

CHAPTER 2

THE LAYOUT OF AN AIRFIELD (*Contd.*)

AIR TRAFFIC CONTROL

Introduction

1. At Royal Air Force airfields all movements of aircraft, both on the ground and in the air, are monitored and controlled by an organization known as Air Traffic Control (ATC). Control is exercised by Very High Frequency (VHF) and Ultra High Frequency (UHF) radio telephone (R/T) by which controllers communicate with pilots. In a simple situation there are two controllers—the airfield controller and the approach controller. They and their staff are located in the Air Traffic Control tower. Other controllers, responsible for the safety of aircraft flying between airfields, may be located in Air Traffic Control Centres (ATCCs) or Air Traffic Control Radar Units (ATCRUs) neither of which need be situated on airfields.

The Control Tower

2. The control tower is situated in a prominent position in the aircraft manoeuvring area. It consists of a series of offices and rooms housing electronic equipment and the meteorological and flight-planning sections. The size and design of ATC towers vary considerably. An example is illustrated in Fig 5.

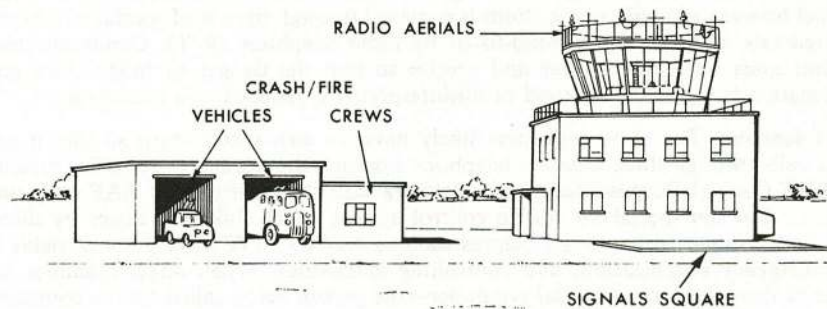


Fig 5 The Control Tower

The Airfield Controller

3. The airfield controller is located in a glass-walled control room built on top of the control tower. From there he has an uninterrupted view of the whole manoeuvring area, of aircraft on the ground, taking-off, in the airfield circuit and landing. He controls all traffic on the ground in the manoeuvring area (aircraft, vehicles and pedestrians), and all flying in the local circuit.

The Approach Controller

4. The approach controller controls aircraft departing the airfield circuit and those making instrument approaches. Since most of these aircraft are out of sight of the airfield, it is not necessary for the approach controller to have a view of the manoeuvring area but he must be in constant contact with the airfield controller. He obtains his information by R/T, landline communications, and from displays.

The Runway Controller

5. To enable more effective control to be exercised over the runway in use, a runway controller is used on many airfields that have a high rate of movements (take-offs and landings). He is stationed in a caravan, painted in red and white squares, positioned to the left of the touch-down end of the runway in use. The runway controller is in direct contact with the airfield controller and is responsible to him for keeping a very close watch on vehicular traffic in the vicinity of the runway and on aircraft taking-off and landing. Equipped with white, red and green signalling lamps and Verey pistols he would, for instance:

- a. Prevent an aircraft from landing with its undercarriage retracted by firing a red Verey cartridge.
- b. Stop an aircraft from taking-off with a panel unlocked or a fuel leak, with a steady red on the signalling lamp.
- c. Warn aircraft in danger of collision, with a steady red on the signalling lamp.
- d. Give permission to take-off, with a steady green.

COMMUNICATIONS

6. **Requirement.** The control of modern, high speed aircraft depends largely on good communications both ground-to-ground and ground-to-air. Swift and accurate contact between ground organizations is achieved through the use of special telephones and tele-talk systems; and ground-to-air by radio telephony (R/T). Communication systems must be reliable, clear and precise so that the danger of instructions and information being misunderstood or misinterpreted is reduced to a minimum.

7. **Telephone.** The tower will most likely have its own switchboard so that it can make calls through three separate telephone systems; the normal Post Office system, the RAF General Purpose Telephone Network (GPTN), which links RAF units and stations, and the special air traffic control system which links the tower by direct land lines straight to important centres such as ATCCs, ATCRUs, other airfields in the emergency organization, and controlling authorities. When direct landlines are installed there is no need to dial a number—the person being called can be contacted at once by simply operating the correct switch.

8. **Tele-Talk.** Although the tower could use its telephone system to contact any section on the unit, it will most likely also have a tele-talk system for direct contact with vital offices and sections on the airfield. Tele-talk is used, for instance, between the tower and the station commander, the medical officer, the met office, and the fire section.

9. **Radio.** The main means of talking to aircraft and vehicles is, of course, by radio telephony (R/T) on VHF or UHF. The importance of these high-frequency bands is that they give clear reception, free from interference. Each airfield has two specially allocated frequencies one used for local airfield control and the other for approach control. Crash vehicles and other vehicles that frequently use the manoeuvring area

will use another frequency. The tower may also have separate frequencies for radar controllers and visiting aircraft. All RAF stations are capable of selecting the military UHF distress frequency which is 243.0 MHz.

R/T Procedure

10. Since R/T is in common use, and cadets may use it when flying with Air Experience Flights, it is as well to know something about its basic principles.

11. **Callsigns.** Before passing any message by R/T, the station being called and also the originating station must both be clearly identified. For example:

“SHAWBURY (*callsign of facility called*)—MVX 23 (*callsign of the aircraft spoken as MIKE VIKTAH ECKSRAY TOO THUR-REE*)—REQUEST TAXI—2 ON BOARD”

From the callsign the aircraft will be identified from a list held in the tower. Provided that no possibility of confusion exists with other aircraft on the same frequency, the controller may allow the callsign MVX 23 to be abbreviated to X 23 for local flying.

12. **Procedure.** Before attempting to use R/T, it is helpful to remember two golden rules:

- *Put brain in gear before engaging mouth.*
- *Always listen out before transmitting.*

In passing information over R/T, the number of words used should be the minimum needed to make the message clear and unambiguous. To help with this, some recommended rules of procedure, and some words with specific meanings, have been developed. These are explained below:

a. *Recommended rules of procedure:*

- Position of microphone must be correct and must not change whilst speaking.
- Voice—pitch and volume normal.
- Conversational tone and rhythm.
- Correct speed; do not gabble.
- Concise speech; the message must be as brief as possible without losing sense.
- Avoid using “err”.
- Personal greetings, “thank you”, “good morning” *etc* are forbidden.
- Hygiene—no food or cigarette in mouth whilst using R/T.
- Never blow into a microphone.

b. *Words With Specific Meanings, Commonly Used by ATC:*

<i>Word</i>	<i>Meaning</i>
WAIT	—I must pause for a few seconds.
ROGER	—Your message received and understood.
WILCO	—Your message received and understood and I will comply with your instructions. (Note that this contains the meaning of “Roger”, and the two are never used together.)

- SAY AGAIN —Repeat your message—I have not understood it. (This may be followed by a specific part of the message, *eg* say again your position.)
- CORRECTION —I have just made a mistake; here is the correct version.
- READ BACK —Repeat this entire transmission back to me exactly as received.
- THAT IS CORRECT —You are correct, or what you have transmitted is correct.
- SPEAK SLOWER —Your transmission is at too fast a speed. Reduce speed.

13. **Practice.** Practice the following R/T calls using the phonetic alphabet (listed in the section on morse code):

Position	Aircraft to Control	Control to Aircraft	Aircraft to Control
1. At Dispersal	Shawbury— MNT 54— Request Taxi—5 on board	MNT 54—Shawbury— Taxi Runway Left/Right QFE or MNT 54—Shawbury Hold	MNT 54— Runway QFE MNT 54—Holding
2. At the Holding position	MNT 54— Request Take-off or MNT 54— Request Line-up	MNT 54—Clear for Take-off or MNT 54—Line-up or MNT 54—Hold	MNT 54—Taking off or MNT 54—Lining-up or MNT 54—Holding
3. When leaving aerodrome traffic pattern	MNT 54— leaving circuit	MNT 54—Regional Pressure Transition level	MNT 54—Regional Pressure Setting mb Transition Level

VISUAL SIGNALS

14. It is necessary to make provision on an airfield for a visual display of signals to pilots in the air or manoeuvring on the ground. These signals may be:
- In the signals area*, which is a square laid out in front of the tower in which may be displayed various signals such as a white letter “T” pointing in the direction of take-off and landing.
 - On the signals mast*, which is adjacent to the signals area and on which signals can be seen more easily by pilots manoeuvring on the ground. For example, at flying training schools a white flag could be flown to indicate that full dual and solo flying is in progress.
 - In appropriate positions on the airfield*, where special signals may be displayed such as obstruction marking (three faced yellow solid marker mounted on a pole set in a rounded base) or bad ground marking (yellow and black striped solid marker).

AIDS

Radio and Radar

15. Pilots cannot "see" the way ahead in bad weather and so the services of radio and radar are employed to enable them to operate in and out of airfields almost regardless of the weather. There are also many forms of radio and radar navigation aids to help them to fly safely between airfields and on operational tasks but these may not necessarily be sited on airfields and may not therefore be seen by cadets on visits.

16. At RAF airfields cadets may see *airfield approach aids and runway approach aids*. An airfield approach aid is designed to guide a pilot down to a safe height in the vicinity of the airfield from which, if he is clear of cloud and can see the airfield, he will land visually. If he is still in cloud and cannot see the airfield from that point, a runway approach aid guides him right down to a position on the correct approach near the touch-down point on the runway in use.

17. In radio there must be a transmitter and a receiver—a transmitter on the ground and a receiver in the aircraft and a transmitter in the aircraft and a receiver on the ground. On the other hand, radar (radio location and range), does not require its target aircraft to transmit or receive, but, using its own special built-in transmitter and receiver fires out pulses of electromagnetic energy, receives back an echo and thus determines the presence, position, heading and speed of the aircraft wherever it is in the sky—provided only that the aircraft is within the range of that particular set. Radar presents this information through a cathode ray tube onto a screen. In this way radar has become the "eyes" of air traffic control.

Radio Aids

18. The two main radio aids likely to be seen at RAF airfields are:

- The Commutated Antenna Direction Finder (CADF).
- The Instrument Landing System (ILS).

19. **CADF** is the common *airfield approach aid* likely to be seen in most towers. It receives an R/T transmission from an aircraft and displays it on a cathode ray tube as a green line of light called a trace. The trace is drawn out from the centre of the screen and points to a compass rose round the screen's perimeter enabling the approach controller to read off the aircraft's bearing from the airfield *or* its course-to-steer to reach the airfield. Using this equipment the approach controller can home the aircraft to a point above the airfield and from there control its descent through cloud (CDTC) to a height and position on the approach from which the pilot can land visually or employ a runway approach aid.

20. **ILS** is a *runway approach aid* in which fixed transmitters on the ground send out a special pattern of radio signals which define a "radio beam" in the sky down which an aircraft can be guided to the touch-down point on the runway in use. Receivers in the aircraft pick up the signals and display the information to the pilot on special instruments to enable him to fly his aircraft in such a way that it will follow the beam down to touch-down. In this system the pilot interprets the signals himself and does not need any outside assistance.

Radar Aids

21. The two main radar aids likely to be seen at RAF airfields are:
 - Surveillance Radar.
 - Precision Approach Radar (PAR).
22. **Surveillance Radar** is an *airfield approach aid*. Its radar screen is in the tower and enables the controller to locate the aircraft and direct it to a position and height near the airfield from which the pilot can land visually or employ a runway approach aid.
23. **Precision Approach Radar (PAR)** is a *runway approach aid* and is also located in the tower. The controller has two screens, one for the aircraft's height and one for its position on the approach path. He uses this information to guide the aircraft down the correct approach path to the touch-down point. In this system the aircraft does not require any special equipment other than its normal R/T through which the pilot receives the controller's instructions—but it does, of course, need the services of a skilled air traffic controller. Neither system is a complete recovery system by itself but together form the Terminal Radar, *ie* Ground Controlled Approach (GCA).

AIRFIELD LIGHTING

24. Royal Air Force airfields used for night flying have a mass of lights designed to assist pilots to taxi aircraft safely about the aircraft manoeuvring area and to take-off and land on the runway in use. Many of these lights will be hooded so that they can be seen only by the pilot, but cadets who visit an airfield while night flying is in progress will see a fascinating display in many colours. The mains electricity supply is used but the airfield will have a stand-by method of supply to cope with power failures.

Location and Types of Lighting

25. The main lights to be seen are as follows:
 - a. *Airfield Identification Beacon*. The airfield identification beacon is positioned on the airfield and flashes the airfield identification letters in morse code using a red neon light.
 - b. *Obstruction Lights*. All high buildings, towers, hangars, and other high obstructions both on and off the airfield, are indicated by red obstruction lights.
 - c. *Floodlighting*. Aircraft servicing platforms will probably be lit by powerful floodlights set high on pylons. Sodium lights on the ground, or set on short poles may also be seen.
 - d. *Taxiway Lights*. Taxiways are marked by edge lights—amber on the outside edge (the edge furthest from the centre of the airfield) and blue on the inside edge. Taxiways 60 ft (18 m) or more wide are marked along the centre line by green lights. By breaking this line into different circuits, it is possible for the airfield controller to select the taxiway in use.
 - e. *Holding Position*. The holding position board is indicated at night by a triangle of three blue lights.

THE LAYOUT OF AN AIRFIELD (cont.)

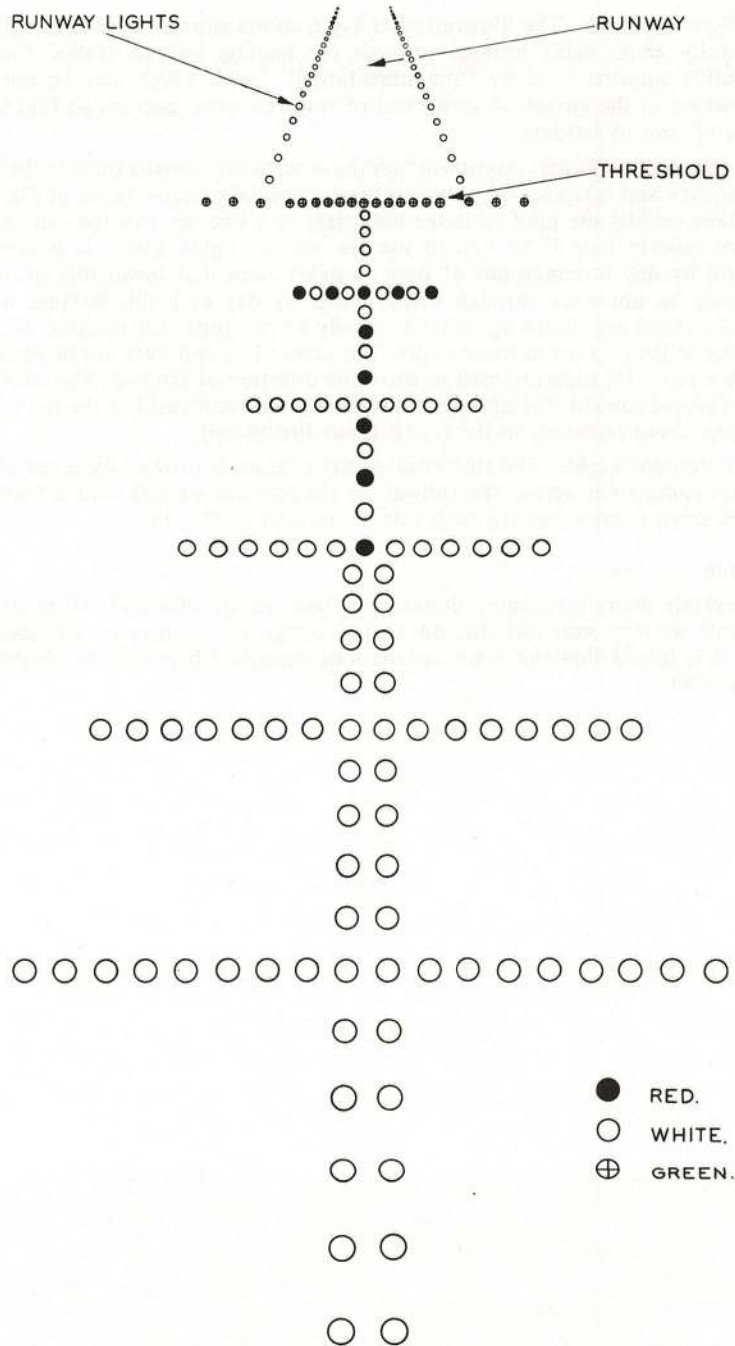


Fig 6 Approach and Runway Lighting

f. *Runway Lights.* The illustration at Fig 6 shows runway edge lighting in high intensity white lights beamed towards the landing aircraft (called "unidirectional") supplemented by "omnidirectional" lights which can be seen from anywhere in the circuit. A great deal of research work goes on to find the best type of runway lighting.

g. *Approach Lighting.* Approach lighting is installed, usually outside the airfield boundary and often set on poles, to form a special pattern shown at Fig 6. This pattern enables the pilot to judge his height and line up with the runway much more quickly than if he had to use the runway lights alone. It is often very useful by day in conditions of poor visibility, and it is invaluable to the pilot making an approach through cloud, either by day or night, because when he breaks cloud and looks up to land visually he can judge his position in relation to the runway so much more easily. The centre line and bars are in white lights with a red "T" superimposed to show the direction of landing. The white lights are beamed towards the approach direction (unidirectional) but the red "T" can be seen from anywhere in the circuit (omnidirectional).

h. *Threshold Lights.* The threshold of the runway is marked by a bar of green lights going right across the runway at the touchdown end with a "wing" of three green lights extending each side of the runway (Fig 6).

Conclusion

26. There are many fascinating things to be seen on airfields and cadets will learn much more as they visit airfields on annual camp or on visits to affiliated RAF station. It is hoped that the main installations described here will be identified on your next visit.

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