PART 2: SECTION 4

CHAPTER 3

NIGHT FLYING

Introduction

1. The ability to fly an aircraft as efficiently by night as by day is required of every pilot. By day the aircraft is controlled by reference to ground objects and the visual horizon, supplemented by certain flight instruments; if these outside aids are not available, all the flight instruments must be used. The same applies at night, except that the aircraft attitude may also be interpreted by the perspective and pattern of lights laid out on the ground. On a dark night, with no lights on the ground to give outside reference, the problem is much the same as when flying in cloud. The importance of accurate instrument flying cannot therefore be overemphasized. Different types of aircraft in different roles may require a slightly different handling technique at night, but the basic principles are the same as by day.

2. Before flying, bright lights should be avoided to allow the eyes to become adapted to the darkness. Full dark adaptation takes about 40 minutes but can be destroyed in a matter of seconds if the eyes are exposed to bright lights. Lack of oxygen materially affects the rate and completeness of dark adaptation, so oxygen should always be used at night.

Night-Flying Briefing

3. It is essential that all pilots and crews receive a thorough briefing before night flying. The object of the briefing is to ensure that all personnel concerned with flying at night know the airfield layout, obstructions, dispersal areas, signals, and the method of controlling aircraft on the ground and in the air. It is usual to control the aircraft by R/T, though visual signals may sometimes be used. The forecast weather conditions, relevant navigational aids, diversion airfields, and night-flying orders should also be included in the briefing.

Pre-Flight Checks

4. The pre-flight checks are unchanged with the addition that all external and internal lighting equipment should be checked. A torch should be carried to assist with these checks and for any emergency.

Knowledge of the Cockpit

5. A thorough knowledge of the location and function of all cockpit controls and switches is essential so that, if necessary, the aircraft can be flown with the cockpit in complete darkness.

Engine Starting

6. To avoid any possibility of confusion, the correct signals for starting, running up, and taxying should always be used. Before running up, the downward identification light should be flashed and, when ready to taxy, the navigation lights should be flashed as a signal to the ground crew to remove the chocks. The navigation lights can also be flashed later to dispense with the marshaller. Where external intercommunication is fitted this should be used in preference to visual signals at night. In aircraft fitted with automatic-flashing navigation lights these should be switched off momentarily to indicate chocks away and to show when the marshaller is no longer required.

Taxying

7. Before taxying from the dispersal area the cockpit lighting should be adjusted to avoid distracting reflections from the cockpit canopy. Marshalling signals are illustrated in A.P. 3296, Air Ministry Flying Orders. It should be remembered that every light visible on an airfield at night is there for a purpose, whether it is an obstruction light, the taxiway lighting, or the tail light of another aircraft. Care must be taken while taxying, as it is difficult to judge speeds and distances at night. If in doubt, stop the aircraft and/or switch on the landing lamp or taxying lamp as an aid. Crew members should be ordered to keep a look-out, if possible using hand-signalling lamps to illuminate any area as directed by the captain.

Take-Off and Climb

8. Before take-off, the cockpit lighting should be reduced to the minimum in which the instruments can be seen. Throughout the take-off run, and immediately after becoming airborne, the direction and attitude of the aircraft should be judged by reference to the flare path. When well clear of the ground, *and before the last flare or the last*

lead-out light is reached, attention should be transferred to the flight instruments and the aircraft kept laterally level, in balanced flight, and given a safe rate of climb while the I.A.S. increases towards the recommended climbing speed. When this condition is attained, the after take-off checks can be made. The pilot should continue the climb away, on instruments, until circuit height is reached, when outside aids may be used to supplement instrument indications.

Engine Failure after Take-Off

9. The action in the event of engine failure after take-off is the same as by day, with the additional action of switching on the landing lamp.

Circuit Flying

10. The circuit pattern is normally the same as by day, but there is often a tendency to converge on the flare path when on the downwind leg ; this can be prevented by using the compass and watching the line of the flare path. With uni-directional flare paths the approach lighting or other airfield lighting should be used to help judge the downwind leg. A careful listening watch should be kept on the R/T so that the movements of other aircraft in the circuit are noted and the circuit planned accordingly.

Approach Lighting

11. The approach is judged in the same way as by day assisted by the changing pattern of the airfield lights. Detailed information on the layout of airfield lighting is found in Section 2, Chapter 2.

12. The full approach lighting system illustrated in Section 2, Chapter 2, is standard for all main instrument approach runways and comprises a double flare path with a single row of lights extending 3,000 ft. downwind from the runway threshold and in line with the centre of the runway. Superimposed on this line and crossing it are five cross bars, each bar shorter than that preceding it (the shortest bar being nearest the runway), so that if two lines were drawn touching the ends of the cross bars they would meet at a focal point 1,000 ft. upwind from the runway threshold. The final cross bar and the last few lights leading to it are red, forming a red omni-directional "T" (the remainder of the approach lighting is uni-directional). The intensity of the lighting can be adjusted to suit prevailing conditions.

13. Some airfields have the same basic layout but the approach lighting is carried a shorter distance from the runway threshold and only two cross bars are used. On subsidiary runways (not instrument approach) only the red "T" is fitted.

14. The centre line of the approach lighting helps to align the aircraft with the centre of the runway and the cross bars act as a horizon. By adjusting the angle of descent so that each successive cross bar appears the same length as the previous one the correct approach path is ensured. If the approach path is too high, successive cross bars appear shorter ; if too low, successive bars appear larger than those preceding. It should be clearly understood that the lighting system is an aid to night landings and not a means in itself. On one side of the runway threshold, 20 feet apart, are angle-of-approach indicators which also aid in judging the approach.

15. The angle-of-approach indicators are set as in the table below :—

Approach Angle	*Approach Path*	*Indicator Lights*	
		Port	*Starboard*
5½° +	Too high	Amber	Amber
4½° – 5½°	Slightly high	Amber	Green
3½° – 4½°	Ideal	Green	Green
2½° – 3½°	Slightly low	Green	Red
Below 2½°	Dangerously low	Red	Red

Landing

16. The landing technique differs little from landing by day, and the type of landing should be the same as that used for day. When learning to fly, or when converting onto a new type at night, difficulty may be experienced in judging the height during the hold-off. To aid in this judgment sufficient day experience on type is necessary to appreciate the correct landing attitude. The round-out should be gentle and the hold-off judged by the perspective of the line of runway lighting, and not by looking a short distance ahead and trying to see the runway itself. Care should also be taken to avoid getting a fixation on the angle-of-approach indicators. The aircraft is kept straight during the landing run by reference to the runway lighting. After landing, and before turning off the runway, the speed should be checked carefully to ensure that it is not too high.

17. **Use of the Landing Lights.** The landing lights may be used as an aid when approaching to land, and in emergencies such as engine failure after take-off. The lights should be switched on during the final stages of the approach and the

illuminated area of the runway used as a supplementary aid to the perspective of the flare path. In poor visibility the landing lights may cause considerable glare, making accurate judgment of the final approach and hold-off difficult. To reduce the glare the lights should, if possible, be dipped in the low position.

Overshoot Procedure

18. The procedure for an overshoot is similar to that by day. Owing to the trim changes likely when full power is applied, particularly on high-powered piston-engined aircraft, it is important that the utmost attention is paid to accurate instrument flying, with particular regard to balanced flight, lateral level, and the correct climbing speed for the amount of flap selected. If the overshoot is started from ground level, the undercarriage should not be raised until a safe height is reached, particularly if flap movement causes a large change of trim.

Pilot Navigation at Night

19. The technique of pilot navigation is discussed in Chapter 14, and the various procedures apply equally by night and by day. However, the following factors should be kept in mind when a night flight is contemplated :—

(*a*) A full briefing is all-important.

(*b*) Map reading, the pilot navigator's most useful fixing aid, is limited at night. For this reason particular attention must be paid during flight planning to the availability and frequencies of suitable radio aids and of light beacons along the route.

(*c*) It is possible to map-read in bright moonlight, and under these conditions most water features such as coastlines, canals, and lakes show up well. Visibility is improved when looking up-moon ; a light covering of snow helps in recognizing some ground features by night.

EMERGENCIES

20. The following paragraphs detail the procedures to be adopted in emergency in the circuit at night.

Runway Obstructed

21. If the runway becomes obstructed, an illuminated "T" is placed in the centre of the flare path at the downwind end, and five red marker lamps are placed across the runway threshold. Aircraft must land on the grass on the starboard side of the flare path, but before doing so A.T.C. should be informed of the intention.

Failure of Navigation Lights

22. If navigation lights fail, contact A.T.C. by R/T to obtain a landing priority and fly the circuit pattern at 600 feet above ground level. Other aircraft will be warned and are to orbit at normal circuit height until otherwise instructed. After landing, clear the flare path at the upwind end and then call control for further instructions.

Use of the Signal Pistol by Night

23. **R/T Failure.** Fly over the airfield on the dead side of the flare path at 600 feet above ground level and fire a green signal. Then complete the circuit still at 600 feet and make the final approach and landing on receipt of green lamp signal from the runway controller. Other aircraft will orbit at circuit height on instructions from A.T.C.

24. **Total Electrical Failure.** Fly over the airfield on the dead side of the flare path at 600 feet above ground level and fire a red signal. Then complete the circuit at 600 feet and land ; clear the flare path at the upwind end. All other aircraft will orbit at circuit height on instructions from A.T.C. If forced to stop after landing, the position of the aircraft should be indicated by hand torch signals while awaiting assistance. All other aircraft on the ground will hold their positions until otherwise instructed.

Procedure when No Signal Pistol is Available

25. **Failure of R/T.** If no signal pistol is available after R/T failure, proceed as instructed in para. 24, but flash a series of dashes on the navigation lights, or downward identification light if fitted, at the stated position in the circuit. If unable to do this, take the action detailed in para. 26.

26. **Total Electrical Failure.** Make a normal approach and take overshoot action at 300 feet above ground level. On hearing this, the runway controller will fire a red/green two-star signal. Other aircraft will then orbit at circuit height until otherwise instructed. The affected aircraft should then complete the circuit and land.

Other Emergencies

27. In an emergency, if the attention of the runway controller or A.T.C. cannot be obtained, a circuit should be made at 600 feet and if necessary the aircraft landed on the emergency side, usually to starboard, of the flare path.

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