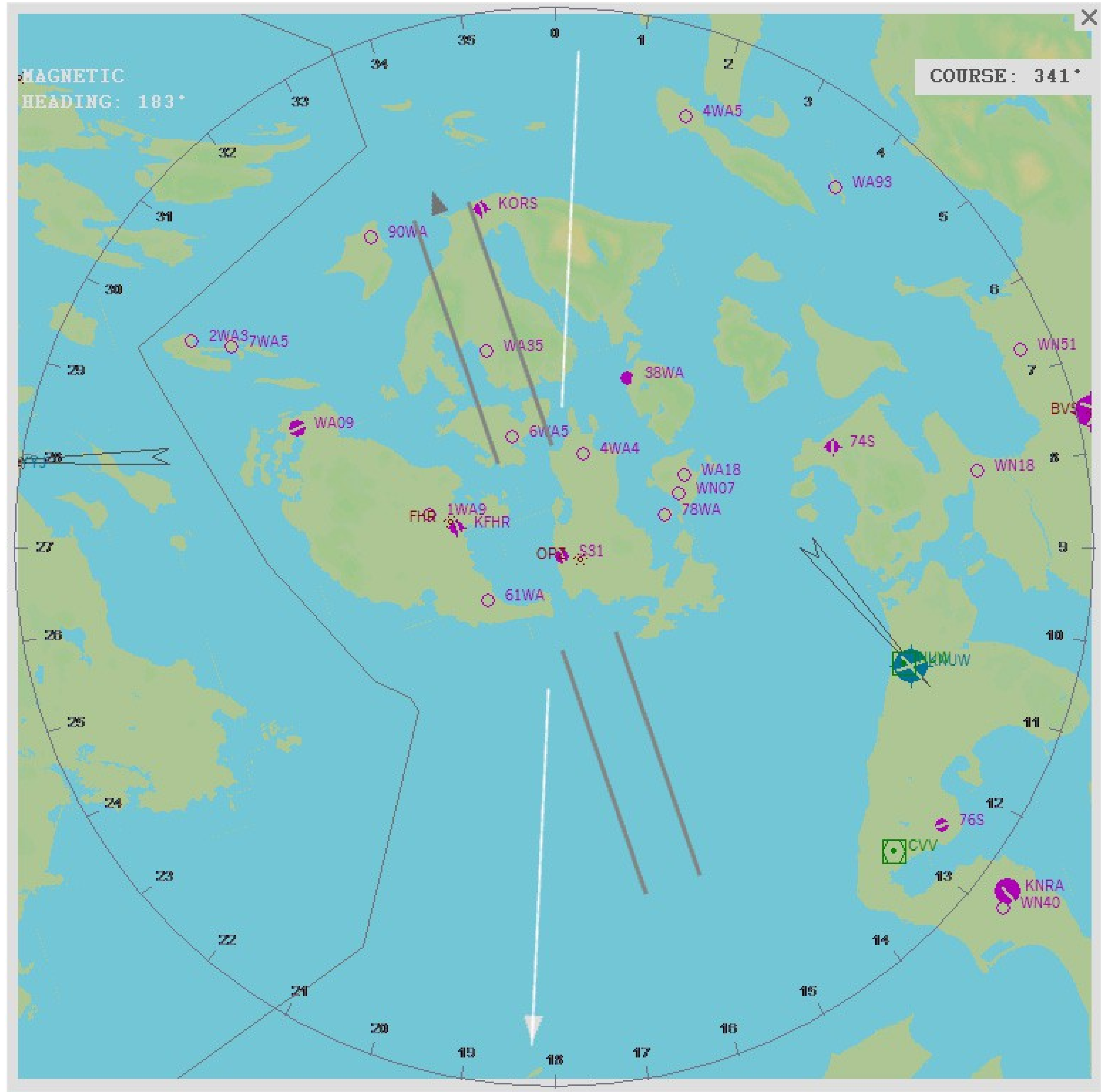
This real-time payload and fuel manager allows you to visually click and load your aircraft. You can service:

- Fuel
- Ammunition
- Oxygen
- Coolant fluid
- Engine oil
- Hydraulic fluid
- Pneumatic system (air)
- Change fuel grade
- Change oil grade

The aircraft initially is prepared for a standard flight with ammunition loaded.

PILOT'S MAP

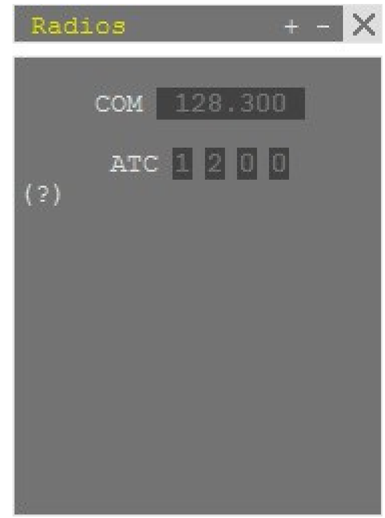
PILOT'S MAP (SHIFT-5). The pilot's map gives full access to similar information that may be found on real maps and allows this information to be easily accessed rather than have to use the default map from the upper menus. This is a period aircraft, so we tried to create this in the true light of a pilot needing to still use visualization or VOR to know precisely where the aircraft is over the map, hence, we did not include the little aircraft icon in the middle. You can access this map by clicking on the map box in the lower left area of the cockpit.

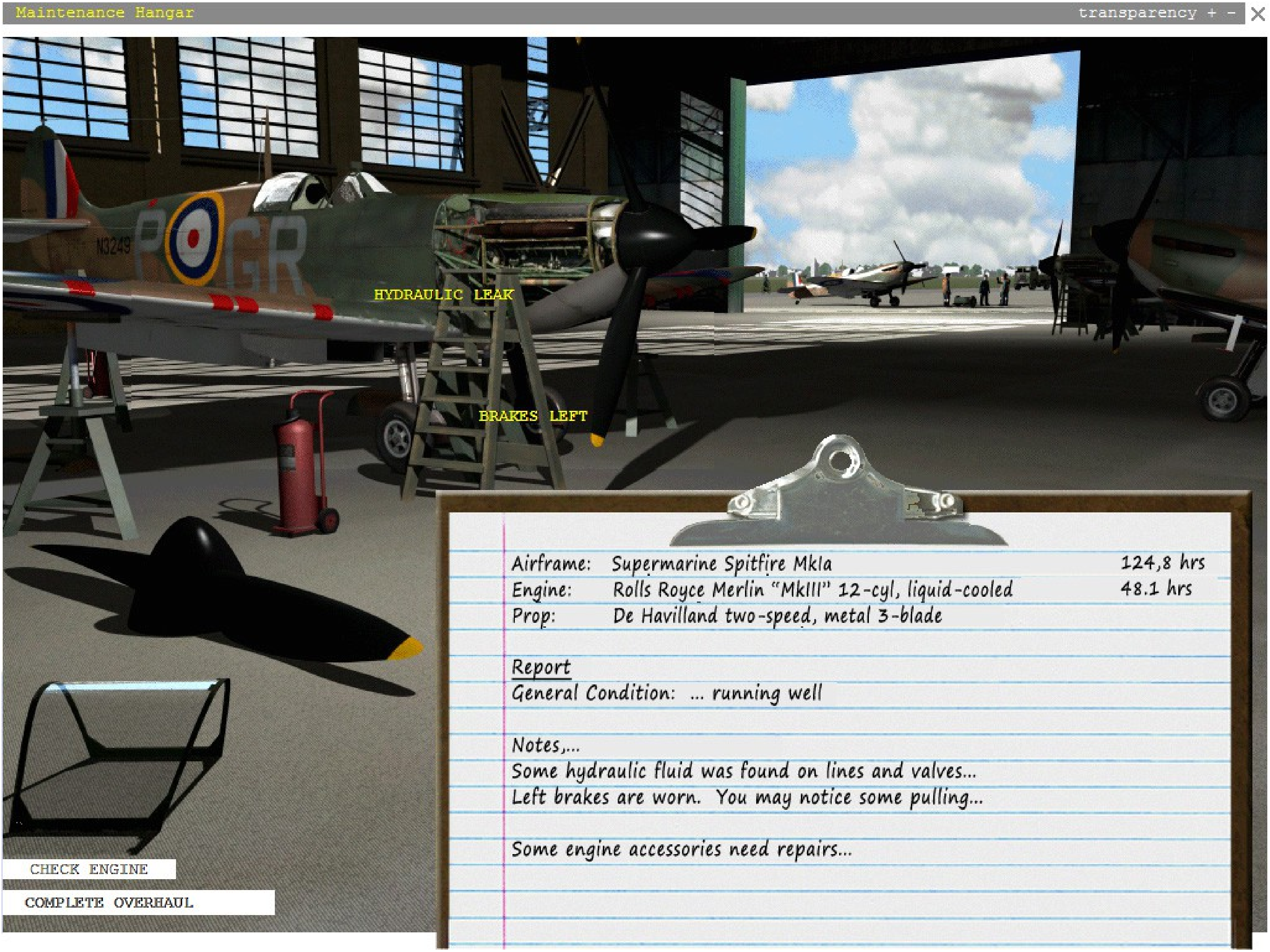


RADIOS

RADIO SELECTOR (SHIFT-6).

The 2D radio selector panel allows you to set the frequency of the radio. Moving the lever at the bottom of the cockpit radio also adjusts this frequency.




Maintenance Hangar
transparency + -
HYDRAULIC LEAK
BRAKES LEFT
CHECK ENGINE
COMPLETE OVERHAUL
Airframe: Supermarine Spitfire MkIa 124,8 hrs
Engine: Rolls Royce Merlin "MkIII" 12-cyl, liquid-cooled 48.1 hrs
Prop: De Havilland two-speed, metal 3-blade
Report
General Condition: ... running well
Notes,...
Some hydraulic fluid was found on lines and valves...
Left brakes are worn. You may notice some pulling...
Some engine accessories need repairs...

MAINTENANCE HANGAR

MAINTENANCE HANGAR (SHIFT-7)

NOTE: *While the maintenance hangar is accessible for non-Accu-Sim installations, engine damage, wear, and advanced systems modeling is part of the Accu-Sim expansion pack.*

The Maintenance Hangar is where you can get a review of how your aircraft engine and major systems are functioning.

You can both see and read your crew chief's report stating:

- A summary of your airframe, engine, and propeller installed
- Hours on airframe and engine since last major overhaul
- General condition of the engine
- Notes

Additionally, you can:

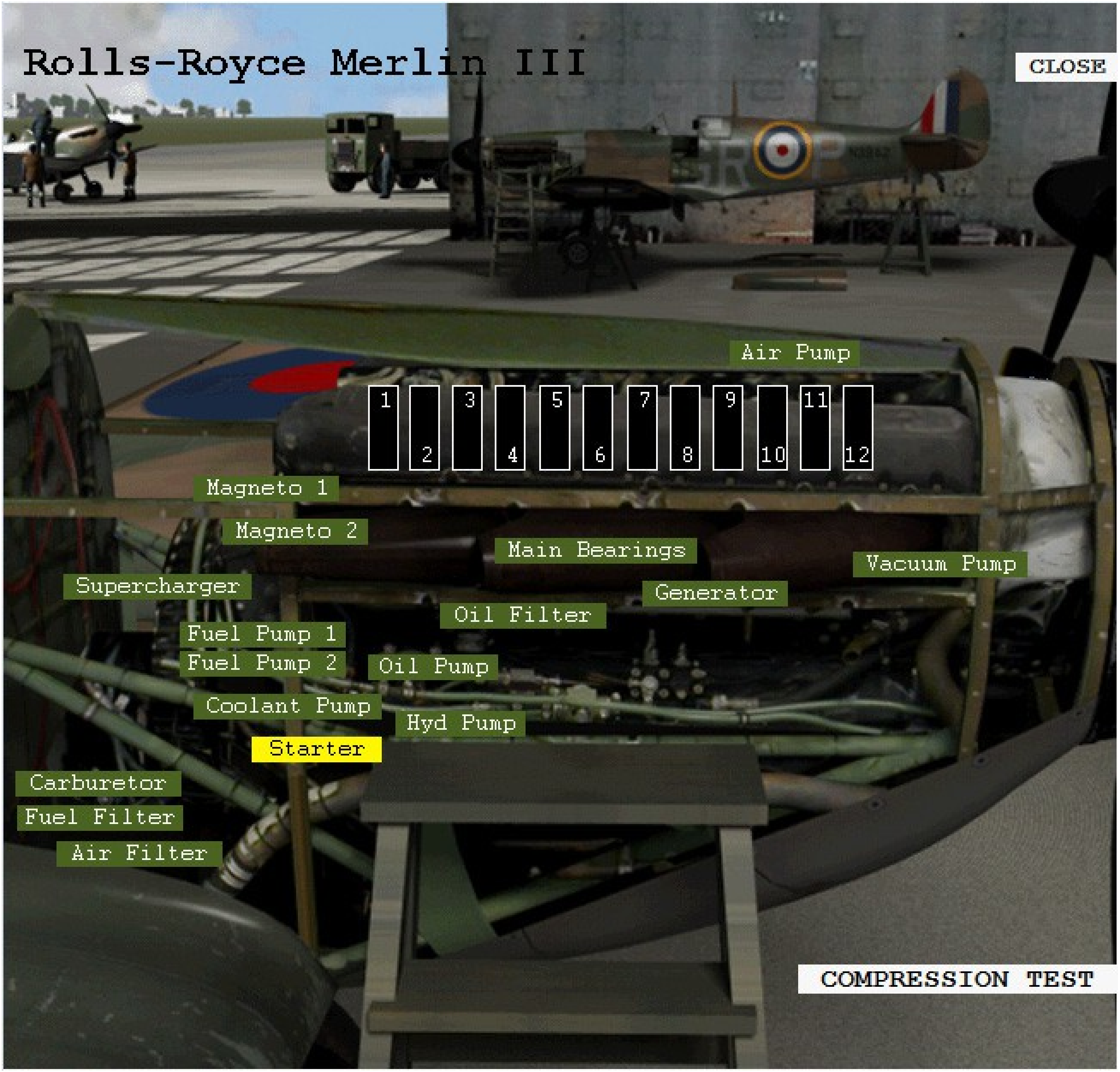
- Change props by clicking the available prop on the floor *(Accu-Sim required)*
- Change between a flat or blown canopy (MkI) by clicking on the canopy on the floor

You can also perform a **COMPLETE OVERHAUL** by clicking on the **OVERHAUL** button. This overhauls the engine and replaces any parts that show any wear with new or re-conditioned ones.

In the above example, your crew chief has reported some hydraulic leaks were found along with some moderate wear on your left brake. To repair each one, simply click on the yellow highlighted area over your aircraft.

You also notice your mechanic has mentioned that some engine accessories need repairs. To look further into the engine condition, click on the **CHECK ENGINE** on the lower left.

Clicking on the **CHECK ENGINE** button pulls up a detailed cutaway of your engine.



Color Codes

Green = OK
Yellow = Watch
Red = Must fix or replace

In the example here, our engine appears to be in pretty good shape with the exception of a worn starter. This is probably because the pilot who flew it previously perhaps cranked the starter for a long period of time without allowing it ample time to cool. Your mechanic's inspection picked up this wear, and it is shown here. A yellow condition means it is recommended that you replace or repair this item, but it is not mandatory. You can choose to keep a close eye on this part and continue flying.

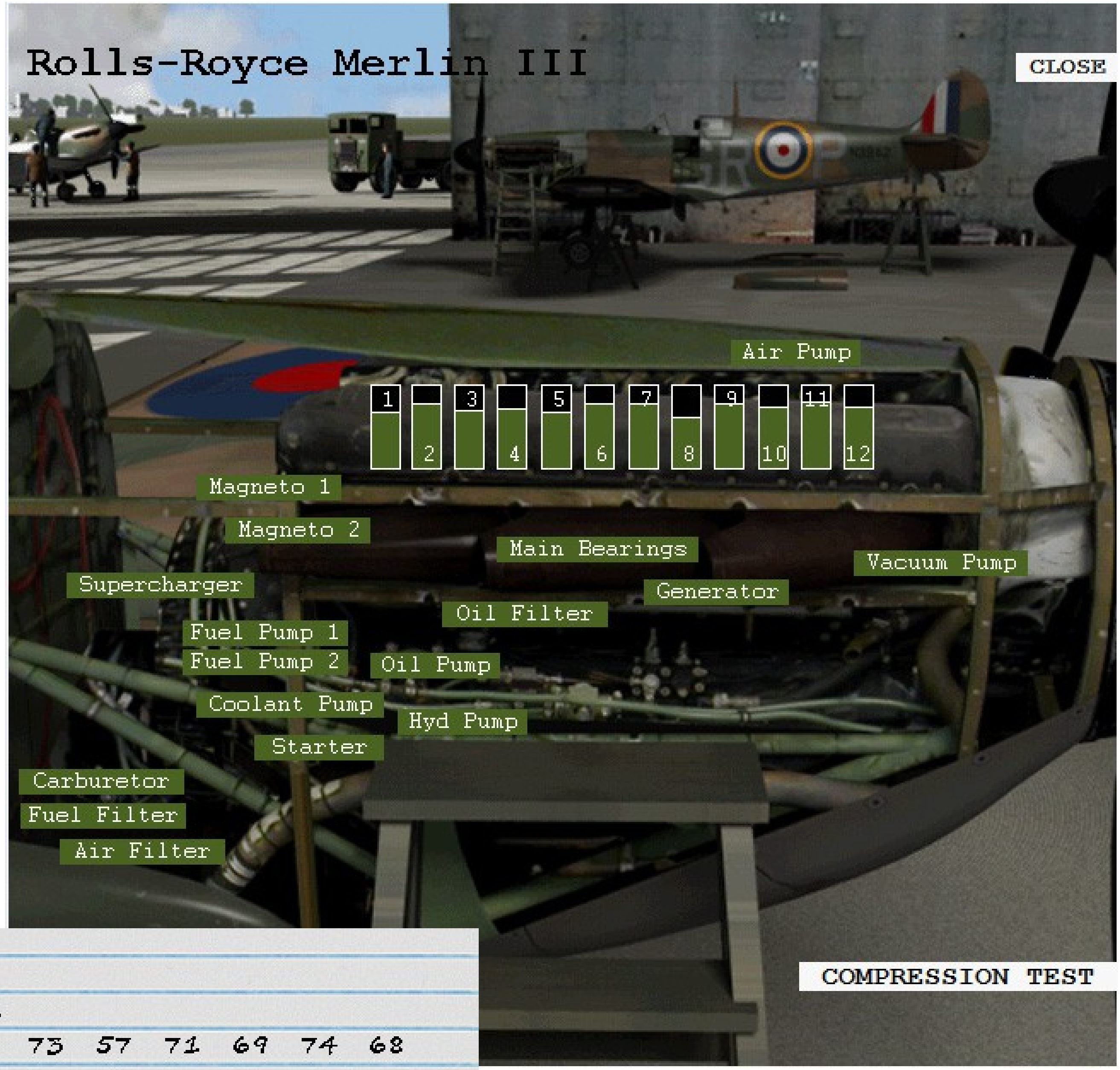
Heavy wear or failure would highlight the part in red.

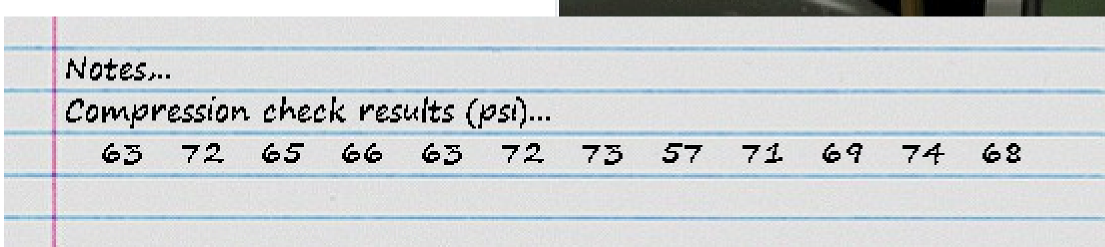
At the lower right is a “Compression Test” button, which tells your mechanic to run a high-pressure air test on the engine cylinders, checking for leaks past the cylinder rings. A civilian may choose to replace a cylinder that is only showing modest wear, perhaps in the 50-60psi range, whereas the military could allow a plane to fly with a cylinder as low as 30 psi.

Low compression on a cylinder isn't necessarily a terrible thing, because as the engine picks up in speed, the worn cylinder becomes productive. It is mostly noticed at lower R.P.M.'s where the cylinder may have trouble firing, and also a marked increase in oil consumption may also occur (sometimes with an accompanying blue smoke out of that cylinder during flight).

However, note that this is a reading of the general condition of the cylinders, and lower condition does bring additional risks of failure, or even engine fires.

Also note, after performing a compression test, your mechanic writes down the exact numbers in his notes.





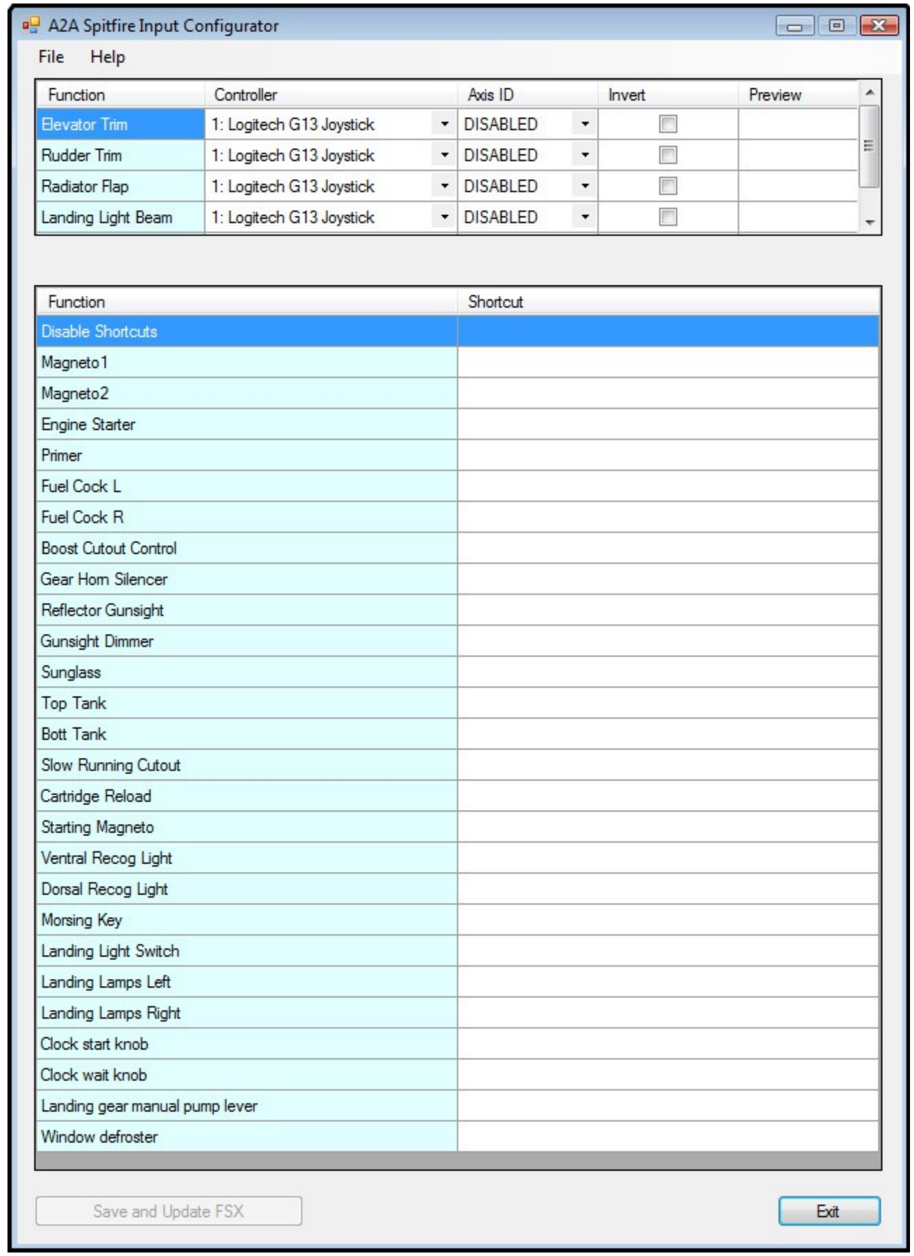
Joystick Mapping Utility

The Spitfire Input Configurator is a small utility that allows users to assign keyboard or joystick mappings to many custom Spitfire functions that can't be found in P3D controls assignments menu. It can be found in the A2A/Spitfire/Tools folder inside your P3D installation directory.

The upper table is the axis assignment menu. From the drop down list, select joystick and axis you want to assign to each function and verify its operation in the 'preview' column. Mark the 'invert' check box if needed.

The lower table is the shortcuts menu. Hover over function name to bring up tooltip with additional information. To make a new shortcut, double click on a selected row to bring assignment window. Then press keyboard key or joystick button you want to assign to this function. For keyboard it's also possible to use modifier keys (Ctrl, Shift, Alt).

When done with the assignments, press "Save and update P3D" button. This will instantly update shortcuts for the Spitfire. There is no need to restart P3D or even reset flight for the changes to take effect, you can adjust shortcuts on the fly.



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Very Special Thanks to our friends and families who stuck by us and worked hard to support our efforts.

It's a misty morning, and your loyal girl patiently waits for your next flight.

She is quite the special aircraft and she is your responsibility.

Take care of her...

From all of us at A2A Simulations, thank you.