DE HAVILLAND DH.82A TIGER MOTH II

GUIDE BY CHUCK

PERFORMANCE SHEET

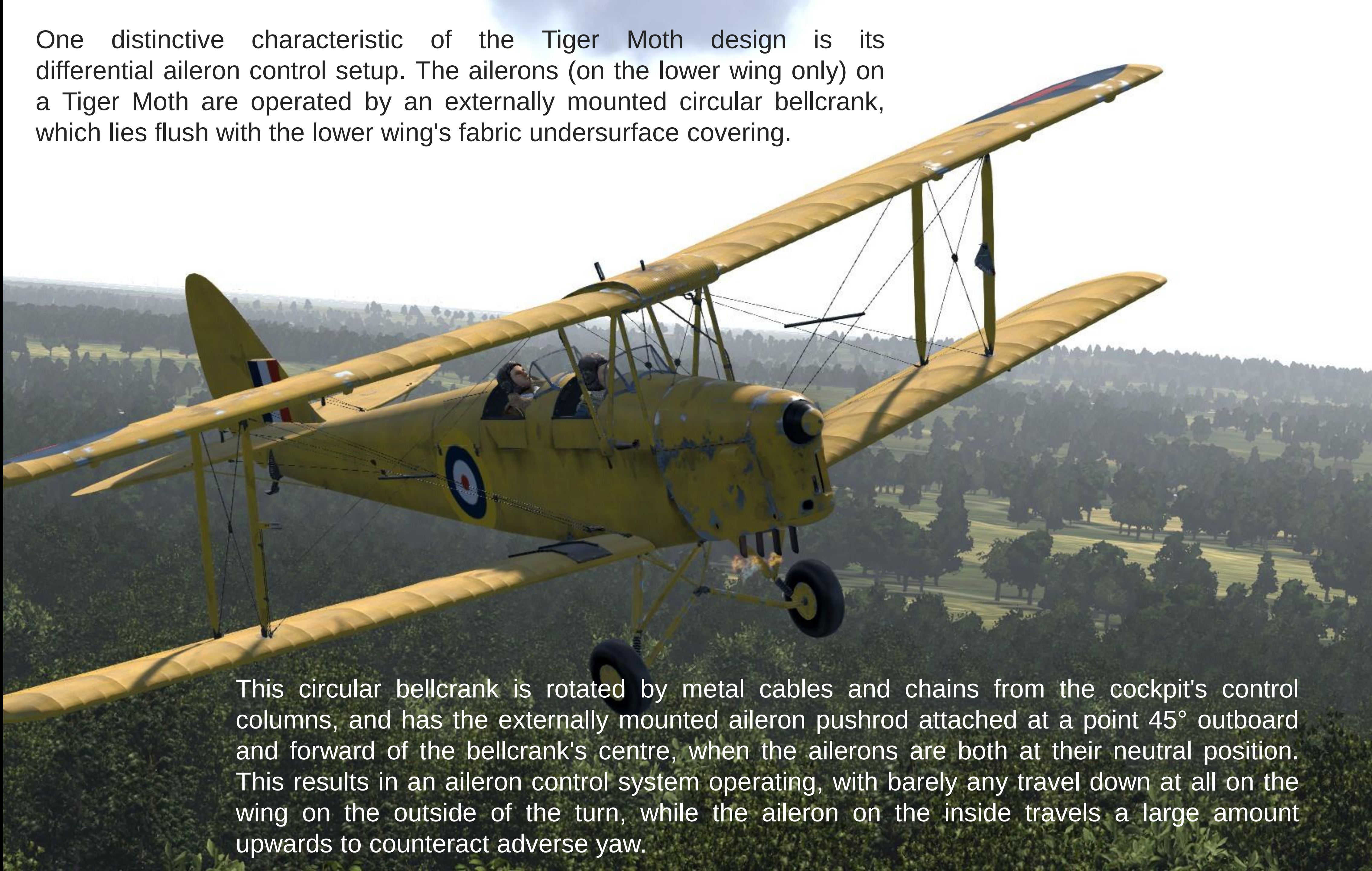
	(Unit)	SPITFIRE Mk Ia 100 oct	HURRICANE Mk IA Rotol 100oct	BLENHEIM Mk IV	TIGER MOTH DH.82	BF.109 E-4	BF.110 C-7	JU-87B-2 STUKA	JU-88 A-1	HE-111 H-2	G.50 SERIE II	BR.20M
TEMPERATURES												
Water Rad Min Max	Deg C	60 115	60 115	-	-	40 100	60 90	38 95	40 90	38 95	-	-
Oil Rad (OUTBOUND) Min Max	Deg C	40 95	40 95	40 85	-	40 105	40 85	30 95	40 80	35 95	50 90	50 90
Cylinder Head Temp Min Max	Deg C	-	-	100 235	-	-	-	-	-	-	140 240	140 240
ENGINE SETTINGS												
Takeoff RPM	RPM	3000	3000	2600 FINE	2350	2400	2400	2300	2400	2400	2520	2200
Takeoff Manifold Pressure	UK: PSI GER: ATA ITA: mm HG	+6	+6	+9 BCO ON	See RPM Gauge	1.3	1.3	1.35	1.35	1.35	890	820 BCO ON
Climb RPM	RPM	2700	2700	2400 COARSE	2100	2300 30 min MAX	2300 30 min MAX	2300 30 min MAX	2300 30 min MAX	2300 30 min MAX	2400 30 min MAX	2100 30 min MAX
Climb Manifold Pressure	UK: PSI GER: ATA ITA: mm HG	+6	+6	+5	See RPM Gauge	1.23	1.2	1.15	1.15	1.15	700	740
Normal Operation/Cruise RPM	RPM	2700	2600	2400 COARSE	2000	2200	2200	2200	2100	2200	2100	2100
Normal Operation/Cruise Manifold Pressure	UK: PSI GER: ATA ITA: mm HG	+3	+4	+3.5	See RPM Gauge	1.15	1.15	1.1	1.1	1.10	590	670
Combat RPM	RPM	2800	2800	2400 COARSE	2100	2400	2400	2300	2300	2300	2400	2100
Combat Manifold Pressure	UK: PSI GER: ATA ITA: mm HG	+6	+6	+5	See RPM Gauge	1.3 5 min MAX	1.3 5 min MAX	1.15	1.15	1.15	700	740
Emergency Power/ Boost RPM @ km	RPM	2850 5 min MAX	2850 5 min MAX	2600 COARSE 5 min MAX	2350	2500 1 min MAX	2400 5 min MAX	2300 1 min MAX	2400 1 min MAX	2400 1 min MAX	2520 3 min MAX	2200 5 min MAX
Emergency Power / Boost Manifold Pressure @ Sea Level	UK: PSI GER: ATA ITA: mm HG	+12 BCO ON	+12 BCO ON	+9 BCO ON	See RPM Gauge	1.40 1 min MAX	1.3 5 min MAX	1.35 1 min max	1.35 1 min max	1.35 1 min max	890 3 min max	820 BCO ON 5 min MAX
Supercharger Stage 1 Operation Altitude	UK: ft GER: M	-	-	-	-	-	-	0 1500	0 1220	0 1220	-	-
Supercharger Stage 2 Operation Altitude	UK: ft GER: M ITA: M	-	-	-	-	-	-	1500+ (AUTO/MAN MODES)	1220+	1220+	-	-
Landing Approach RPM	RPM	3000	3000	2400	As required	2300	2300	2000	2100	2300	2400	2200
Landing Approach Manifold Pressure	UK: PSI GER: ATA ITA: mm HG	As required	As required	As required	See RPM Gauge	As required	As required	As required	As required	As required	As required	As required
Notes		Use "Rich" mixture for normal operation. Use "Lean" mixture for fuel conservation for RPM under 2600 & boost @ +1 or lower.		Boost Cut-Out Override (BCO) during takeoff often required	**Min Oil Press: 35 psi** **Max Oil Press: 45 psi**			No Abrupt Throttling	Eng. very sensitive to ata/rpm	Eng. very sensitive to ata/rpm		Boost Cut-Out Override (BCO) during takeoff often required
AIRSPEEDS												
Takeoff – Rotation	UK: mph GER/ITA: km/h	120	120	110	55	180	190	170	185	150	170	175
Max Dive Speed		420	390	260	160	750	620	720	675	600	410	600
Optimal Climb Speed		165	175	135	66	240	270	215	250	240	240	210
Landing – Approach		160	160	140	55	200	220	170	200	200	175	175
Landing – Touchdown		90	90	85	50	160	180	150	180	140	160	160

TABLE OF CONTENT – TIGER MOTH

PART 1: AIRCRAFT HISTORY

The **de Havilland DH.82 Tiger Moth** is a 1930s biplane designed by Geoffrey de Havilland and was operated by theRoyal Air Force (RAF) and others as a primary trainer. The Tiger Moth remained in service with the RAF until replaced by the de Havilland Chipmunk in 1952, when many of the surplus aircraft entered civil operation. Many other nations used the Tiger Moth in both military and civil applications, and it remains in widespread use as a recreational aircraft in many countries.

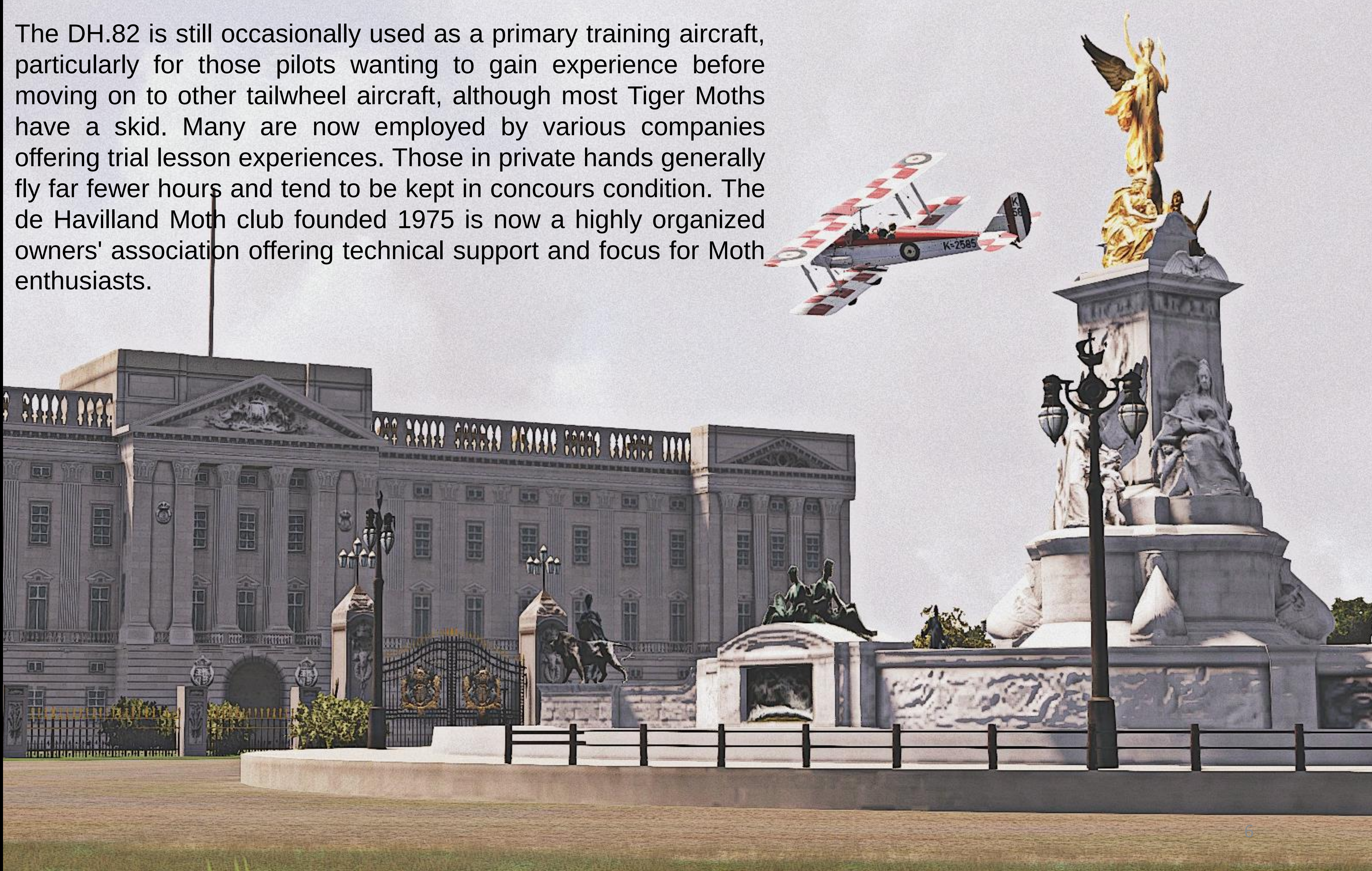
One distinctive characteristic of the Tiger Moth design is its differential aileron control setup. The ailerons (on the lower wing only) on a Tiger Moth are operated by an externally mounted circular bellcrank, which lies flush with the lower wing's fabric undersurface covering.



This circular bellcrank is rotated by metal cables and chains from the cockpit's control columns, and has the externally mounted aileron pushrod attached at a point 45° outboard and forward of the bellcrank's centre, when the ailerons are both at their neutral position. This results in an aileron control system operating, with barely any travel down at all on the wing on the outside of the turn, while the aileron on the inside travels a large amount upwards to counteract adverse yaw.

PART 1: AIRCRAFT HISTORY

The DH.82 is still occasionally used as a primary training aircraft, particularly for those pilots wanting to gain experience before moving on to other tailwheel aircraft, although most Tiger Moths have a skid. Many are now employed by various companies offering trial lesson experiences. Those in private hands generally fly far fewer hours and tend to be kept in concours condition. The de Havilland Moth club founded 1975 is now a highly organized owners' association offering technical support and focus for Moth enthusiasts.



PART 1: AIRCRAFT HISTORY

Numerous examples of the Tiger Moth are still flying today (an estimated 250). The number of airworthy Tiger Moths has increased as previously neglected aircraft (or those previously only used for static display in museums) have been restored.

PART 2: AIRCRAFT VARIANTS

	(Unit)	DH.82A TIGER MOTH II
TEMPERATURES		
Water Rad Min Max	Deg C	N/A
Oil Rad (OUTBOUND) Min Max	Deg C	N/A
ENGINE SETTINGS & PROPERTIES		
Engine & Fuel grade		De Havilland Gypsy Major I 73 octane fuel
Takeoff RPM	RPM	2350
Takeoff Manifold Pressure	UK: PSI GER: ATA ITA: mm HG	See RPM Gauge
Climb RPM	RPM	2100
Climb Manifold Pressure	UK: PSI GER: ATA ITA: mm HG	See RPM Gauge
Normal Operation/Cruise RPM	RPM	2000
Normal Operation/Cruise Manifold Pressure	UK: PSI GER: ATA ITA: mm HG	See RPM Gauge
Combat RPM	RPM	2100
Combat Manifold Pressure	UK: PSI GER: ATA ITA: mm HG	See RPM Gauge
Emergency Power/ Boost RPM @ km	RPM	2350
Emergency Power / Boost Manifold Pressure @ Sea Level	UK: PSI GER: ATA ITA: mm HG	See RPM Gauge
Landing Approach RPM	RPM	2350
Landing Approach Manifold Pressure	UK: PSI GER: ATA ITA: mm HG	See RPM Gauge
Notes and Peculiarities		**Min Oil Press 35 psi Max Oil Press 45 psi**

CREW MEMBERS

DH.82 TIGER MOTH

FRONT SEAT INSTRUCTOR

PART 3: AIRCRAFT & COCKPIT FAMILIARIZATION

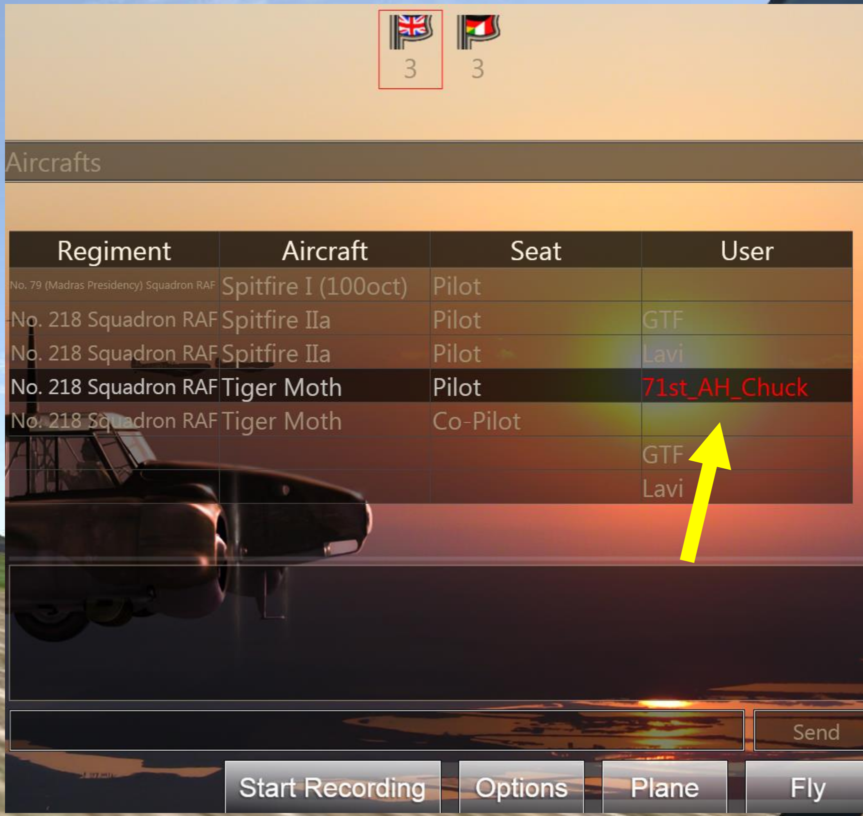
DH.82 TIGER MOTH

FRONT SEAT INSTRUCTOR

IF YOU ARE FLYING THE TIGER MOTH SOLO, DO NOT GO INTO THE INSTRUCTOR SEAT WHILE YOU ARE IN THE AIR: THE AI WILL SIMPLY CRASH YOU INTO THE GROUND.

IF YOU WANT TO FLY WITH SOMEONE ONLINE, DO THE FOLLOWING:

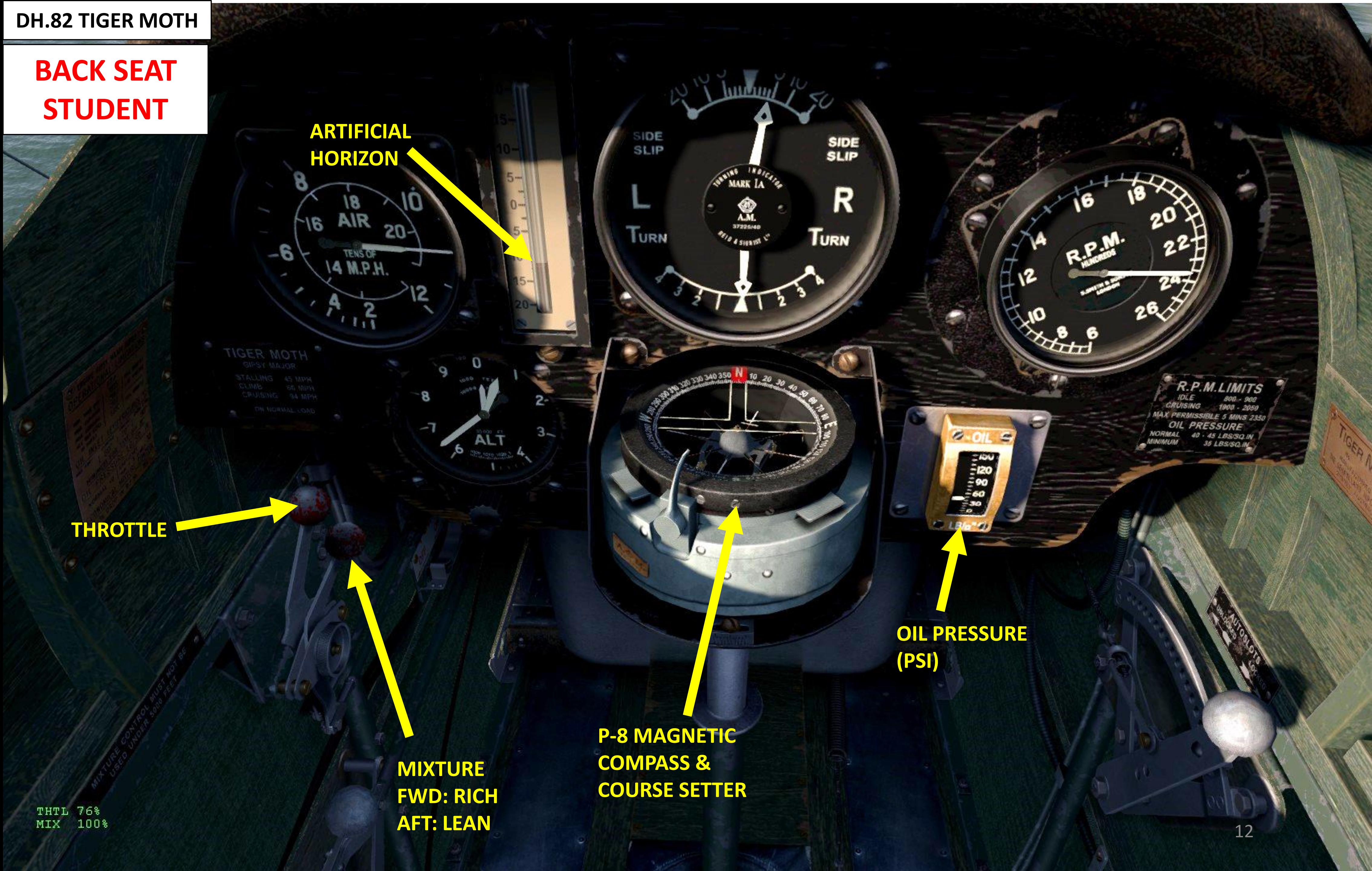
1) STUDENT PILOT SPAWNS IN A TIGER MOTH.
2) INSTRUCTOR CLICKS ON THE FACTION FLAG TO SELECT A MULTIPLAYER SLOT.
3) INSTRUCTOR SELECTS CO-PILOT SEAT, CLICKS FLY AND SPAWNS.



PART 3: AIRCRAFT & COCKPIT FAMILIARIZATION

DH.82 TIGER MOTH

BACK SEAT STUDENT



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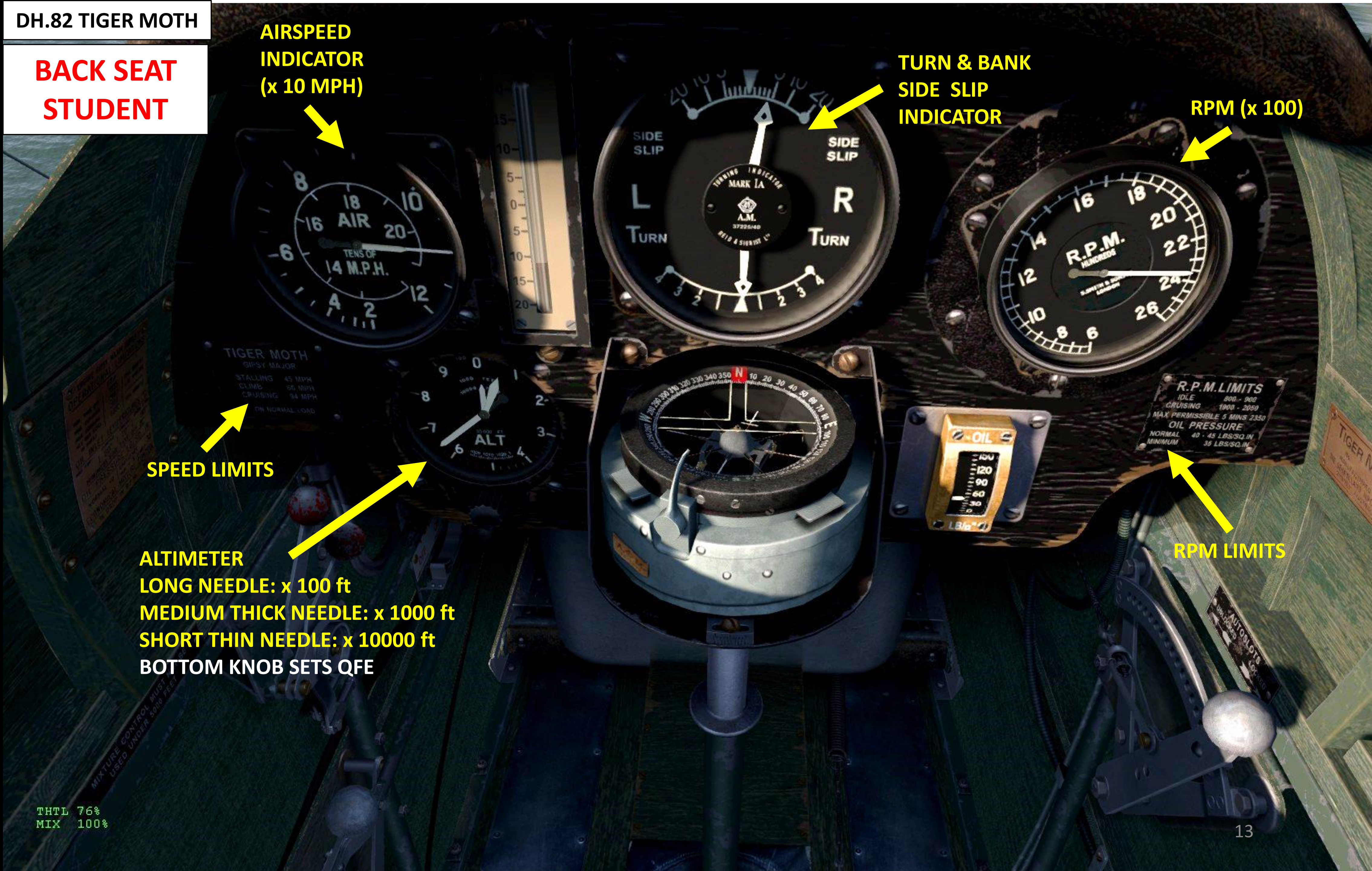

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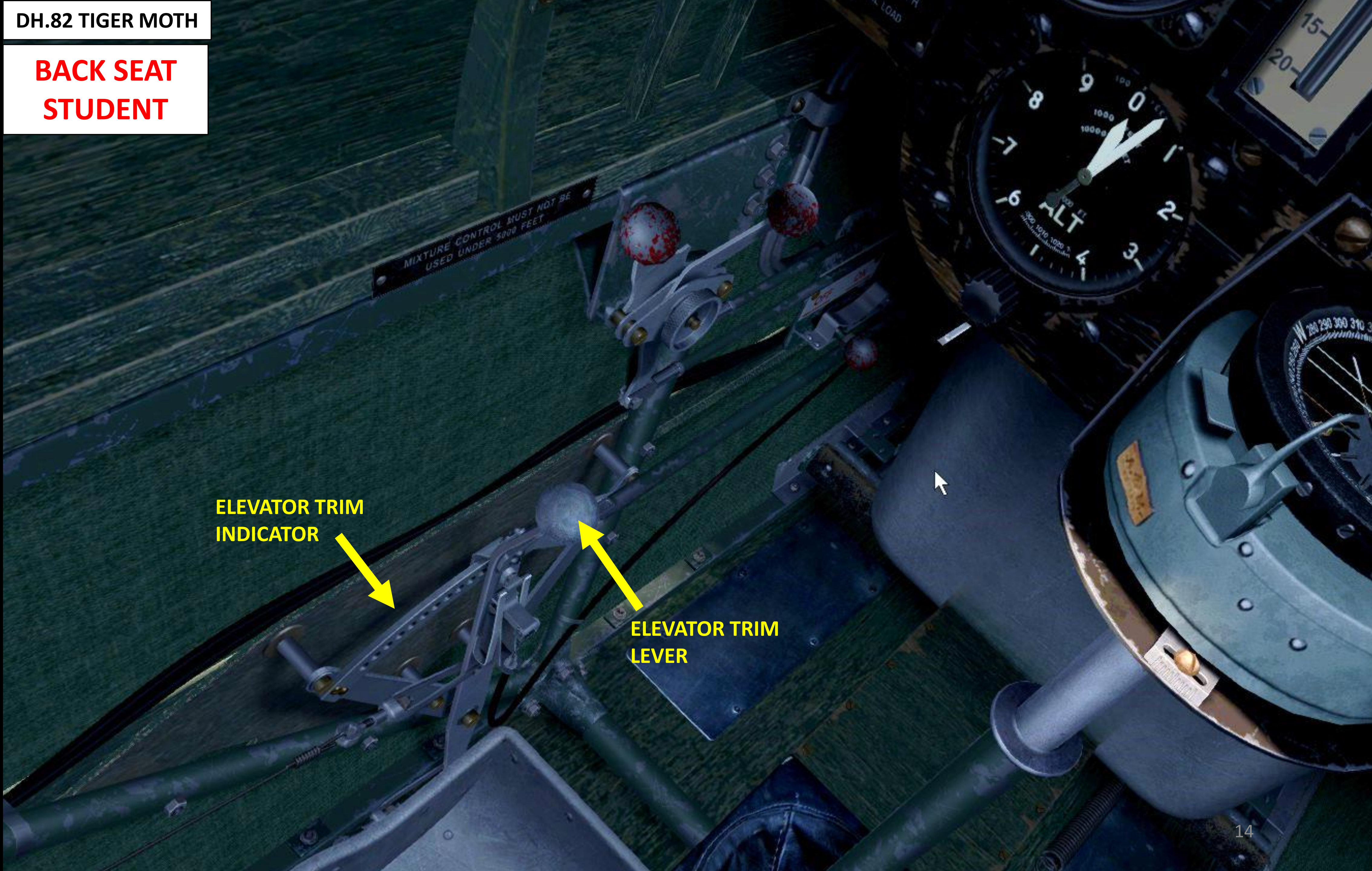
DH.82 TIGER MOTH

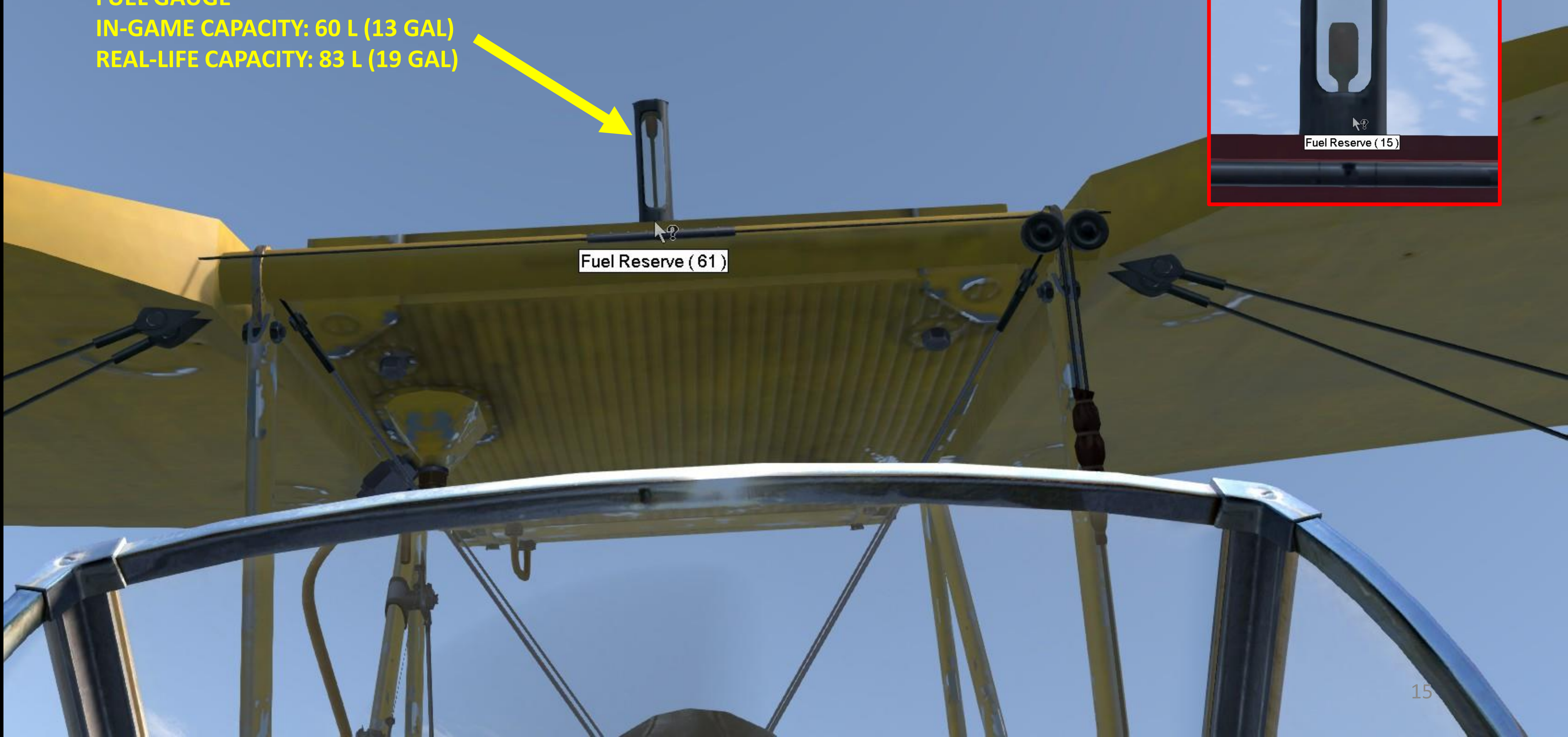
BACK SEAT STUDENT



PART 3: AIRCRAFT & COCKPIT FAMILIARIZATION

BACK SEAT STUDENT

INTERESTING FACT:
It seems that the fuel gauge for the Tiger Moth didn't have any graduations. Therefore, the pilot would simply look at the gauge and guess how much fuel was left. The picture on the right shows a gauge with 15 liters left. Since there are no graduations or units on the gauge, my educated guess is that the label displayed is the fuel quantity in liters since the Russian developers like to work with the metric system.



PART 3: AIRCRAFT & COCKPIT FAMILIARIZATION

DH.82 TIGER MOTH

BACK SEAT STUDENT

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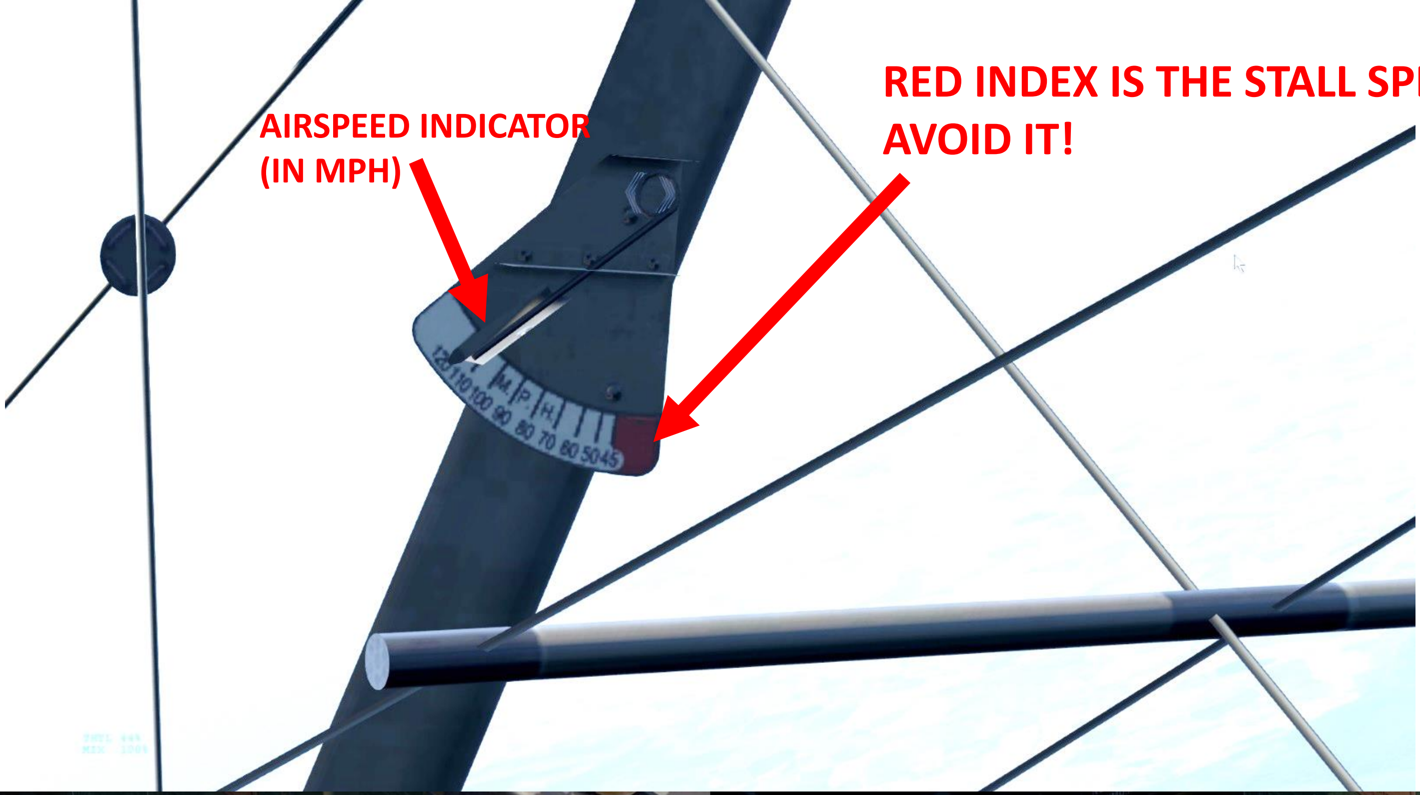
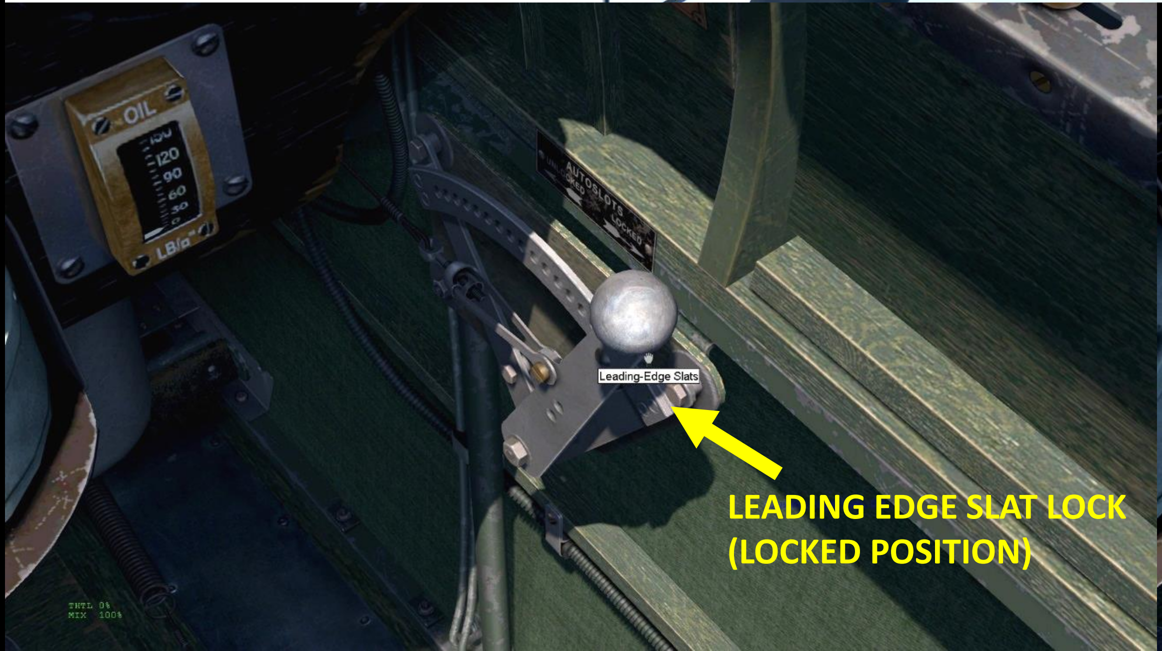
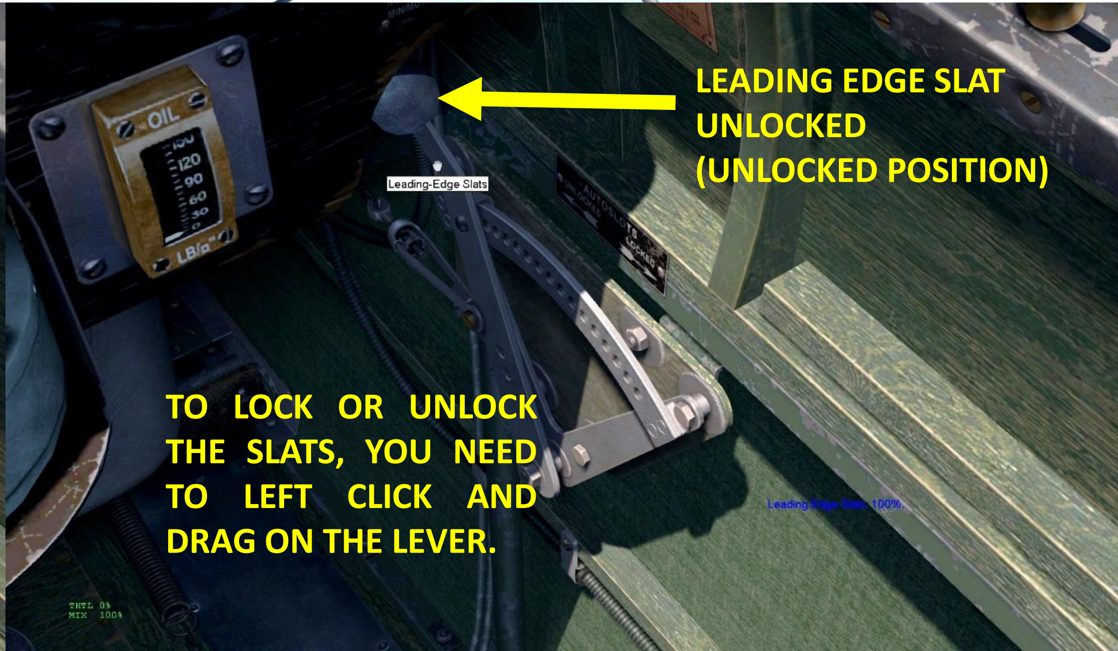






PART 3: AIRCRAFT & COCKPIT FAMILIARIZATION

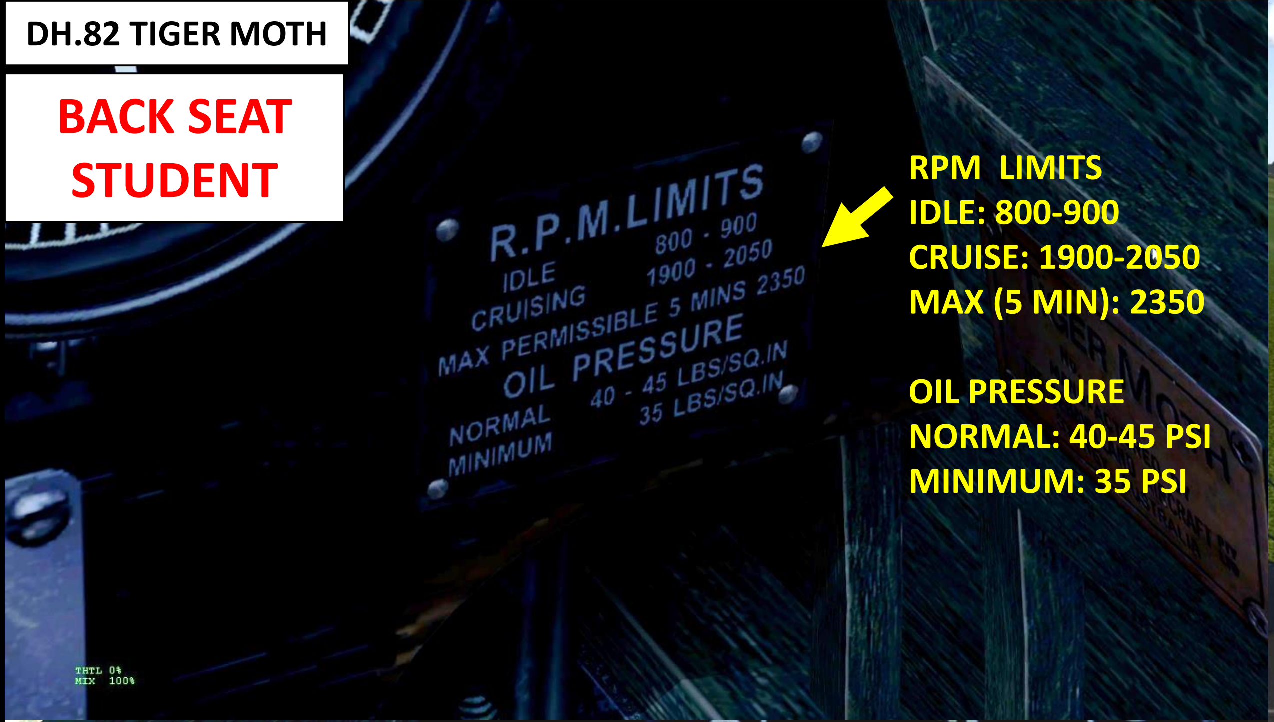
LEADING EDGE SLATS ARE AUTOMATICALLY DEPLOYED WHEN YOU ARE TURNING AT LOW SPEEDS. HOWEVER, YOU NEED TO MAKE SURE THAT THE SLATS ARE UNLOCKED. IF THEY ARE LOCKED, THE SLATS WILL NOT DEPLOY.

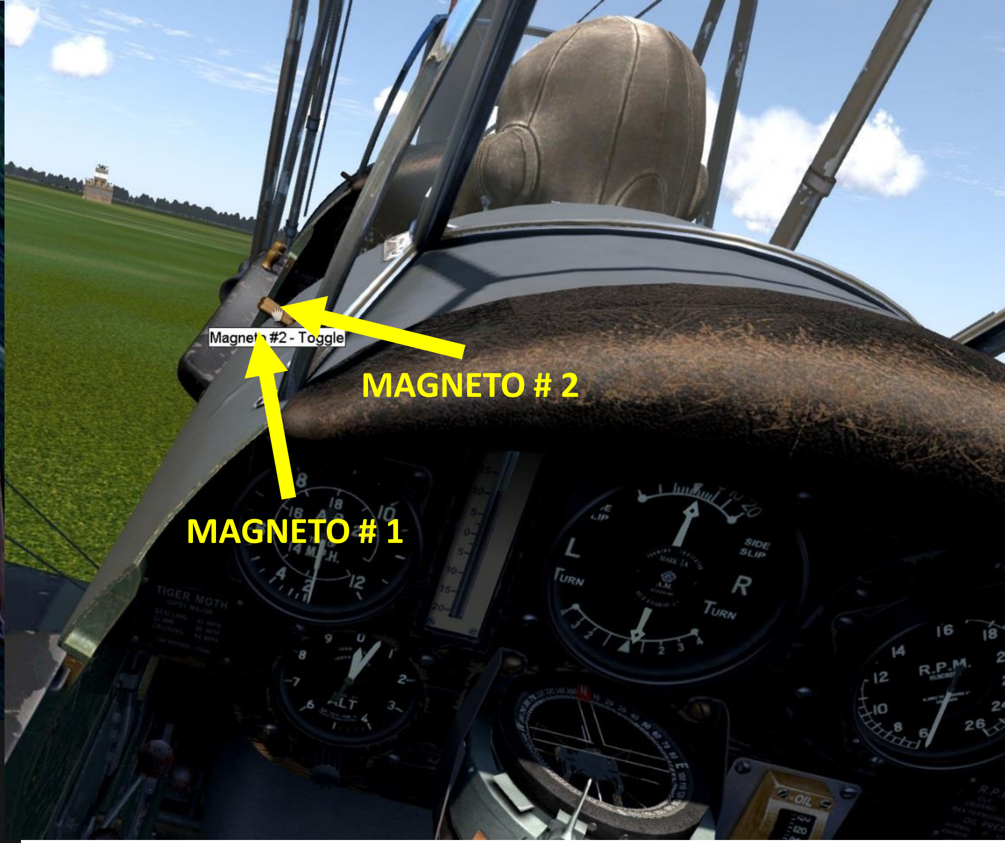
PART 3: AIRCRAFT & COCKPIT FAMILIARIZATION

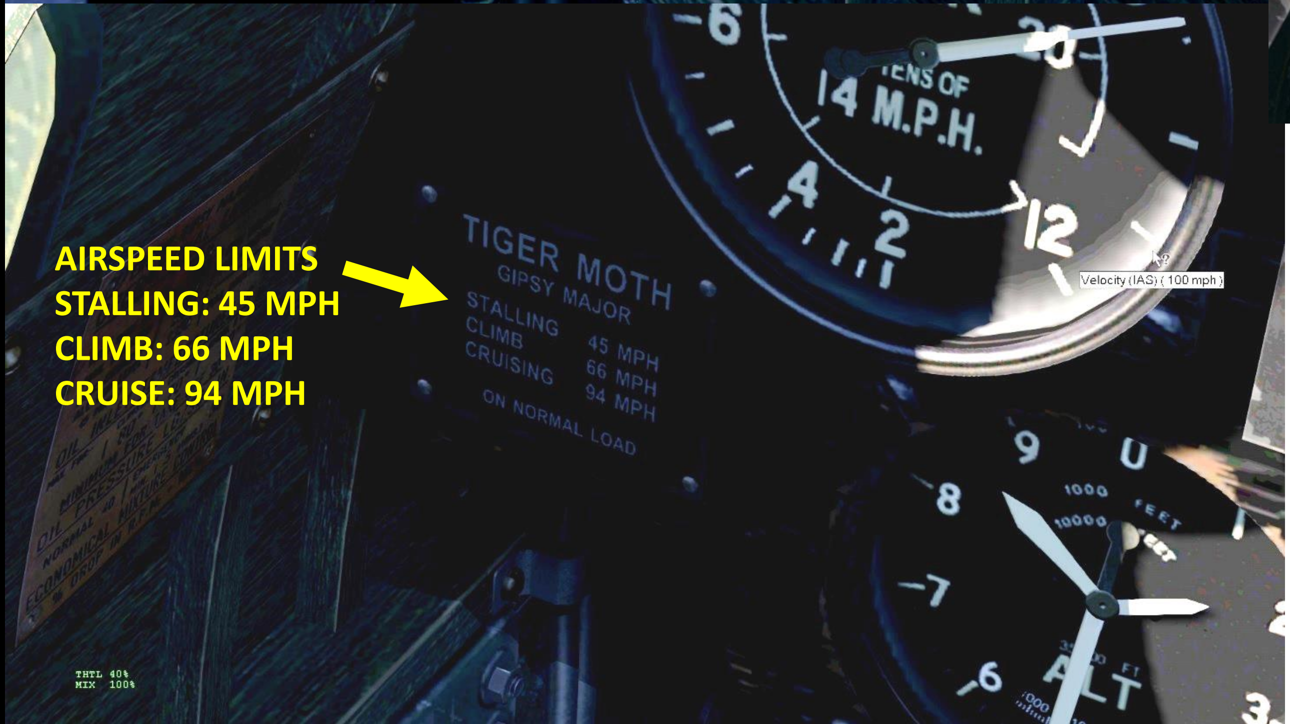
PART 3: AIRCRAFT & COCKPIT FAMILIARIZATION

DH.82 TIGER MOTH

BACK SEAT STUDENT

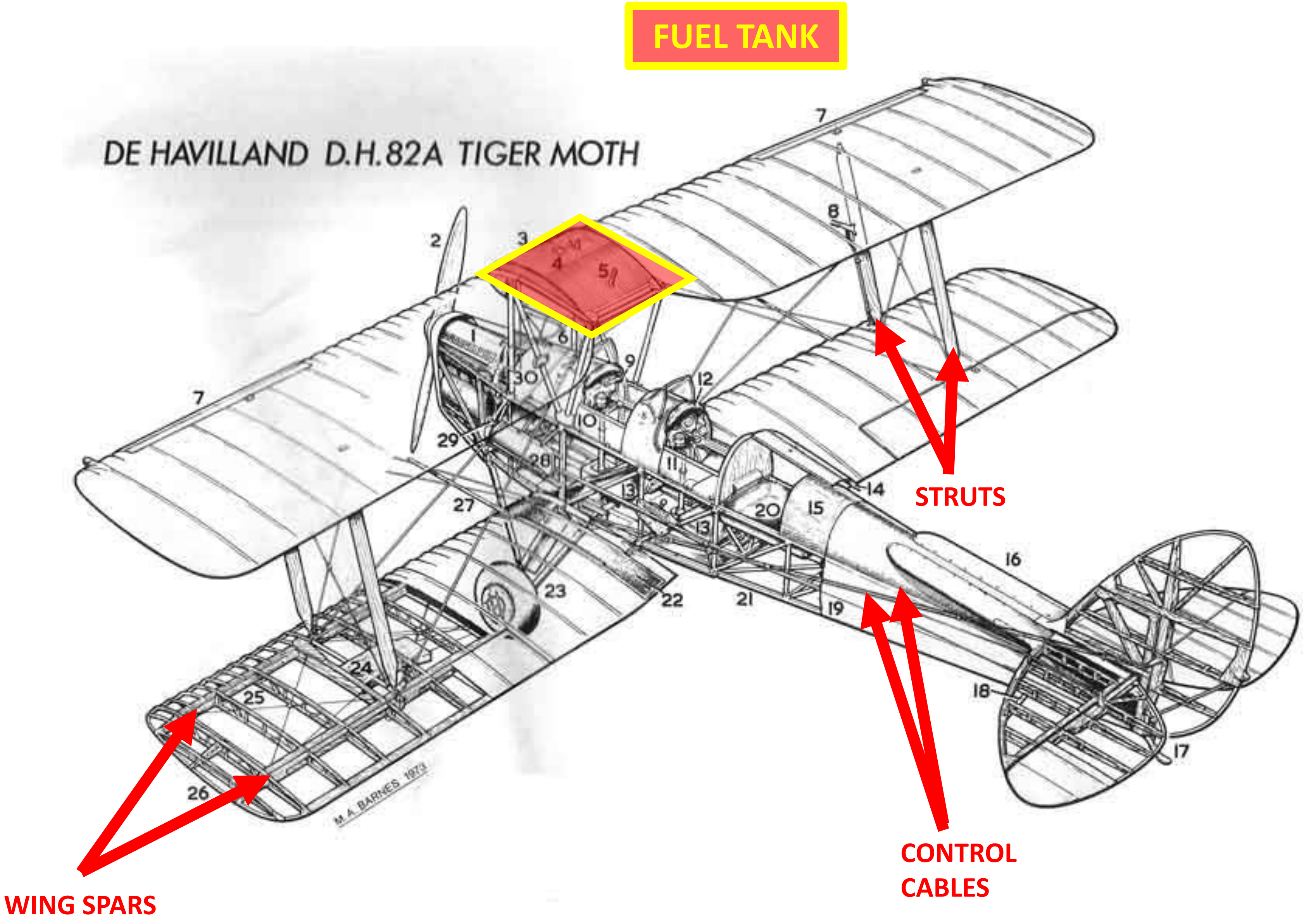






PART 3: AIRCRAFT & COCKPIT FAMILIARIZATION

CRITICAL COMPONENTS



1. D.H. Gipsy Major I Engine
2. Fixed Pitch Wooden Propellor
3. Fuel Tank (19 gallons)
4. Fuel Filler Point
5. Fuel Contents Gauge
6. Fuel Supply Pipe
7. Automatic Slats
8. Pitot Head
9. Intercom. Speaking Tube
10. Hinged Cockpit Side Panels
11. Dual Flying Controls
12. Sponge Rubber Padding
13. Welded Aluminium Seats
14. Luggage Locker Access Door
15. Plywood Decking
16. Anti-Spin Strakes
17. Steerable Tail Skid
18. Tailplane Bracing Tube
19. Fabric Covering
20. Luggage Locker
21. Welded Steel Tubing
22. Walkway
23. Divided Axle Type Undercarriage
24. Aileron Sprocket Housing
25. Spruce Spars and Ribs
26. Light Alloy Tip
27. Bracing Wire Spreader Bars
28. Oil Tank (2.1 gallons)
29. Oil Tank Filler
30. Rear View Mirror

RAF

HOW TO RECOGNIZE A TAIL NUMBER

The system used for most British aircraft flying in the Battle of Britain was rather uniform regardless of plane type or squadron.

Tail Number. Usually a single-character letter from A to Z. Numbers entered into the Tail Number field will be translated into a corresponding letter, such as 2 into B, 11 into K, etc.

The only exception is the Tiger Moth when assigned to the London School of Flying regiment. In this case the aircraft code will consist of three letters.

Serial Number. Usually a five-character string starting with a letter and followed by four numbers.

Some Examples (symbols in **bold** can be set by the player, symbols in *italics* are automatically set by Cliffs of Dover)

Plane	Squadron	Tactical #	Serial #
Hurricane Mk I	No. 151 Squadron	*DZ*-**E**	**L1754**
Hurricane Mk I	No. 312 Squadron	*DU*-**J**	**L1926**
Spitfire Mk I	No. 74 Squadron	*ZP*-**J**	**K9867**
Spitfire Mk II	No. 41 Squadron	*EB*-**Z**	**P7666**
Blenheim Mk IV	No. 40 Squadron	*BL*-**V**	**R3612**
Short Sunderland	No. 201 Squadron	*ZM*-**Q**	**T9087**

PART 4: CONTROLS

DE HAVILLAND DH.82A TIGER MOTH II		
DESCRIPTION	MAPPED TO	ESSENTIAL / NON-ESSENTIAL
Wheel Chocks		ESSENTIAL
View-Position #1, # 2	L_ALT+1, L_ALT+2	ESSENTIAL
Next Manned Position (Cycles through air crew)	C	ESSENTIAL
course setter - increase	NUMPAD + (CUSTOM)	CLICKABLE IN COCKPIT
course setter - decrease	NUMPAD - (CUSTOM)	CLICKABLE IN COCKPIT
toggle selected engine (ignition)	“I” by default	ESSENTIAL
directional controls (ailerons, elevators, and rudder)	Joystick & Rudder Pedal axes	ESSENTIAL
Trim controls (elevator)	Joystick hat switch	ESSENTIAL
Field of View + (allows you to zoom out)		ESSENTIAL
Field of View – (allows you to zoom in)		ESSENTIAL
throttle	Throttle axis	ESSENTIAL
toggle canopy/hatch		ESSENTIAL
increase mixture	+	ESSENTIAL
decrease mixture	-	ESSENTIAL
bail out		ESSENTIAL
Toggle Independent Mode (allows you to use/hide mouse cursor and take control of your gun)	F10	ESSENTIAL
Deploy / Retract Leading Edge Slats (Lock)		CLICKABLE IN COCKPIT

PART 5: WEAPONS AND ARMAMENT

The Tiger Moth was a trainer: not a fighter. There are no weapons on this plane in the current version of the game.

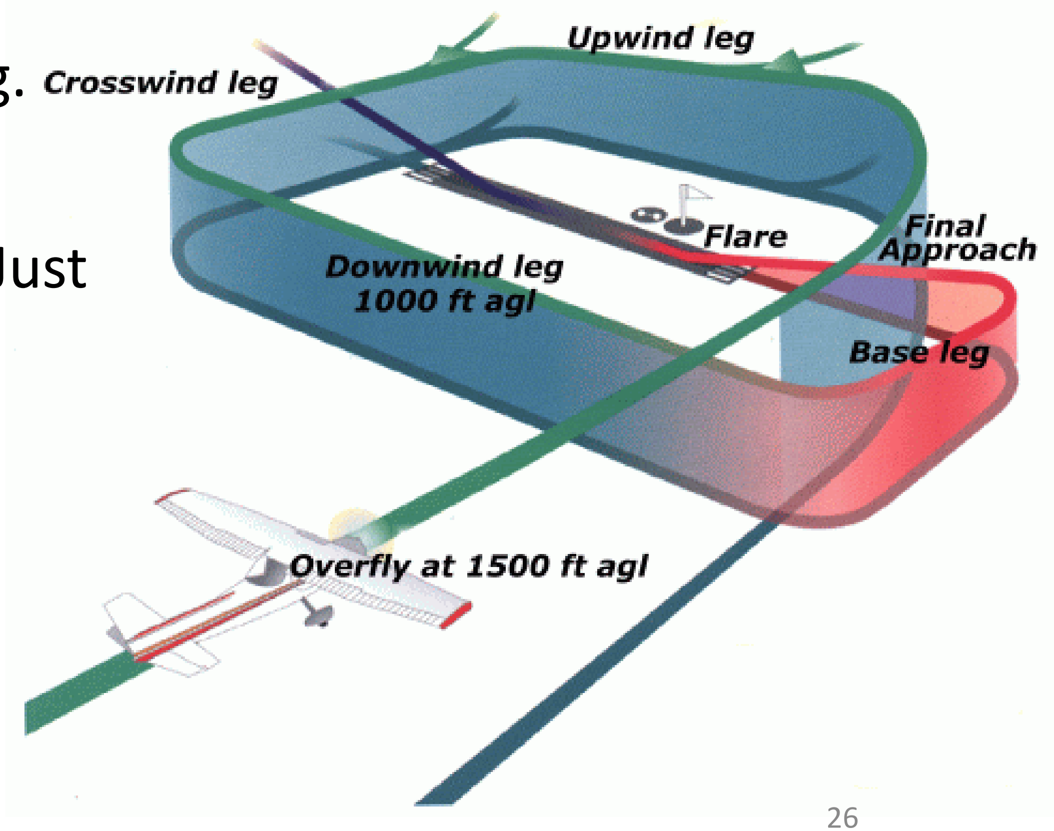
PART 6: TAKEOFF

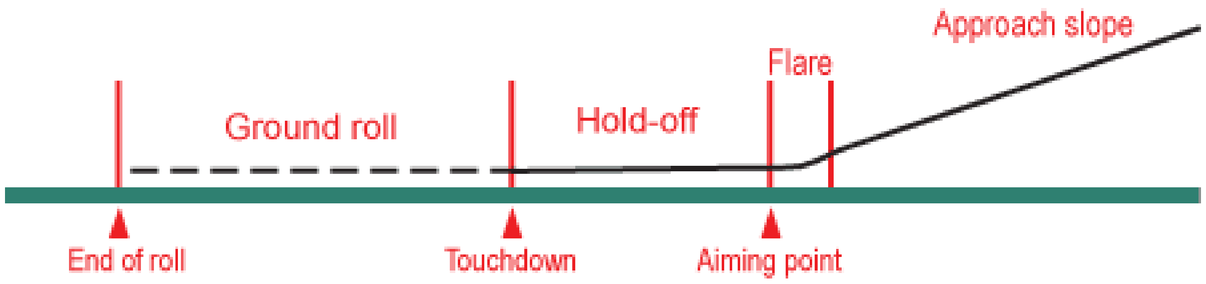
NOTE: This procedure is NOT the real-life start-up procedure, it has been simplified in the sim.

1. Open fuel cock (ON)
2. Ensure that mixture is set to fully rich.
3. Crack throttle half an inch forward.
4. Turn both magnetos ON
5. Make sure your propeller is clear (“Clear prop!”)
6. Engine ignition! (press “I” by default)
7. Wait for oil pressure to reach at least 35 psi.
8. Taxi to the runway.
9. Make sure you are facing yellow panels on the runway. This means you are facing the right direction for takeoff.
10. Perform last takeoff checks: Hatch closed, good mixture, and good oil pressure.
11. Gradually throttle up. Compensate for engine torque and wind using right aileron and rudder pedals to keep the aircraft straight. Slightly push the control column forward to lift the tail.
12. Rotation is at 55 mph.
13. Unlock automatic leading edge slats and set RPM to 2100 max for climb.

PART 7: LANDING

1. Start your approach at 55 mph @ approx. 1500 ft.
2. RPM set as required to maintain speed.
3. You do not need to deploy your landing gear: it is fixed! ☺
4. Cut throttle and try to keep your nose pointed to the end of the runway.
5. Touchdown at 50 mph in a 3-point landing.
6. Stick fully back.
7. There are no brakes on the Tiger Moth. Just cut throttle until you come to a stop.

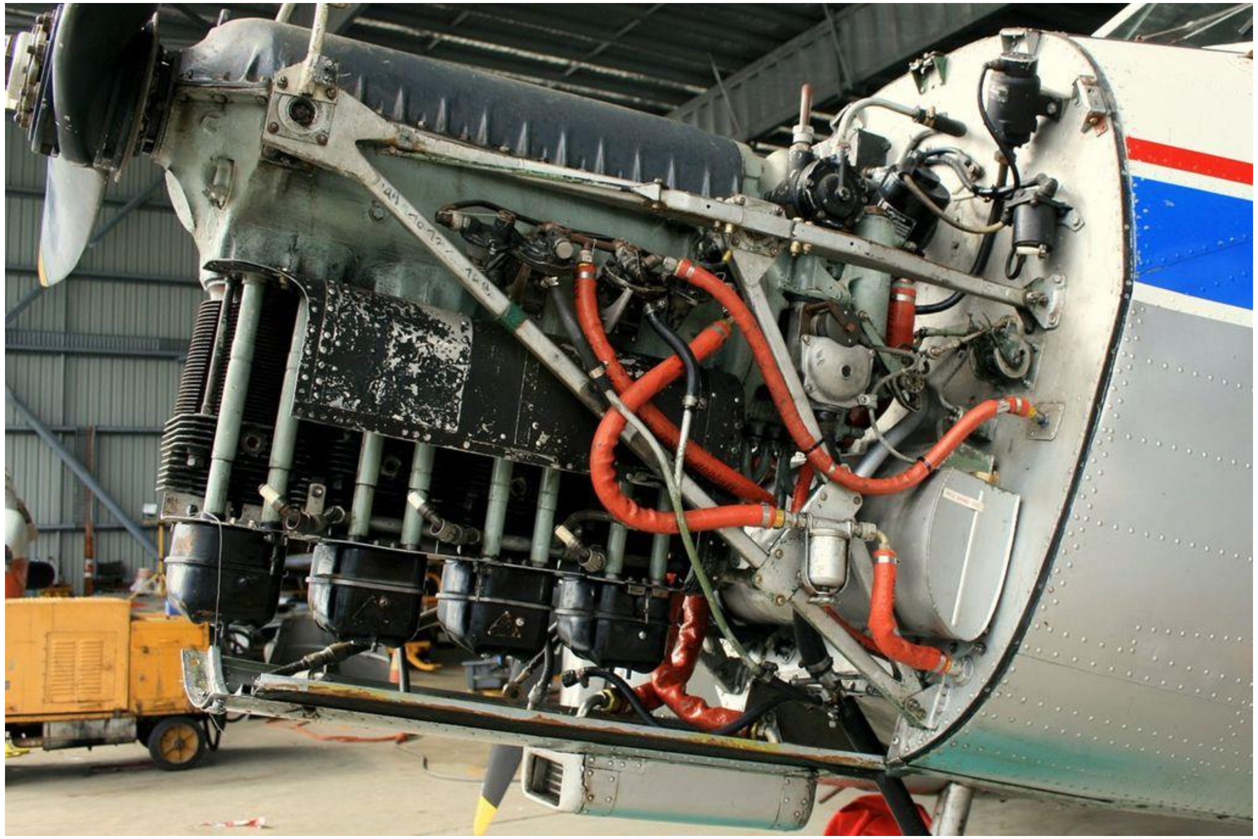




PART 8: ENGINE MANAGEMENT

The **de Havilland Gipsy Major** or **Gipsy IIIA** is a four-cylinder, air-cooled, inline engine used in a variety of light aircraft produced in the 1930s, including the famous Tiger Moth biplane. Many Gipsy Major engines still power vintage aircraft types worldwide today. The engine was a slightly modified Gipsy III, which was effectively a de Havilland Gipsy engine modified to run inverted so that the cylinders pointed downwards below the crankcase. This allowed the propeller shaft to be kept in a high position without having the cylinders blocking the pilot's forward view over the nose of the aircraft.

PART 8: ENGINE MANAGEMENT



One initial disadvantage of the inverted configuration was the high oil consumption (up to four pints per hour) requiring regular refills of the external oil tank, this problem improved over time with the use of modified piston rings. The advent of World War II cut short all civilian flying and after the war de Havilland was too busy concentrating on jet engines to put much energy into its piston engines. The Gipsy did not go without a fight though. In Canada the Gipsy Major was the engine of choice for the DHC1 Chipmunk trainer, which later replaced the Tiger Moth in the RAF. By that time however, the Gipsy Major was eclipsed by the Blackburn Cirrus Major in Britain and the American Lycoming and Continental horizontally opposed engines abroad (in a twist of irony, the Blackburn itself was based on Frank Halford’s old ADC Cirrus engine of which Blackburn had bought the licence in 1934). In its final supercharged form, the Gipsy Major used in helicopter applications delivered 220 hp (164 kW).

PART 8: ENGINE MANAGEMENT

ENGINE MANAGEMENT IN THE TIGER MOTH IS VERY SIMPLE. YOU JUST NEED TO CONTROL YOUR THROTTLE AND MONITOR YOUR RPM. THE PROPELLER HAS A FIXED PITCH, AND THERE ARE NO WATER RADIATOR CONTROLS

RPM LIMITS
IDLE: 800-900
CRUISE: 1900-2050
MAX (5 MIN): 2350

OIL PRESSURE
NORMAL: 40-45 PSI
MINIMUM: 35 PSI

PART 8: ENGINE MANAGEMENT

FOUR	ENGINES IN CLIFFS OF DOVER	FOUR

Mixture Control

Engine	Operation
Gypsy Major	Mixture Lever in rear cockpit has 2 operating positions only: RICH and WEAK. The mixture should be set to RICH at all times under 5000 feet. Above 5000 feet, mixture ajustment should not cause a drop in RPM.
Merlin II - XII	Mixture Lever has 2 operating positions only: RICH (NORMAL) and WEAK. An interlocking arrangement returns the mixture control to RICH when the throttle is closed. **Note: Mixture Control moves AFT for RICH and FORWARD for WEAK.**
Mercury XV	Mixture Lever has 2 operating positions only: RICH (NORMAL) and WEAK. An interlocking arrangement returns the mixture control to RICH when the throttle is closed. **Note: Mixture Control moves AFT for RICH and FORWARD for WEAK.**
DB 601 A - A1	The DB 601 Series engines are Direct Fuel Injection engines and do not have a pilot selectable mixture control.
Jumo 211 B/D	The Jumo 211 B/D Series engines are Direct Fuel Injection engines and do not have a pilot selectable mixture control.

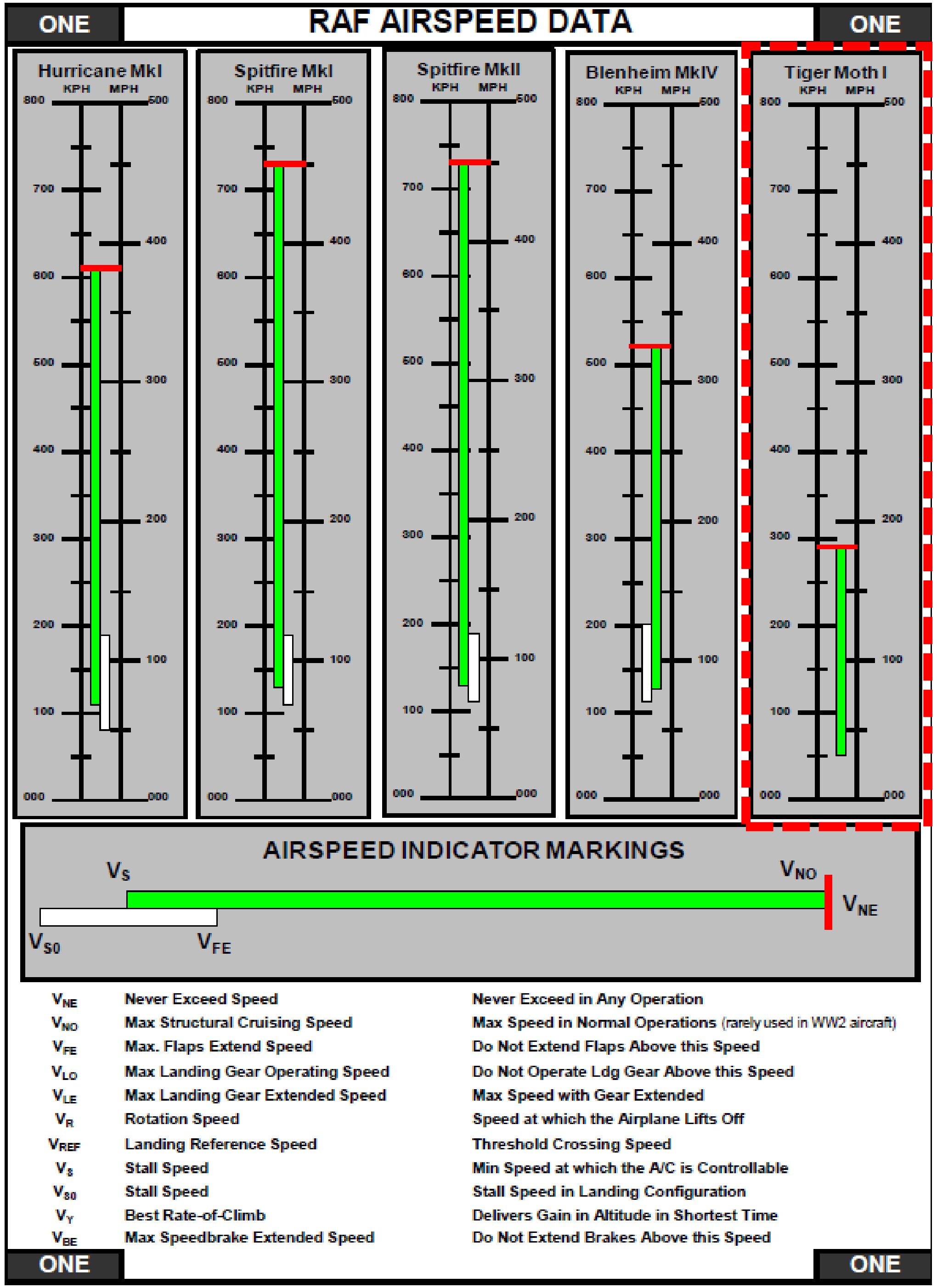
PART 9: AIRCRAFT PERFORMANCE

AIRSPEEDS

Takeoff – Rotation	UK: mph GER/ITA: km/h	50-55
Max Dive Speed		160
Optimal Climb Speed		66
Landing – Approach		55
Landing – Touchdown		50

- The aircraft is quite easy to fly and very forgiving, however it only has ailerons on the bottom wing so its roll rate is not quite as quick as other biplane aircraft.
- For more information on either aircraft or engine performance, consult the **2nd Guards Composite Aviation Regiment** Operations Checklist. It is a fantastic resource (link below).

https://drive.google.com/open?id=0B-uSpZROuEd3NGN4c0JRNHJpYkk&authuser=0



ONE	Tiger Moth			ONE
Aircraft Type	Engine & Prop	Fuel	Reference	
Tiger Moth II	Gypsy Major / FP	73 Oct	Pilot's Notes: Feb 1944	

AIRSPEED LIMITATIONS

	Design Speeds	MPH	
V_{NE}	Never Exceed Speed	180	Never Exceed in Any Operation
V_{FE}	Max. Flaps Extend Speed	NA	Do Not Extend Flaps Above this Speed
V_{LO}	Max Landing Gear Operating Speed	NA	Do Not Operate Ldg Gear Above this Speed
V_{LE}	Max Landing Gear Extended Speed	NA	Max Speed with Gear Extended
V_{R}	Rotation Speed	NA	Speed at which the Airplane Lifts Off
V_{REF}	Landing Reference Speed	55	Threshold Crossing Speed
V_{S}	Stall Speed - Engine On	30	Min Speed at which the A/C is Controllable
V_{S}	Stall Speed - Engine Off	40	Stall Speed in Landing Configuration
V_{Y}	Best Rate-of-Climb	66	Delivers Gain in Altitude in Shortest Time
V_{BE}	Max Speedbrake Extended Speed	NA	Do Not Extend Brakes Above this Speed

AIRSPEED INDICATOR OPERATING RANGES

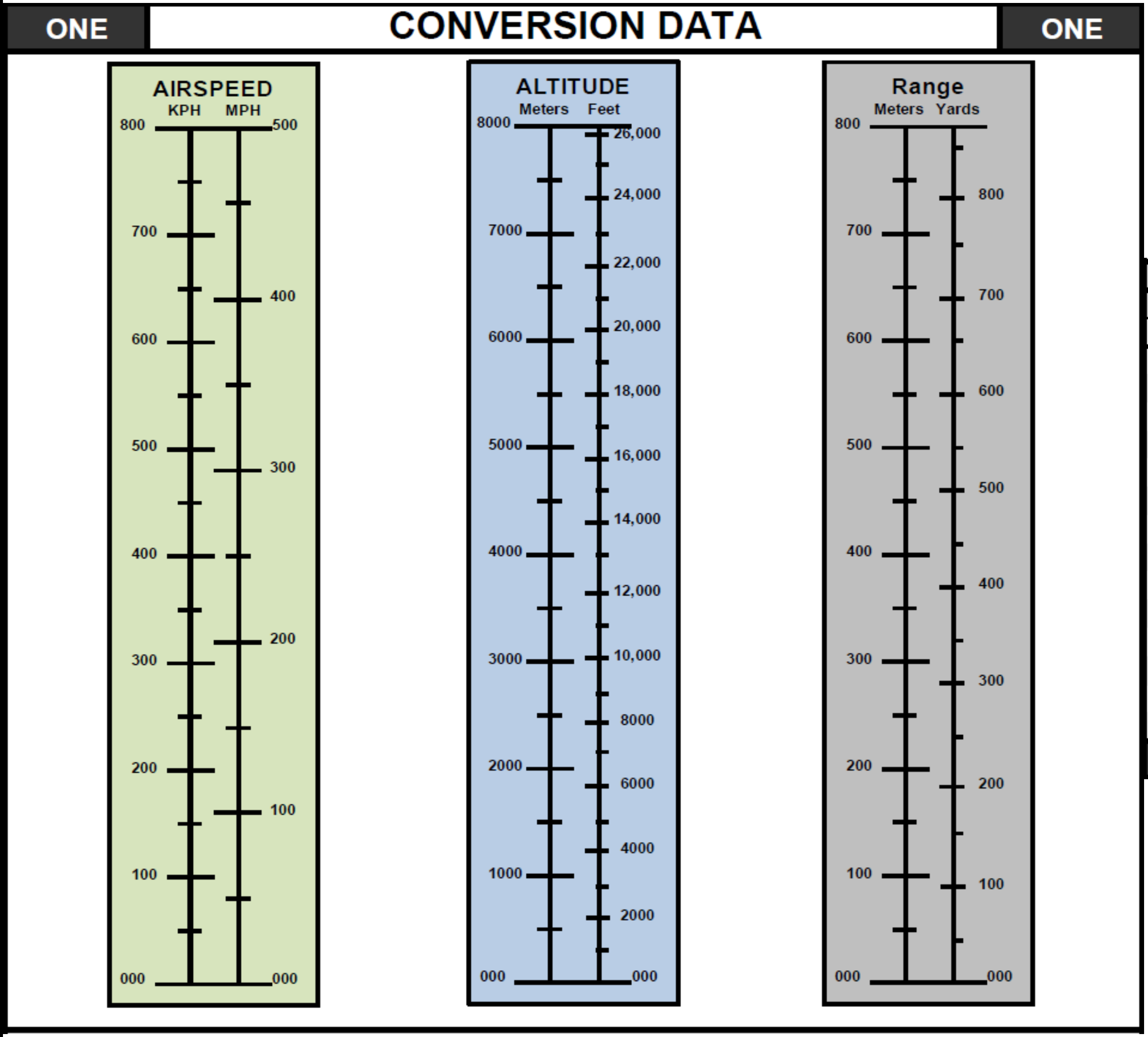
ASI MARKING	MPH Range	Description
White Arc	NA	Full Flap Operating Range. Lower Limit is Max. Weight V_{SO} . Upper Limit Max Speed w/Flaps Extended.
Green Arc	30 - 180 MPH	Normal Operating Range. Lower Limit is Max. Weight V_{S} . Upper limit Is Max Structural Cruising Speed.
Red Line	180 MPH	Maximum Speed for ALL operations.

LIMITING OPERATIONAL CONDITIONS

Condition	Full Throttle	Max Climb	Norm Climb	Max Cruise	Norm Cruise	Max Dive	73 Octane
Limit	5 min	30 min	Cont	30 min	Cont	20 secs	
RPM	2350	2100	2050	2100	1950	2200	
Mixture	Rich Setting to be used below 5000 feet.						

Oil Pressure		Oil Temperature		
Oil Pressure	Emer Min = 30 PSI	Oil Temperature	Min = 30° C	Max = 80° C
	Normal = 40 - 45 PSI		Emergency Max = 90° C	

PART 9: AIRCRAFT PERFORMANCE



International Civil Aviation Organization International Standard Atmosphere							
Temperature		Altitude Above Sea Level		Atmospheric Pressure			Mach 1
°F	°C	feet	meters	inches Hg	mm Hg	psia	mph
59	15	SL	0	29.92	760	14.70	761
55	13	1000	305	28.86	733	14.17	758
52	11	2000	610	27.82	706	13.67	755
48	9	3000	914	26.82	681	13.17	752
45	7	4000	1219	25.84	656	12.69	750
41	5	5000	1524	24.90	632	12.23	748
38	3	6000	1829	23.98	609	11.78	745
34	1	7000	2134	23.09	586	11.34	742
31	-1	8000	2438	22.22	564	10.92	740
27	-3	9000	2743	21.39	543	10.51	736
23	-5	10000	3048	20.58	523	10.10	734
5	-15	15000	4572	16.89	429	8.29	720
-13	-25	20000	6096	13.75	349	6.75	706
-31	-35	25000	7620	11.10	282	5.45	693
ONE							ONE

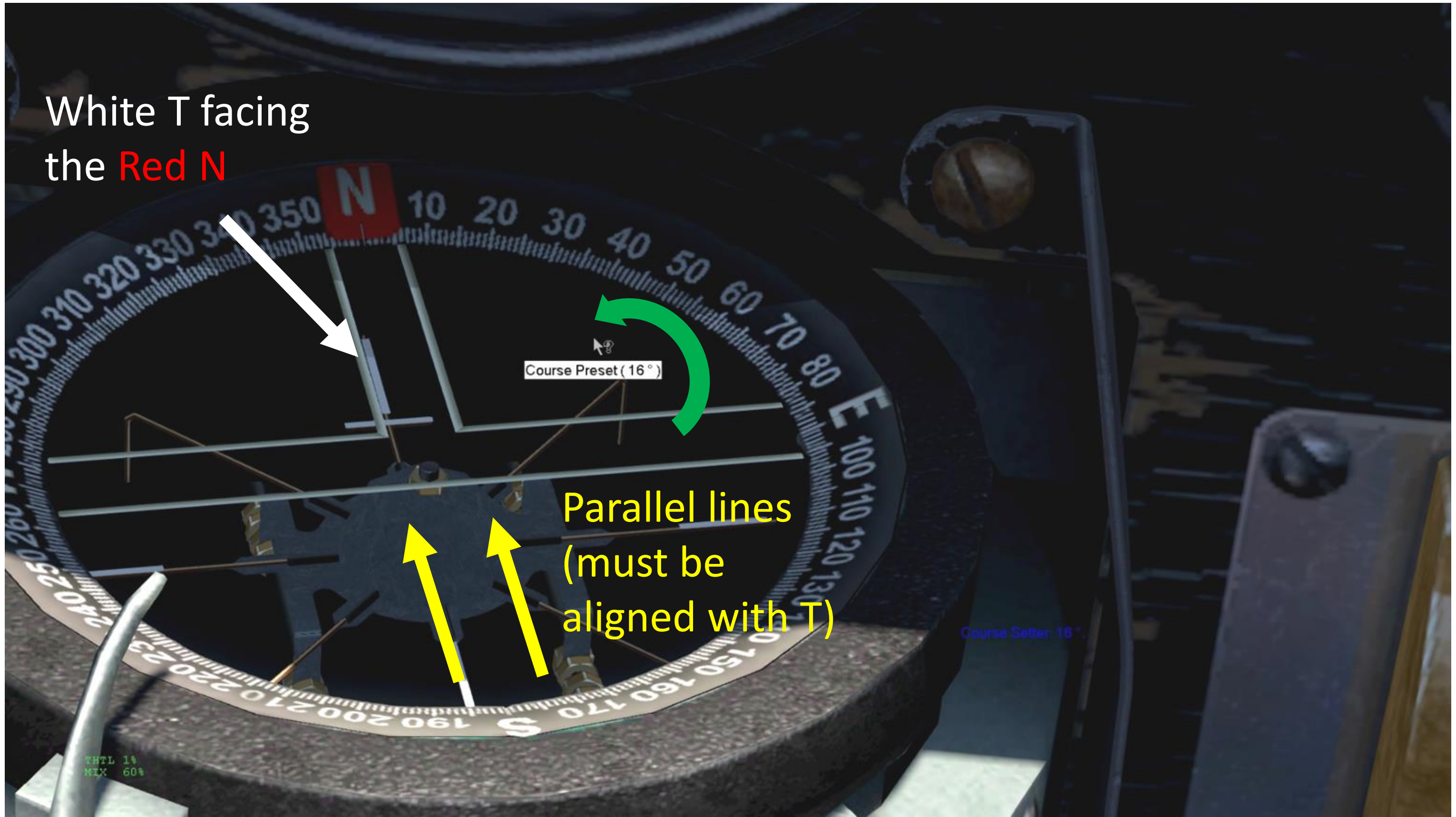
P-8 COMPASS TUTORIAL

- Using the magnetic compass is quite useful to know where you are going.
- Unlike modern British fighters like the Spitfire and the Hurricane, the Tiger Moth is not equipped with a directional gyro. What you have instead is a simple compass indicating magnetic north with a course setter allowing you to give you a reference heading (that you set) to follow.
- The magnetic compass is slow to respond after violent manoeuvers. This is one of the real life drawbacks of this system.

P-8 MAGNETIC COMPASS

The white T indicates magnetic north. You can use the course setter to help you reach a certain heading. For that, you need to deduce your geographical heading based on your magnetic heading (shown by compass). Here is an example:

1) You want to go to a geographic heading of 006. You need to take into account magnetic declination. This means that we want to go to a magnetic heading of 006 + 010 degrees = 016
2) Set the course setter to 016 (magnetic heading). Steer the aircraft until the white T is facing the red N and is parallel to it.
3) When you are properly aligned (as shown on following picture), this means that you are on course. You are heading towards a REAL geographical heading of 006 by following a magnetic heading of 016.



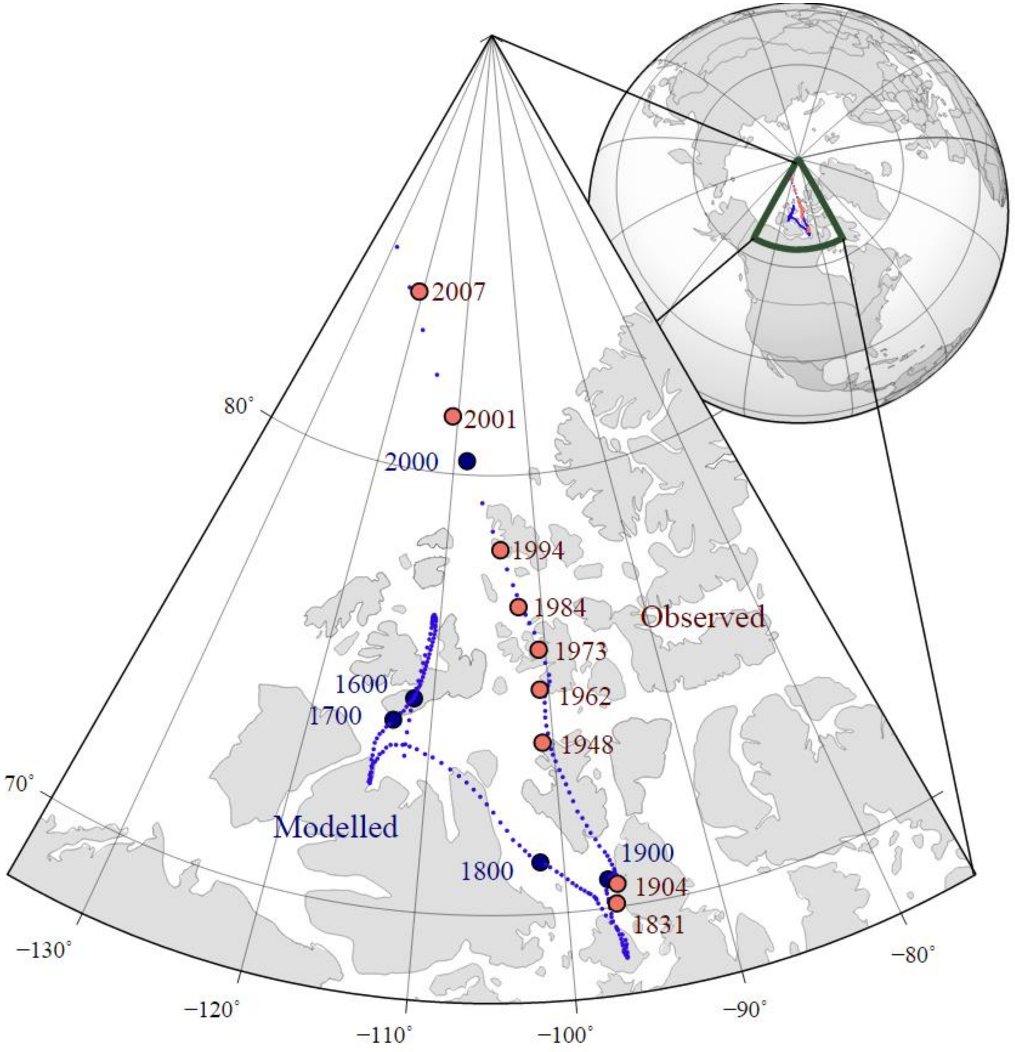
PART 10: COMPASS TUTORIAL

About Magnetic Declination

The direction in which a compass needle points is known as magnetic north. In general, this is not exactly the direction of the North Magnetic Pole (or of any other consistent location). Instead, the compass aligns itself to the local geomagnetic field, which varies in a complex manner over the Earth's surface, as well as over time. The local angular difference between magnetic north and true north is called the magnetic declination. Most map coordinate systems are based on true north, and magnetic declination is often shown on map legends so that the direction of true north can be determined from north as indicated by a compass.

This is the reason why in Cliffs of Dover, the magnetic compass needs to be “adjusted” to take into account this magnetic declination of the magnetic North pole (which is actually modelled in the sim, which is pretty neat).

In 1940, the magnetic declination required an adjustment of 10 degrees and 8 minutes. We round that to 10 deg.



The movement of Earth's north magnetic pole across the Canadian arctic, 1831–2007.