air cadets

the next generation

air cadet publication

ACP 34

aircraft operation

volume 1 - airmanship I

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ACP 34
AIRCRAFT OPERATION

CONTENTS

Volume 1

Airmanship I

ISSUED 2000

CHAPTER 1

AIRFIELDS

Introduction

1. One of the exciting activities available to Air Cadets is flying. You will not only be given the opportunity to fly in powered aircraft and gliders, but you will also be allowed to handle the controls. This publication details some important facts that you must know, in preparation for this kind of flying. The following paragraphs will familiarise you with the place, the aircraft and the procedures, to ensure a safe, and pleasant experience.

Layout of an Airfield

Layout of an Airfield

2. First of all, we will describe airfields and their associated installations (Note: in the RAF, "aerodrome" and "airfield" mean the same thing, but "aerodrome" is more formal and is usually used in official books).

3. Some terms that you need to understand are:

a. Airfield - an area (including any buildings and support installations) used for the accommodation, take-off and landing of aircraft.

b. Airport - an airfield with additional facilities for freight and passengers (for example customs, money-changing, immigration, baggage areas and restaurants).

c. Aircraft manoeuvring areas - parts an airfield which have been specially prepared for the movement of aircraft on the ground (for example runways, taxiways, aircraft servicing platforms, operational readiness platforms and dispersal hardstandings).

4. Note that aircraft manoeuvring areas can be anything from quite small level areas of grass to vast areas of asphalt and concrete, with complex patterns of runways and taxiways. Grass airfields are adequate for light aircraft engaged mostly in flying instruction and civil flying club activity, but paved runways and taxiways are needed for heavier, faster aircraft. A triangular pattern of three runways is useful because it allows aircraft to take-off and land as near as possible into wind, but for

today's high performance aircraft the length of the runway has become as important as the wind direction. The present trend is for operations to be confined to one long runway, or at the most two, the longer one being designated the "main instrument runway". This will usually be in line with the prevailing wind and will be equipped with full lighting, radio installations and safety equipment.

3 Main types of Airfield

5. In summary, airfields fall broadly into three types:

a) The basic grass airfield.

b) The triangular-patterned runway.

c) The modern main instrument runway.

Features of main Runway type

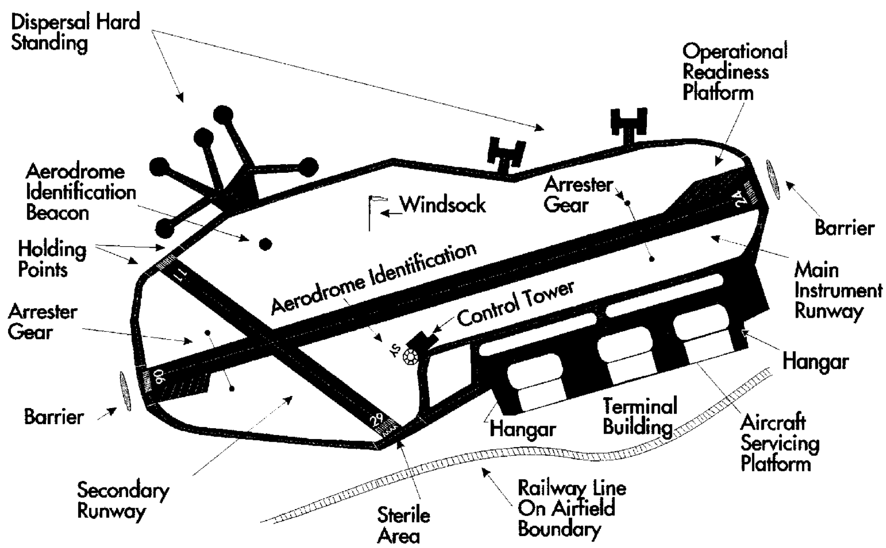
6. The following diagram at Fig 1-1 shows the layout of a typical airfield used by modern high-speed jet aircraft.

Runways

7. Construction. Runways are constructed of concrete or layers of asphalt. Concrete stands up better than asphalt to jet engine blast and fuel spillage.

8. Dimensions. Runways vary in width and length according to the role of the particular airfield.

Fig 1-1 *Typical layout of a main instrument runway*



At a typical RAF airfield, the main instrument runway will normally be 45m wide and 1,800m or more long, with subsidiary runways of the same width, but not necessarily as long. At airfields where transport aircraft operate, the main runway is normally 60m wide and 2,700m or more long.

9. Markings. The markings on runways are illustrated in Fig 1-2 and are described below:

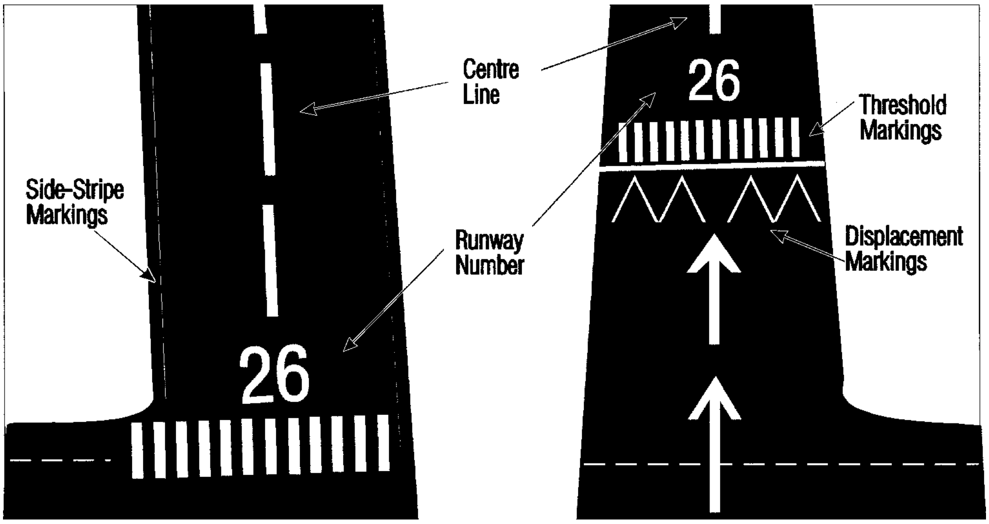


Fig 1-2 *Runway Markings*

a. Colour. Runway markings are white (do not confuse with taxi way markings which are yellow).

b. Runway Numbers. Each runway is marked by two white painted numerals indicating the magnetic headings of the runway direction, taken to the nearest 10° (see Fig 1-2). For example:

Runway Numbers

(1) Magnetic heading 238°(M)-runway number 24.

(2) Magnetic heading 058°(M)-runway number 06.

The magnetic heading is taken from the direction of approach. Thus the magnetic heading for one end of the runway is 180° different from the other (as in the above example 238° - 180° = 58°)

c. Threshold Markings. The runway threshold is denoted by longitudinal white stripes painted symmetrically about the runway centre-line (see Fig 1-2).

Where the landing threshold has to be moved up the runway because of some form of obstruction in the final stages of the approach (e.g. the railway line in Fig 1-1), four chevrons and a bar are added. By making the pilot land further up the runway, the aircraft will be at a safe height when it crosses the obstruction. The area between a displaced threshold marking and the beginning of the runway is known as the sterile area; note, however, that this area is not necessarily sterile for taxying aircraft or for aircraft stopping after landing in the opposite direction.

d. Centre-Line and Side-Stripe markings. As shown in Fig 1-2, the runway centre is indicated by a broken white line (arrowheads in the sterile area). Where there is little contrast between the runway and the surrounding area, and also on runways more than 45m wide, each side of the runway will be marked with a solid white line.

Arrester Gear

RHAG

10. Some runways are equipped with “arrester gear”, which can bring an aircraft to a stop in a very short distance. To use this system aircraft must be equipped with a strong hook which is lowered for landing, to engage a cable suspended across the runway. When the hook engages the cable, the cable is played out, cable-braking occurs to bring the aircraft swiftly to rest. The cable can be braked in a variety of ways: the system in use in the Royal Air Force is the Rotary Hydraulic Arrester Gear (RHAG), which relies on large paddles rotating in liquid for its braking effect.

Over-Run Areas and Arrester Barriers

Over-run areas Arrester Barriers

11. Where space permits, areas beyond the ends of the runways are provided for accidental or emergency use by aircraft over-running or under-shooting the runway (see Fig 1-1). These “over-run areas” are cleared of obstacles, have a reasonably even surface, and are capable of supporting an over-running aircraft without seriously damaging the undercarriage. Over-run areas can also have barriers consisting of large strong nets made of nylon rope. They can be raised and lowered by the airfield controller by remote control. If a fast jet aircraft experiences a brake

failure on landing and overruns, the net will literally "catch" the aircraft, stopping it with minimum risk of damage to the aircraft or injury to the crew.

Operational Readiness Platforms (ORPs)

ORPs

12. ORPs are specially-prepared areas (associated with fighter or strike airfields) built alongside the end of a runway. They are used for parking aircraft, either for rapid take-off with minimal warning ("scramble") or for final flight preparation. To provide the maximum safe use of the space available, the platforms are usually marked with taxying lines for individual aircraft, with areas set aside for essential ground equipment.

Dispersal Hardstandings

Dispersed for Safety

13. Many RAF airfields still use widely-dispersed areas, known as "dispersal hardstandings" or "dispersals", for parking aircraft. The aim is to spread the aircraft around the airfield, to make it more difficult for enemy aircraft to damage or destroy all the parked aircraft during an attack. Some airfields may have hardened aircraft shelters (HAS), which protect the aircrews and groundcrews as well as aircraft. The walls of a HAS are made of very thick reinforced concrete, and it is capable of "stand alone" operations, with its own air supply and other essential services.

Aircraft Servicing Platforms (ASPs)

ASPs

14. ASPs are large paved areas for the servicing and turn-round of aircraft. They also facilitate the speedy handling of passengers and freight. They are usually rectangular, with wide access tracks, and are normally close to hangars or airport terminal buildings.

Taxiways

Taxiways

15. Construction. Taxiways connect all the various parts of the aircraft manoeuvring area (e.g. Dispersal to runway, ORP to runway etc) and enable aircraft to move about easily. Taxiways are usually constructed in the same way as runways, and are normally a minimum of 15m wide.

16. Markings. Taxiway markings are in yellow, as shown in Fig 1-3 and are described below:

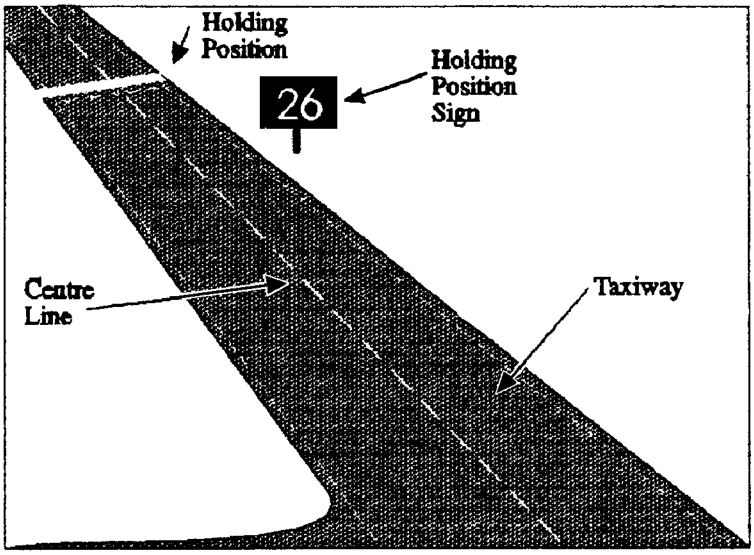


Fig 1-3 *Taxiway markings*

a. Centre Line. The centre of a taxiway is indicated by broken yellow lines.

b. Edge Marking. Where there is little contrast between the taxiway and the surrounding area, the edges of the taxiway are marked with dashed yellow lines.

c. Holding Position. At a junction of a taxiway with a runway, taxying aircraft are required to "hold" (i.e. stop) until it is safe to move onto the runway. The "holding position" is indicated by two yellow lines, one solid and one broken, painted across the taxiway at right angles to its centre line and 70m from the nearest edge of the runway. A holding position sign, displaying the runway number in black on a yellow background (old models), or in white on a red background (new models), is also placed at this 70m point on the edge the taxiway (airfield boundary side).

Windsocks

Windsocks

17. Normally, there are two or more windsocks on an airfield to provide a quick and easy way of indicating wind direction. They are positioned away from trees and buildings which may cause local wind turbulence. The main windsock (the one least subject to local effects) has a white ring round its base.

Obstructions

Identifying Hazards

18. Any object that might be hit by a taxying aircraft, or by one landing or taking-off, is an obstruction. Obstructions may be permanent (e.g. building housing ILS equipment) or temporary (e.g. a mechanical digger or a group of workmen on the airfield). It is essential that the whereabouts of all obstructions are made known to pilots. Thus, obstructions must be clearly marked both by day and by night. For example, some specialised vehicles e.g. runway control caravans and sweepers used on the airfield are painted with red and white squares and have yellow roofs. Other vehicles regularly using the manoeuvring area are painted yellow all over. On some airfields however, for operational reasons, “tone down” measures may have been taken and vehicles may not be so distinctively marked. Some vehicles, e.g. Air Traffic Control vehicles and refuellers are equipped with a flashing amber light, while others like ambulances and fire engines, have flashing blue lights.

Airfield Identification

Airfield Letters

19. Each airfield is identified by means of two letters - e.g. SY for Shawbury. These letters are normally displayed in a “signals square” close to the ATC tower. At airfields with identification beacons, the same letters are used by the beacon - flashing them in Morse code.

Airfield Lighting

Lighting types

20. Royal Air Force airfields used for night flying have a mass of lights designed to assist pilots to taxi aircraft safely, and to take-off and land on the runway in use. Many of these lights will be hooded so that they can only be seen from a certain angle. If you visit an airfield while night flying is in progress you will see a fascinating display of lights in many colours. Mains electricity is generally used to supply power to an airfield but there will generally be an alternative method of supply to cope with power failures.

Location and Types of Lighting

21. The main types of lighting are as follows:

a. Airfield Identification Beacon. The airfield identification beacon is in an open space on the airfield and it flashes the airfield identification letters in

Morse code using a high-intensity red light.

b. Obstruction Lights. All high buildings, towers, hangars and other high obstructions, both on and in the vicinity of the airfield, are marked by red obstruction lights.

c. Floodlighting. Aircraft servicing platforms are often lit by powerful floodlights set on pylons. Sodium lights on the ground or on short poles may also be seen.

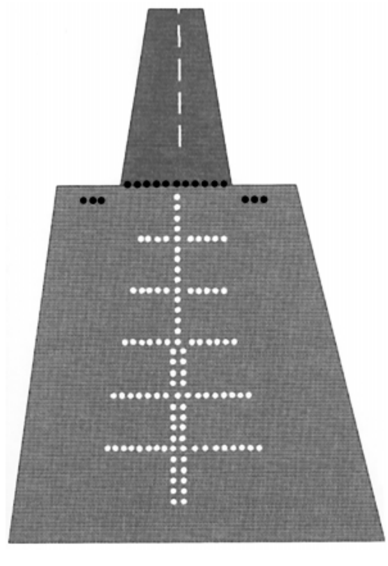
d. Taxiway Lights. Taxiways which are less than 18m wide are marked by blue edge lights along each side. Taxiways which are 18m or more wide are marked only along the centre line, and the lights are green. The airfield controller can switch the lights of different taxiways on or off, according to which are required for use.

e. Holding Position. Holding position signs are illuminated at night by either their own internal lighting (new models) or by a triangle of 3 blue lights fixed externally to the board (old models).

Approach lighting

f. Approach lighting. Approach lighting is installed, usually outside the airfield boundary and often set on poles, to form a special pattern shown at Fig 1-4.

Fig 1-4 *Approach lighting*



This pattern helps the pilot to judge the aircraft's height and to line up with the runway on the approach to land. In addition, these high- intensity white lights are invaluable in conditions of poor visibility by day, as well as at night, in helping the pilot to find the approach path visually, towards the end of a radio or radar-controlled approach.

g. Threshold Lights. The threshold of the runway is marked by a row of green lights across the runway at the touchdown end, plus "wings" of three green lights on each side of the runway (Fig 1-4). However, where the threshold is displaced up the runway (see para 9c), the "wings" are omitted.

h. Runway Lights. Main runways have high-intensity unidirectional edge lights (seen only from the direction of landing), plus some omnidirectional edge lights. As omnidirectional lights shine in all directions they can be seen from aircraft flying near the airfield, and pilots in the circuit can use them to see the outline of the runway and judge their position relative to it.

Conclusion

22. There are many fascinating things to be seen on airfields and you will learn much more when you visit airfields on annual camp or on visits to Royal Air Force stations. On your next visit, try to identify some of the features described in this chapter, or on page 34.1.1b NOTES.

Sample Questions

Do not mark the paper in any way - write your answers on a separate piece of paper, in the form of a sentence.

1. The Royal Air Force uses which type of arrester gear?

    a) RHOG
    b) RHAG
    c) RHUG
    d) RAG

2. What does HAS stand for?

    a) House And Shelter
    b) Hardened Aircraft Shelter
    c) Home Aircraft Shelter
    d) Hardened Aircraft Shed

3. What colour are the obstruction lights on high buildings within aircraft operations?

    a) Blue
    b) White
    c) Green
    d) Red

4. How far is the holding position normally situated from the edge of the runway?

    a) 60m
    b) 64m
    c) 70m
    d) 62m

CHAPTER 2

THE TUTOR

Introduction

1. AEFs. The Royal Air Force has 12 units throughout the country known as Air Experience flights (AEFs). Their role is to provide air experience flying for cadets and they are equipped with Tutor aircraft.

2. The Tutor is a small single-engined, low-winged monoplane with a simple clean appearance. It is built by the GROB Company in Germany.

Wingspan	***10.0m***
Length	***7.6m***
Height	***2.4m***
Max all-up mass	***990kg***
Engine	***Lycoming 180hp***
Never exceed speed (VNE)	***185kts***

Fig 2-1 The GROB G115E Tutor

3. The undercarriage is fixed, with brakes on the two main wheels and a steerable nose wheel. The side by side seating includes dual controls, enabling either pilot to have full control of the aircraft. Cadets fly in the left seat.

4. The aircraft is constructed of modern composite materials, specifically carbon reinforced plastic. This covering will not take the weight of anyone standing on it. When entering or leaving the cockpit therefore, great care must be taken to avoid stepping off the strengthened wing root. The marked “walking strip” is provided - walk only on th strip provided.

5. The aircraft has a Lycoming engine of 180 horse power which drives a 3-bladed variable pitch, propeller.

6. AVGAS. One hundred and fifty litres (33 gallons) of aviation gasoline (AVGAS) are carried in two tanks, one in each wing. This is sufficient to provide $2^1/_2$ hours normal flying. By contrast, this is not enough to permit some jet aircraft to taxy to the end of the runway for take-off!

Radios

7. Two radios provide both air-to-ground and air-to-air communication. One operates within the UHF band and one within the VHF band. It is important that cadet passengers do not interfere with any of the settings on the radio control boxes.

Instruments and Controls

8. An aircraft cockpit is a fascinating collection of dials, instruments, levers, knobs, switches and controls. Many of these are extremely important, and unauthorised operation of them could be embarrassing to the pilot (and subsequently to you), or even cause an accident. It is absolutely essential therefore, that you **TOUCH NOTHING IN THE COCKPIT** unless and until the captain of the aircraft tells you what to touch and when to touch it, eg the button which energizes the engines electric starter will turn the propeller which can cause lethal injuries to anyone standing within its operating disc.

9. General Cockpit Layout. The cockpit of the Tutor is simple compared with that of modern operational aircraft. Nevertheless there will be much in it that will be strange to you at first. Terms you need to know are “instruments”, (which indicate what the aircraft is doing) and “controls” (which are used to manoeuvre the aircraft, ie to make it do things).

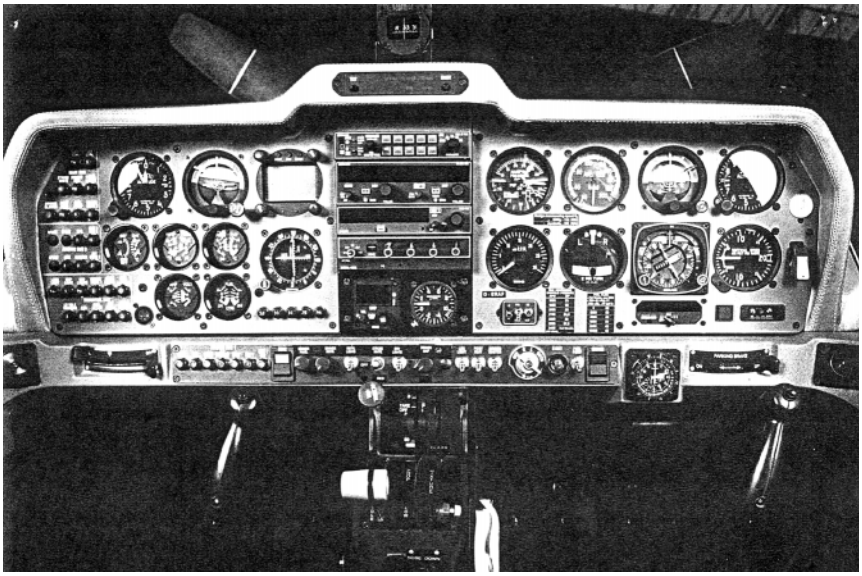


Fig 2-2 Flight Instruments

10. Flight Instruments and Controls. There are six basic instruments and three controls concerned with the aircraft itself and its flight through the air:

a. The basic flight instruments (Fig 2-2) are:

(1) Attitude Indicator (AI). The AI indicates the attitude of the aircraft – nose up, nose down, banked to right or left, etc it is a gyroscopic instrument.

(2) Airspeed Indicator (ASI). The ASI tells the pilot the speed at which the aircraft is travelling through the air. It is calibrated in knots.

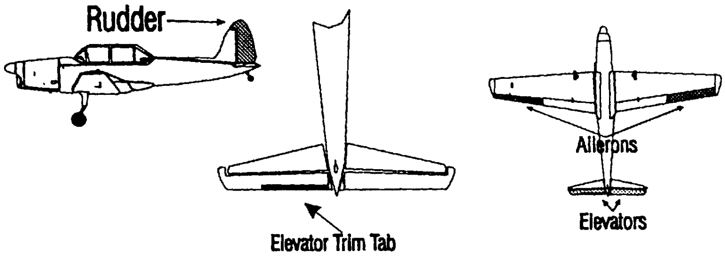
(3) Altimeter. The altimeter indicates the aircraft's height above the pre-set datum. Most instruments have three hands – one to indicate hundreds of feet, one to indicate thousands of feet and one to indicate tens of thousands of feet – and the dial is calibrated in single figures, 0 to 9. Care is, therefore, needed to ensure that the aircraft's correct height is read.

(4) Rate of Climb and Descent Indicator (RCDI)/Vertical Speed Indicator (VSI). This instrument shows the pilot the rate at which the aircraft is climbing or descending.

(5) Turn and Slip Indicator. This instrument tells the pilot the rate at which the aircraft is turning, the direction of the turn, and whether the aircraft is skidding or slipping. The turn needle is gyroscopic but the ball in the curved glass tube moves under the influence of gravity and centrifugal force. In balanced turns the ball; remains in the central position; in slipping turns, the ball falls inwards, and in skidding turns, it is flung outwards.

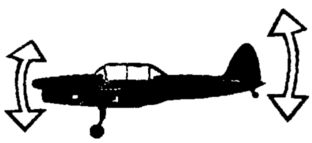
(6) Horizontal Situation Indicator (HIS). The HIS (another gyroscopic instrument), after being synchronized with the compass, tells the pilot the heading of the aircraft.

b. The main flying controls operate the elevators, ailerons and rudder and are used by the pilot to manoeuvre the aircraft.



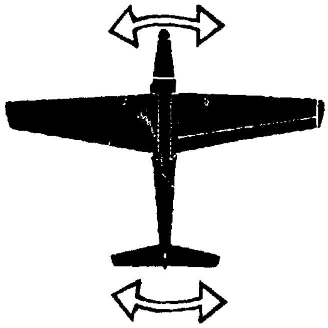
These controls are:

(1) The Control Column. The control column (or "stick") operates the ailerons and elevators and is used to control the aircraft in the rolling and pitching planes. When the control column is moved forward, the nose of the aircraft goes down; when moved back, the nose rises. When the control column is moved to the left, the aircraft's left (port) wing goes down and the right (starboard) wing rises. This causes the aircraft to "bank" to the left, giving a turn to the port. The opposite happens – ie a turn to starboard – if the control column is moved to the right.



Pitching Plane

Rolling Plane



Yawing Plane

(2) Rudder Pedals. The rudder is operated by the pilot's feet and causes the aircraft "yaw" – that is to turn without banking. The rudder is used a lot during aerobatics, but for most normal flying its main purpose is to maintain balanced flight.

11. Engine Instruments and Controls. There are several instruments associated with the engine, the two most important are grouped on the left side of the flying instruments. There are also 3 controls for adjusting the engine performance mounted on the centre console.

a. Engine Instruments.

(1) RPM. The rpm gauge shows the speed at which the engine is rotating in revolutions per minute (rpm). The reading "20" gives 2,000 rpm.

(2) Manifold Pressure (MP). This instrument gives an indication of how much power is being supplied by the engine, it responds to throttle movements and is calibrated in inches of mercury (it is the pressure in the engine inlet manifold).

(3) Temperatures and Pressures. Two small instruments under the left (secondary) AI show various temperatures (in degrees Celsius) and pressures (in pounds per square inch – psi) within the engine.

b. Engine Controls:

(1) Throttle. The throttle lever is on the centre console. If pushed forward (opened), it increases the engine output – rather like the accelerator pedal on a car.

(2) RPM Control. The RPM control is a blue lever to the right of the throttle. it enables the pilot to adjust the RPM of the engine and hence the efficiency of the propeller.

(3) Mixture Control. The mixture control lever is the red lever next to the RPM control. It enables the pilot to adjust the fuel/air ratio of the mixture going into the engine.

Other Controls

12. Wheel Brakes. The control lever for the brakes (which are on the main wheels) are small toe operated pedals mounted above the rudder pedals. The pilot can select left or right wheel brake by pushing on the left or right pedal. This is how the aircraft is steered on the ground whilst taxying in confined areas where nose wheel steering, conducted to the rudder pedals, is insufficient. To slow down during the landing run, the pilot would apply both brake pedals evenly whilst keeping the rudder bar approximately central, in order to stay in a straight line.

13. Flaps. The flaps are used on the approach to land, as they give a lower approach speed (for safety) and a more nose down attitude (for better forward vision). Flaps are at the rear inner edge of each wing (see Fig 2-2).

14. Elevator Trimmer. This allows the pilot to make fine adjustments to the elevator so that the aircraft can be flown at selected pitch attitude without pressure on the stick.

Briefing

15. Before you can go for a flight in a Tutor, you must know how to:

a. Take your place in the LH seat.

b. Fit on your parachute.

c. Plug into the radio and intercom equipment.

These, and other matters, are considered in the next Chapter.

Sample Questions

Do not mark the paper in any way - write your answers on a separate piece of paper, in the form of a sentence.

1. The Tutor is a:

   a. Low winged monoplane.
   b. Mid winged monoplane
   c. High winged monoplane
   d. Mid winged biplane

2. What three engine controls does the engine have in a Tutor?

   a. Accelerator, choke and throttle.
   b. Throttle, choke and RPM.
   c. Throttle, RPM and mixture controls.
   d. Mixture, accelerator and throttle.

3. How much fuel can a Tutor carry?

   a. 9 gallons (40 litres)
   b. 1.8 gallons (8 litres)
   c. 90 gallons (409 litres)
   d. 33 gallons (150 litres)

4. The radios on a Tutor have two bands, they are?

   a. AM/FM
   b. VHF/LW
   c. UHF/VHF
   d. UHF/VHF

5. How is the engine started on the Tutor?

   a. Electronic ignition
   b. Cranking handle
   c. Turning the propeller
   d. Electric started motor

CHAPTER 3

PRE-FLIGHT BRIEFING

– AIR EXPERIENCE FLIGHTS IN TUTORS

Introduction

1. The successful completion of any flight depends largely on the thoroughness of the preparations made by the captain and the crew before take-off.

2. The main purpose of a pre-flight briefing is to ensure that the captain, crew and passengers thoroughly understand the object of the flight and have done everything necessary to ensure its efficient and safe completion. Briefings vary widely and depend in great measure upon the role of the aircraft and the object of the flight. For example, the crew of a Nimrod aircraft may require a briefing lasting many hours, whilst a pilot making a short flight in a simple aircraft in the local flying area may need only a short briefing.

3. Pre-flight briefing for you really starts from the time you join the Corps. For example, by reading the previous chapters you can learn a lot about what to expect at the airfield and in the aircraft. There is also a film that will be shown to cadets who are being prepared for air experience flights. There is, however, a great deal more to pre-flight preparation of the uninitiated, and you must always listen carefully to the briefings.

4. When visiting an airfield you must remember that it can be dangerous to wander about aimlessly or in isolation, especially on the roads or in the aircraft manoeuvring area. It could be fatal to be struck by a propeller; to get too close to running jet engines; to walk in front of a landing glider and so on. Keep with your party, and keep a good look-out.

Briefing for Air Experience Flights

5. The pre-flight briefing given to cadets by the Air Experience Flight (AEF), will cover the following:

a. The aim of the exercises.

b. The fitting and operation of parachutes.

c. The fitting and operation of the protective helmet assembly.

d. The fitting and operation of life-preserving waistcoats, if required for that flight.

e. The fitting and operation of the aircraft safety harness.

f. Checking for loose articles.

g. Action to be taken in emergency, including abandoning the aircraft.

h. What you can and CANNOT touch in the cockpit.

i. Basic operation of the aircraft radio.

j. The local flying area.

k. Weather conditions.

l. Precautions on the ground in the aircraft manoeuvring area.

m. Medical aspects of flying.

The Aim of the Exercise

6. The initial aim of the experience flights is to introduce you to the aircraft and familiarize you with the cockpit environment. Early exercises will include the effect of some of the aircraft controls, and you will have the opportunity of actually flying the aircraft. As experience is gained, other aspects of flying will be introduced (eg turning, aerobatics), in line with the air experience syllabus.

The Parachute

Back Type Parachute

7. Description. The parachute used in the Tutor is the back type consisting of the parachute pack, 2 leg straps, a chest strap connecting the shoulder straps and rip-cord and handle.

8. Fitting. After checking that the parachute is serviceable, don it initially like a haversack and connect the chest strap fittings. Bring up the leg straps individually between the legs and clip the fasteners to the rings situated at waist level on the outside of the hip joints.

Fig 3-1 *A parachute fitted*

9. Adjustment. There are four adjusters on the harness to allow for different body sizes but the majority of adjustment is done by lengthening or shortening the leg straps.

Quick Release

10. Method of Release. Returning the parachute harness after flight (of after use!) is simple. Release the chest straps first by sliding the metal cover sideways using the thumb catches to unlock it and unhook the two halves. Then release the leg straps.

Life Preserver

Preserver and Contents

11. Description. The life preserver consists of a waistcoat worn over the flying overalls by aircrew flying over or near the sea. It contains a stole which is inflated automatically from a carbon dioxide cylinder when the beaded handle is pulled sharply downwards. An oral inflation valve allows for topping-up, by the wearer blowing into it. The stole, when inflated, will float a survivor in a safe and comfortable

attitude in water. The survivor's head has all-round support. The body takes up an angle of approx 45° to the surface waves. The life preserver will also automatically turn an unconscious survivor the right way up from a face down position.

Aids to Location

12. Life-preserving waistcoats are provided with:

a. Whistle and lanyard.

b. A heliograph mirror which can reflect the suns rays to flash signals to rescuers.

c. A light which is battery operated – activates when it comes into contact with water.

d. SARBE. This is a small transmitter and battery which when operated sends out radio signals to search aircraft or surface vessels.

Fig 3-2 *Life Preserver*

THE AIRCRAFT SAFETY HARNESS

13. Description. The aircraft safety harness is attached to the aircraft itself. It ensures that the wearer will not fall out of the seat if the aircraft is inverted, and it provides crash protection. It consists of five adjustable straps. Two adjustable

shoulder straps come up from behind the seat over the shoulders and down over the chest. Two adjustable lap straps come from each side of the seat and go over the legs (Fig 3-3). The fifth strap comes up from the front centre of the seat, and it has a quick release box at its free end. Once the parachute is fitted and the wearer is sitting in the seat, the aircraft safety harness must be put on. It goes on over the parachute harness.

Fig 3-3 *Aircraft Harness*

14. Fitting. To fit the aircraft safety harness, loosen off the adjustable straps and insert the four adjustable harness lugs.

15. Adjustment. The harness is adjusted by first pulling up on the free ends of the lap straps – these straps must be made as tight as possible. Next, the shoulder straps must be tightened fully, by pulling down on their free ends until the harness is completely tight and affords maximum restraint against forward movement. Finally the fifth (or negative G) strap is tightened to prevent upward movement.

16. Method of Release. To release, depress the yellow thumb-catch then turn the operating knob of the quick-release box approximately 60°, either left or right, to the undo position. The harness attachment lugs will then fall from the slots.

Loose Article Check

Foreign Objects

17. The paraphernalia carried in the pockets of cadets is generally limited only by the cadets imagination and the size of the pockets! Most of it, if dropped in the cockpit, could lead to dangerous situations if not recovered. Numerous accidents have been blamed on "foreign objects" being left in the aircraft by careless people. Ordinary items such as coins, pencils and keys might easily foul the flying controls and cause a serious accident. Passengers are to remove everything from their pockets before a flight to ensure that this does not happen. If you do drop something always report it to the captain so that a thorough search can be made until found. Only then will the aircraft be allowed to fly again. Never conceal the fact that you might have dropped something in an aircraft – it could cost lives!

Action in an Emergency

Remember what to do

18. Emergencies in a Tutor – or any other Royal Air Force aircraft – are rare. However, even with the best-laid plans, things can go wrong. If an emergency does arise the most important things to remember are:

* DO NOT PANIC

* DO AS YOU ARE TOLD

19. Having said that, an emergency is not the time or place for a captain to explain what you must do in response to his orders. You must know what to do! If the captain decides that the aircraft must be abandoned, he will give the warning order "Check parachutes". Depending upon the time available, the captain will already have jettisoned the canopy, or will jettison it shortly after giving the warning order. It may be possible for you to help in jettisoning the canopy, and this will have been explained at the pre-flight briefing. Having given the warning order, and when it is certain that the aircraft must be abandoned, the captain will give the executive order "Jump Jump".

Jump-jump

20. As soon as the captain has ordered "Jump Jump", you should release the aircraft safety harness (not your parachute harness!), stand up in the cockpit and dive head first over the side of the aircraft, aiming to clear the trailing edge of the wing. It is vital that you do this immediately the captain has ordered "Jump Jump".

21. Having fallen well clear of the aircraft, all you have to do is to pull the metal handle (or "D" ring) which is attached to the rip-cord. The handle is on the right shoulder of the parachute harness. It is large and not difficult to locate, although you may have to look for it, rather than just feel! As the handle comes out quite a long way, it must be held firmly and given a good pull to its fullest extent (Fig 3-4). This releases the parachute from the pack and completes the essential part of the bale-out procedure. A parachute landing is roughly comparable to jumping off a wall about 3-4 metres high.

***Fig 3-4** Rip-cord extended*

The Cockpit

Only touch when told

22. You read earlier that an aircraft cockpit is a fascinating collection of knobs, levers, switches, etc, but no matter how intriguing they are, you must touch nothing unless instructed by the captain. Normally, the items you will be told to handle are the control column, the rudder pedals and the throttle lever.

Radio

23. The inner part of the protective helmet assemble contains earphones with a boom microphone (Fig 3-5). Once the headset is connected to the aircraft the intercom system becomes "live".

Fig 3-5 *Headset and Helmet*

24. The radio will normally be set up for operation from either seat. If the need arises for you to participate in the operation of the radio the captain will tell you precisely what to do.

Local Flying Area and Weather

25. You should be given a general briefing on the local flying area and the weather to be expected. Places of interest will probably be pointed out, and you should look for them during the flight. Most cadet crew rooms have a local map and it pays to study this for its major features whilst waiting to fly.

Precautions on the ground

Beware of propeller discs

26. The aircraft movement area can be a dangerous place for the careless. It is vital to keep alert with your eyes and ears open when walking about. One golden rule is never to walk within the propeller disc, even if the engine is stopped – a habit which may stop you doing so when the engine is running! Keep a good look-out for moving aircraft at all times and move only where you are told you may go.

Medical Aspects

Colds and flu don't mix - Inform Flt Commander

27. As height above ground increases, the normal air pressure reduces. The human body normally adjusts quite naturally to this without difficulty. However, with a cold, or the catarrhal after-effects of a cold, discomfort may well be experienced

in the ears and sinuses. Blocked “tubes” can prevent pressures from equalizing or your ears from “clearing”, sometimes with painful results. Royal Air Force aircrew do not fly in these circumstances and you must not do so either. If you do have a cold, or are still suffering from the after-effects of one, tell the escorting officer who will inform the flight commander.

28. Some people find the flying environment a little strange and some may feel slightly unwell in the air. This is not unusual and need not cause concern. The feeling wears off with almost everyone after a few flights. Should you feel at all nauseous, simply inform the captain who will tell you what to do. Slow deep breathing often helps to avoid it and minimizes the effect.

Conclusion

Enjoy your Air Time

29. Before arriving at an AEF you will have been briefed at your squadron and may have seen the training film as part of your training. At the AEF you will see a safety video and receive a pre-flight briefing on the exercise you are to carry out and on the airfield from which you are to fly. Provided you have also prepared yourself well by studying these notes, you will be able to make the best possible use of every minute that you are airborne.

Sample Questions

Do not mark the paper in any way - write your answers on a separate piece of paper, in the form of a sentence.

1. Which of the following is not covered in the flight briefing?

   a. Flying controls
   b. Weather conditions
   c. Loose article check
   d. Fitting and operation of parachutes

2. If you are about to fly but have a cold who should you tell?

   a. Your parents
   b. Your friends
   c. Your Flight Commander
   d. Your doctor

3. On a life preserver the battery operated light is activated:

   a. As soon as the jacket is inflated
   b. When the beaded handle is pulled sharply
   c. When it gets dark
   d. As soon as the jacket comes into contact with water.

4. What does AEF stand for?

   a. Air Experience Flight
   b. Air Excellent Flight
   c. Air Extensive Flight
   d. Air Exciting Flight

CHAPTER 4

VGS AND GLIDING

Introduction

1. VGS and Types of Glider. Air Cadet Volunteer Gliding Schools (VGSs) are situated throughout the country to provide glider training for cadets. Some Air Cadet gliders are self-launched – and these are described in the next chapter. This chapter covers the operation of winch-launched gliders.

2. The backbone of the winch-launched fleet is the VIKING two-seater, used for both basic and advanced cadet training. The aircraft are of glass reinforced plastic (GRP) construction. The Viking is a two-seater and has tandem seating for the crew with dual controls, the instructor occupying the rear seat.

3. Medical/Physical Requirements. Cadets who attend glider flights must be medically fit to obtain the most from the experience. You should be aware of some physical limitations before starting your gliding career. The minimum weight for gliding is 48 kg and the maximum is 103 kg (fully clothed, less parachute). There is also a maximum height restriction in the Vigilant of 992 mm from the seat to the top of the head (to ensure clearance between head and canopy).

4. Solo at 16. Cadets begin gliding with a gliding induction course (GIC) or air experience gliding (AEG). Opportunities for pilot training will follow on the gliding scholarship (GS) course, and cadets who show an aptitude for gliding are able to fly solo at or above the minimum age (by law) of 16 years.

Fig 4-1 *Viking Pre-launch checks*

After flying solo there are opportunities for specially recommended cadets to be given advanced gliding training (AGT) and some may eventually become Flight Staff Cadets and gliding instructors.

5. Team Work Wins. Gliding requires teamwork and a high standard of airmanship if everyone is to enjoy the activity to the full. Individuals are given clearly defined duties, which they must carry out responsibly so that gliders can be launched safely and, after landing, brought back to the launch point. Working in the open air as part of a team, and enjoying the pleasure of flying in a quiet, vibration-free aircraft, make gliding a really worthwhile experience.

The Glider

6. Controls. A glider's controls and control surfaces are like those of a conventional aircraft. In other words, a glider is controlled by the co-ordinated movement of the elevators, ailerons and rudder, which the pilot operates through the control column and the rudder pedals, just as in the Tutor. In addition, winch-launched gliders have:

a. A yellow toggle which the pilot pulls to release the cable when the glider has reached the top of the launch.

b. A lever to operate the airbrakes.

7. Airbrakes. There are various types of airbrake. Those on Air Cadet gliders are panels which extend upwards from the top surface of the wing. When retracted within the wing the top edge lies flush with the wing surface.

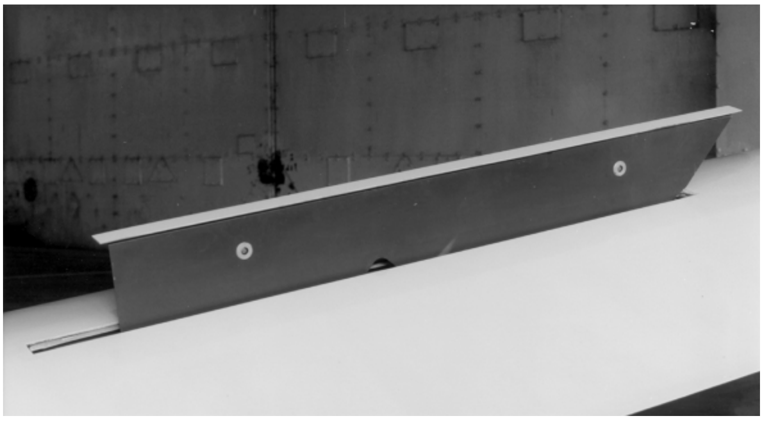


***Fig 4-2** Airbrakes*

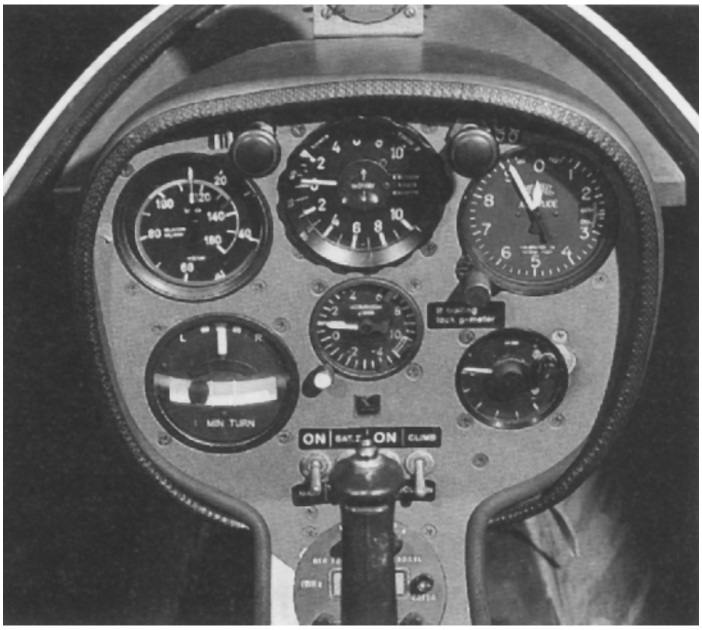
When extended they increase the drag and reduce the lift, allowing the glider to descend more quickly without increasing the speed. This enables the pilot to land in a much smaller space than would otherwise be possible.

8. Seat Harness. An aircraft seat harness, one for each seat, is fitted so that the occupants can strap themselves securely to the seat.

Fig 4-3 *Aiorcraft Safety Harness*

9. Flight Instruments. Although the glider is normally flown by visual reference to the horizon, four flight instruments are fitted for accuracy. Three of these, the airspeed indicator, the altimeter and the turn and slip indicator function similarly to those fitted in the Tutor. However, the fourth (the Variometer) is specific to gliders. Its purpose is to indicate whether the glider is losing or gaining height. This is not quite as simple as it sounds, as a glider might at one moment be in still air, descending gradually to maintain flying speed, then the next moment it might encounter air which is rising fast enough to overcome that descent and make the glider gain height. Equally, it might enter descending air which will increase the rate of descent. The variometer is invaluable in helping the pilot to find rising air, and to stay in it to prolong the flight. In fact, the Viking has 2 variometers, one of which indicates rising or descending air by means of audio tones from a loud speaker.

Fig 4-4 Glider Instruments



Launching

10. Since a glider has no engine it must be accelerated to its flying speed in some other way. One method is aerotowing – whereby a powered aircraft pulls a glider off the ground and up to a pre-determined height by means of a towing cable. However, the opportunity for this is rare, so we shall concentrate on the method you are more likely to experience, the winch launch.

11. A winch (Fg 4-5) is a drum on which is wound about 1,500 metres of strong, flexible steel cable. The drum is turned by a powerful engine which the winch driver (Fig 4-6) controls through an automatic gearbox.

12. "All Out" for Take-off. The winch is normally sited close to the upwind boundary of the airfield. The cable is attached to the rear of a motor vehicle and drawn out to the launch point at the other end of the airfield, downwind of the winch. When the pilot is ready the cable is attached to the glider. The pilot checks there is no hazard from behind, by asking the wing tip holder "ALL CLEAR ABOVE AND BEHIND?" and calls "TAKE UP SLACK". This instruction is passed to the winch driver by a signaller using either lamp signals or large bats. On receiving the signal the winch driver slowly reels in the cable until it is taut. When the pilot is satisfied that the

Fig 4-5 *The Van Gelder Winch*

Fig 4-6 *Winch Driver*

slack has been taken up the order "ALL OUT" is given. The signaller signals this to the winch driver who then opens the winch throttle to wind the cable in. The cable pulls the glider forward and after a short distance it becomes airborne. Initially the glider climbs gently, but the attitude quickly steepens and height is gained rapidly. When the cable is about 70° to the horizontal, the pilot releases it and is then free to commence the gliding exercise.

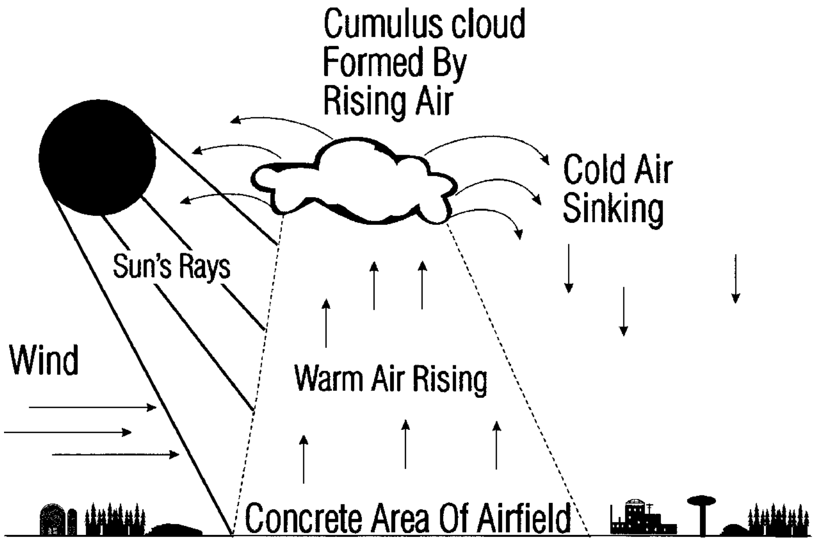
13. When released, the cable falls to earth, steadied by a small parachute. It is then reeled in by the winch driver ready for the next launch. The height achieved from a winch launch varies with wind strength, the speed at which the cable is being wound onto the drum, and the length of cable being used. However, as a rough estimate the height gained is usually about one third of the cable length being used (eg 1,000 metres of cable gives a launch height of 1,000 feet). A winch launched flight normally lasts for 6-10 minutes, giving the pilot ample time to complete some exercises and a standard circuit of the airfield.

Soaring

14. Soaring with Thermals. Soaring is the art of finding rising air and, then using it to gain height, thus prolonging the flight. For example, "thermals" caused by uneven heating of the earth are common on hot sunny days. Surfaces such as green fields, woods and lakes do not heat up as rapidly as concrete, tarmac, built-up areas, sandy areas or dry fields. Thus concrete or tarmac areas will become much hotter than the surrounding green fields. The air over the concrete will therefore rise (like a hot air balloon); this rising air is called a thermal. Thermal activity is not

continuous, the warm air being released in the form of bubbles which rise at intervals like invisible air balloons.

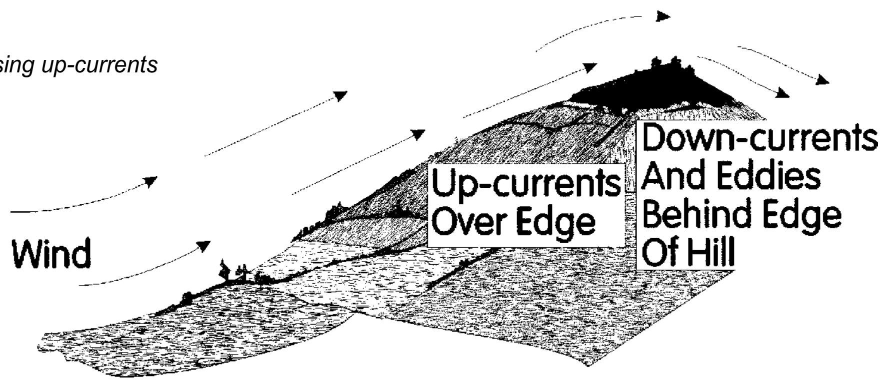
Fig 4-7 *Thermal Conditions*

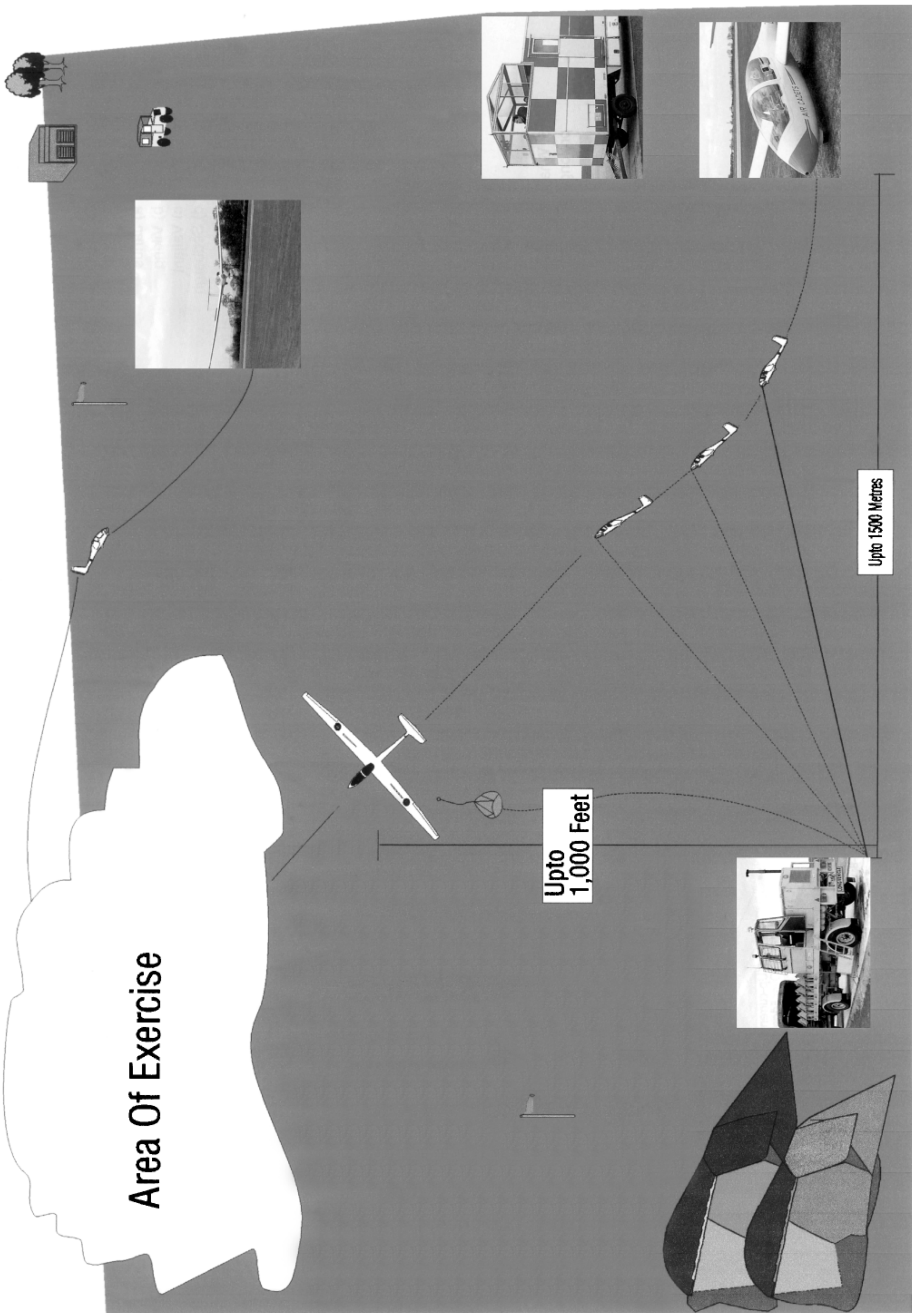


If the rising air is moist, cumulus or heap type clouds will form (see Fig 4-7) which can give pilots a good idea of where thermals are forming. If thermal activity is suspected the pilot will keep an eye on the variometer and when he finds rising air the pilot will try to circle in it and gain height. Even with the aid of the variometer, it requires considerable skill and experience to get maximum use from thermals.

15. Rising air can also be found on the windward side of hills. When the surface wind strikes the face of a hill or ridge it will be deflected upwards, becoming an up-current (Fig 4-8). By staying in this rising air the pilot will be able to maintain or gain height, according to the strength of the up-current. Care must be taken not to fly the glider behind the ridge, as down-currents there would cause the glider to lose height rapidly.

Fig 4-8 *Using up-currents*




Area Of Exercise
Upto 1,000 Feet
Upto 1500 Metres

Sample Questions

Do not mark the paper in any way - write your answers on a separate piece of paper, in the form of a sentence.

1. The winch launched glider mainly used in the ATC is the:

a. Janus.
b. Viking.
c. Vigilant.
d. Sedbergh.

2. Which instrument is specific to gliders?

a. Airspeed indicator.
b. Turn and slip indicator.
c. Variometer.
d. Altimeter.

3. Most gliders in the Air Cadet fleet are made from:

a. Fabric.
b. Metal.
c. Glass reinforced plastic.
d. Polycarbon fibres.

4. The most common method of getting a glider airborne is:

a. Aero-tow.
b. Car-tow.
c. Winch.
d. Bungee.

5. What is the term used for that type of gliding where the flight is prolonged by the use of rising air?

a. Soaring.
b. Cruising.
c. Lofting.
d. Loitering.

CHAPTER 5

GLIDING – VIGILANT

1. Self Launch. The purpose of this chapter is to introduce the VIGILANT and to give you an idea of what it is like to fly.

Fig 5-1 *The Vigilant in Flight*

2. The Vigilant differs from the other Air Cadets gliders in that it has an engine and propeller so that it can launch itself. It can taxi, take-off and climb under its own power to a height selected by the instructor. It can be flown as a glider by allowing the engine to idle, or for some advanced exercises, by shutting down the engine. It is used to train cadets in the effect of controls, climbing, gliding, turning, stalling, circuit flying, approach and landing, etc. It will also soar, given reasonable soaring conditions. The engine is not powerful enough for rapid climbing, and it takes some 5 minutes to reach 2,000 feet. However, the reduced ground handling time results in much more airborne time for you.

Fig 5-2 *The Cockpit Layout*

The Aircraft

3. Built in Germany. The Vigilant T Mk 1 is a GROB 109B self launching motor glider designed and built in Germany but modified to incorporate RAF requirements.

4. It is a low-winged cantilever monoplane with folding wing, a 'T' tail, and side-by-side seating with dual controls (Fig 5-2). The cockpit has 2 Perspex doors which open upwards, giving easy access and good all-round vision. The cockpit has heating (provided the engine is running). The seats are not adjustable but seat cushions can be added or taken out to suit the cadet. The rudder pedals are adjustable.

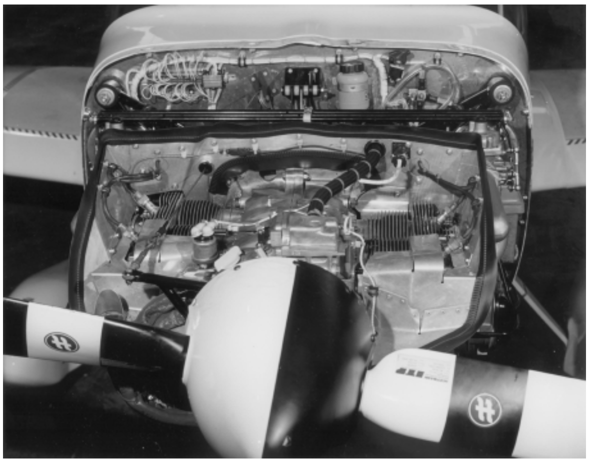


Fig 5-3 *The Vigilant's engine*

5. GROB 2500 E1 Engine. Power is provided by a GROB 2500 E1 horizontally-opposed 4-cylinder air-cooled petrol engine, developing 95 BHP at 3400 rpm.

6. The engine has a direct drive to a 2-bladed variable-pitch propeller having 3 settings: fine, for most flying, coarse pitch, for cruising, and feathered for gliding with the engine off. Hot air can be fed to the carburettor when there is a risk of carburettor icing.

7. Duplicated Controls. Other engine controls and instruments include an ignition switch, an RPM gauge, and oil pressure gauge. There is also a throttle control for each pilot, and a handle for feathering the propeller. The engine is started electrically, with power from the aircraft's own 12V battery. An engine-driven alternator keeps the battery charged. There is a choke control for cold starting, similar to that found in some motor cars.

8. 100 Litres of AVGAS Carried. A 100-litre (22 gallon) fuel tank is mounted in the fuselage behind the pilot's seats. Fuel reaches the engine via a pipe through the seat bulkhead, to a fuel cock between the seats, and then through a fireproof engine-bay bulkhead to an electric fuel pump. This pump feeds fuel to an engine-driven mechanical pump and then to the 2 carburettors. Fuel used is AVGAS 100 octane.

9. The fixed undercarriage consists of 2 main wheels and a tail wheel. The main wheels are mounted on spring steel leaves. The tail wheel is connected to the rudder by springs and steel struts, so that the tail wheel elastically tracks the rudder up to a maximum rudder deflection of 30°. Thus, when taxying, the aircraft can be steered with its tail wheel, by moving the rudder pedals left or right. This is sufficient for gentle turns, but for sharper turns differential braking (using the "toe brakes" on the rudder pedals) is needed.

10. SSR. The Vigilant has modern avionics which include a 760-channel VHF radio for both air-to-air and air-to-ground communications. A secondary surveillance radar (SSR) transponder is provided which, when interrogated by ground Radar, automatically identifies the aircraft and its position.

11. The Vigilant has flight instruments similar to those in the Viking – air speed indicator, altimeter, turn and slip indicator, variometers – plus an artificial horizon similar to the one in the Tutor.

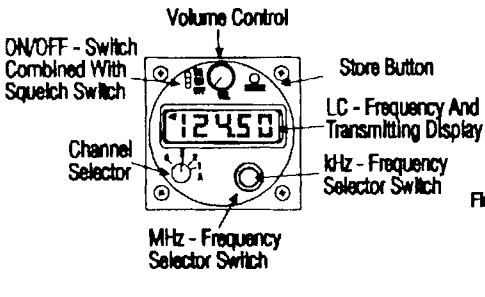


Fig 5-4 VHF Radio Set

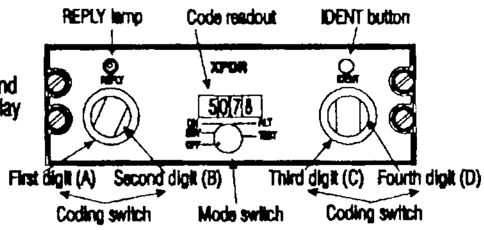


Fig 5-5 SSR Set

12. Airbrakes. The flying controls are conventional, with elevators and ailerons operated by the control column, and a rudder operated by pedals. The Vigilant has airbrakes similar to those of the Viking. They are operated by a lever, each pilot having a control. On final approach the pilot keeps one hand on the control column

and the other on the airbrake lever. The airbrakes are locked into the closed position by pushing the lever forward against the over centre lock.

Fig 5-6 *The Airbrakes Extended*

Checks

13. Pre-use Checks. The Vigilant is operated just like other RAF aircraft. The crew carry out checks at each stage to ensure that the aircraft is serviceable and that the correct procedures are followed. These checks are listed in full on the "Flight Reference Cards" carried by the pilots, and they are too detailed to be repeated here. However, the following summary will give you a flavour of what is involved.

a. Initial Checks. On approaching the aircraft, check that it is positioned clear of obstacles and other aircraft, that there are no obvious faults (eg fuel and oil leaks) and that a ground fire extinguisher is available. In the cockpit, check that the ignition is off, parking brake on, aircraft fire extinguisher stowed and fuel contents sufficient for the flight.

b. External Checks. A thorough external check now follows, whereby the pilot walks systematically around the aircraft checking visually that everything looks serviceable and that all covers and external locks have been removed.

c. Cockpit Checks. The crew now checks in the cockpit for loose articles, enters the cockpit and straps in. The instructor checks that both he and the student can obtain full rudder movement. The checks continue: harness tight and locked; controls (other than the rudder) free to move; instruments correctly set and no obvious damage; canopy doors properly closed and locked.

d. Engine Checks. Engine starting checks include: parking brake on; throttle closed; fuel on; choke selected (normally needed only for the first start of the day); control column held fully back; propeller unfeathered and clear of persons and objects. The pilot now turns the ignition key, and as soon as the engine is running smoothly, pushes in the choke (if used). Immediately after starting, the pilot checks that the oil pressure is rising and the starter warning light is out. The throttle is then set to give 1500-1700 rpm and the pilot checks other items including the radio and transponder.

e. Taxying Checks. Apart from checking that the area ahead is clear, before moving off and at all times whilst on the move, there are 3 special checks to be done whilst taxying:

(1) The operation of the wheel brakes is tested as soon as taxying begins.

(2) The rudder pedals are used to check the rudder movement and the tail wheel steering.

(3) The turn indicator, artificial horizon and compass are checked for correct functioning.

f. Power Check. Before the first flight each day, when the engine is warm enough, it must be checked for the ability to reach full power (2550 to 2750 rpm). For convenience this is often done at the holding position.

g. Pre-Take-Off Checks. At the holding position, everything vital to a safe flight is checked: trimmer position, throttle, choke position, carburettor heating, fuel (cock, pump, contents), flight and engine instruments, doors, harness, flying controls, air brakes, anti-collision lights.

h. Take-Off Checks. During the take-off, the pilot checks that the throttle is fully open, that the engine is operating correctly, and that the ASI is functioning.

Fig 5-7 *The Vigilant's Walking Strip*

Fig 5-8 *The 'T' tail Plane*

Fig 5-9 *The Wing Tip with Lights*

Flight Reference Cards

14. By now you may feel daunted by all these checks. However, aircrew are not required to remember everything, and in fact trying to do the checks from memory is actively discouraged. It is standard procedure to use the "Flight Reference Cards" provided for all RAF aircraft.

Operating the Aircraft

15. Taxying. The Vigilant has excellent visibility from the cockpit and good manoeuvrability provided by the steerable tail wheel. After releasing the brakes the pilot opens the throttle just enough to get the aircraft moving. Once moving, the throttle setting must be reduced, otherwise the aircraft would continue to accelerate.

The aircraft is taxied at no more than a fast walking pace. Closing the throttle will usually bring it to a halt on grass, but if the aircraft is on a smooth surface, gentle use of toe brakes will be needed.

16. Take-Off. After checking that the take-off path is clear and that there are no other aircraft on the approach, the pilot will taxi onto the runway and line up for take-off. With the brakes off, the throttle is then opened smoothly to full power. There is a slight tendency for the aircraft to swing to the right, but this can easily be checked by the application of a little left rudder; larger rudder pedal movements should be avoided while the tail wheel is on the ground. With the control column kept slightly aft of neutral, the aircraft will fly off the ground at about 46 knots. The tail wheel must not be raised too high during the take-off run because of the small propeller ground clearance. After take-off, the aircraft is held in a shallow climbing attitude whilst the air speed builds up to 60 knots. This speed is then maintained during the climb. On reaching 800 feet above ground level, and if staying in the circuit, the aircraft is put into level flight (60 knots and approximately 2300 rpm) then turned through 180° onto the down wind leg. The subsequent circuit pattern depends upon the nature of the exercises to be carried out.

17. The Vigilant is considered to be an easy aircraft for students to fly. The controls are light and responsive and even cadets of slight build should have no difficulty in flying the aircraft. Whether it is Air Experience, a Gliding Induction Course (GIC) or a Gliding Scholarship (GS), which will come later, you will enjoy flying this aircraft. The training is progressive, so you are not “thrown in at the deep end”. For example, you will start with the effects of controls, but the instructor will of course still do the take-off and landing. Much of the time you will be doing all the flying with only occasional comment and advice given by the instructor. From then on it is a matter of perfecting flying technique and learning to do the standard circuit patterns, Fig 5-10. During the flights, training is given to ensure that you understand the consequences of trying to fly the aircraft too slowly or of mishandling the aircraft in other ways. Similarly, you must be thoroughly familiar with the correct course of action in case of an engine failure after take-off. Eventually, you will have fully mastered the control of the aircraft and at GS level you will be able to carry out the take-off and landing yourself.

18. The syllabus includes the following exercises:

a. Ground Lesson on airfield discipline.

b. Introduction to the Glider.

c. Effects of Controls.

d. Engine starting and taxying.

e. Climbing, gliding and level flight.

f. Take off and climb.

g. Medium turns.

h. The approach and landing.

i. The stall.

j. Circuits.

k. Engine failure after taken off (EFATO).

l. First solo.

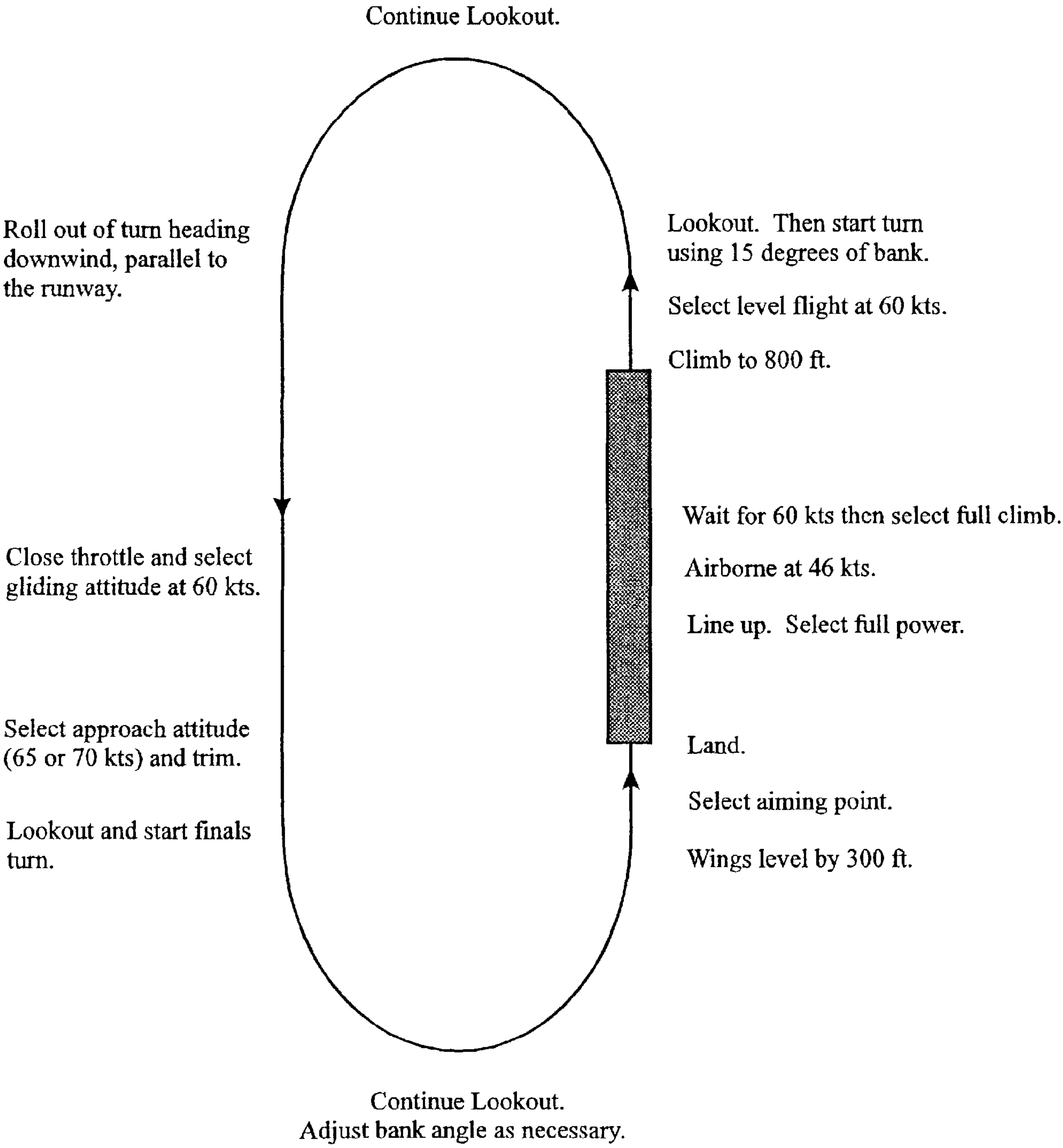


Fig 5-10 *A Typical Circuit*

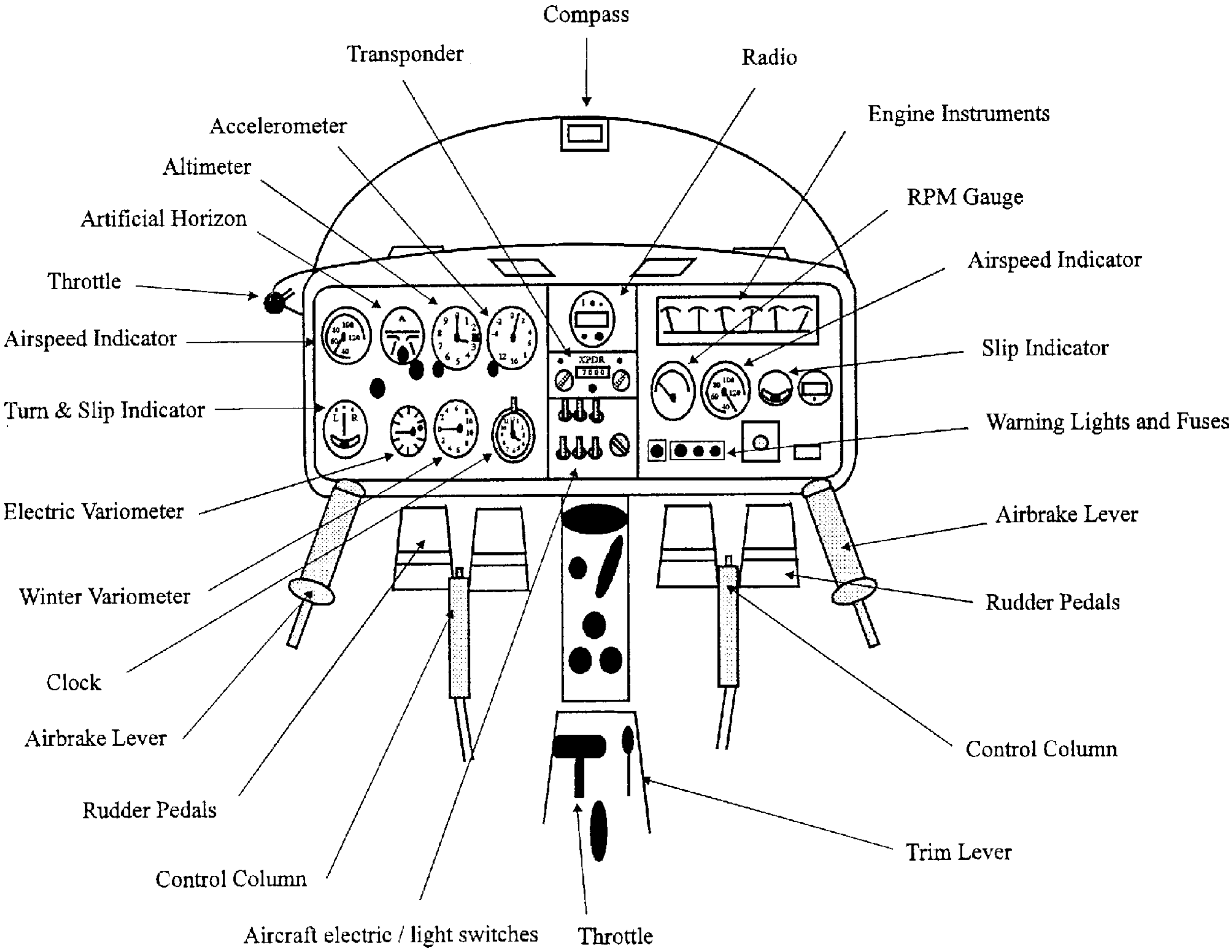


Fig 5-11 *Cockpit Layout*

Sample Questions

Do not mark the paper in any way - write your answers on a separate piece of paper, in the form of a sentence.

1. In the Vigilant, at what height is the circuit normally flown?

   a. 800 feet
   b. 900 feet
   c. 1000 feet
   d. 750 feet

2. Checks are required before and during take-off. Aircrew should?

   a. Memorize the checks
   b. Check everything
   c. Use Flight Reference Cards
   d. Rely on past experience

3. How many channels does the Vigilant's radio have?

   a. 770
   b. 750
   c. 760
   d. 670

4. The propeller on the Vigilant has?

   a. 2 blades with 3 pitch settings
   b. 3 blades with 2 pitch settings
   c. 1 blade with 3 pitch settings
   d. 3 blades with 3 pitch settings

5. The Vigilant has 100 Litres of fuel. Is it?

   a. AVGAS 90 octane
   b. AVGAS 110 octane
   c. AVGAS unleaded
   d. AVGAS 100 octane

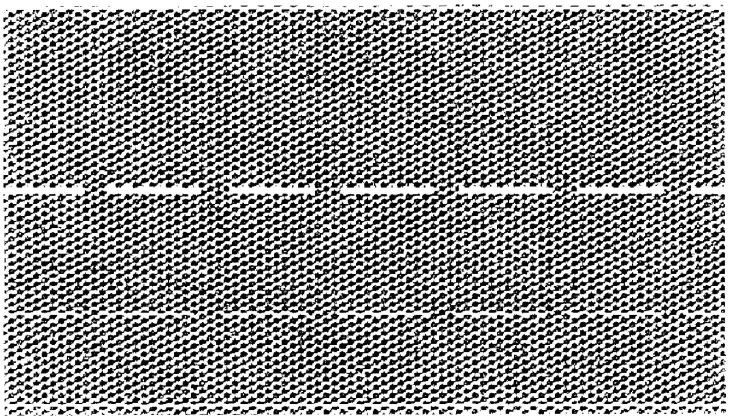
CHAPTER 1

INSTRUCTORS GUIDE

Page 34.1.1-4 Para 9

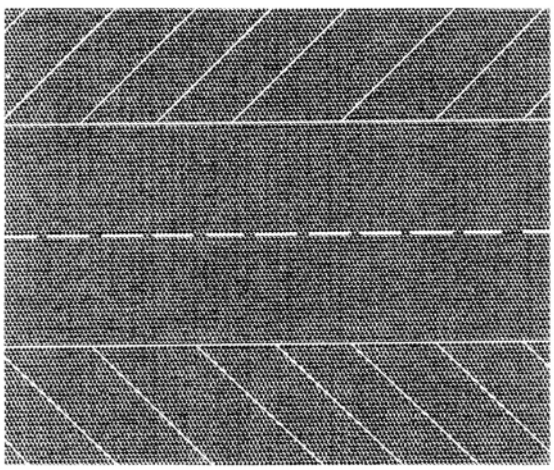
AIRFIELDS

On larger airfields some taxiways may also have an off-centre white broken line (similar to road markings). This is for the safe passage of ground vehicles moving within the main aircraft areas.



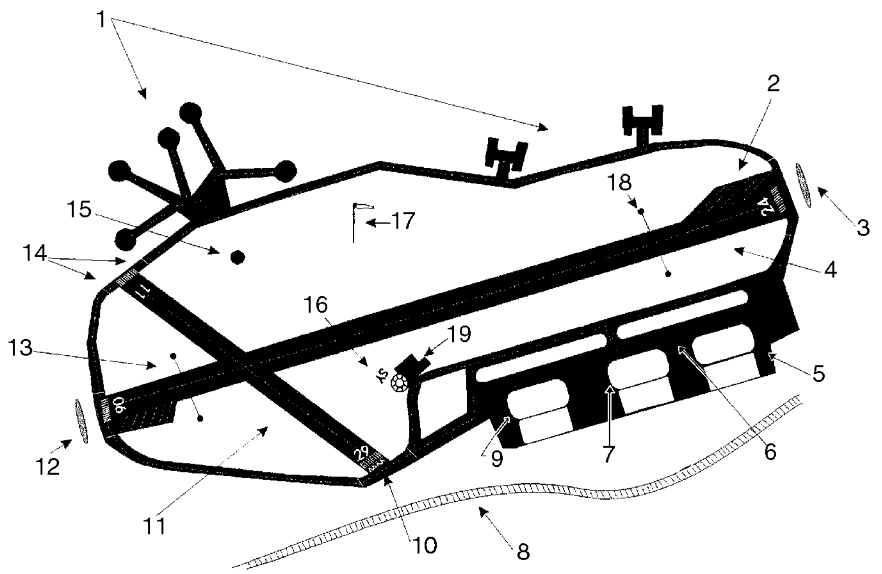
Barriers. At RAF airfields, the standard configurtation for the upwind barrier may be "UP" or "DOWN", according to Command policy and the type of aircraft. For obvious reasons, propeller-driven aircraft are not cleared to use a barrier, although the controller would raise the barrier if the aircraft captain called for it in dire emergency.

On runways where the shoulders have the appearance of operational paving but are not to be used as such, those areas are marked with diagonal yellow stripes.



CHAPTER 1

Page 34.1.1-9 para 22



AIRFIELD FEATURES

CHAPTER 2

INSTRUCTORS GUIDE

Page 34.1.2-1 Para 1

Each year some 50,000 Air Experience Flights are carried out throughout the Air Cadet Organisation. This means that at the beginning of 1999 the total sortie count was 2,050,000.

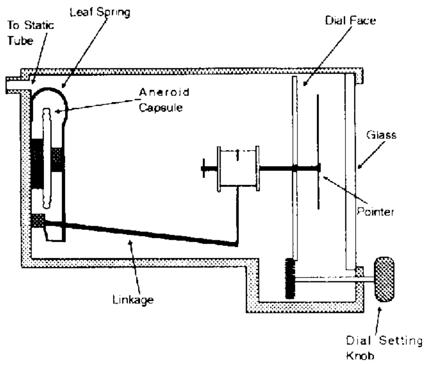
Page 34.1.2-3 Para 10

Artificial Horizon/Attitude Indicator: This instrument gives an indication of pitch and roll when there is no horizon to be seen. It is visualised by the use of a fixed symbol representing the aircraft, with a moving horizon line controlled by a gyroscope. Using the displays of pitch attitude and bank angle, manoeuvres such as turns may be completed on instruments alone.

Air Speed Indicator: Essentially this instrument measures the pressure difference between static and dynamic air. This is done by the use of a diaphragm or sometimes a capsule. If the aircraft is stationary there is only static pressure. When the aircraft is in forward motion the dynamic pressure builds up through the open ended pitot tube, which faces into the airflow, and the diaphragm swells accordingly. The difference between the two pressures (static and dynamic), is displayed in units of speed rather than units of pressure.

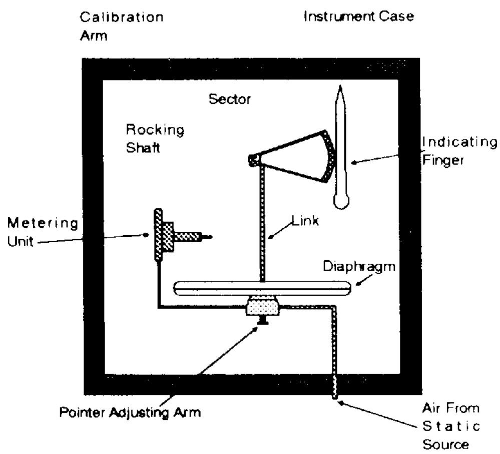
Direction Indicator: This instrument allows a pilot to turn onto and fly headings without the turning and acceleration errors connected with a magnetic compass. It does not seek magnetic north like a compass and so needs to be synchronised with the aircraft compass before use. It is a gyroscopic instrument and is susceptible to errors including apparent drift (due to the gyro maintaining its position in space, rather than relative to the earth), and real drift (caused by imperfections in manufacture). Hence, it must be re-synchronised every 10 minutes or so. During turns the gyro is free to maintain its upright position and the instrument has a toppling limit. Older types had a limit of 55° in pitch and roll but more modern types have been increased to 85°. The next generation instrument has no toppling limits at all. In practise, before doing any manoeuvres likely to topple the gyro, it is good airmanship to "cage" it -i.e. to lock it and prevent all movement except its spin - using the cage knob at the front of the instrument.

The Altimeter: This instrument indicates the distance above a preset datum with reasonable accuracy. The datum may be an airfield, sea level or a standard datum for the area in which the aircraft is operating. The instrument consists of an airtight box fed by a static vent/line to give the instrument the same pressure as exists externally. The instrument uses an evacuated capsule which is prevented from collapsing by a leaf spring. As height is increased the pressure decreases, allowing the spring to expand the capsule which is connected via a linkage onto the instrument dial. The altimeter is essentially an aneroid barometer with its scale in height units rather than in pressure units.



CHAPTER 2

Vertical Speed Indicator: The VSI measures the rate of climb or descent. Its main uses by the pilot are to maintain level flight or a constant known rate of descent. It consists of an airtight case with a capsule and a linkage to the indicating finger. It is fed by outside static pressure which is compared with the pressure at a choke point, calibrated to leak at a given rate. In a climb or descent the outside pressure (via static tube) will change but the choke restricts the flow. Thus, the capsule will contract (in a climb) or expand (in a descent), and the linkage will move the finger on the dial.



Turn and Slip Indicator: This instrument is used by pilots to achieve turns at a given rate without slip or skid and therefore, primarily a reference for balanced flight. The instrument is in fact two in one and because their uses are so closely related they are mounted in one case. The ball shows slip and the needle shows rate of turn - left or right. The turn indicator is a gyro which moves in one plane only (vertically). The gyro has springs attached so that in a turn the gyro tilts and the springs equal the tilt. This movement is displayed via a pointer. Slip indicator is a ball that moves within a glass tube. When a turn is in balance correctly the ball lines up with the normal axis of the aircraft indicating no slip or skid. If a turn is made with too little bank and too much rudder, the resulting yaw throws the ball towards the outside of the turn, indicating a skid, while too little rudder and too much bank makes the ball move towards the inside of the turn, indicating a slip. The turn rate is displayed by a needle against a scale. On the turn and slip indicator shown in Fig 2-4, the first mark on the scale is for a “rate 1” turn, i.e. a turn of 180° per minute.

The Control Column. The control column (or “stick”) operates the ailerons and elevators. In an aircraft in straight and level flight, move the stick slightly to the left and the aircraft “rolls” slowly to your left; centralise the stick and the roll stops - the aircraft is now “banked” and is turning left. move the stick gently to the right and the aircraft will roll gently to the right. Again, you can stop the roll by centralising the stick - say, when the wings are level if you want to fly straight ahead, or when you are banked to the right if you want to turn right. From straight and level flight, move the stick slightly forward and the nose “pitches” gently away from you (moves downwards); centralise, and it stops pitching. Ease gently back on the stick and the nose pitches towards you (rises), and stops when you centralise.

Self Assessment Questions - Answer Sheet

Chapter 1 Page 34.1.1-10

1. b
2. b
3. d
4. c

Chapter 2 Page 34.1.2-7

1. a
2. c
3. d
4. c

Chapter 3 Page 34.1.3-10

1. a
2. c
3. d
4. a

Chapter 4 Page 34.1.4-8

1. b
2. c
3. c
4. c
5. a

Chapter 5 Page 34.1.5-11

1. a
2. c
3. c
4. a
5. d