PILOT'S NOTES

FOR

De Havilland
TIGER MOTH

GYPSY MAJOR I ENGINE

PILOT'S HANDLING NOTES

In these Notes it has been the aim to exclude, so far as is consistent with clarity, information that is common to the construction and operation of all types of aircraft, and to include only details peculiar to the Type.

The Notes are arranged in six sections:—

Part I	Descriptive	Paras	1—17
,, II	Engine Starting and Pre-Flight Running	,,	18—22
,, III	Handling	,,	23—35
,, IV	Emergencies	,,	36—41
,, V	Operating Data	,,	42—48
,, VI	Summary of Pilot's Checks ..	,,	49—54

Conversion factors are set out on pages 15 and 16.

In Part VI have been summarised for convenient reference the Pilot's Checks included in the text of Parts II and III, and in addition it contains an "External Pre-Flight Check," which a pilot should carry out before accepting an aircraft for flight.

Club aircraft will normally have been inspected and passed as serviceable by the Clubs' Engineers before being handed over to Members, and it is to be emphasised that the "External Pre-Flight Check" set out herein is not as detailed as the inspection required by a Licensed Aircraft Engineer before the issue of a Certificate of Safety for Flight.

PART I

DESCRIPTIVE

GENERAL

Airframe

1. The Tiger Moth is an externally braced biplane designed for *ab initio* instruction. It has two open cockpits arranged in tandem. The fuselage, of metal tubular construction with a plywood top decking, is fabric covered. Wings and tail unit are of wood with fabric covering. The undercarriage is fixed. The aircraft is aerobatic.

Power Plant

2. The power unit is a Gipsy Major I 120 b.h.p. four cylinder in-line inverted air cooled engine, unsupercharged. The propeller is a fixed pitch left-hand tractor.

Seating

3. The instructor occupies the front cockpit. Solo flying should always be carried out from the rear cockpit.

Equipment

4. Both cockpits are fitted with a complete set of flying controls and instruments. Seats are of the non-adjustable bucket type, with Sutton harness. A small locker, to which access is gained from the starboard side, is provided behind the rear cockpit. Most Tiger Moths are only partially equipped for night flying but a landing lamp can easily be fitted. A blind flying hood is also easily fitted. A fire extinguisher and First Aid Kit are carried as normal equipment.

FUEL SYSTEM

Fuel Tank

5. Fuel is supplied from a 19 gallon capacity tank situated in the centre section of the top wing. 73 octane fuel is used normally, but unleaded fuel of any octane number up to 80 is also suitable. Feed is by gravity through a filter to the carburettor.

Fuel Cock

6. The fuel cock is operated by a push-pull control on the port side of both cockpits. To OPEN cock—PUSH FORWARD.

Fuel Gauge

7. A "boiler" type fuel gauge is mounted on top of the fuel tank. A rod directly attached to a float rises in a glass cylinder and indicates the fuel level. The level of the liquid in the cylinder must be ignored and readings taken from the position of the top of the rod. Readings are accurate only when the aircraft is in flying position.

OIL SYSTEM

8. The engine is of the dry sump type.

9. A tank of 2½ gallons capacity is fitted to the port side of the fuselage. Not more than 2.1 gallons of oil should be carried so as to leave an adequate air space.

MAIN SERVICES

Vacuum System

10. Gyroscopic instruments are operated by the suction from two venturi tubes fitted one on either side of the fuselage forward of the front cockpit.

AIRCRAFT CONTROLS

Flying Controls

11. (*a*) Full dual controls are fitted.

(*b*) The rudder bars are not adjustable in the air but the position of the foot-rests may be altered on the ground prior to flight.

(*c*) The rudder is connected to the tail skid to facilitate steering whilst taxying. **Rough usage of the rudder controls must be avoided while the aircraft is stationary or moving slowly.**

(*d*) The front control column is so arranged as to be easily removable before a passenger is carried, as also is the rod connecting the two rudder bars.

(*e*) There are no flaps, but most aircraft of the type are fitted with lockable automatic leading-edge slats.

Trimming

12. (*a*) Elevator trimming is effected by a spring loading device fitted to the control column, and a trimming control lever is provided on the port side of both cockpits. Adjustment is obtained by disengaging this lever from a quadrant and moving it to one of 28 positions. Operation of the lever is in the natural sense, i.e., movement FORWARD trims NOSE HEAVY; movement BACKWARD trims TAIL HEAVY.

(*b*) A spring loading device for trimming is fitted to the rear rudder bar. This can be adjusted only on the ground by a turn buckle on the starboard side.

(*c*) No aileron trimming device is fitted.

Control Locking

13. (*a*) No control locking mechanism is provided for the rudder controls, but a control column locking bar may be available; alternatively, the control column may be secured firmly back and central by means of the Sutton harness. Similarly the rudder bars may be securely lashed or strapped.

(*b*) If locking mechanism is fitted for the automatic slats, a lever is mounted in a quadrant on the starboard side of the rear cockpit. Slats are unlocked with the lever in the forward position. To ensure positive locking of the slats the cable should be taut when the lever is at least four holes from the extreme rear position.

ENGINE CONTROLS

Throttle

14. A throttle control of standard type with a screw friction device is fitted in a quadrant on the port side of each cockpit. The throttle is CLOSED with the lever pulled fully BACK.

Mixture

15. (*a*) A mixture control is fitted to the rear cockpit throttle quadrant only. Below 5,000 feet the control should always be set at rich mixture, i.e., fully back. Above 5,000 feet, for maximum power at any throttle setting the mixture control should be slowly adjusted until maximum r.p.m. are obtained. The mixture strength will then be correctly adjusted for the height at which the aircraft is flying.

(*b*) On closing the throttle the mixture control is automatically returned to rich.

(*c*) On most aircraft the mixture control is locked rich or is disconnected.

Ignition Switches

16. (*a*) Twin ignition switches are fitted outside the fuselage, forward of each cockpit on the port side. The front switch of each pair controls the starboard magneto which is fitted with an impulse starter. The rear switch of each pair controls the port magneto and should not switched on until the engine is running.
The switches are OFF when in the DOWN position.

(*b*) Both switches for the front cockpit should be in the ON position before using the rear cockpit switches for starting and vice versa.

LIGHTING

17. (*a*) Current is provided by a 12 volt battery housed on the floor of the front cockpit when required.

(*b*) Navigation lights are normally controlled by a tumbler switch below and on the right-hand side of the instrument panel in the rear cockpit. The lights are OFF when the switch is in the UP position.

(*c*) The Downward Identification Light is controlled by a standard type combined switch and morse key, the forward of the two switches being moved forward for steady light and centrally to allow the morse key to be used. Normally this switch is mounted on the top right-hand side of the rear cockpit.

(*d*) Cockpit Lighting is operated by rheostatic switches fitted to the lights, one light normally being mounted on the right-hand side of the instrument panel in each cockpit.

(*e*) The type and position of the Landing Lamp switch (if fitted) may vary on individual aircraft.

Note. As no generator is installed, availability of electric services will depend upon the state and capacity of the batteries.

PART II

ENGINE STARTING AND PRE-FLIGHT RUNNING

Pilot's Cockpit Check before Starting Engine

18. First check that IGNITION SWITCHES are OFF, then continue from the bottom left-hand side of the cockpit and round in a clockwise direction, finishing with the controls at the centre bottom.

Note.—*In some aircraft the instruments, and so the check, may not follow exactly in the order given below.*

(*a*) Tail Trimmer	Full and free movement. Set fully back.
(*b*) Fuel Cock	On, and adequate petrol in tank.
(*c*) Mixture Control	Rich.
(*d*) Throttle	Full and free movement. Close throttle and adjust friction nut.
(*e*) Port Door	Properly closed.
(*f*) Intercom. (when fitted) ..	On.
(*g*) Altimeter	Set to height above sea level or to zero for circuits and landings.
(*h*) Compass	Movement of verge ring and apparent serviceability.
(*i*) Starboard Door	Properly closed.
(*j*) Cockpit Lights (*Night Flying only*)	Switch and rheostat working.
(*k*) Downward Identification Light (*Night Flying only*)	Switch and key working.
(*l*) Slats	Lever—full movement and set to locked.
(*m*) Navigation Lights (*Night Flying only*)	Switch and all lights working.
(*n*) Fire Extinguisher	Secure.
(*o*) Harness	Condition.
(*p*) Control Column	Full and correct movement of controls.

Note.—*Due to the interconnection of the rudder and tail skid, rudder movement on the Tiger Moth should be checked only whilst taxying.*

Starting (Cold)

19. (*a*) **Chock the wheels.** See that the switches are OFF. Turn on the petrol and flood the carburettor by raising the starboard side of the engine cowling and depressing the button on top of the carburettor float-chamber until petrol drips from the overflow pipe at the rear of the under cowling.

(*b*) With (i) Throttle closed, (ii) Control column held back, (iii) Ignition switches OFF, the propeller should be turned over four compressions to "suck in."

(*c*) With the throttle set approximately half an inch open and the switches of one cockpit only in the ON position, the front switch (i.e. controlling the magneto with the impulse starter) at the other cockpit should be switched ON to "Contact" (UP position), and the propeller swung. As soon as the engine has started the remaining switch should be switched ON.

(*d*) The mixture control must be in RICH throughout.

(*e*) As soon as the engine is firing normally, check that the oil pressure is rising. If the pressure does not rise within 30 seconds, the engine should be switched off and a Licensed Engineer informed.

Starting (Hot)

20. With the engine hot the procedure is as above except that it is not normally necessary to "suck in," and it may not be necessary to flood the carburettor.

Failure to Start

21. Difficulty in starting is most frequently due to too rich a mixture in the cylinders. To correct this, turn the propeller backwards over approximately twelve compressions with the switches OFF and the throttle fully open. Then close the throttle and proceed as for Starting (Hot).

Running Up

22. (*a*) Unless the engine is already warm, run for at least four minutes at 800 to 1,000 r.p.m. to warm up.

(*b*) Check magnetos for dead cut at idling r.p.m. by switching off one at a time, then switch both Switches OFF momentarily to check their effective earthing.

(*c*) Then holding the control column right back, open throttle to 1,600 r.p.m. for two or three seconds only, and test each magneto separately (maximum drop permitted is 100 r.p.m.).

(*d*) Throttle right back and check slow running, then return to normal idling r,p.m.

(*e*) During engine-run check that oil pressure is correct. This should settle down to between 30-60 lb. per square inch at 700 r.p.m. and above.

Note.—*A full throttle check should be made if a fault is suspected (maximum r.p.m. 1,825 to 2,100 according to the propeller fitted).*

PART III

HANDLING

Taxying

23. (*a*) From the rear seat the forward view is poor and the nose of the aircraft must constantly be swung from side to side.

(*b*) No brakes are fitted, but as the tail skid is connected to the rudder, taxying is not difficult on grass, except in high winds when use should be made of the ailerons and ground crew on the wing tips may be necessary. **Rough usage of the rudder controls when stationary or moving slowly must be avoided. Taxying on concrete requires great caution.**

Taking Off

24. (*a*) The natural swing of the aircraft to the right is easily counteracted by use of the rudder.

(*b*) The aircraft will fly off comfortably at 39 kts (45 m.p.h.) and a steady climb away at 56 kts (65 m.p.h.) should be made to 500 feet, at which height the engine should be throttled back about half an inch.

(*c*) The following check should be made before take-off :—

T	Trim	Half to two-thirds forward.
T	Throttle Friction Nut	Tight.
M	Mixture	Rich.
F	Fuel	Turned on, and sufficient for flight.
F	Slats	Free.
G	Gauges	Oil pressure normal. Altimeter set.
H	Harness	Fastened.
H	Hatches (doors) ..	Closed.

Climbing

25. (*a*) The best climbing speed is 56 kts (65 m.p.h.). The tail trim lever should be so positioned to absorb the load on the stick.

(*b*) A full throttle climb should not be sustained for more than five minutes, and the recommended power for continuous climbing is 2,000 r.p.m. or the r.p.m. obtained with the throttle half an inch from the fully open position on the quadrant, whichever is the lower.

Flying

26.

Average cruising speed ..	74 kts (85 m.p.h.)
Maximum permissible speed	139 kts (160 m.p.h.)
Minimum safe crusing speed	56 kts (65 m.p.h.)
Powered approach	52 kts (60 m.p.h.)

Stalling

27. The stall is straightforward with no unusual features and little tendency to drop a wing or to spin accidentally.

Average Stalling speed:—

(i) With slats locked	39 kts (45 m.p.h.) I.A.S.
(ii) With slats unlocked	37 kts (43 m.p.h) I.A.S.

Stability

28. The aircraft is stable around all three axes.

Trim

29. (*a*) With the elevator tail trim correctly adjusted it is possible to fly hands-off in all normal conditions of flight.

(*b*) As the spring loading device fitted to the rudder control is only adjustable on the ground it is possible to hold direction in level flight with feet off the rudder bar for only one particular condition of flight for which this trim has previously been adjusted prior to take-off, e.g., for normal cruising.

Slats

30. (*a*) When the slats are unlocked they will delay the stall by about 2 m.p.h. They also have the effect of making the stall, when it occurs, more gentle.

(*b*) To avoid the possibility of slats being damaged, they should be locked when taxying and before aerobatics or spins are attempted.

Spinning

31. Spinning in this aircraft is straightforward and the standard recovery action of *first* applying full opposite rudder, and then easing the stick forward until the spin has stopped, is immediately effective. Recovery normally takes about three-quarters of a turn.

Aerobatics

32. (*a*) The aircraft is aerobatic, and the following speeds are recommended for commencing each manoeuvre:—

Loop	104 kts (120 m.p.h.)
Slow Roll	96 kts (110 m.p.h.)
Roll off top of loop	117 kts (135 m.p.h.)
Inverted gliding	69 kts (80 m.p.h.)

(*b*) Care should be taken that the engine r.p.m. do not exceed 2,470.

(*c*) **All flick manoeuvres, outside loops and bunts, are prohibited.**

Flying for Range

33. (*a*) The speed which will give maximum range IN STILL AIR is 69-75 kts (80-86 m.p.h.), but in a low speed aircraft like the Tiger Moth the optimum engine r.p.m. for maximum range depends more on the wind strength and direction than is the case with faster types.

(*b*) Normally it will be found that for all practical purposes cruising at 1,900 r.p.m. will provide a satisfactory balance between speed and fuel consumption.

(*c*) The maximum cruising r.p.m. are 2,100 for not more than one hour, but an engine speed of 1,950 r.p.m. should not be exceeded in normal cruising flight.

Descent

34. (*a*) After closing the throttle set elevator trimming control back so that the aircraft descends at 56 kts (65 m.p.h.) without load on the stick.

(*b*) Check that slats are unlocked.

(*c*) If descending from a considerable altitude, open the throttle to clear and warm the engine at every 1,000 feet.

(*d*) The following check should be made on Down Wind Leg before approaching to land:—

M	Mixture	Rich.
F	Fuel	Contents adequate.
F	Slats	Free.
H	Harness	Tight.

Observe any signals from Aerodrome Control. Check that landing path is clear and that no other aircraft are approaching.

(*e*) The following check should be made after landing:—

T	Tail Trim	Fully back.
T	Throttle Friction Nut ..	Loose.
L	Slats	Locked.

Running Down on Termination of Flight

35. (*a*) Run the engine for one minute at about 800 r.p.m. and test magnetos for dead cut. Turn off petrol cock, switch off ignition and then open throttle fully. When engine has stopped return throttle lever to closed position.

(*b*) Before leaving aircraft carry out the following check:—

(i) Ignition Switches ..	Off.
(ii) Fuel	Off.
(iii) Throttle	Closed.
(iv) Chocks	In position.

PART IV

EMERGENCIES

Re-starting the Engine in Flight

36. Should the engine stop in flight, for reasons other than lack of fuel or mechanical defect, it can normally be re-started by diving steeply and, if necessary, pulling out of the dive sharply. The loss of height will normally be between 1,000 and 2,000 feet. The throttle should be set one-third open and fuel and ignition switches checked ON.

Missed Landing

37. If it becomes necesssary to go round again, the throttle should be fully opened, the speed raised to 56 kts (65 m.p.h.) and the aircraft climbed when this speed has been obtained. The load on the stick before re-trimming is not great.

Fire Extinguisher

38. A Fire Extinguisher is fitted on the right of the pilot's seat in the rear cockpit. It may be operated in position, spraying the carburettor and filter. It may also be removed and used as a hand extinguisher.

Fire in the Air

39. In the event of fire in the air:—

(i) Turn OFF petrol.

(ii) Close throttle.

(iii) Switch OFF ignition.

(iv) Reduce speed and side slip away from fire.

(v) Operate fire extinguisher.

Ditching

40. Because of the fixed undercarriage, the aircraft tends to nose over on to its back on touching the water. When a ditching is unavoidable the aircraft should be made to strike the water in a flat turn so that the force of impact is taken on the wing. This should be done at as slow a speed as possible.

First Aid Kit

41. The First Aid Kit is normally stored on the port side of the fuselage behind a rip panel aft of the rear cockpit, or, alternatively, in the locker.

PART V

OPERATING DATA

Engine

42. Gipsy Major I 118-122 b.h.p. four cylinder in-line. Inverted. Air cooled.

Fuel

43. Normally 73 octane, or unleaded fuel of any octane number up to 80.

Oil

44. D.E.D. 2472 B/O Normal.
D.E.D. 2472 A/O Winter.

Engine Limitations

45. The principal engine limitations are as follows:—

Maximum Take-off ..	2,100 r.p.m.
Minimum Take-off ..	1,825 r.p.m.
Climbing	2,100 r.p.m.
Maximum Cruising ..	2,100 r.p.m. (not exceeding 1 hour)
Maximum Diving (not less than one-third throttle)	
Gipsy Major I & IF..	2,350 r.p.m. } not exceeding 20 secs.
Gipsy Major IC ..	2,400 r.p.m. } not exceeding 20 secs.
Gipsy Major IJ ..	2,500 r.p.m. } not exceeding 20 secs.
Oil Pressure	Minimum 30-lb. per square inch, for five minutes.
	Maximum 60-lb. per square inch.
	Normal 40/45-lb. per square inch.

Fuel and Oil Consumption

46. (*a*) **Fuel**

At 1,900 r.p.m. ..	6½ gallons per hour.
At 2,100 r.p.m. ..	9½ gallons per hour.

(*b*) **Oil**

1 to 2 pints per hour.

Tyres

47. Pressure, 16-lb. per square inch.

Flying Limitations

48. (*a*) Maximum speed .. 139 kts (160 m.p.h.)

(*b*) Maximum all-up weight 1,825-lb. normal flying.
1,770-lb. aerobatics.

(*c*) **The aircraft is aerobatic but flick movements, outside loops and bunts may under no circumstances be carried out.**

Part VI

SUMMARY OF PILOT'S CHECKS

External Pre-Flight Check

49. *The check is carried out by starting at the point of entry to the cockpit, on the port side, and continuing round the aircraft clockwise, as follows:—*

(*a*)	Magneto Switches	OFF.
(*b*)	Port Aileron	Condition and movement.
(*c*)	Port Mainplanes	Condition of fabric, slats and leading edge ribs. Tension of bracing wires.
(*d*)	Port Venturi	Condition and security.
(*e*)	Port Undercarriage	Security of fairing. Condition and pressure of tyre. Presence of chock.
(*f*)	Engine	Oil Filler Cap secure. Cowling secure. Absence of oil leaks. Condition and security of propeller. Condition and security of exhaust.
(*g*)	Ground in front of Propeller	Fit for propeller swinger.
(*h*)	Starboard Venturi	Condition and security.
(*i*)	Pitot Head	Uncovered.
(*j*)	Starboard Aileron, Mainplane and Undercarriage ..	As for port side.
(*k*)	Starboard side and underside of fuselage	Condition.
(*l*)	Locker	Contents secure and suitable and catches properly fastened.
(*m*)	Instrument Flying Hood ..	Condition, movement and security.
(*n*)	Starboard Control Wires ..	Condition and tension.
(*o*)	Tail Unit	Condition of surfaces and leading edges. Condition of skid and spring.
(*p*)	Port side of Fuselage and Port Control Wires	As for starboard side.
(*q*)	First Aid Kit	Installed.
(*r*)	Front Cockpit .. .. (*before solo flight only*)	Harness secure. Throttle friction nut free. Switches both ON. No loose articles. Doors securely closed.

Pilot's Cockpit Check before Starting Engine

50. First check that IGNITION SWITCHES are OFF, then continue from the bottom left-hand side of the cockpit and round in a clockwise direction, finishing with the controls at the centre bottom.

Note.—*In some aircraft the instruments, and so the check, may not follow exactly in the order given below.*

(*a*)	Tail Trimmer	Full and free movement. Set fully back.
(*b*)	Fuel Cock	On, and adequate petrol in tank.
(*c*)	Mixture Control	Rich.
(*d*)	Throttle	Full and free movement. Close throttle and adjust friction nut.
(*e*)	Port Door	Properly closed.
(*f*)	Intercom. (when fitted) ..	On.
(*g*)	Altimeter	Set to height above sea level, or to zero for circuits and landings.
(*h*)	Compass	Movement of verge ring and apparent serviceability.
(*i*)	Starboard Door	Properly closed.
(*j*)	Cockpit Lights .. .. (*Night Flying only*)	Switch and rheostat working.
(*k*)	Downward Identification Light (*Night Flying only*)	Switch and key working.
(*l*)	Slats	Lever—full movement, and set to locked.
(*m*)	Navigation Lights .. .. (*Night Flying only*)	Switch and all lights working.
(*n*)	Fire Extinguisher	Secure.
(*o*)	Harness	Condition.
(*p*)	Control Column	Full and correct movement of controls.

Note.—*Due to the interconnection of the rudder and tail skid, rudder movement on the Tiger Moth should be checked only whilst taxying.*

Pilot's Check Cross Wind before Take-off

51.	T	Trim	Half to two-thirds forward.
	T	Throttle Friction Nut	Tight.
	M	Mixture	Rich.
	F	Fuel	Turned on, and sufficient for flight.
	F	Slats	Free.
	G	Gauges	Oil pressure normal. Altimeter set.
	H	Harness	Fastened.
	H	Hatches (doors) ..	Closed.

Pilot's Check on Down Wind Leg before Landing

52.	M	Mixture	Rich.
	F	Fuel	Contents adequate.
	F	Slats	Free.
	H	Harness	Tight

Observe any signals from Aerodrome Control. Check that landing path is clear and that no other aircraft are approaching.

Pilot's Check after Landing

53.	T	Tail Trim	Fully back.
	T	Throttle Friction Nut	Loose.
	L	Slats	Locked.

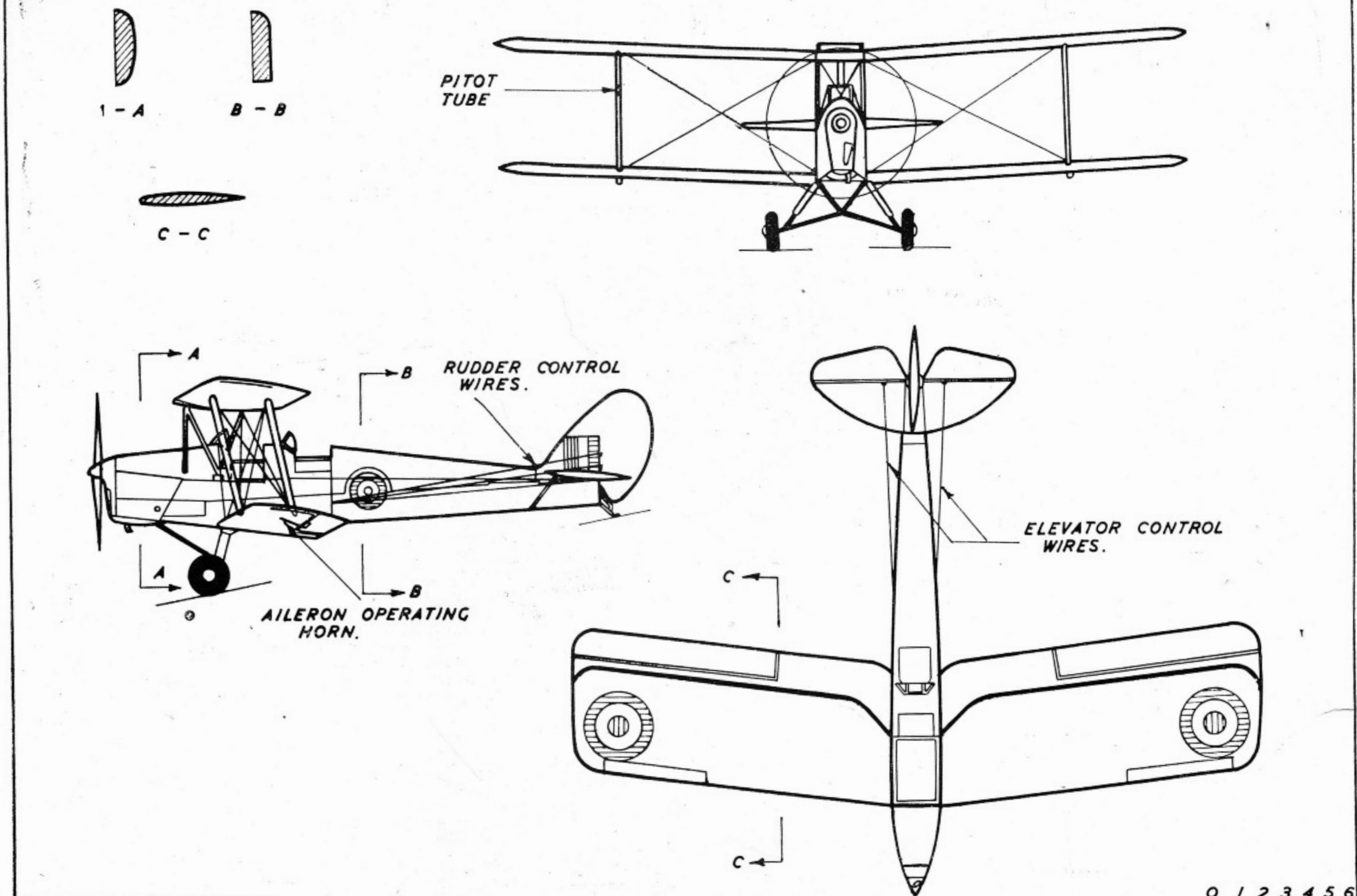
Pilot's Check after Stopping Engine

54.	(i) Ignition Switches	Off.
	(ii) Fuel	Off.
	(iii) Throttle	Closed.
	(iv) Chocks	In position.

Part V

ILLUSTRATIONS

CONTROL UNIT TYPE 307
OFF
ON
WARNING
HEIGHT
FEET
SIDE SLIP
SIDE SLIP
L
R
TURN
TURN
R.P.M.
M.P.H.



D. H. 82 TIGER MOTH.

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TIGER TAILS

John Fricker continues his occasional series of reminiscences

CASTLE CAMPS in August 1942, is a satellite of the Fighter Command airfield of Debden, in Essex, and against its skyline crouch the sleek black silhouettes of newly-delivered D.H. Mosquito NF Mk IIs of No 157 Squadron. To the squad of youthful Air Training Corps cadets marching expectantly round the perimeter track, this sunny Sunday morning excursion into the sleepy Essex countryside marks a long-awaited entry into a new and exciting world. For the first time, they are on the other side of the fence in the heady environment of an operational RAF station; but, even more unbelievably, they are there to fly.

Anticipation at the prospect of an aerial initiation in the RAF's newest and most potent combat aircraft is almost unbearable as they halt in front of the deadly shape of a Mosquito, but a sudden about-turn presents a somewhat different picture. Parked on the grass is a rather earlier and less glamorous de Havilland product. Drab in its wartime camouflage, Tiger Moth T6258 looks even more forlorn with its top cowling badly dented from the boots of countless erks when filling the 19 gal (86,4 l) upper wing centre-section fuel tank and airfield mud thick upon its wing walkway.

Disappointment at the change in prospects is transitory, however, and the thought of an unknown world waiting to be discovered in the air re-awakens both anticipation and some apprehension. At least in the Tiger Moth one is required to dress the part of an airman to the full, with a Sidcot flying suit of stiff canvas, helmet, goggles and Gosport tubes, and a seat-type parachute. For the first time ever, one lowers oneself gingerly into the deep cockpit, with its soft leather crash pad behind the tiny metal-framed windscreen, and savours the heavy ambiance of dope and petrol. The little plywood doors are closed and one is helped to sort out the thick webbing straps of the Sutton harness. Top left-hand strap first, and position the large slotted metal spigot, after invariably untangling its attachment string from beneath the seat, through the appropriate brass-rimmed hole of the right-hand seat strap. Top right and lower left straps complete the sequence, and the whole assembly is secured when almost unbearably tight by the spring-pronged retention pin.

Initially, it is a strange and uncomfortable environment as one sits trussed in the narrow plywood shell, vision masked by the metal-framed Mk VIII goggles and heating limited to the breathy exhortations of the Gosport tubes. Little can be seen over the long nose unless one cranes round to one side, when an overalled mechanic comes into view to initiate one into the classic pre-flight litany of the biplane age.

"Switches off, fuel on, throttle closed, sucking-in."

"Switches off, fuel on, throttle closed, suck-in."

Alternate swings of the big wooden propeller produce a satisfactory metallic clonk from the impulse unit to produce a boosted spark from one magneto, and fuel begins to dribble from the carburettor overflow pipe as all four cylinders are primed. One will later learn that when an impulse unit occasionally sticks, a sharp tap with the nearest blunt instrument at the base of the offending magneto at the rear of the engine, identified by its scars from previous persuasion, will invariably restore it into operation.

"Throttle set. Contact." And as the pilot flicks the rear switches up on the port side of the fuselage, the well-tuned Gipsy Major I bursts into song, the propeller shredding its oil-thick smoke as the tachometer and vertical oil pressure gauge come to life in the cockpit. Moments later, the ground drops away to present a new perspective on the world, and impart an irrevocable change on the outlook and ambitions of an enchanted child.

Was it, in retrospect and having subsequently flown in Mosquitoes among a few hundred other aircraft types, such a bad thing to receive one's flying initiation in a Tiger Moth? On a fine summer's day, there is still today no better way of encapsulating the quintessential qualities of flight than in an open cockpit biplane. You are of the air rather than in it, enveloped by the battering slipstream, which the small windscreens in the Tiger Moth appear to deflect straight into your face, especially in the rear cockpit.

For CG reasons, this is where the Tiger is flown solo, although cockpit differences are few, apart from the even worse view from the back seat than the front. Each instrument panel is dominated by a massive bowl-type P.II compass at its lower centre, of the type widely-used by the wartime RAF, although perhaps better suited to boats than aircraft. The compass is surmounted by an equally large Reid and Sigrist two-needle venturi-driven turn-and-slip indicator with a five-inch dial, which is the Tiger Moth's key (and in fact only) blind flying instrument, as well as being virtually essential for accurate visual flight. An altimeter and engine instruments complete the array, and cockpit equipment further includes the so-called "cheese-cutter" quadrants for elevator trim on the port side and slat-locking to starboard.

Like all Tiger Moth engineering, these are nothing if not robust, comprising large alloy levers working in notched quadrants, interlinked, in the case of the trimmers, between the two cockpits to apply direct spring bias to the elevator circuit. The slat-locking lever is accessible only from the rear cockpit, and is applied when taxying to prevent damage to the automatic Handley Page slats on the upper wings through being bounced around on the ground and before aerobatics. It is a curious design feature of the Tiger that the slats are on different wings from the ailerons, thus depriving the latter of much of their benefit.

Although the Tiger Moth first appeared in 1931, its earlier technology deriving from its D.H. 60 Moth origins is evident from such things as the external control wires for its rudder and elevators; its steerable steel-sprung tail-skid and absence of brakes. Coupled with the relatively narrow-track undercarriage, these features restrict the Tiger mainly to into-wind grassfield operation, and necessitate the maintenance of fast-disappearing skills in taxying and ground handling. On grass, the tail-skid gives a good purchase to swing the long nose steadily from side to side so that you can see where you are going, with the stick hard back against the stomach except when taxying downwind. In anything more than a zephyr, you are soon reminded of the vital need to use full aileron control on the ground when taxying or turning cross-wind to minimise weathercocking (stick into wind), assisted by generous applications of rudder and blasts of throttle to kick the tail round when necessary.

Solo at Southend

A receipt in my log-book from the County Borough of Southend-on-Sea for three pounds seven shillings and eleven pence dated 21 May 1949 marks the first application in earnest of these homilies, when after a second session of 45 minutes dual and the recent acquisition of my "A" licence, I am sent solo for the first time to fly 25 minutes in Tiger Moth G-AINY. This vast background of experience, however, emboldens me to apply to join the recently-reconstituted RAF Volunteer Reserve in the following year, when they open their ranks to civil pilots, and to my vast surprise and gratification, I am accepted.

It is therefore at No 17 Reserve Flying School, from the hallowed turf of RAF Hornchurch, still redolent with the shades of Richard Hillary and Paddy Finucane, and the spirit of Stanford Tuck, Al Deere, "Sailor" Malan and many other Battle of Britain heroes of the previous decade, that my real acquaintance with the Tiger Moth, as well as my first systematic flying training, begins. Although all RAFVR flying schools are run by civilian organisations — Messrs Short Bros and Harland Ltd in our case — and our instructors are nominally civil, they are all CFS-qualified and categorised, and we learn to fly all over again the RAF way. Which, of course, is the best and only way, as I rapidly find in the course of a couple of hours' intensive dual on the RFS Tiger Moths, to tighten up some of my sloppy flying habits before being allowed off on my own again.

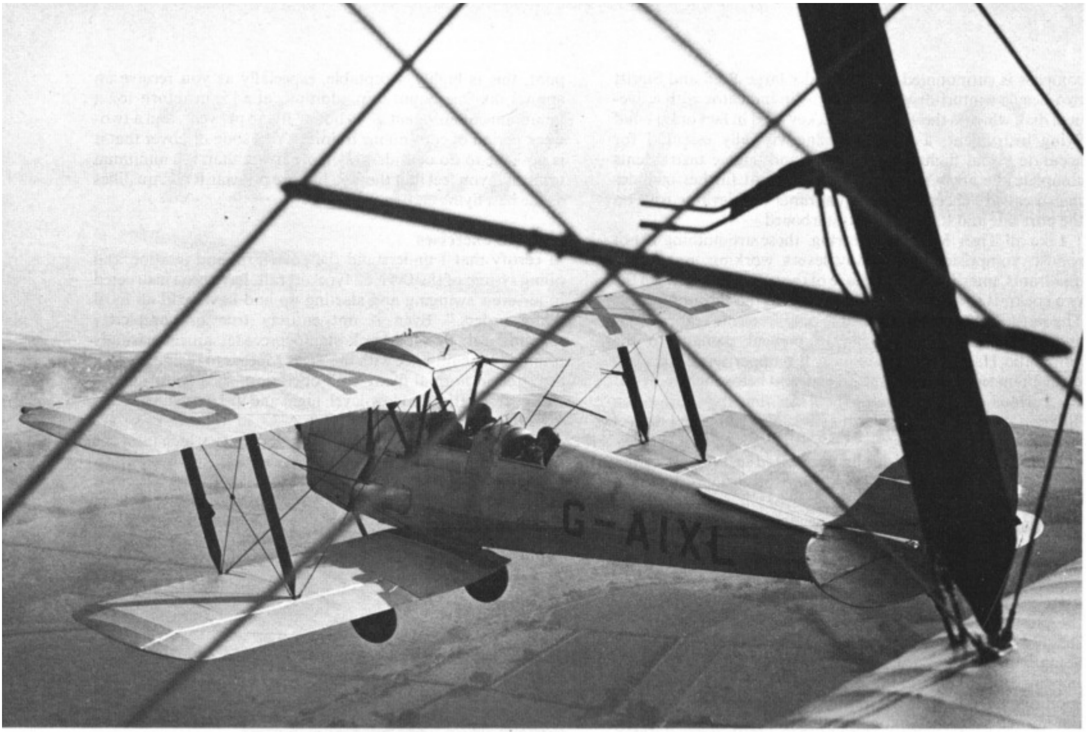
After the ordeal of scraping together enough money to gain a civil licence, the idea of actually being paid to receive superlative training is, to say the least, refreshing. The RAFVR is a seven-day per week operation, and you are free to fly at any time, receiving a full day's pay, according to rank, for an eight-hour stint, including ground training. Even as a cadet pilot, this is highly acceptable, especially as you receive an annual tax-free bounty, in addition, of £35, in return for a minimum commitment of 40 hours' flying per year, and a two-week period of continuous training. You soon discover that it is possible to do considerably more flying than the minimum total, and you feel that the VR, like the pre-war RAF, qualifies as the best flying club in the world.

Unusual exercises

"I certify that I understand the petrol, oil and ignition and oiling system of the D.H. 82 type aircraft, have been instructed in airscrew swinging and starting up and have read all local flying orders." Even if not entirely true or completely grammatical, this log-book stamp precedes an increasingly intimate acquaintance with the Tiger Moth into realms seldom explored in normal flying club operation, such as formation flying, aerobatics and low-level, night and instrument training.

Initial exercises — Nos 12 and 13 in the book — are concerned mainly with take-offs and landings, which offer the quickest acquaintance with the idiosyncracies of any aircraft. Instead of Gosport tubes, we now have the luxury of electric intercom, but this involves wearing an oxygen mask (without

(Above and below) A Tiger Moth in RAF standard training configuration in 1940, showing the absence of anti-spin strakes, and the gas detection diamond on the fuselage forward of the fin. Note the Handley Page slats on the upper wing, seen here in the closed position, and the large ailerons on the lower mainplanes, which were not particularly effective at large angles of deflection and low airspeeds. The heading illustration, opposite, shows a Tiger Moth at an RAF Initial Training Wing.



You can "almost hear the wind in the wires" remarks the author about this photograph of a civilian Tiger Moth (post-war, following RAF service). The anti-spin strakes are also shown here to advantage.

tubes), to provide a microphone, as well as headphones on our leather helmets. It hisses and crackles, but is just about readable above the battering roar of engine and slipstream.

Release all 130 horses of the Gipsy Major to 2,100 rpm with the silver-knobbed throttle lever on the port cockpit wall, and the broad wings press against the wind, the slats edging open to clutch at the sky. Straight-arm the long stick forward to raise the tail, taking care not to overdo it. There is little ground clearance, and it is only too easy, as I later observe, to dig the propeller tips into the turf and somersault the Tiger over on to its back. Stop the nose from wandering across the horizon with a touch of left rudder and complete the transition from earth to sky with a touch of aft stick.

Floating draughtily away at 55 knots (102 km/h), the Tiger immediately imparts its unique personality to its pilot — a peculiar combination of knife-edge stability and control, especially laterally and directionally — which calls for constant attention and correction in the slightest turbulence for the flying precision required. In the RAFVR, you soon learn that 55 knots does not mean 54 or 56 knots (100 or 103 km/h), while deft footwork is certainly needed to nail the long top needle of the turn and slip indicator to the centre, and

A post-war photograph of a Tiger Moth in RAF markings (silver finish with day-glo bands), serving with No 227 Operational Conversion Unit, principally for the training of Army Air Corps pilots.

especially so in turns.

Like all de Havilland aeroplanes of the 1930s, the Tiger Moth is somewhat short of vertical fin area and directional stability. Application of the non-Frise and wide-chord ailerons on the lower mainplanes also results in generous amounts of adverse yaw, despite their differential action, calling for further and carefully co-ordinated use of the sensitive rudder.

This requirement for accurate flying was one of the main reasons why the Tiger emerged as the classic trainer of the tailwheel era, although by current standards, its handling has many shortcomings. In the cruise, these become less apparent when, at the normal economical setting of about 1,950 rpm and 75 knots (139 km/h), using about 7½ Imp gal (34 litres) of fuel per hour, control harmonisation and stability are at their best. Cross-countries become an enjoyable adventure, particularly the RAF low-level exercises (No 27) at an official minimum of 250 ft (76 m).

Getting the Tiger Moth back on the ground, however, is something else again, and achieving a daisy-cutting three-pointer is an elusive goal that can make your whole day. You learn the importance of an accurate approach — engine-off, of course, as standard — with the aircraft trimmed precisely to 55 knots (102 km/h), slats unlocked, and the Gipsy burbling round at about 550 rpm. In pre-flap days, almost infinite glide-path control is available through crossing the controls and side-slipping, the rudder being powerful enough to counter full aileron for extreme slip angles and very high rates of descent, maintaining about 60 knots (111 km/h) on the ASI.

Over the threshold, take care to rudder out all drift and be prepared to work hard, while peering round the windscreen to assess final height during the landing flare, to get the stick fully back and stall the aircraft on to the ground from a height of a few inches. The Tiger has a fairly steep ground angle and unless you achieve full aft stick immediately before ground contact, the sweet bliss of a rumbling three-pointer will give way to divergent kangaroo-hops across the airfield. The rubber-in-compression springing and low-pressure tyres have relatively low rebound ratios, but finesse is still required to achieve even a tidy arrival.

We are also taught precautionary landings, dragging the Tiger in with power at 50 knots (92,6 km/h). Nose-high, forward view is even more restricted, and still more precise judgement is needed to lower the aircraft carefully to the ground with the throttle, for minimum ground run. Final exercises in the circuit are wheel landings — difficult with the lightly loaded Tiger — from a glide approach at about 60 knots (111 km/h), flying on in the level attitude, and easing the stick progressively forward after touch-down to avoid bouncing. The only possible technique in an inescapable cross-wind, but watch directional control as the tail comes down.

Stalls and spins

Upper-air work, which means about 5,000 ft (1 525 m) in the Tiger Moth, starts with stalling and spinning, as a prelude to aerobatics. Power-off stalls with slats unlocked see the airspeed falling below about 40 knots (74 km/h) IAS, and at this point you learn the use of rudder as primary lateral control in the absence of aileron effectiveness, and to avoid stalling one wing. Spinning involves locking the slats, with a very slight sharpening and increase in speed of the stall, and is great fun in a Tiger. As the long nose comes slowly up and the speed falls back towards the 40 knot (74 km/h) mark, you anticipate the stall as the controls go soggy and boot in full rudder while clutching the stick back into your stomach. Either way, the Tiger spins cleanly and tightly, with immediate response to opposite rudder and progressive forward stick, and moderate loss of height — no more than two or three hundred feet — per turn. It is also quite easy to demonstrate the classic situation of spinning off a turn by crossing the controls and allowing the airspeed to decay — worth keeping in mind to avoid in the circuit.

All post-war Tigers have upper fuselage strakes extending forward of the tailplane, but opinions differ as to their value. They were added early on in World War II when a few rogue Tigers displayed less predictable spin recovery characteristics than normal, but these were attributed to the installation of underwing practice bomb-racks and other warlike accoutrements which altered the moments of inertia. The strakes have been standard ever since — except on Dutch Tiger Moths, which added a large and unattractive angular dorsal fin — but there are doubts among some *aficionados* that they are still necessary.

A final check before aerobatics is Exercise 21 — flown dual, and with some apprehension, since it is concerned with re-starting the engine in flight. This is another anachronism of the biplane age and is no longer taught, so far as I am aware, but provides a memorable and useful experience. First pick a field to force-land, just in case, and at a safe height pull up into a stall, with the engine throttled back, and finally switched off. Some persistence is required to stop the prop windmilling by achieving minimum airspeeds, but eventually all is quiet except

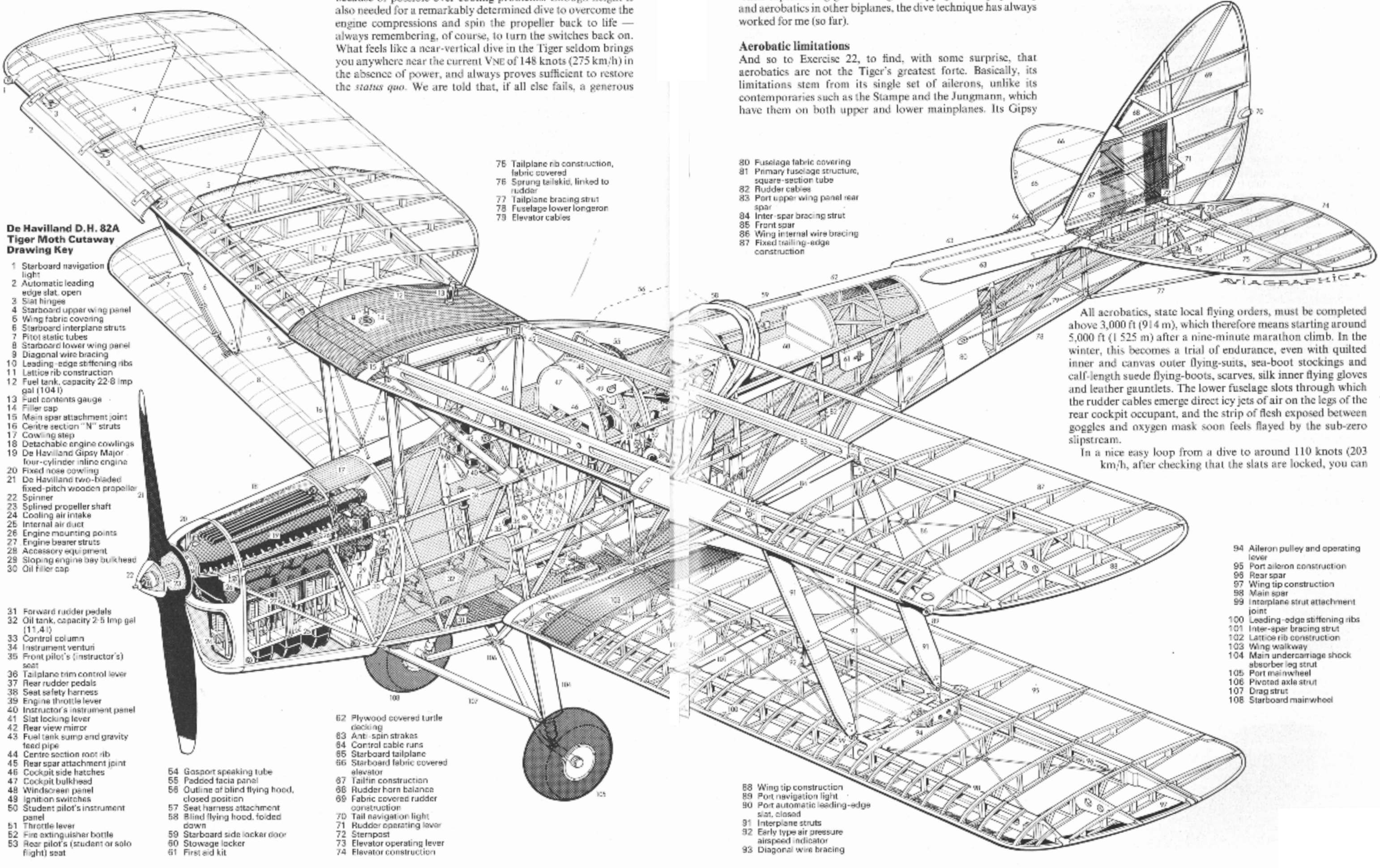
A Tiger Moth II photographed by the author in 1949 at which time it was serving with No 17 RFS, Hornchurch. Note the folded blind-flying hood behind the rear cockpit.

for the wind in the wires as down you float behind the stiff and stationary blades.

Apart from the height lost, which is not excessive, it is not recommended to continue gliding engine-off for too long because of possible over-cooling problems. Enough height is also needed for a remarkably determined dive to overcome the engine compressions and spin the propeller back to life — always remembering, of course, to turn the switches back on. What feels like a near-vertical dive in the Tiger seldom brings you anywhere near the current VNE of 148 knots (275 km/h) in the absence of power, and always proves sufficient to restore the *status quo*. We are told that, if all else fails, a generous application of g by a sharp pull-out will usually start the propeller windmilling again, but on subsequent occasions when experiencing genuine engine stoppage during spinning and aerobatics in other biplanes, the dive technique has always worked for me (so far).

Aerobatic limitations

And so to Exercise 22, to find, with some surprise, that aerobatics are not the Tiger's greatest forte. Basically, its limitations stem from its single set of ailerons, unlike its contemporaries such as the Stampe and the Jungmann, which have them on both upper and lower mainplanes. Its Gipsy Major also normally has no provision for inverted operation, so its repertoire is confined mainly to positive g manoeuvres.



De Havilland D.H. 82A Tiger Moth Cutaway Drawing Key

1 Starboard navigation light
2 Automatic leading edge slat, open
3 Slat hinges
4 Starboard upper wing panel
5 Wing fabric covering
6 Starboard interplane struts
7 Pitot static tubes
8 Starboard lower wing panel
9 Diagonal wire bracing
10 Leading-edge stiffening ribs
11 Lattice rib construction
12 Fuel tank, capacity 22·8 Imp gal (104 l)
13 Fuel contents gauge
14 Filler cap
15 Main spar attachment joint
16 Centre section "N" struts
17 Cowling step
18 Detachable engine cowlings
19 De Havilland Gipsy Major four-cylinder inline engine
20 Fixed nose cowling
21 De Havilland two-bladed fixed-pitch wooden propeller
22 Spinner
23 Splined propeller shaft
24 Cooling air intake
25 Internal air duct
26 Engine mounting points
27 Engine bearer struts
28 Accessory equipment
29 Sloping engine bay bulkhead
30 Oil filler cap
31 Forward rudder pedals
32 Oil tank, capacity 2·5 Imp gal (11,4 l)
33 Control column
34 Instrument venturi
35 Front pilot's (instructor's) seat
36 Tailplane trim control lever
37 Rear rudder pedals
38 Seat safety harness
39 Engine throttle lever
40 Instructor's instrument panel
41 Slat locking lever
42 Rear view mirror
43 Fuel tank sump and gravity feed pipe
44 Centre section root rib
45 Rear spar attachment joint
46 Cockpit side hatches
47 Cockpit bulkhead
48 Windscreen panel
49 Ignition switches
50 Student pilot's instrument panel
51 Throttle lever
52 Fire extinguisher bottle
53 Rear pilot's (student or solo flight) seat
54 Gosport speaking tube
55 Padded facia panel
56 Outline of blind flying hood, closed position
57 Seat harness attachment
58 Blind flying hood, folded down
59 Starboard side locker door
60 Stowage locker
61 First aid kit
62 Plywood covered turtle decking
63 Anti-spin strakes
64 Control cable runs
65 Starboard tailplane
66 Starboard fabric covered elevator
67 Tailfin construction
68 Rudder horn balance
69 Fabric covered rudder construction
70 Tail navigation light
71 Rudder operating lever
72 Sternpost
73 Elevator operating lever
74 Elevator construction
75 Tailplane rib construction, fabric covered
76 Sprung tailskid, linked to rudder
77 Tailplane bracing strut
78 Fuselage lower longeron
79 Elevator cables
80 Fuselage fabric covering
81 Primary fuselage structure, square-section tube
82 Rudder cables
83 Port upper wing panel rear spar
84 Inter-spar bracing strut
85 Front spar
86 Wing internal wire bracing
87 Fixed trailing-edge construction
88 Wing tip construction
89 Port navigation light
90 Port automatic leading-edge slat, closed
91 Interplane struts
92 Early type air pressure airspeed indicator
93 Diagonal wire bracing
94 Aileron pulley and operating lever
95 Port aileron construction
96 Rear spar
97 Wing tip construction
98 Main spar
99 Interplane strut attachment joint
100 Leading-edge stiffening ribs
101 Inter-spar bracing strut
102 Lattice rib construction
103 Wing walkway
104 Main undercarriage shock absorber leg strut
105 Port mainwheel
106 Pivoted axle strut
107 Drag strut
108 Starboard mainwheel

All aerobatics, state local flying orders, must be completed above 3,000 ft (914 m), which therefore means starting around 5,000 ft (1 525 m) after a nine-minute marathon climb. In the winter, this becomes a trial of endurance, even with quilted inner and canvas outer flying-suits, sea-boot stockings and calf-length suede flying-boots, scarves, silk inner flying gloves and leather gauntlets. The lower fuselage slots through which the rudder cables emerge direct icy jets of air on the legs of the rear cockpit occupant, and the strip of flesh exposed between goggles and oxygen mask soon feels flayed by the sub-zero slipstream.

In a nice easy loop from a dive to around 110 knots (203 km/h, after checking that the slats are locked, you can pull the Tiger round as tight as you like to thump your own slipstream at the bottom. There is also plenty of rudder authority for full-blooded stall turns in either direction, but rolling manoeuvres are another thing altogether. At small angles of deflection, from a starting speed of around 105 knots (194 km/h), the ailerons are quite light and effective, but with full stick deflection in a slow roll, they become heavy and start running out of steam as the Tiger becomes inverted and speed falls off with the loss of power and application of forward stick.

Considerable skills (and, preferably, anthropoidally-long arms) are required to maintain sufficient aileron to achieve a constant rate of roll, and it is only too easy to dish out in the latter stages. Unforgettable, too, your first experience of negative *g*, when no matter how tightly you are strapped in, you leave your seat and seem to hang half-way out of the cockpit, your feet also falling off the rudder pedals, with nothing but thin, cold air between your helmeted head and the unyielding ground 5,000 ft (1 525 m) below. Total discomfort in this situation is assured in the Tiger by the stream of petrol which vents unerringly into the face of the rear-seat occupant from the centre-section fuel tank when inverted.

This you invariably experience during rolls off the top of a half-loop from entry at about 120 knots (222 km/h), together with the usual aileron limitations and power loss when inverted. Despite all these difficulties, however, the Tiger is capable of a graceful aerobatic routine in the hands of skilful, experienced and dedicated pilots, as proved in the past by such masters as Geoffrey Tyson, Neville Browning and C A Nepean Bishop.

Under the hood

Exercise 15: Instrument Flying. Behind the rear cockpit of the RFS Tiger Moths is a curious affair of bungee-sprung green canvas which can be extended over its metal hoops to engage with a hook in the centre of the windscreen arch to form an instrument flying hood. The resultant ill-lit interior is not recommended to sufferers from claustrophobia, but provides an effective environment in which to learn the art of blind flying on (very) basic instruments.

In the pre-directional gyro and artificial horizon days represented by the Tiger, the Reid and Sigrist turn-and-slip indicator is the primary reference for lateral and directional attitudes, through the bottom and top needles, respectively. You are already only too familiar with the fancy footwork needed to keep the top needle in the middle in visual flight, and as the rate of turn indicator, the lower needle provides some reference as to bank angles, in conjunction with the airspeed indicator and big bowl compass.

There are complications, of course, with the latter from turning and acceleration errors, particularly on northerly and southerly headings, that a directional gyro never knew, but, with practice, it is surprising what can be done with such basic references. For pitch information, you are dependent on the airspeed indicator, although this can be deceptive on occasions, and suffers from a certain amount of lag. This results, from time to time, in some interesting manoeuvres when attempting to recover from instructor-induced "unusual attitudes" under the hood.

These include spin recovery on primary instruments, which is a pressing invitation to vertigo and air-sickness if you are that way inclined. A spin is fairly easy to identify on instruments since the needles stay in line, although way off centre, and the ASI remains steady at a bit above the normal stalling speed. The bottom needle is centred, unusually, by rudder in the direction of its displacement, and the wings are then held level by maintaining the turn needle in the middle. All controls are neutralised before easing out of the ensuing dive, remembering to relax back pressure on the stick momentarily if excessive *g* causes the bottom needle to precess into a sudden maximum rate turn indication.

The attention paid to instrument flying by the RAF in the 1950s to become an "all-weather air force" is reflected in our VR training, and we spend many weary hours under the hood. A grand finale is to fly a complete cross-country triangle from take-off back to the airfield on instruments and by stop-watch, accompanied by an instructor as safety pilot.

After a quick visual circuit to spin-up the venturi-driven turn and slip indicator gyro, and being pointed into wind, a completely blind take-off in the Tiger Moth presents an interesting challenge in concentration, mainly in keeping the top needle precisely centred with the rudder and the compass needle between the lubber lines. After an hour or so under the hood, in a marginally-stable lightly-loaded biplane, especially in thermic conditions in the summer, the relief on being told from the front that you can emerge into daylight to find yourself in the Hornchurch circuit has to be experienced to be believed.

Alas, like the Reserve Flying Schools, historic Hornchurch and its associations as Sutton's Farm landing ground dating back to WWI, has long since gone. Its three hangars, watch office and buildings erased from existence as if they had never been; its smooth green sward encroached upon by the ever-expanding suburban sprawl, defaced by rubbish tips and torn up for gravel. Fortunately, however, the Tiger Moth lives on, although in dwindling numbers, lovingly preserved and carefully flown, imparting biplane skills to a new generation of lightplane pilots. Long may it continue to do so, for it is the embodiment of much of our flying heritage. □

(Above left) Dutch airworthiness authorities required Tiger Moths to be fitted with massive and unsightly dorsal fin extensions in place of the anti-spin strakes on the fuselage. They provided a major improvement in directional stability. (Below) Most of the post-war RAF Tiger Moths finished up in the hands of Rollason at Croydon in the mid-'fifties, after demobilisation. Large numbers were disposed of for about £5-£25 each to civilian operators. A rebuilt Tiger Moth today will fetch anything up to £20,000.

THE D.H. " TIGER MOTH "

Manufacturers: The De Havilland Aircraft Co. Ltd., Hatfield, Herts. Also several Canadian factories.

Purpose: Two-seater " ab-initio " trainer.

Origin and Development: Prototype appeared in 1931. First batches of production machines delivered to supplement Tomtits, etc., in 1932. Early versions had 120 h.p. Gipsy III motor. Large-scale production commenced with inauguration of Expansion Scheme.

Power Plant: One De Havilland Gipsy-Major motor. Maximum power, 130 h.p. at 2,350 r.p.m. Cruising, 120 h.p. at 2,100 r.p.m.

Construction: Wings—Spruce spars and ribs, fabric covering. Fuselage—Steel tube framework, fabric covering. Welded joints. Tail unit—Wood frame, fabric covering.

Dimensions: Span, 29 ft. 4 in. Length, 23 ft. 11 in. Height, 8 ft. 9½ in.

Areas: Wings, 239 sq. ft.

Weights: Empty, 1,115 lb. Loaded (Aerobatic C. of A.), 1,770 lb. (Normal C. of A.), 1,825 lb. Crew, 320 lb. Fuel, 146 lb. Oil, 20 lb.

Performance: Maximum speed, 109 m.p.h. at 1,000 ft. Cruising, 93 m.p.h. Speed at 5,000 ft., 105 m.p.h. Landing speed, 46·5 m.p.h. Initial climb, 673 ft./min. Service ceiling, 13,600 ft. Take-off run, 156 yards. Landing run, 133 yards. Fuel consumption, 6 gallons/hour. Range, 302 miles.

Loadings: Wing, 7·64 lb./sq. ft. Power, 15·2 lb./h.p.

Tankage: Fuel, 19 gallons. Oil, 2 gallons.

Remarks: The Tiger Moth is the last of a long line of two-seat open cockpit Moths, commencing with the Cirrus Moth in 1925, developing through the Gipsy and Moth Major designs. It was used by nearly every civil flying club in Great Britain before the outbreak of war, as well as by some twenty-five foreign governments. The Canadian version has a sliding cockpit canopy and may be fitted with skis. Floats may be fitted. " Queen Bee " wireless-controlled aircraft is modified Tiger Moth.

Photo by courtesy of " The Aeroplane."

Two standard colour schemes are at present in use on the Tiger Moths. In all cases the upper surfaces of wings and tail-plane are shadow-shaded light earth and dark green, but while some machines have only the decking of the fuselage camouflaged, the rest have the fuselage camouflaged on top and something more than half-way down the sides. The cowling is included in all schemes, and is not left silver, as in earlier days. The balance of fuselage sides and belly, and undersides of wings and tail-plane, are painted training yellow. The rudder and fin are sometimes left yellow, but are camouflaged on some machines. The first machines to be camouflaged had the top sides of wing tips yellow.

Red and blue cockades are carried above the wings, and red, white and blue below. Red, white and blue cockades are also carried on the fuselage sides. When the major part of the fuselage is camouflaged the upper half of the cockade is outlined in yellow. Red, white and blue vertical stripes are painted on fin.

A serial number is painted beneath the wings and on the sides of the fuselage. One of the later production machines has the number R 5130. Large identification numbers are generally painted on the fuselage beneath the rear cockpit. At one Reserve School a machine carried the number " 56 " in red, and had the serial number N 9181. Certain Tigers in service use, previously owned by civil clubs, still retain the civil registration letters on the fuselage sides in addition to R.A.F. markings.

The first Tiger Moths delivered to the newly-formed Elementary and Reserve Schools were painted all-yellow, except for the cowling, which was all-aluminium finish. Cockades on wings and fuselage were red, white and blue. A serial number such as L 6923 was painted on fuselage, rudder and beneath wings. This particular machine had the identification number " 20 " on the cowling, which happened to be yellow like the rest of the machine.

A very early batch of Tigers, built to an order of 1931, were painted all-silver and had red, white and blue stripes on the rudder. The serial number of one of these early versions was K 2567. Some were delivered to the special Aerobatic Flight at C.F.S. and had red and white dicing on top wing.

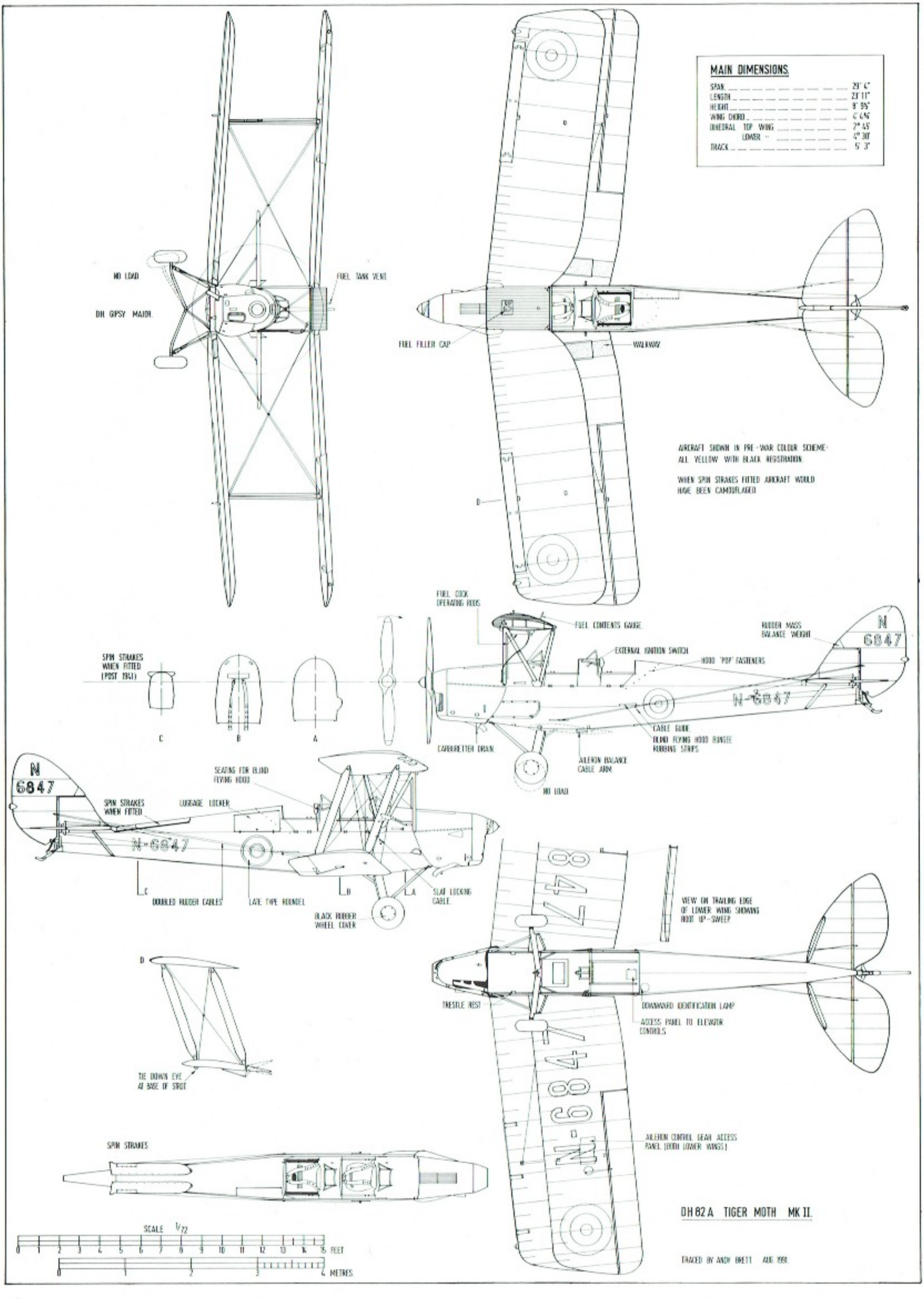
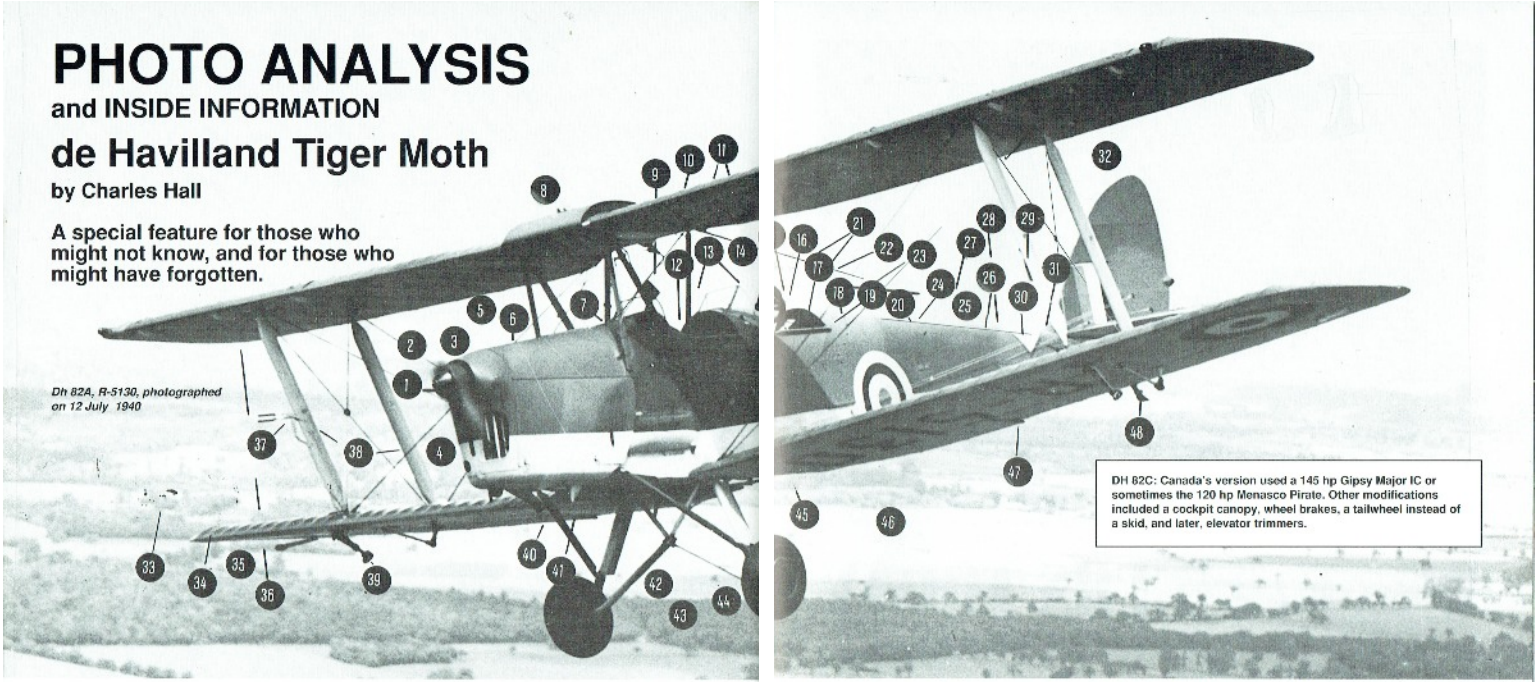

MAIN DIMENSIONS.
SPAN 29' 4"
LENGTH 23' 11"
HEIGHT 8' 9½"
WING CHORD 4' 4⅝"
DIHEDRAL TOP WING 2° 45'
LOWER " 4° 30'
TRACK 5' 3"
NO LOAD
DH GIPSY MAJOR
FUEL TANK VENT
FUEL FILLER CAP
WALKWAY
AIRCRAFT SHOWN IN PRE-WAR COLOUR SCHEME - ALL YELLOW WITH BLACK REGISTRATION.
WHEN SPIN STRAKES FITTED AIRCRAFT WOULD HAVE BEEN CAMOUFLAGED.
FUEL COCK OPERATING RODS
FUEL CONTENTS GAUGE
RUDDER MASS BALANCE WEIGHT
EXTERNAL IGNITION SWITCH
HOOD 'POP' FASTENERS
SPIN STRAKES WHEN FITTED (POST 1941)
CARBURETTER DRAIN
CABLE GUIDE
BLIND FLYING HOOD BUNGEE RUBBING STRIPS
AILERON BALANCE CABLE ARM
N 6847
N-6847
SEATING FOR BLIND FLYING HOOD
LUGGAGE LOCKER
SPIN STRAKES WHEN FITTED
DOUBLED RUDDER CABLES
LATE TYPE ROUNDEL
BLACK RUBBER WHEEL COVER
SLAT LOCKING CABLE
VIEW ON TRAILING EDGE OF LOWER WING SHOWING ROOT UP-SWEEP
TRESTLE REST
DOWNWARD IDENTIFICATION LAMP
ACCESS PANEL TO ELEVATOR CONTROLS
TIE DOWN EYE AT BASE OF STRUT
SPIN STRAKES
AILERON CONTROL GEAR ACCESS PANEL (BOTH LOWER WINGS)
SCALE 1/72
FEET
METRES
DH 82 A TIGER MOTH MK II.
TRACED BY ANDY BRETT AUG 1991.

PHOTO ANALYSIS
and INSIDE INFORMATION
de Havilland Tiger Moth
by Charles Hall

A special feature for those who might not know, and for those who might have forgotten.



Dh 82A, R-5130, photographed on 12 July 1940

DH 82C: Canada's version used a 145 hp Gipsy Major IC or sometimes the 120 hp Menasco Pirate. Other modifications included a cockpit canopy, wheel brakes, a tailwheel instead of a skid, and later, elevator trimmers.

October 26 this year will mark the 60th anniversary of the first flight of the Tiger Moth. Around 9000 examples were built, many hundreds of which are still airworthy today. At one time, 40 aircraft a week were leaving the Stag Lane factory. 19 four-seat Jackaroo conversions were made, although many of these reverted to normal configuration afterwards.

1 Spinner, spun from aluminium, attached to hub of propeller.

2 Wooden prop. fixed pitch, carved from laminated mahogany.

3 Nose cowling fixed to airframe.

4 Cooling air intake, exits through bottom of rear cowling.

5 de Havilland Gipsy Major, four cylinder in-line engine producing 130 hp Each cylinder is of 1,530 ccs volume. Engine inverted from original Moth style to improve pilot view over the nose.

6 Top and side panels detachable.

7 Behind top panel, strengthened corrugated step for use during refuelling.

8 Fuel in corrugated tank 19 Imp.gals. Filler cap at front, contents gauge at rear. Fuel is fed by gravity via metal tube to carburettor. No fuel pump in system although a special type can be fitted for prolonged inverted flight.

9 Oil tank for 2.5 gallons, lower fuselage side. Hot oil is cooled by airflow.

10 Engine firewall slopes forward at base to provide space for rudder bar.

11 Control columns are no-nonsense simple poles with a handgrip. Known to become extremely slippery because of sweating pupil palms. Sensible pilots always wear gloves. Open cockpits are likely to produce a tiny hand which is frozen.

12 Front compartment would be occupied by instructor during training flights. "Gosport-tube" allowed instructor to give advice, (shout comments), to pupil in rear seat. Pupil also had similar mouthpiece, but less vitriolic comments emanated from this end.

13 Shaped seats made from aluminium pressing with hollow to accommodate seat-type parachute. Dual controls and instruments in both cockpits.

14 Rear rudder pedals on either side of front seat.

15 "Sutton Harness": two shoulder straps, two lap straps. Metal fittings with holes overlap, steel peg pushed through to latch assembly.

16 Throttle on left side in each cockpit, tailplane trim control lever below.

17 Pupil's seat, no more comfortable than that of instructor. When flown solo, pilot always occupies rear seat because of centre of gravity limitations.

18 Collapsible blind-flying hood could be added to rear cockpit. This totally suffocating, claustrophobic torture-chamber obscured the outside world so that the pupil was forced to fly purely by reference to his instruments. Up until this time, most learners would have been accused of "clock-watching". i.e. using his ASI, (airspeed indicator), instead of the horizon.

19 Cockpit side doors, front and rear, both sides, fold downwards. Small spring fasteners latch doors when closed. Tigers can be flown quite happily with these doors open, although this naturally increases the draught.

20 Stowage locker, sufficient for overnight bag, tie-down ropes in case of unexpected precautionary landing.

21 (In shadow), ignition switches outside, below both windscreens. Two levers, one for each magneto. Note:These switches are visible to the one who swings the prop. so that he can check that when told that the switches are "off", this is really true. These are the well known switches which are referred to when we hear the shout of "Contact !"

22 Top of fascia padded to soften the blow in the event of a nose-over after landing. (Originally leather-covered horsehair, later Dunlopillo.)

23 Fire extinguisher in rear cockpit.

24 First aid kit inside break-in panel on port side.

25 Primary fuselage structure made from square-section metal tubes with welded joints. 1 inch section T.45 steel.

26 Plywood covered turtle-deck of DH 82A. (Earlier DH 82 was topped with fabric-covered stringers instead of wood.)

27 Duplicated cables run direct from rudder pedals to connections either side of rudder. Exit points through fuselage protected by double-fabric patches over cut-outs and leather sew-ons.

28 Single cables connect to operating levels above and below elevators. These also exit through fuselage sides.

29 All lower fuselage fabric covered, red doped, followed by primer and camouflage of brown and green with trainer yellow underneath.

30 Warfare-gas detection panel, dull yellow. After landing, pilot was expected to see if it had changed colour.If so, he was to take off again and try his luck elsewhere.

31 Anti-spin strakes. Introduced in late 1940, therefore NOT added to R5130. Flat plates were added as forward extensions of the tailplane. Early versions were reluctant to recover from spins, but the extra horizontal surface provided a marked increase in salvation.

32 Typical DH curved fin and rudder, wood with fabric covering.

33 Wings staggered, (upper wing ahead of lower), provides better downward view for front pilot.

34 Early tests showed that the wingtips dragged on long grass when taxiing. A simple remedy was to saw a few inches off the struts and reassemble.

35 Ailerons on lower wings only, with mass balance weights.

36 Slats on upper wings. They open automatically as wing angle of attack reaches stalling point. Airflow is then deflected back over top surface to maintain control. Slats operate independently, so one might stay closed. Lever in cockpit to lock slats in closed position for certain aerobatics.

37 Pitot tube airspeed indicator.

38 Wooden interplane struts with metal end fittings. Some used hollow, metal streamlined tubes, (Canadian version.)

39 Flare tubes for night landings under tips. Operated by use of batteries in front cockpit.

40 Rear view mirror attached to diagonal of left centre section strut. This allowed the instructor to observe the changing colours of the student's face during aerobatics.

41 Exit in emergency considered to be too restricted for a service trainer. Top centre-section, containing fuel tank moved forward to allow free escape from front cockpit. Wings were then modified to have sweepback towards the tips, as that the centre of gravity remained at the original design position. At the same time, the rear lift wire was transferred to forward anchorage to allow free access to and from front seat.

42 Undercarriage struts made from hollow steel tubes with aluminium streamlined covering. Legs provide telescopic, spring-dampened vertical travel. Diagonal components are bent outwards to make horizontal wheel axles. Inter-section of 'X' allows slight pivot action when legs are compressed at touchdown. Drag struts prevent rearwards travel of gear.

43 Dunlop low pressure tyres, (700 x 7.5).

44 No brakes on standard Tiger.

45 Wing walkways of black, non-slip material over strengthened areas next to fuselage.

46 Wings of wooden construction based on main and rear spars with ribs spaced at regular intervals of approximately 18 inches. Intermediate nose ribs between main ribs to reinforce leading edge. Structure is braced internally by metal tubes, fore and aft. Cross bracing wires run diagonally between spars. All ribs are identical with no taper or change of chord, apart from extreme ends.

47 Speed indicator attached to strut as in ancient times. Simple metal flange is pushed backwards by airflow, which moves past backplate marked with numbers to register speed in knots. Visible from both cockpits but could only be used during landing by cross-eyed pilots.

48 Sprung, steerable tailskid.