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**AIR PUBLICATION 1806A**

**PILOT'S NOTES – THE BUFFALO I AEROPLANE**

**WRIGHT CYCLONE GR. 1820 G. 105A ENGINE  
BAC/1. 41/BAC**

**Air Publication 1806A - Pilot's Notes**



### Notes on Formatting 1/23/02

The following is the text and general content of the Pilot's Notes for the Brewster Buffalo I, in service with the R.A.F. in the Far East. This is one of two (photocopied) versions from Brewster files available – my choice of which version was based on the fact that this version appeared to be the later of the two, and also because it is slightly lighter on diagrams (and thus download time!)

A couple of caveats – in general, the original format of text, often quirky and frequently inconsistent – has been retained. However, the original was a 6" x 8" pamphlet and this version has obviously been reformatted for 8 ½ x 11 size. Some items like the fuel and oil system diagrams have been combined onto one page instead of each having its own. Similarly, some listing (like the table of contents) were originally a single column eating up a number of pages – they've been changed into double columns to save space. The photos in the original photocopy were irreproducible. Fortunately, in the case of the cockpit photos, the originals were available, but instead of the circled-number-with-arrow system of identifying instruments and equipment, I've used number overlays. The introductory photo in the original was of Buffalo W8131's port side. That photo was not available so I've used a shot of the starboard side from the same photographic session.

Most of the text was scanned in but scanning glitches (especially where subparagraphs were involved) meant re-keyboarding. I've tried to insure that the original is reflected where possible, but one item has consistently proved impossible; my word processor program (thanks Mr. Gates!) resolutely changes the British spelling of 'c-e-n-t-r-e' to 'center' with nary an apology.

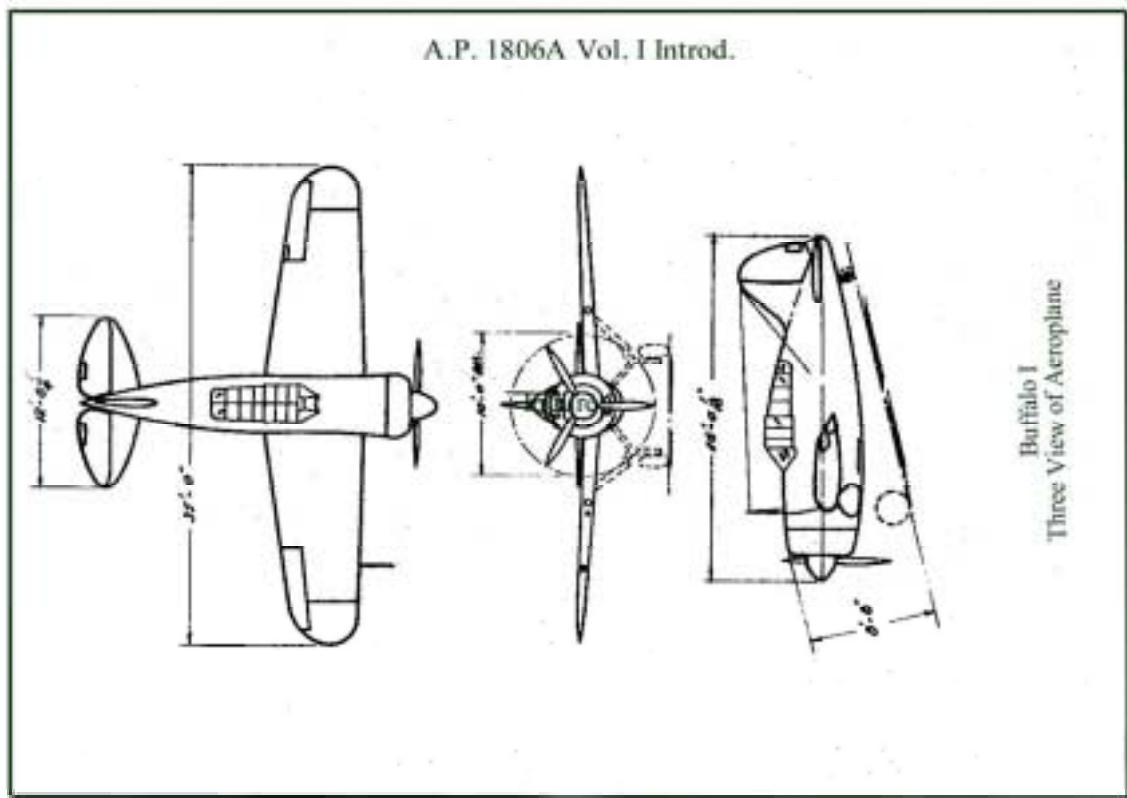
-- Jim Maas

To which I should add: in converting Jim's Word document to an Adobe PDF file, I had to make a few more formatting changes.

-- Dan Ford



**Figure 1**



**Figure 2**

## General Contents List

Introduction

Section 1 - Pilot's Controls and Equipment

Section 2 - Handling and Flying Notes for Pilot

A.P. 1806A Pilot's Notes Introd.

### INTRODUCTION

Note: This Introduction and Sections 1 and 2 are also issued separately as 'Pilot's Notes.'

1. The Buffalo I is a midwing, single seater, high speed aeroplane designed for day and night combat.
2. A Wright Cyclone GR1820 G105A 9 cylinder radial engine is mounted in the forward nose of the fuselage and drives a ten foot diameter, three-bladed Hamilton hydromatic airscrew.
3. The pilot is seated just forward of the approximate midpoint of the fuselage. He is protected from flame in the engine compartment by a fire wall which isolates him from the forward nose of the aeroplane. He is protected by armour plate from a cone of gun fire originating forward of the aeroplane. A sliding canopy constructed of transparent Plexiglas shelters his head and shoulders and permits him full view in all directions except downward. View in a downward direction is obtained through four Plexiglas windows mounted just under the pilot's knees. The pilot's seat support tubes are designed to carry a sheet of armour plate on the aft side.
4. Directly in front of the pilot is the main instrument panel. Slightly to his port side is an auxiliary panel which carries engine controls such as switches. Slightly to his starboard side is another auxiliary panel which mounts engine gauges.
5. A four-way control is incorporated in the heating system by means of which warm air, taken from a muff around the exhaust manifold, may be supplied to the cockpit, the windscreen or to the wing guns or shut off completely subject to the desire of the pilot. The pilot's seat is adjustable for up and down position by means of a simple lever control.
6. One section of the sliding canopy previously mentioned or the entire canopy may be jettisoned at the will of the pilot. This provides an exit in times of emergency and the opening thus made will be large enough to permit the pilot with parachute to leave the aeroplane. One panel section of the canopy may be detached in case of fogging of the windscreen.
7. The pilot's controls are of the conventional type, that is, an upright control column which actuates the elevators by a fore-and-aft motion of the column and actuates the ailerons by a side-to-side motion of the column. Rudder control is accomplished by a set of two pedals. Trimming is effected by four trim tabs, one of which is installed on the port aileron, one on the rudder, and two on the elevator. The three controls for these tabs are mounted on the port cockpit shelf near the pilot's elbow.
8. An oil cooler is mounted on the center line of the aeroplane directly under the engine compartment. An automatic valve by-passes the oil around the cooler until a temperature of 740C. is reached.
9. The main plane is constructed of a center box beam to which are attached nose and trailing edge ribs. A metal covering is fitted over the ribs and at the point of junction between the metal skin and the box beam the beam has been provided with machined offsets so that there is a continuous smooth exterior contour in a chordwise direction. Flush riveting is used on all exterior surfaces of the wing.

10. Fixed surfaces are constructed of full cantilever metal covered fabrication. Movable surfaces are fabric covered for lightness.
11. The aeroplane is provided with metal covered landing flaps. Outboard of these flaps are located the ailerons which are constructed of duraluminum ribs and stringers and which are covered with fabric.
12. A landing lamp is housed flush with the underside of each of the port and starboard main planes. These two lamps are fitted with controls so that the lamps may be swung down into approximately vertical position when landing or taking off.
13. A fuel tank is built into the beam of each main plane. The tanks are protected by armour plate on the forward face of the beam and by a covering of Linatex and horsehide leather on all sides of the tank so as to provide self sealing in case of puncture.
14. The tail plane is built as a separate unit which is bolted to the aft end of the fuselage. The surfaces of the tail plane are faired into the fuselage surfaces. The fixed surfaces of the tail plane are metal covered and the movable surfaces are fabric covered.
15. The undercarriage is hydraulically retractable and in retracted position fairs into the lower surface of the main plane and the fuselage. The wheels are rigidly fixed to the main shock strut which is hinged to the main plane at a point about one third the distance from the center line of the aeroplane to the plane tip. Tire main strut and wheel are raised and lowered by a retracting strut which reaches between the center of the aeroplane and the landing wheel and which jack-knives into a folded position.
16. A warning horn and lamp are provided to give aural and visual warning to the pilot whenever he throttles below 1200 RPM to make a landing without having his undercarriage down and locked in landing position.
17. The landing wheels are fitted with brakes which may be operated independently or simultaneously by the pilot. The controls for the brakes are located on the top of the rudder pedals.
18. The wireless equipment may be a transmitter receiver T.R.9D or T.R.1133A. A flare chute is located in the aft end of the fuselage and the release control for it is mounted in the cockpit. Two oxygen bottles, mounted in a wire mesh enclosure to prevent scattering of the bottle fragments if struck by a bullet, are mounted aft of the pilot and within reaching distance. An oxygen regulator and a mask are mounted on the starboard side of the cockpit convenient to the pilot.
19. A .50 caliber gun is mounted on both sides of the fuselage forward of the pilot and is designed to fire through the arc of the airscrew. Mechanism is provided so that the guns will not fire when the airscrew blade is within the muzzle blast of either gun.
20. A .50 caliber gun is mounted in the port and starboard main planes. Both of these guns fire forward through apertures in the leading edge of the plane. All four guns, the two fuselage guns and the two main plane guns, may be slightly adjusted horizontally and vertically for direction of fire.
21. Any combination of guns may be thrown into action by means of gun selector switches which are mounted on the electrical panel. The impulses are controlled by a button on the top of the control column.
22. A camera gun is located in the leading edge of the starboard plane and is also thrown into action by a selector switch on the electrical distribution panel and operated by the same control column button which governs the guns.
23. The electrical distribution panel which contains, besides the switches enumerated above, a bank of switches for the landing, navigational, identification and cockpit lamps, is located on the starboard side of the cockpit adjacent to the pilot.

**SECTION 1- PILOT'S CONTROLS AND EQUIPMENT**  
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## SECTION I - PILOT'S CONTROLS AND EQUIPMENT

### INTRODUCTION

1. This section gives the location and, where necessary, explains the function and operations of the controls and equipment in the pilot's cockpit. The layout of the various items mentioned is illustrated in Figures 1, 2, and 3.

### AEROPLANE CONTROLS

#### Control Locking

2. A parking harness to lock the control column is carried in the baggage compartment. It consists of a metal plate and four cables which run front the plate to the attachment points within the cockpit. The two forward attachment points are provided for in the form of lugs on the outboard side of the rudder pedals. The two aft attachment points are provided for in the form of two holes located at shoulder height in frame 76 which is just aft of the pilot's seat. One of the aft cables is provided with a turnbuckle assembly for adjustment and the other is provided with a catch assembly which permits ready release of the parking harness.

#### Elevator, Aileron and Rudder Controls

3. The elevators are operated by a push pull tube system, and stops are provided on the stick torque tube in the cockpit to prevent excessive deflection of the control.

4. The ailerons are also operated by a push pull tube system which is designed to give a positive independent control of the aileron on each side of the aeroplane. A differential movement of the ailerons is incorporated giving a movement of 26° up and 15° down. Aileron stops are provided on the stick torque tube in the cockpit.

5. The rudder is controlled by foot pedals. Extra flexible aircraft cables connect the pedals with the rudder. The pedals are adjustable for pilot leg reach by pressing inboard on the small discs which are mounted on the inboard side of the pedals. This releases a catch and the position of the pedals may be altered. Stops to limit rudder movement are located on the cables below and aft of the pilot's seat.

#### Trimming Tabs Control

6. General. All control surfaces except the starboard aileron are fitted with tabs. Control is accomplished by means of hand wheels located on the port cockpit shelf and connected with the control surface by means of chains, cables, flexible drive shafts and irreversible screws. The cockpit controls are plainly marked as to both function and direction of rotation which in every case is the same as the resultant motion of the aeroplane.

7. Elevator Trimming Tabs Control. The trimming tabs for the elevators are controlled by means of a hand wheel mounted vertically on the port cockpit shelf. Control is transmitted by chain, cable and screw. The direction of rotation of the hand wheel for "Nose Down" is forward and downward.

8. Rudder Trimming Tab Control. The trimming tab on the rudder is controlled by a hand wheel mounted horizontally just above the elevator tab control on the port cockpit shelf. When the wheel is rotated clockwise, the action of the tab tends to turn the nose of the aeroplane to starboard.

9. Aileron Trimming Tab Control. The trimming tab (provided for the port aileron only) is controlled from the hand wheel mounted vertically and athwartships, just above the rudder tab control hand wheel on the port cockpit shelf. When the wheel is rotated inboard, (clockwise), the action of the tab tends to push the starboard wing down.

## HYDRAULIC OR ELECTRICAL CONTROLS

### Undercarriage Controls (See Figure 4)

10. Normally, the undercarriage is raised by a double acting cylinder which is connected to the inboard undercarriage folding strut by lift struts. The operating lever, which controls the raising of the main undercarriage, is located at the starboard side of the cockpit on the hydraulic control valve and just forward of the flap control handle. The main undercarriage is held in the raised position by two locks. (Landing gear 'up-locks').

11. To lower the undercarriage the control lever must be placed at 'Down'. A small oleo cylinder will then disengage the hooks and the main cylinder will force the undercarriage downwards until it locks in the fully lowered position. When the red warning light goes out and the undercarriage position indicator shows that the undercarriage is fully lowered, pressure will start to build up in the hydraulic system (as indicated by the gauge on the starboard auxiliary panel). The control lever must then be returned to the 'Neutral' position. A safety latch on the aft side of the lever is provided so that the control lever cannot be pulled past the neutral position to the 'Up' position accidentally.

12. To raise the undercarriage the safety catch on the aft side of the control lever must be released and the control lever moved to 'Up'. A cable connected with the lever will mechanically release the lock holding the undercarriage in the extended position, and the hydraulic system will then retract the undercarriage.

13. Normally, the maximum pressure required for raising and lowering the undercarriage will be approximately 825 lb./sq. in. (For operation of the flaps approximately 600 lb./sq.in. will be required). The relief valve on the engine driven pump is set for approximately 1100 lb./sq.in. The hand pump is capable of creating a pressure of approximately 1800 lb./sq.in.

14. Undercarriage Position Indication. Three separate means for indicating the position of the undercarriage are provided, two visual and one aural. One of the visual indicators is installed on the main instrument panel and consists of a pointer which moves sideways on a track. One end of this track is marked 'Up' and the other 'Down'.

15. An electrically operated red jewel light is located on the port side of the main instrument panel. This lights when the engine is throttled below 1200 RPM and the undercarriage is not fully lowered and locked down, thus reminding the pilot that the landing preparations have not been completed. A momentary contact toggle switch, located on the electrical distribution panel outboard of the volt-ammeter, is provided to test the bulb in the warning light.

16. A vibrator horn is installed just aft of the pilot's head. This is arranged so that it blows when the engine is throttled below 1200 RPM and the undercarriage is not fully lowered and locked down.

### 17. Undercarriage Emergency Instructions.

- (i) If the engine fails, try the hand pump.
- (ii) If this does not lower the undercarriage and/or the control valve becomes inoperative in the 'Neutral' or 'Down' position –
- (iii) Open emergency valve wheel (blue and yellow wheel near hydraulic control valve) by turning counterclockwise and –
- (iv) Pull the emergency release handle under the starboard side of the main instrument panel. When the position indicator shows the undercarriage has dropped as far as it will go –
- (v) Pull the undercarriage emergency lock handle under the port side of the main instrument panel. Keep a strain on this handle until the warning light goes out, indicating that the undercarriage is locked in the 'Down' position.
- (vi) If control valve becomes inoperative in the 'Up' position, first cut the yellow cable just outboard of the hand pump with the pliers provided and perform operations (iii) through (v).



- (vii) To prevent loss of fluid be sure to close the emergency valve wheel mentioned in (iii) before further operation of the hydraulic system.

18. Tail Wheel Lock- The self-centering tail wheel swivel is equipped with a pin which is designed to lock the tail wheel in a trailing position. To release the tail wheel, the lever on the port cockpit shelf should be moved forward. In this position, the locking pin is withdrawn and the tail wheel becomes fully swiveling. The purpose of locking the tail wheel in the 'Trailing' position is to lessen the possibility of ground looping while landing. The tail wheel must be looked during landing and take-off and should be unlocked to facilitate taxiing and parking only.

19. Flaps Control- The flaps are controlled by a ball knob lever mounted on the hydraulic control valve located on the starboard side of the cockpit. To release the latch, the knob is pushed in.

20. To lower the flaps the lever must be swung to the 'Down' position. The flaps are operated by two hydraulic cylinders in each wing. When the flaps reach the desired 'Down' position, as shown by the visual indicator directly below the main instrument panel, the control lever must be returned to the 'Neutral' position.

21. To raise the flaps the flap control lever must be swung to the 'Up' position. This will allow the springs in the flap cylinder to raise the flaps. When the operation is completed, as is shown by the position of the flap indicator, the lever must be returned to the 'Neutral' position.

22. A hand pump is incorporated in the system which may be used in case of failure of the engine driven pump. To operate this pump, the flap or landing gear control valve levers should be placed in the desired position, and the hand pump lever which is located just forward of the valve control lever should be pumped fore-and-aft. This pump handle will have to be pulled up before pumping can take place.

## ENGINE CONTROLS AND EQUIPMENT

### Throttle and Mixture Controls

23. The throttle is incorporated in the engine quadrant on the port side of the cockpit. This is provided with a sea level stop and provision is made for automatically returning the mixture to 'Rich' when the throttle is closed.

24. The Chandler-Evans carburetor automatically compensates for the normal enrichening effect due to altitude when in low blower. The carburetor is equipped with a mixture control quadrant which will permit manual leaning. The quadrant is marked for Full Rich, Cruising Lean and Cut Off. For all operations above 630 H.P. in low blower and 542.5 H.P. in high blower the mixture control should be on Full Rich except where there is evidence of excessive richness, then manual leaning may be used for obtaining smooth engine operation. For all operations below 630 H.P. in low blower and 542.5 H.P. in high blower, the mixture control should be on Cruising Lean. Manual leaning should be consistent with smooth engine operation and cylinder temperature limits. Manual leaning is necessary to obtain the best performance for maximum speed in high blower.

### Fuel and Oil (See Figures 5 and 6)

25. Fuel System – This consists of two main tanks, one in each wing (built into the wing beam), an engine driven pump with a by-pass and relief valve, two hydraulic fuel quantity gauges with check valves, a fuel selector valve, and an emergency hand pump with a built-in relief valve.

26. Each wing tank holds 66.67 British Imperial Gallons of fuel. The starboard wing tank outlet is located several inches above the bottom of the tank leaving 20.83 British Imperial gallons of fuel which is available when the fuel valve is turned to 'Reserve'. A remote control for a four way selector valve is located on the port side of the cockpit. This control allows the pilot to shut off the fuel or to select fuel from the starboard or port tank or from the 'Reserve'. The pilot must not take off or land on the starboard tank.

27. Two hydraulic fuel quantity gauges and a calibration chart are mounted on the starboard auxiliary panel. In order to read the gauges, the fuel gauge pump handle must be pulled out and then released. The gauges are calibrated to read in the 'Tail on Ground' and 'Flight' condition.

28. The tanks are filled through openings in the leading edges of the wings just inboard of the outer undercarriage strut position.

29. The fuel pressure should run between 6 and 7 pounds.

30. Emergency Hand Fuel Pump - The lever which controls this pump is located on the inboard side of the port cockpit shelf just forward of the pilot. To operate the pump, the handle must be pulled up and moved in a fore-and-aft direction.

31. Oil System - An oil tank is mounted aft of the forward fuselage truss. The tank has a capacity of 9.17 British Imperial Gallons plus an additional foaming space which cannot be filled due to the position of the filler neck.

32. The oil system is provided with an automatic oil temperature control and a check valve attached to the bottom of the oil tank. These, in conjunction with the oil cooler, maintain the oil temperature at approximately 74° C.

33. The control valve causes the oil to by-pass the cooler when the temperature is below 74° C., directing the outlet oil from the engine back to the bottom of the oil tank in close proximity to the suction outlet. Consequently, the entire tank supply of oil is virtually by-passed when starting the engine. The check valve unit prevents the flow of oil from the tank inlet line to the engine scavenger pump when the engine is not in operation.

#### Slow Running Cutout Control

34. Placing the mixture control in the full forward position cuts off the fuel supply at low engine speeds for stopping the engine.

#### Engine Instruments

35. The engine instruments on the port auxiliary panel are as follows: tachometer, engine gauge unit, carburetor air intake indicator, ignition switch.

36. The engine instrument on the main panel is as follows: manifold pressure gauge.

37. The engine instrument on the center auxiliary panel is as follows: thermo-couple indicator for Number 2 cylinder head.

38. The engine instruments on the starboard auxiliary panel are as follows: hydraulic pressure gauge, fuel quantity gauges.

#### Engine Priming and Starting Equipment

39. The ignition switch is located on the port auxiliary panel. The positions of this switch are plainly marked ('Both', 'L', 'R', 'Off').

40. The primer pump is located on the starboard side of the main instrument panel. To prime, the knob must be turned to the left and the handle pulled out. When the engine is cold pump the control in and out about five full strokes and do not pump the throttle. When the engine is warm, prime only two strokes. When the engine is hot, do not prime, open the throttle about 3/4 of an inch.

41. The starter switch is located on the starboard side of the main instrument panel, just to the left of the priming pump. To operate the switch should be pushed in and held in this position for 15 sec. At the end of this time the

switch must be pulled full out to engage the engine. When the engine fires the switch should be released. It then will return to the neutral position.

### Supercharger Control

42. This control is incorporated in the engine quadrant on the port side of the cockpit. The lever should be pushed forward for high blower.

43. The engine is equipped with a two speed super-charger. Normally, the low blower will be used. The high blower can be used above 10,000 feet to obtain maximum speeds and rates of climb. The high blower shall not be used for cruising at altitudes at which cruising power is available in the low super-charger ratio as fuel economy is inferior and the tendency to detonate is greater. In using the high speed supercharger, the control shall be shifted at or above the altitude at which a maximum of 30.5 in. of mercury manifold pressure is obtained with full throttle and low blower ratio (approximately 11,000 ft. altitude without ram). In changing from one super-charger ratio to the other in either direction the engine shall be partly throttled to avoid rough engagement of the clutches. Changes should not be made more frequently than at five minute intervals so that the heat generated will have time to vanish. Changing from one gear ratio to another shall be done without any pausing in the 'Neutral' position. During the change in gear ratio a slight change in engine speed may be observed. This is normal for a two speed engine and has no detrimental effect.

44. The pitch control is located on the port side of the main instrument panel. When the pitch control handle is pushed to the extreme forward position, it places the airscrew in position for take-off. When pulled full out it places the airscrew in coarse pitch. In intermediate positions the control permits constant speed operation at selective RPM over the normal range of engine operation. The control is set so that for take-off in low blower and fine pitch the engine will turn at 2350 RPM and 43.5 inches of mercury manifold pressure.

### Carburetor Air Control

45. Warm air will be required only when outside air conditions are such that ice is forming on the wings. This warm air is obtained through a duct formed by the accessory cowl and which is provided with a valve. The valve is controlled by a push-pull knob located on the starboard side of the main instrument panel. The knob should be pushed forward for cold air. The air scoop is fitted with a thermometer bulb. The gauge is located on the port auxiliary panel. The engine should be run either 'Full Hot' or 'Full Cold'. Do not run in any intermediate position.

## HOOD, SEAT, ETC.

### Hood

46. The hood enclosure may be operated from inside or outside 'the aeroplane. A handle in the forward underside of the sliding enclosure can be pulled down in order to open or close the hood from inside. From outside the aeroplane, a disc on the starboard side of the aeroplane (in line with the forward edge of the windscreen) may be pressed in to release the hood catch. The enclosure may be latched in the closed position, 1½ inches open, 6 inches open, or fully open.

47. Emergency Exit: The sliding canopy is provided with a horizontal cable along its starboard side. In case of emergency this cable may be pulled, releasing the entire canopy. A handle and two pins are provided on the inside port side of the canopy by means of which a two panel length of the enclosure may be discarded. This leaves room for the pilot to leave the aeroplane. There is also a small knock-out panel incorporated in this removable panel which is just large enough for the pilot to get out his arm and clean the windscreen.

48. Seat: The seat is constructed to take an English type (Mark V safety harness) parachute, and is adjustable in a vertical direction. A lever on the starboard side of the seat can be pulled back and the seat then may be moved up or down into the desired position. A lever on the port side of the seat permits parachute adjustment for the pilot.

Shoulder straps on the parachute are anchored to lugs on the back of the seat. When the pilot wants to lean forward, he may partially release the shoulder straps by means of the lever. When he again leans back, the shoulder harness will automatically snap into position.

## ARMOUR

49. Protection of Pilot: Provision is made so that the pilot is protected by armour plate from a cone of fire originating forward of the aeroplane. Frame 19, just aft of the forward truss, and frame 39, in front of the main instrument panel, are both provided with armour plate, as is the side of the fuselage between stations 39 and 47. The back of the pilot's seat has provision for mounting a sheet of armour plate. The windscreen is provided with a panel of bullet-proof glass 1½ inches thick.

50. The fuel tanks are provided with armour plate along the wing front spar from the centerline of the aeroplane outboard to the end of the tanks. Both the fuel and oil tanks are self-sealing as they are covered with a combination of Linatex and horsehide leather.

## OPERATIONAL EQUIPMENT

51. Electrical Distribution Panel: This panel is located on the starboard cockpit shelf, and contains all the light switches, rheostats, and fuses. It also is fitted with a volt-ammeter, a battery on-and-off switch, and a container for spare bulbs and fuses. The fuses are accessible by means of a hinged cover. Spare fuses for each circuit as well as spare bulbs for each cockpit lamp are provided. Rheostats are furnished, as mentioned above, for controlling the brilliance of the cockpit lamps. Each group of lamps may be individually controlled. The volt-ammeter is capable of indicating the generator current, generator voltage or battery voltage. This is controlled by means of the three way switch located adjacent to the volt-ammeter. The switch remains on the generator current reading unless manually turned to one of the other settings. When the switch is released it automatically returns to the generator current indication. The 24 volt electrical system has a 600 watt generator and a 36 ampere hour 24 volt accumulator.

52. Gun Heating Control: A knob is provided on the starboard side of the cockpit on top of the bracket containing the wing gun charging handles. By means of this control heat may be diverted to the wing guns.

53. Cockpit Heating Control: Heat may be supplied to the windscreen for defrosting purposes or to the cockpit by means of the same control that governs the supply of heat to the wing guns. The control knob is plainly marked as to use.

54. Air Speed Pressure Head Heater. The air speed indicator is provided with a heating element. This is electrical and is controlled by an on-and-off switch on the electrical distribution panel marked 'Pitot Heater'.

55. Ventilator: Ventilation is provided by means of fixed louvres just under and aft of the pilot.

56. Instruments: The flight instruments are grouped on the main instrument panel directly in front of the pilot. They are: (i) an altimeter, reading in thousands of feet, (ii) an airspeed indicator reading in miles per hour. (iii) a bank and turn indicator, (iv) a gyro-horizon, (v) a directional gyro-compass, and (vi) a rate of climb meter, reading in thousands of feet per minute. A compass is also provided.

57. Brake Controls: The brake controls are located on the rudder pedals. The pilot may operate the brakes by pressing forward with his toes on the top bar of the rudder pedals. The position of the brake pedal relative to the rudder pedal may be changed by releasing the catch on the outboard side of the pedal.

58. Gun Firing Control: Two gun charging handles, one on each side of the cockpit under the main instrument panel, are provided for the fuselage guns. Two handles are provided on the starboard cockpit floor alongside the pilot for the wing guns.

59. Gun selector switches are provided for in the form of safety toggle switches which are located on the electrical distribution panel. Guards are provided on the switches to lessen the possibility of the pilot setting off the guns by accident. Any combination of guns may be fired.

60. The gun firing control, a push button, is located on the top of the control column. Two ammunition rounds counters are provided on the center auxiliary panel for the fuselage guns. The counters for the wing guns are located in the top of each wing and are readily visible from the cockpit. The counters show the number of rounds remaining in the ammunition box.

61. Camera Gun Control: A mounting for a Fairchild type camera gun is provided in the leading edge of the starboard wing just outboard of the main undercarriage strut. A control switch for the camera gun is located in the cockpit on the electrical distribution panel.

62. Reflector Gun Sight: Provision is made on the top of the main instrument panel for mounting the reflector gun sight. The dimmer switches for the gun sight are located on the port side of the main instrument panel.

63. Landing Lamps: The landing lamps, one on each side of the aeroplane, are housed in the under surface of the main wing. The lamps are raised and lowered individually and are controlled by two switches on the electrical distribution panel. The lamps must not be lowered when flying at speeds above 140 mph.

64. Navigation and Identification Lamps: A running light is provided in each wing tip. The port wing tip lamp is provided with a red glass and the starboard, wing tip lamp with a green glass. The switches for these lamps are located on the electrical distribution panel.

65. A mounting for the identification lamps is provided on the top of the aeroplane aft of the pilot and also on the underside of the aeroplane aft of the pilot. The controls for these lamps are mounted on the starboard side of the cockpit above the electrical distribution panel.

66. Wireless Controls: The aeroplane is equipped with a combined transmitter and receiver, either type T.R. 9D or T.R. 1133A, as well as a R3003. These are located aft of the baggage compartment.

67. T.R. 9D Installation: With this installation, a type C mechanical controller is mounted on the port side of the cockpit. The remote contactor and the remote contactor switch are mounted on the lower center of the center auxiliary panel. The microphone-telephone socket is fitted on the starboard side of the cockpit adjacent to the pilot's seat.

68. T.R. 1133A Installation: With this installation, the contactor and microphone telephone socket are as described in the previous paragraph, but the type C mechanical controller is replaced by a push button electrical control unit.

69. Remote Controls: All remote controls for communicating equipment, with the exception of the R3003, are located on the port side of the cockpit.

70. R3003 Installation: In connection with the R3003 a control unit type 18 is mounted in the starboard rear corner of the cockpit. The pilot's on-off switch and emergency buttons are located on the starboard side of the cockpit above the electrical distribution panel.

71. Radio Master Switches: Master switches for the T.R.1133A, Master Contactor and R3003 are located immediately inside the baggage compartment door.

72. Aerials: Two aerials are provided with each aeroplane. A horizontal fixed aerial is designed for use with the T.R. 9D wireless. A vertical aerial is mounted under the fuselage near the undercarriage, and is designed for use with the T.R. 1133A wireless. The vertical aerial consists of a 30 inch rod. Either aerial may be removed.

73. Parachute Flare Release Control: The control handle for release of the flare is located on the starboard side of the cockpit. The handle should be pulled forward to release the flare. The chute through which the flare is released is located in the aft end of the fuselage on the starboard side.

74. Oxygen Equipment: Provision is made for mounting two oxygen cylinders on the starboard side of the aeroplane aft of the pilot's seat. The cylinders are fitted with an enclosure of wire mesh on the side and top nearest the pilot. Provision is made for mounting a Mark VIII-A regulator on the starboard side of the cockpit. A bayonet socket for the low pressure supply to the mask is fitted on the starboard side of the cockpit. There is also a spring clip fixed to the starboard side of the cockpit near the pilot's shoulder to hold the mask hose clear of his movements.

75. Signal Recognition Device: The control for the signal recognition device is located on the port side of the cockpit just aft of the pilot. The lever should be pulled forward in order to operate the device.

76. Shutter Control: Cowl shutters are provided for the aeroplane. The control for these shutters is located on the under side of the main instrument panel. When the control is pushed forward, or in, the shutters close. The shutters should be open for ground warm up, for take-off and during climbs.

#### MISCELLANEOUS EQUIPMENT

77. Fire Extinguisher: Hand. Provision is made for mounting a one quart capacity carbon dioxide fire extinguisher on the starboard side of the fuselage near the pilot. This is accessible from the outside through a door in the side of the fuselage.

78. Automatic Fire Extinguisher: This system consists of a cylinder of carbon dioxide which is connected by tubing to a perforated tubing ring which encircles the engine and the carburetor just aft of the engine cylinder row. The system will be set off automatically at approximately 1800 C in case of over-heating in the engine compartment. A special shock actuator is also provided on the front wing beam at the center line of the aeroplane so that in case of crash the system will be automatically set off at 6G. The carbon dioxide cylinder, which holds approximately 5 lbs. of gas, is located on the starboard side of the fuselage aft of the pilot. It is accessible from the outside of the aeroplane through the wireless access door. The manual control for the system is located near the top of the starboard auxiliary panel. To manually release the gas the control handle is pulled out. The manufacturer recommends that the system be tested every four months but if this is not done the cylinder should be weighed periodically. If it is found that the weight of the cylinder has decreased by two pounds or more, the cylinder must be recharged to its full capacity.

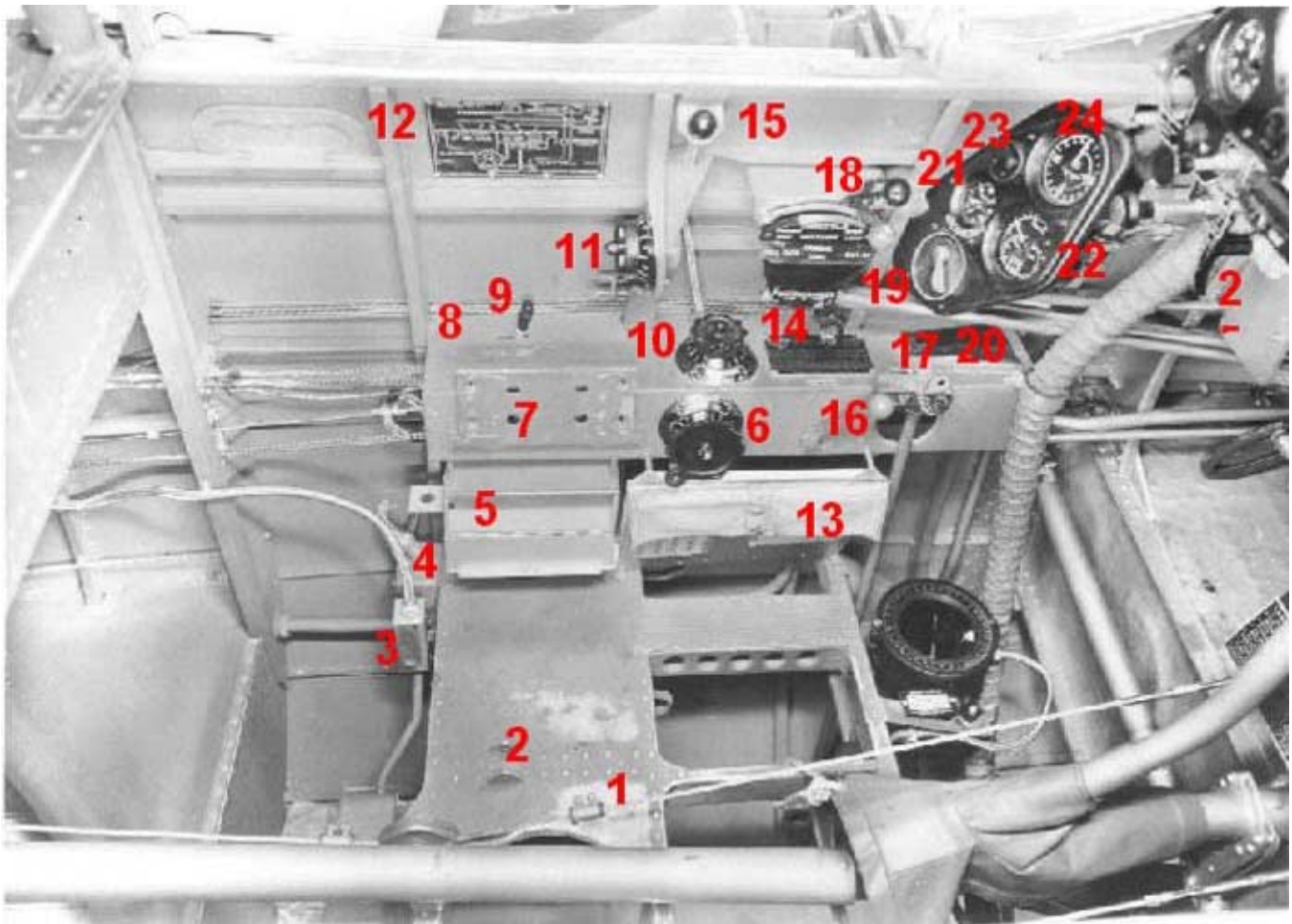
79. First-Aid Outfit: The first-aid outfit is stowed in a locker aft and to the starboard side of the pilot. The locker is plainly marked 'First Aid' in red letters.

80. Relief Tube: A pilot's relief tube is provided and is attached by a spring clip to the port side of the pilot's seat. A plug is provided which should be kept in the relief tube when the tube is not in use.

81. Navigational Equipment: A chart board is located in the lower portion of the main instrument panel. When this board is needed, it may be pulled out into position for use.

82. Map and writing pad cases are provided and are located on the port side of the cockpit under the cockpit shelf.

83. Baggage compartment: A compartment for baggage is located just aft of the pilot on the bottom of the fuselage.

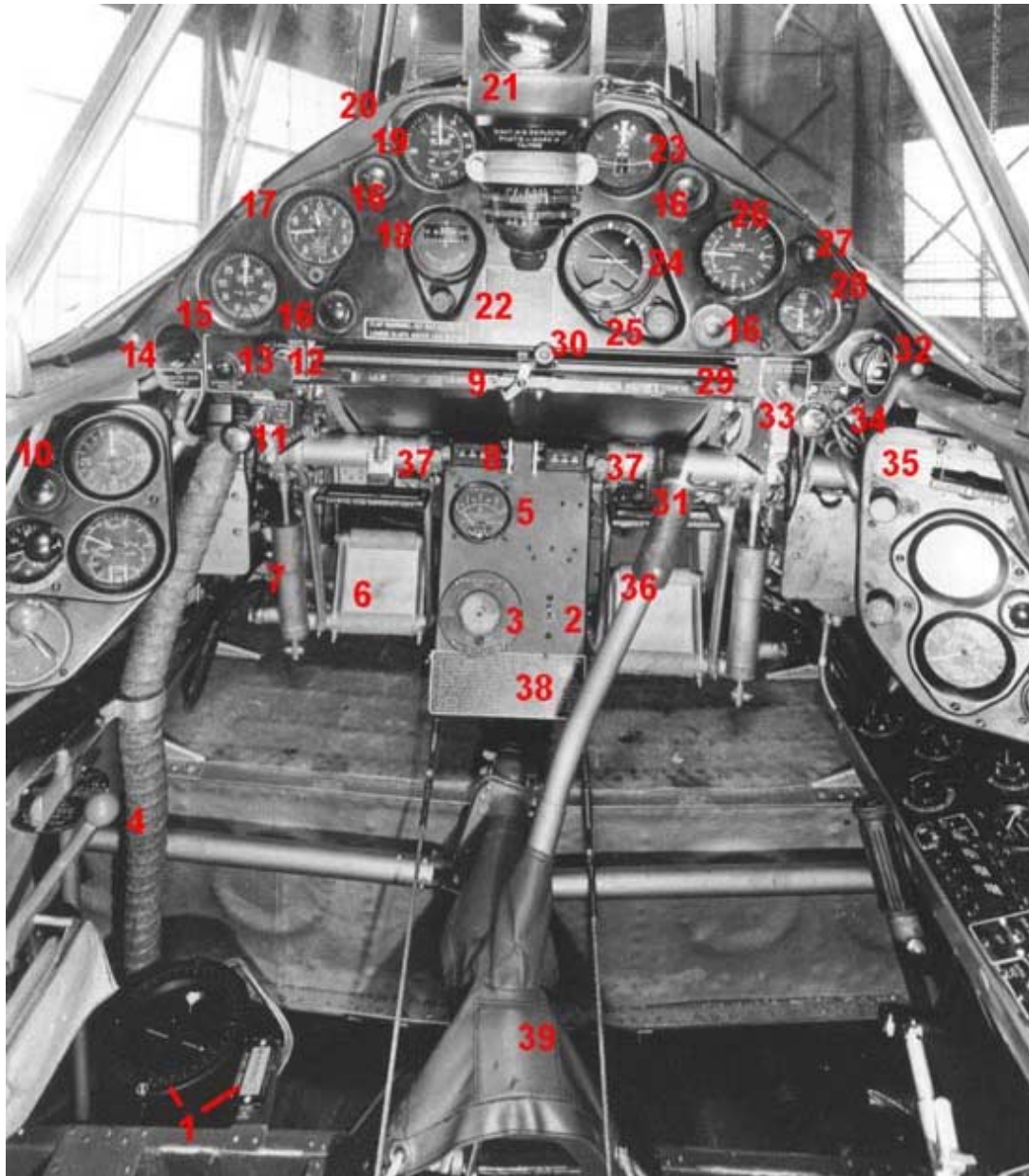


**Figure 1: Buffalo I Cockpit – Port Side (above)**

- |  |  |
|--|--|
| 1. Rudder cable stop                               | 13. Map case                               |
| 2. Pilot's seat support lug                        | 14. Supercharger control                   |
| 3. Dummy receptacle                                | 15. Cockpit lamp                           |
| 4. Electrical junction box-port wing               | 16. Fuel pump                              |
| 5. Pencil and pad box                              | 17. Fuel tank selector cock                |
| 6. Elevator tab control                            | 18. Throttle and mixture control           |
| 7. Mounting plate for T.R.9D and T.R.II33A Control | 19. Ignition switch                        |
| 8. Port cockpit shelf                              | 20. Pliers for emergency landing procedure |
| 9. Tail wheel lock control                         | 21. Air intake temperature gauge           |
| 10. Rudder tab control                             | 22. Engine gauge unit                      |
| 11. Aileron tab control                            | 23. Port auxiliary Rudder tab control      |
| 12. Fuel system diagrams                           | 24. Engine speed Aileron tab control       |
|  | 25. Port fuselage gun charging handle      |

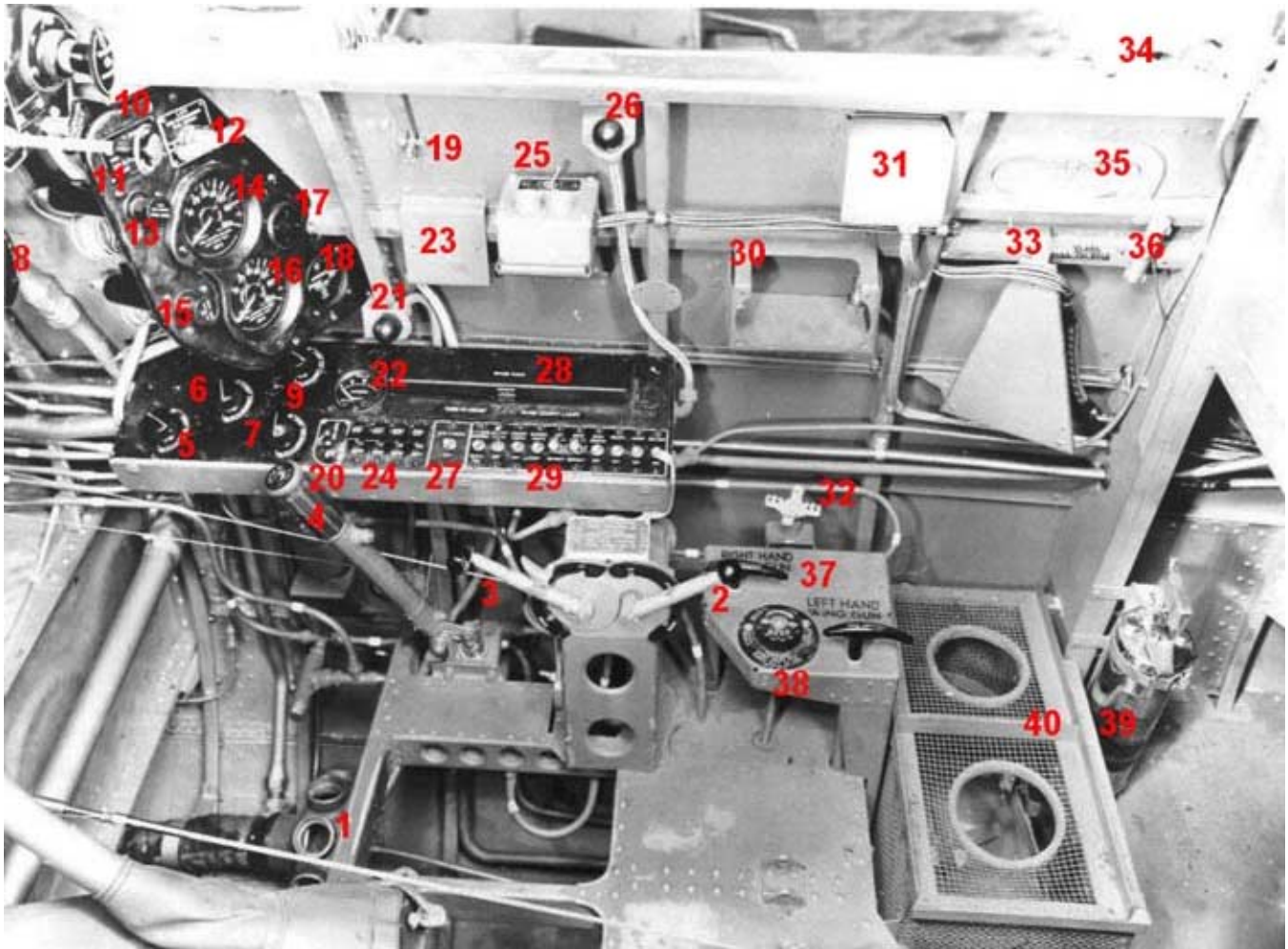
**Figure 2: Buffalo I Cockpit – Forward (next page)**





- |   |                                       |   |
|---|---------------------------------------|---|
| 1. Compass and correction card          | 14. Reflector sight switch            | 28. Eight day clock                                 |
| 2. Remote contactor switch              | 15. Manifold pressure gauge           | 29. Flap position indicator                         |
| 3. Remote contactor indicator           | 16. Instrument panel indirect lamps   | 30. Chart board knob                                |
| 4. Windscreen heater hose               | 17. Altimeter                         | 31. Gun firing switch                               |
| 5. Cylinder head temperature gauge      | 18. Directional gyro                  | 32. Engine primer pump                              |
| 6. Rudder and brake pedal               | 19. Airspeed indicator                | 33. Carburetor air preheater control                |
| 7. Brake cylinder                       | 20. Removable reflector panel         | 34. Starter control                                 |
| 8. Fuselage gun rounds counter          | 21. Reflector gun sight               | 35. Starboard auxiliary panel                       |
| 9. Undercarriage position indicator     | 22. Take-off & landing check off list | 36. Control column                                  |
| 10. Port auxiliary instrument panel     | 23. Bank and turn indicator           | 37. Undercarriage emergency lock and release        |
| 11. Cowl shutter control                | 24. Gyro horizon                      | 38. Undercarriage emergency operating instructions  |
| 12. Airscrew pitch control              | 25. Caging knob for gyro horizon      | 39. Boot for protection of control column mechanism |
| 13. Undercarriage position warning lamp | 26. Rate of climb indicator           |   |
|   | 27. Chart board lamp                  |   |





**Figure 3: Buffalo I Cockpit – Starboard Side (above)**

- |   |  |
|---|--|
| 1. Heater distribution valve                  | 22. Volt-ammeter                                       |
| 2. Flap raising and lowering control          | 23. Identification lamp switch bracket                 |
| 3. Undercarriage raising and lowering control | 24. Gun selector switch                                |
| 4. Emergency hydraulic hand pump              | 25. R3003 wireless control                             |
| 5. Rheostat for auxiliary panel lamps         | 26. Starboard cockpit lamp                             |
| 6. Rheostat for main instrument panel lamps   | 27. Gun camera switch                                  |
| 7. Rheostat for compass lamps                 | 28. Fuse access cover on electrical distribution panel |
| 8. Starboard fuselage gun charging handle     | 29. Lamp switches                                      |
| 9. Chart board lamp                           | 30. Oxygen regulator bracket                           |
| 10. Starboard auxiliary panel lamp            | 31. Electrical junction box                            |
| 11. Fuel tank calibration plate               | 32. Emergency undercarriage operating valve            |
| 12. Manual control for fire extinguisher      | 33. R3003 control unit bracket                         |
| 13. Fuel gauge pump handle – port tank        | 34. Canopy position lock                               |
| 14. Fuel gauge – port tank                    | 35. Hand grip  |
| 15. Fuel gauge pump handle – starboard tank   | 36. Parachute flare release handle                     |
| 16. Fuel gauge – starboard tank               | 37. Wing gun charging handles                          |
| 17. Indirect lamp                             | 38. Heater control                                     |
| 18. Hydraulic system pressure gauge           | 39. Hand fire extinguisher                             |
| 19. Outside release for canopy                | 40. Oxygen bottles support bracket                     |
| 20. Generator – battery volt – ammeter switch |  |
| 21. Electrical distribution panel lamp        |  |

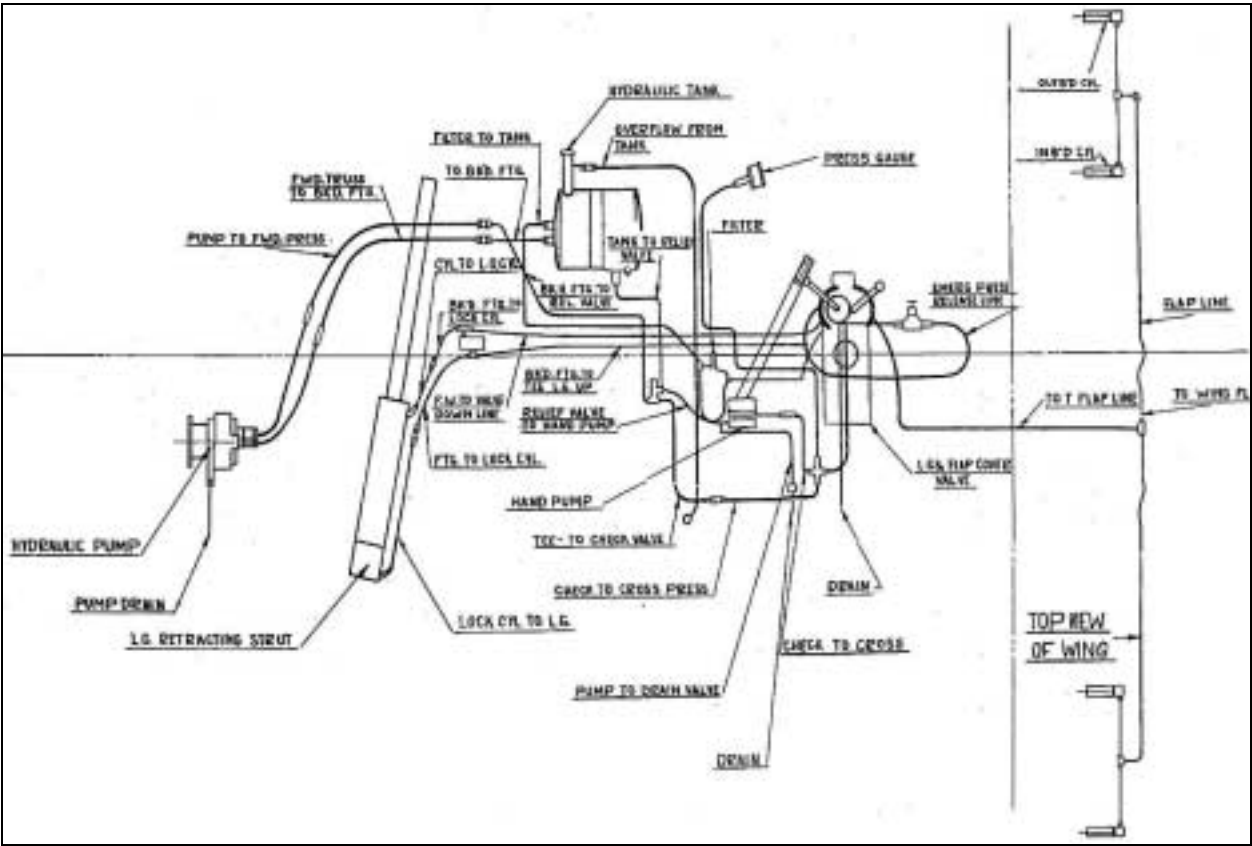
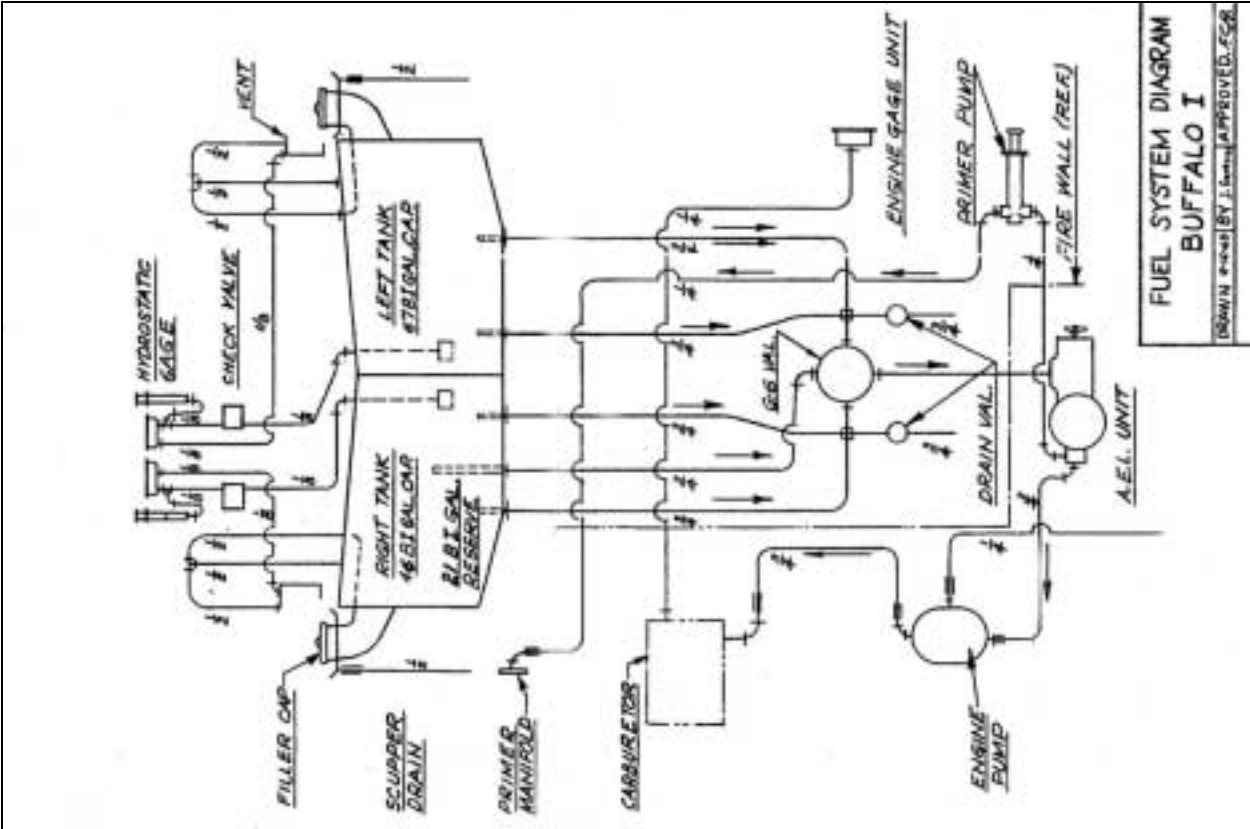


Figure 4: Buffalo I Hydraulic System (above); Figure 5: Buffalo I Fuel System (below)



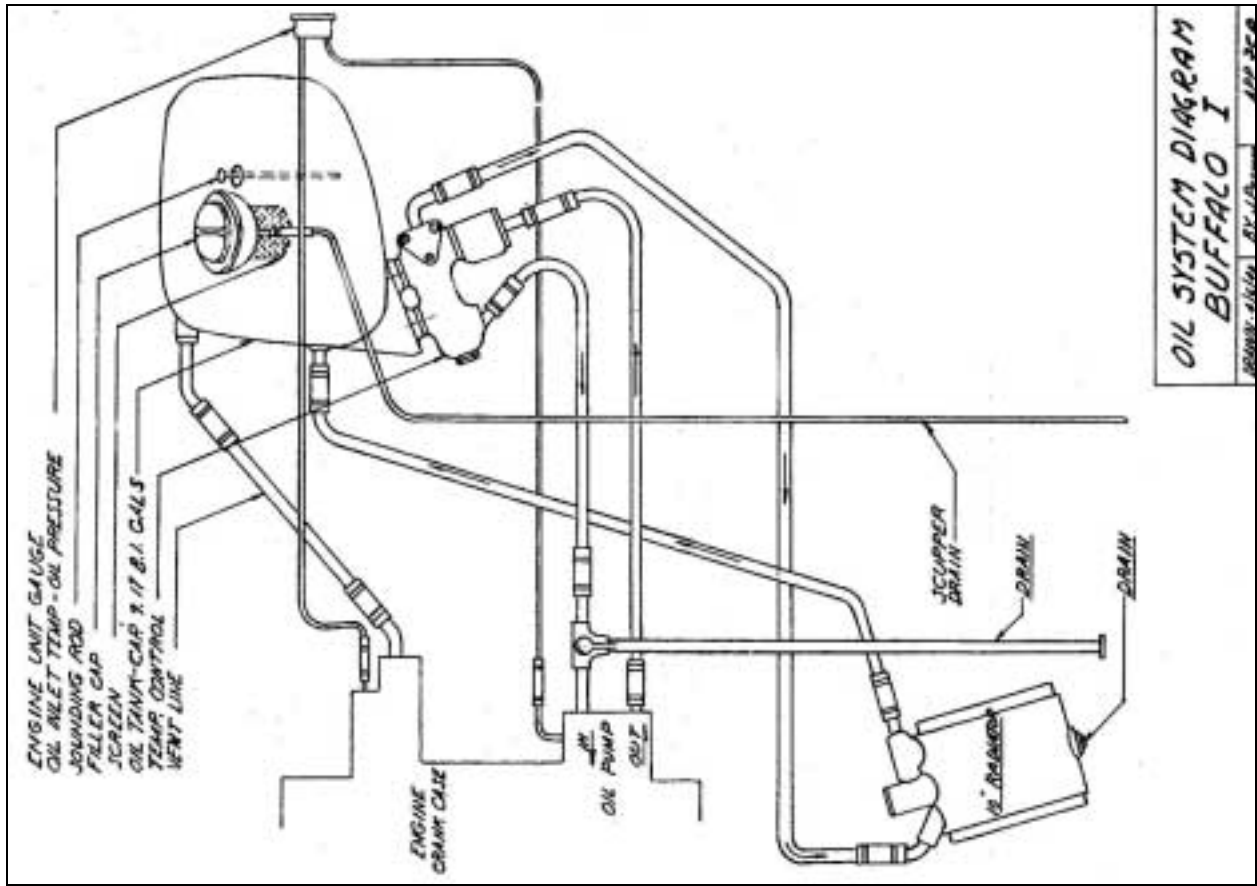


Figure 6: Buffalo I Oil System

## A.P. 1806A Pilot's Notes Sect. 2

### SECTION 2 - HANDLING AND FLYING NOTES FOR PILOT

#### INTRODUCTORY NOTES

##### LIST OF CONTENTS

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Preparation for Take-Off	7	Approach and Landing	21
Take -Off	8	Final Approach and Landing	22
Actions after Take-Off	9	Procedure After Landing	23
Engine Failure	10	Fuel Capacities and Consumption	24
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#### INTRODUCTORY NOTES

1. Full details of the equipment of this aircraft are given in Section 1 and pilots must be acquainted with these details before flying the aircraft.

#### FITNESS OF AIRCRAFT FOR FLIGHT

2. Ensure that the total weight and disposition of load is in accordance with weight sheet summary and that aircraft is in all other respects fit for flight.

#### PRELIMINARIES

3. On entering the cockpit make the following preparations: See that -
  - (i) Ignition switches are - OFF.
  - (ii) Undercarriage and flap levers are in - NEUTRAL.
  - (iii) Battery and generator switches - ON.
  - (iv) Blower in LOW RATIO (M).  
Then check: -
  - (v) Fuel tank contents -
  - (vi) Controls for free movement.

#### STARTING ENGINE AND WARMING UP

Note: - Avoid unnecessary running of the engine on the ground.

4.
  - (i) Mixture control fully back to FULL RICH.
  - (ii) Pitch control lever forward to FULLY FINE.
  - (iii) Open cowling gills by pulling handle FULLY BACK.
  - (iv) Carburetor heat to COLD.
  - (v) Turn fuel cock to LEFT TANK.

- (v) Turn on main engine switches.
  - (vi) Build up fuel pressure with wobble pump and operate priming pump.
  - (viii) Energize starter and engage when sufficient momentum has been obtained.
- Note: - The opening of the throttle does not prime the carburetor and throttle setting should be approximately 1/4 opening for starting
- (ix) Check oil pressure and warm up engine at 1000 r.p.m. until oil temperature shows a steady rise of at least 10° C.

## TESTING ENGINES AND INSTALLATIONS

### DURING WARMING UP

- 5. Watch cylinder head temperatures during ground running (para. 26)
  - (i) Check fuel pressure which should be 6 to 7 pounds.
  - (ii) Check brake pressure by operating toe pedals.
  - (iii) Check oil pressure, which should be over 50 pounds.
  - (iv) Check flap gear by operating flaps, returning handle to neutral when finished.
  - (v) During running up at 32" Hg boost pressure:- Test switches (Normal drop in revs is approx. 50 r.p.m.)
  - (vii) Check propeller pitch operations by pulling out to coarse pitch, watch for drop in revs and then return to FINE PITCH
  - (vii) Check revs, and main engine instruments.

### TAXYING OUT

- 6. Before moving off:
  - (i) Check that tail wheel lock is in free position,
  - (ii) Check that cowling gills are open and that head temperatures are normal. (See para. 26)

This aircraft is easy to taxi and the brakes are satisfactory. The view ahead is average, but the aircraft can be swung from side to side without difficulty in order to look ahead. If the aircraft has to be taxied fast and straight for any distance, it is advisable to lock the tail wheel in order to prevent tail wheel shimmy, but this must be unlocked before turning. Try and avoid running the engine under 1000 r.p.m. in order to avoid fouling of the plugs or over 1200 r.p.m. to avoid overheating.

### PREPARATION FOR TAKE-OFF

- 7. Prior to take-off check the list of vital actions as follows:
  - (i) T - Trimming tabs. Aircraft should be trimmed very slightly nose heavy. Aileron tab should be neutral. Rudder tab should be turned approximately at 3-1/2 divisions to starboard to give Right rudder to overcome any swing to the left when taking off.
  - (ii) M - Mixture. Mixture control should be in FULL RICH.
  - (iii) P - Pitch. Pitch control should be fully forward for FINE PITCH.
  - (iv) FLAPS - These may be used to assist the take off run, but are not necessary under normal conditions.
  - (v) GILLS - Cowling gills. In hot weather these should be fully open, in cold weather they may be shut.
  - (vi) Tail wheel should be locked for take-off but in order to assist turning it should not be locked until the aircraft is headed into wind.

Note: - If the aircraft has been ticking over for any period, it should be run up against the brakes in order to clear the engine.

### TAKE-OFF

- 8. Take-off is normal but the aircraft tends to swing to the left. This can be counteracted by rudder. During take-off stick loads are rather heavy and the stick must be forced forward to raise the tail. If it is desired to

obtain a minimum run, flaps may be used, but these should not be raised after take-off until a height of at least 500-ft. has been obtained. Care must be taken not to exceed maximum permissible boost of 43½ inches or engine revolutions of 2,350.

#### ACTIONS AFTER TAKE-OFF

9. As soon as machine is finally clear of the ground:
  - (i) Raise undercarriage by releasing the catches and moving undercarriage selector lever to UP position.
  - (ii) Reduce boost to correct climbing boost of 35.5" Hg.
  - (iii) Reduce r.p.m. by pulling back Pitch Control slowly until correct climbing revs of 2300 have been obtained. (Turning the control knob gives a vernier adjustment – clockwise to increase revolutions, anticlockwise to decrease revolutions).
  - (iv) Check undercarriage indicator and return undercarriage lever to NEUTRAL, when undercarriage is fully up.
  - (v) Climb away at 145 m.p.h. I.A.S.
  - (vi) Check engine instruments and cylinder head temperatures, etc. (See para. 26)
  - (vii) If it is desired to close the cabin hood, great care must be taken not to get the elbow out into the airstream.
  - (viii) If flaps have been used these should be raised at 500 feet and when up the flap lever must be returned to NEUTRAL.

#### ENGINE FAILURE DURING TAKE-OFF

10. In case of engine failure during take-off maintain ample flying speed by putting the nose down, and then
  - (i) If the undercarriage is not already UP select undercarriage UP position and if possible assist by operating the hand pump. (Once locks on the undercarriage are released the undercarriage will collapse on landing).
  - (ii) Lower the flaps.
  - (iii) Switch off, and if time, turn off petrol.
  - (iv) Land straight ahead.

#### CLIMBING

11. During all climbs careful check should be kept of cylinder head temperatures. Maximum permissible head temperature is 260° for 5 minutes. The best climbing speed is 145 m.p.h. with boost and r.p.m. as follows: (Also see Para. 26).

<u>Height</u>	<u>Boost</u>	<u>R.P.M.</u>	<u>Blower</u>	<u>Mixture</u>
Sea Level	43.5	2350 (3 min. only)	Low (M)	Full Rich
1000 ft. to 10000 ft.	Maintain 35.5 in. Hg.	2300	Low (M)	Full Rich
10000 ft. to 17000 ft.	Maintain 33.5 in. Hg.	2300	High (S)	Full Rich
17000 ft. and upwards	Full Throttle	2300	High (S)	Full Rich

Reduce climbing speed be 3 m.p.h. for every 2000 ft. above 5000 ft.

Note: - The above engine conditions apply to climb ONLY and in any case must not exceed 15 min.

## CRUISING

12. The engine should normally be run at the lowest power output suitable for the occasion, and maximum permissible cylinder head temperatures must not be exceeded. (See para. 26).

Note: - (i) For engine operating data, etc. see data plate in cockpit  
(ii) For limiting operational conditions see para. 26.  
(iii) For detailed fuel consumptions and maximum range conditions see para. 24 (a), (b) and (c).

## GENERAL FLYING

13. Loaded to full operational requirements, this aircraft is only neutrally stable. Under full load conditions, great care must be exercised to see that the aircraft is not subjected to undue acceleration loadings either on the turn or when pulling out of a dive. Tabs are efficient and the rudder tab is ample to allow feet off flying at all speeds. The aileron tab is efficient but the aircraft will show signs of a lateral instability at certain speeds when fully loaded. The elevator tab is powerful and must be used with care. (See para. 19). The instability noted above will be most obvious when climbing or when doing an engine assisted approach.

WARNING: - The fuselage and the wing guns must always be fired together. If, for any reason, the ammunition for the two fuselage guns should become exhausted before the ammunition for the wing guns, it will be found that the C.G. will travel aft sufficiently far for the aircraft to become very unstable. In these circumstances pilots must exercise the greatest care to avoid subjecting the aircraft to high acceleration loadings, both on turns and on recovery from a dive, as the stick loads will be found to be almost negative. Instability will also be apparent on the climb and in level flight, and also during an engine assisted approach with the wheels down. Pilots should exercise great care when flying on instruments or at night in the above mentioned conditions.

Note the following:

- (i) The aircraft becomes nose heavy when flaps or undercarriage are lowered, and vice versa.
- (ii) Landing flaps may not be lowered at speeds in excess of 161 I.A.S.
- (iii) Landing lamps may not be extended at speeds in excess of 140 I.A.S.
- (iv) When flying this aircraft under icing conditions, it has been found that ice formation is liable to occur along the leading edge of the aileron. If this happens, the lateral control may become completely out of balance and the stick may be "snatched" violently. If icing is suspected only very gentle turns should be attempted until it is found that lateral control is normal.

## INSTRUMENT FLYING

14. Attention is drawn to the fact that this aircraft is only neutrally stable fore and aft, and unstable in the climb when fully loaded, and particular attention must be paid to this fact when flying by instruments.

## STALLING

15. The stall on this aircraft is normal and occurs at the following speeds:
- (i) Undercarriage up and flaps up - 78 m.p.h. I.A.S.  
Undercarriage down, flaps down, - 73 m.p.h. I.A.S.

Due warning of the stall is given by a shuddering of the aircraft, and the stall itself is generally preceded by quite a loud bang.

## SPINNING

16. Deliberate spinning of this aircraft is prohibited. If the machine is spun inadvertently, the standard methods of recovery should be applied and the following points should be noted:
- (i) That the rotation of the spin is extremely erratic.
  - (ii) Just before control is regained the spin commences to smooth out, and this is a sign that recovery is imminent and NOT that the spin is becoming worse.
  - (iii) For recovery, rudder must be applied before the stick is moved forward.
  - (iv) Considerable rearward loading occurs on the stick and some considerable force is needed to move this forward, and pilots must be prepared for this.

## GLIDING

17. The following points should be noted:
- (i) That at gliding speeds there is a distinct absence of “feel” of the elevator control. This should not be mistaken for a lack of control.
  - (ii) The best gliding speed with flaps UP is approximately 110 m.p.h. I.A.S.
  - (iii) The best gliding speed with flaps DOWN is approximately 90 m.p.h. I.A.S.
  - (iv) An engine assisted glide can be done at 80 m.p.h. I.A.S. with flaps down, but this is not recommended owing to the flatness of the approach, and signs of fore and aft instability.

## SIDE-SLIPPING

18. This aircraft can be side-slipped in the normal manner.

## DIVING

19. This aircraft has good diving characteristics and may be dived to its terminal velocity with undercarriage in up or down position, provided maximum permissible engine revolutions of 2760 are not exceeded. The following points should be noted:
- (i) Propeller should be set to COARSE PITCH prior to the dive.
  - (ii) Supercharger should be in LOW RATIO (M).
  - (iii) Throttle should be set at approximately one-third open.
  - (iv) Cowling gills must be CLOSED.
  - (v) During the dive the aircraft will need considerable left rudder bias to keep it straight.
  - (vi) As speed increases the aircraft becomes tail heavy and it may be trimmed during the dive.
  - (vii) Stick loads on recovery are light, particularly when fully loaded with C.G. in the furthest aft position, and care must be taken to avoid excessive acceleration loading by pulling out too quickly. If the aircraft is not trimmed correctly, tail heaviness during the dive makes it necessary to hold the stick firmly during recovery in order to avoid too rapid a pull out.
- NOTE: - TABS MUST ON NO ACCOUNT BE USED FOR RECOVERY.

## AEROBATICS

20. This aircraft is excellent for all aerobatics and loops, slow rolls and combinations thereof are permitted. Ample height should be allowed for recovery from any maneuver, as acceleration is rapid. Spinning and inverted flying are prohibited.

## APPROACH AND LANDING

21. The approach is normal but final approach and landing should always be made with FLAPS DOWN.

### Preliminary actions before approach

- (i) Open hood.



- (ii) Ensure mixture control is back to Rich
- (iii) Close cowling gills
- (iv) Blower to low ratio (M).

Vital actions before landing

- (i) U – Undercarriage. Lower undercarriage by releasing catches in undercarriage selector lever and pushing to Down position. (For emergency undercarriage operation see Section 1, para. 17)
- (ii) P – Pitch. Push pitch control FULLY IN.
- (iii) FLAPS – When in position, release catch on the flap selector handle and push to DOWN position. Flaps must not be lowered at speeds in excess of 161 m.p.h. I.A.S.

FINAL APPROACH AND LANDING

22. Final approach should be done at 90 to 95 m.p.h. I.A.S. with or without the engine. There is considerable lack of ‘feel’ on the elevator control and excessive speed during an approach must be guarded against. The landing is normal, there is a slight hold-off and it is possible to get the tail down before the wheels. The aircraft must be held straight after landing and brakes must be applied gently to bring it to a stop. Unlock tail wheel.

PROCEDURE AFTER LANDING

23. Taxi clear of the landing area:  
 Stop, look down, and: -
- (i) Raise flaps, and return flap lever to NEUTRAL.
  - (ii) Open cowling gills.
  - (iii) Return undercarriage lever to NEUTRAL

Stop engine by:

- (iv) Putting automatic mixture control forward to IDLE CUT OFF
- (v) When engine stops, switch off main engine switches, turn off petrol, and switch off battery and generator switches.

FUEL CAPACITIES AND CONSUMPTIONS

24. Note the following:
- (i) Effective fuel capacity:  
 Port tank 66.5 Imperial Gals. Starboard tank 66.5 Imperial Gals.
  - (ii) Fuel Consumptions:  
 The following figures should be taken as a guide and it must be appreciated that only consistently accurate flying will give the best results. (For limiting operating conditions see par. 26).
    - (a) Maximum continuous cruising at 1000 ft. and 30” Hg., 1900 r.p.m. and 260 I.A.S. RICH – 42 Imperial gallons per hour (approximately).
    - (b) Normal continuous cruising at 11,000 ft. and 24” Hg., 1900 r.p.m. and 220 I.A.S. CRUISING LEAN – 32 Imperial gallons per hour (approximately).
    - (c) As in (b) at 1400 r.p.m. and 188 I.A.S. CRUISING LEAN – 21.5 Imperial gallons per hour (approximately).
    - (d) Extreme range at 8,000 feet, 23.5” Hg., 1200 r.p.m. and 129 I.A.S. CRUISING LEAN – 15.5 Imperial gallons per hour (approximately).

Note: It will be found that mixture must be leaned out by hand to get best results and cruising lean position cannot always be relied upon.

## OIL CAPACITY

25. The oil tank has an effective capacity of 9.15 Imperial gallons.

### ENGINE DATA - NOTES ON THE CYCLONE R.1820-G.105A ENGINE

26. Note the following:

(i) Limiting operational conditions (fuel not less than 90 octane).

Take-off (3 minutes limit)	Maximum r.p.m.:	2,350
	Maximum manifold pressure:	43½ inches
Climbing (15 minutes limit)	Maximum r.p.m.:	2,300
	Maximum manifold pressure: "M" gear	35½ inches
	"S" gear	33½ inches
Maximum continuous cruising (RICH) ("M" or "S" gear)	Maximum r.p.m.:	1,900
	Maximum manifold pressure:	30 inches
Emergency all-out level (5 minutes limit)	Maximum r.p.m.:	2,350
	Maximum manifold pressure: "M" gear	43½ inches
	"S" gear	34½ inches
Dive	Momentary maximum r.p.m. (throttle not less than 1/3 open)	2,760

(ii) Oil pressures: -

Minimum (5 minute limit)	50 lbs./sq. in.
Normal	60 lbs./sq. in.

(iii) Oil Temperature: -

Minimum for taking off	10° C. rise
Optimum for all conditions of flight	74° C.
Maximum	88° C.

(iii) Cylinder Temperatures: -

Minimum for taking off	150° C.
Maximum for continuous cruising	205° C.
Maximum for emergency all-out level (5 minute limit)	260° C.

THE HEIGHT AT WHICH HIGH BLOWER MAY BE ENGAGED WILL DEPEND UPON THE  
CARBURETOR RAM AVAILABLE

27.

POSITION ERROR TABLE

60	I.A.S.	ADD	3	m.p.h.
80	I.A.S.	ADD	4	m.p.h.
100	I.A.S.	ADD	5	m.p.h.
120	I.A.S.	ADD	6	m.p.h.
140	I.A.S.	ADD	7	m.p.h.
160	I.A.S.	ADD	8	m.p.h.
180	I.A.S.	ADD	9	m.p.h.
200	I.A.S.	ADD	10	m.p.h.
220	I.A.S.	ADD	11	m.p.h.
240	I.A.S.	ADD	12	m.p.h.
260	I.A.S.	ADD	12.5	m.p.h.
280	I.A.S.	ADD	12.5	m.p.h.
300	I.A.S.	ADD	10	m.p.h.