18
NIGHT FLYING

AIM

To teach the student how to control the aeroplane at night, on the ground and in the air.

INSTRUCTIONAL GUIDE

Night flying is a compromise between instrument and visual flight. Another explanation is that night flying in this context is instrument flying combined with visual lookout techniques. These concepts need to be emphasized from the beginning of the exercise. Before students undertake night solo circuit operations they must have received sufficient instrument flight training to enable them to carry out the following manoeuvres solely by reference to instruments:

(a) climb and climbing turns

(b) straight and level flight and level turns

(c) descent and descending turns

(d) unusual attitude recovery full panel

Prior to solo cross country flight at night a pilot must be competent at joining, departing and operating in a circuit area remote from extensive ground lighting, and unusual attitude recovery with the loss of the DG and AI.

Whenever possible, a collective briefing of all pilots engaged in a particular night flying programme should be held and the following points should be covered:

(a) the lay out of the runway, taxiway and other airfield lights

(b) ATC information, to include:

(i) taxiing procedures

(ii) circuit direction and height;

(iii) the number of aeroplanes engaged in night flying at a given time

(iv) radio procedures and frequencies and

(v) emergency procedures

(c) meteorological information and

(d) where night pilot navigation exercises are to be carried out, details of other airfield night flying activities, also serviceability, frequencies and call signs/designations of en route and diversion radio navigation aids.

Precautions necessary to adapt the eyes to night vision should be explained and the student warned against looking at any bright light which will lengthen the time required for night adaptation.

It is extremely important that a student be given a thorough pre-flight briefing. The type of briefing will depend on the stage reached by the student. For the purpose of this manual night flying exercises and associated briefings are considered under two headings:

(a) Circuits and landings

(b) Pilot navigation by night

PRE-FLIGHT BRIEFING CONSIDERATIONS

CIRCUITS AND LANDINGS

COCKPIT AND ENGINE STARTING CHECKS

A thorough knowledge of the location and method of operation of all cockpit controls and switches is essential. Ensure that the student knows how to control the brilliance of internal cockpit lighting and impress the importance of keeping this as low as possible. Mention should be made of the generator/alternator charging rate and the minimum RPM necessary for this charge rate.

Any local rules with regard to engine starting and taxiing in the tarmac area should be explained.

TAXIING

Taxiing at night requires considerable extra care compared with taxiing by day, for the following reasons:

(a) Distance at night is deceptive when judged by stationary lights, which may be nearer than they appear.

(b) Speed is deceptive, consequently there will be a tendency to taxi too fast.

(c) A careful lookout must be maintained for lights of other aeroplanes and other obstructions.

TAKE-OFF

The take-off is similar to that by day. Directional control is maintained initially by reference to the flare path. As soon as the aeroplane is airborne, transfer to instruments with particular emphasis on maintaining the attitude (especially ensuring a positive climb rate is maintained) and keeping straight. In this way the aeroplane is climbed away immediately it becomes airborne, precluding any risk of striking the ground shortly after take-off. The slight risk due to climbing at a lower airspeed than normal is accepted to gain this positive climb away from the ground. The attitude seen directly after take-off should be maintained solely by reference to instruments until the altimeter indicates a safe height and the VSI indicates a positive rate of climb. On aeroplanes equipped with retracting undercarriage and flaps, no attempt should be made to retract either until this height has been reached.

ENGINE FAILURE AFTER TAKE-OFF

In the event of engine failure at night the normal engine failure after take-off procedures should be adopted and the landing light(s) should be used as an aid to avoid obstacles.

THE CIRCUIT

The circuit pattern to be followed at night is normally the same as that flown by day and is flown mainly by reference to instruments, using the airfield lighting as a means of monitoring the aeroplane's position. Pilots should be warned of the tendency to over bank at night. The student must be briefed on radio procedures where they differ from procedures normally used by day.

APPROACH

Powered approaches should be carried out at night. The approach is judged by reference to the flare path as seen after turning on to final approach. If the approach path is correct the distance between the flare path lights will remain equidistant. If the pilot is overshooting, the distance between lights appears to increase, and if undershooting, the distance between lights appears to decrease.

An alternative method of judging the correctness of the final approach path is shown in Figure 18-1:

- If the upwind runway lights appear to significantly converge the approach is too low
- If the runway lights appear almost parallel along their entire length the approach is too high

Some airfields may have such aids as VASIS installed, but it should be emphasized that they should only be used as an aid to the pilot's judgment. On no account should an approach at night be carried out referring only to such aids. The importance of turning from the base leg on to final approach at the correct height and distance from the flare path must be emphasized. Normally the turn on to final approach should be completed by not lower than 500FT above the ground.

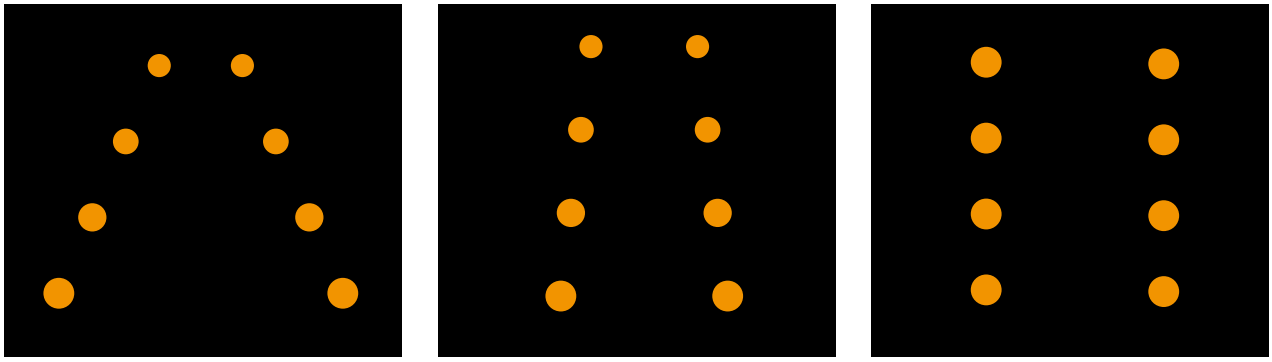
LANDING

The landing at night is made by reference to the flare path. Owing to the deceptive appearance of the ground, no attempt should be made to refer to it as is done by day. The effect of night conditions on inexperienced pilots frequently induces a tendency to round out and hold off too high.

The use of landing lights is normally delayed until a student has displayed the ability to consistently land safely without their use. When landing lights are used students must be warned not to look directly down the beam but slightly ahead and to one side of it.

Possible cues to a good landing at night in a light aeroplane is to consider the commencement of the flare when the flare path 'appears to be above your feet', actually commencing the flare when the flare path gives the appearance of 'passing either side of your middle'. The 'hold off' commences when the flare path appears to be at 'ear level'.

Figure 18-1: Night flying final approach in the circuit.



TOO LOW
Lights appear
to be significantly converging

NORMAL
Lights appear
to be slightly converging

TOO HIGH
Lights appear
to be almost parallel

PILOT NAVIGATION BY NIGHT

Prior to the actual briefing on this exercise, the pilot must be acquainted with the operational standards and aeroplane equipment and instrumentation requirements which must be met before night flying is permitted outside the circuit area of an airfield.

The principles of navigation at night are basically similar to those applicable by day, except that map reading at night calls for a special technique. The aeroplane is navigated according to a predetermined flight plan which is corrected from time to time by use of reliable pin points and radio navigation aids.

Some instructors advocate preparation of a sketch map of the route, which will include sufficient data to limit (or negate) the use of various pieces of in-flight documentation. This technique can be especially helpful if the aeroplane is not equipped with an auto pilot.

A comprehensive briefing is essential to the success of a night cross-country exercise. A thorough study of the meteorological forecast for the route must be made and an accurate flight plan compiled.

If forecast or reported actual meteorological conditions indicate any segment of the fl ight cannot be conducted within all the criteria for VFR then the flight should not commence.

The route selected should take into account the availability of features of use at night, such as lights of large towns, aerodrome and coastal lights and rotating beacons. The lights of vehicles on a busy major road can also be of value. Lakes and other water features show up well on moonlit nights, especially when viewed against the moon.

It may be beneficial to plan a route to a destination via good night pin points even if this involves a greater mileage. The use of radio navigation must be considered and its limitations must be stressed. The planned altitudes must be either above the lowest safe altitude for particular segments or sufficient to ensure at least 1,000FT above any obstruction within ten miles either side of track.

Accurate heading and time keeping is essential and corrections should be made only when positions fixed either by pin point or radio navigation aids are positive.

EMERGENCIES LOST PROCEDURES

The procedure to be adopted when lost at night remains substantially the same as by day, although the pilot must be aware that the choice of alternate aerodromes is more limited. Brief on the importance of seeking navigational assistance from ATS immediately there are doubts as to position.

Point out there are many ways in which ATS can help in such circumstances, such as radar coverage, radio direction finding and arranging for lights to be displayed near the aeroplane's probable position. Additionally, the police radio network may be used to determine what town you are orbiting.

It must be stressed that where a flight is planned to a destination not equipped with a suitable radio navigation aid,

sufficient fuel must be carried for flight to an alternate landing ground so equipped, which must be within one hour's flight time of the destination.

ENGINE FAILURE

Should this happen away from the aerodrome the pilot should immediately endeavor to re-start the engine and send out a 'MAY DAY' call. The aeroplane should be flown at a low forward airspeed consistent with maintaining full control without an excessive rate of descent. Check that the latest value of the Area QNH is set on the altimeter and consider the altitude indicated against the known height of terrain. Consideration should be given to using only the optimum flap setting, as greater settings may lead to undesirably steep attitudes - it is obviously preferable to touch down in a flat attitude. Use of landing lights in the latter stages will be beneficial.

AIR EXERCISE

CIRCUITS AND LANDINGS

(a) Cockpit checks and engine starting

(b) Taxiing

(c) Take-off, circuit, approach and landing

(d) Overshooting at night

(e) Pilot navigation at night

COCKPIT CHECKS AND ENGINE STARTING

Carry out the normal external and internal checks before flight but in addition, check all night flying equipment, such as navigation and landing lights and internal cockpit lights. Ensure that the navigation lights are switched on before starting the engine and after starting set the desired RPM to maintain an adequate generator/ alternator charge.

TAXIING

Emphasize the necessity for extra caution when taxiing at night owing to the deceptiveness of both speed and distance. Watch for a tendency to taxi too fast. Show the taxiway lighting and indicate the route to be followed.

If possible hold at the holding point or in the run up bay in such a position that a following aeroplane will see two navigation lights. Stress the necessity of ensuring that parking brakes are on and effective, and also that engine idling RPM is sufficient.

TAKE-OFF

Maintain directional control during the take-off run by primarily watching the flare path supplemented by reference to the instruments. When safely airborne, however, transfer attention entirely to the instruments. This will be effected more easily if some reference has been paid to them during the actual take-off run.

Once airborne, stress the necessity of maintaining the attitude by reference to the AI, keeping the wings level until the altimeter indicates the aeroplane is well clear of the ground and the VSI indicates a steady rate of climb. No attempt should be made to retract landing gear and flaps until this stage has been reached.

CIRCUIT

After take-off at night, the aeroplane should be climbed straight ahead to a minimum height of 500 feet. Stress the importance of not looking back for the flare path until the aeroplane is stabilized on the cross wind leg of the circuit. Plan the circuit so that it is not too tight and adequate time is left for engine handling procedures, checks, and actions in the unfamiliar conditions of night flying.

Point out that the circuit is flown mainly by reference to instruments and the aeroplane's position monitored by continual reference to the airfield lighting. Indicate also other aeroplane's positions in the circuit, emphasizing the importance of maintaining a good lookout and providing adequate spacing.

APPROACH

The turn on to final approach should normally be completed by no lower than 500 feet above the ground.

A flare path demonstration should be given to the student on the initial night flight. This is best achieved by turning on to final approach further back from the flare path than normal the aeroplane then being below the ideal approach path. Hold height after the turn and point out the closeness of the lights on the flare path. As the flare path is approached indicate how the distance between lights will increase. The ideal distance should be indicated and later, as height is maintained, the distance between lights will still further widen showing that the aeroplane is now too high and overshooting.

After overshooting from the above demonstration turn on to final approach at the correct height and distance out from the flare path. Point out again how the flare path is used to recognize the over or undershooting conditions. If the airfield is equipped with VASIS or approach path indicators, stress the

importance of using these only as an aid to the pilot's judgment which primarily is based on impressions gained by the look of the actual flare path. The aim of the approach should be to round out and hold off not before the 500FT markers.

The use of landing lights should only be demonstrated and practiced after a student has attained a consistently safe standard of approaches and landings without their use. When used, emphasize the importance of looking slightly ahead and to one side of the actual beam.

LANDING

Point out that landing by night involves judgment of height above the ground by reference to the flare path lights and that no attempt must be made to look for the actual ground. The most frequent fault, especially in early stages of night flying training, is for students to round out and hold off too high. After touchdown, stress that no attempt must be made to turn off the flare path until the aeroplane has been braked nearly to a standstill. When landing lights are used, emphasize that the initial round out should still be made by reference to the flare path. Students frequently show a tendency to round out late when initially using landing lights.

GOING AROUND AT NIGHT

Point out that this exercise requires no special technique other than that it is done primarily by reference to instruments. However, warn the pilot against premature retraction of landing gear and flaps during the overshoot.

COMMON FAULTS

Common faults displayed by students at night include:

(i) Taxiing too fast. This is sometimes occasioned by the belief that high idling RPM must be maintained even whilst taxiing at night

(ii) Failure to maintain an accurate heading after take-off, caused by over-concentration on other instruments

(iii) Failure to track parallel to the flare path on the down wind leg due to either inability to assess any drift or to hold a constant heading

(iv) Failure to establish a steady rate of descent on the base leg resulting in too high a turn on to the fi nal approach

(v) Looking for the ground during both the round out and the hold off period

(vi) After landing trying to turn off the runway at too high a speed

PILOT NAVIGATION AT NIGHT

Choose a route bearing in mind the principles outlined in the Pre-Flight Briefing Considerations.

The feasibility of map reading will obviously depend on the state of the weather and the moon. Individual lights such as aerodrome beacons and coastal lights are most useful but watch for errors arising from the student's estimation of distance from them. As the usual tendency is to underestimate distance, make the utmost use of a combination of map ground features and lights to demonstrate the extent of this error until the student is capable of readjusting his perception to give more accurate estimates.

Avoid the use of small lights on the ground (except navigation aids), as particularly in the early stages the scattered lights around small communities may give the impression of quite large towns.

Demonstrate the use of all available radio aids, using the same procedure as by day. Point out any limitations of these navigation aids under night operating conditions.

At all times ensure that the student is aware of the approximate bearing and distance of a prominent, unmistakable feature which can be reached reasonably easily should there be a breakdown in navigation.

COMMON FAULTS

Students frequently experience difficulty in reading their map and navigation log in the comparatively dim cockpit lighting, this difficulty leading to large errors in heading, altitude and airspeed. This problem is overcome with experience and also clearly underlines the necessity for thorough and methodical flight planning and the use of a sketch map.

A common fault, as previously mentioned, is for students to considerably underestimate their distance from known lights. Only experience and guidance from the instructor will eradicate this fault.