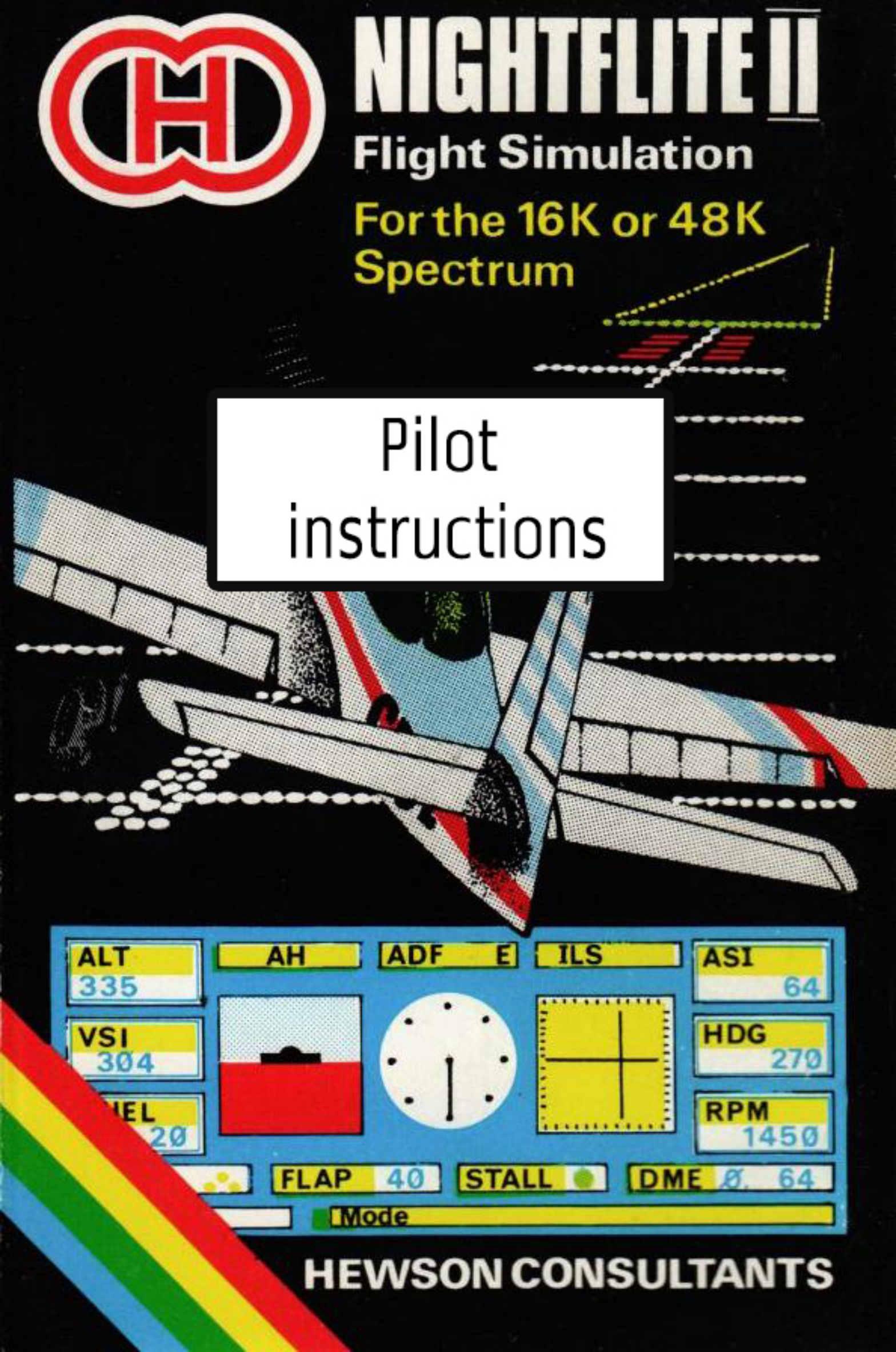
NIGHTFLITE II

Flight Simulation

For the 16K or 48K Spectrum

Pilot instructions



HEWSON CONSULTANTS

NIGHTFLITE 2

1. INTRODUCTION

Congratulations! You are the proud owner of Nightflite 2 for the 16K or 48K Spectrum, written entirely in machine code for maximum enjoyment. Your purchase will provide hours of fun because it simulates all the complexity and difficulty of flying a light aircraft. To make the most of your cassette as soon as possible you are advised to read all the instructions thoroughly. If you are a novice pilot pay particular attention to the step by step flying lessons in section 4. Happy landings!

2. LOADING THE CASSETTE

Load the program using LOAD " " on your ZX Spectrum and press < Enter > . Start the tape at the beginning and wait until a menu of different modes is printed on the TV screen, then switch off the tape.

3. SYSTEM CONTROLS

The keys which control the program have been carefully selected to help the user remember which key does what. For example:

i) the < K > key is used to increase RPM because it is also labelled " + ".

ii) The < S > key is used to switch the engine sound on and off.

iii) The < G > key is used to raise the landing gear (and the adjacent < H > key is used to lower it).

Each time a key is introduced in these instructions the reason for its use is indicated in brackets.

You have about 40 seconds in which to make your selection from the main menu, or else the program will automatically select Mode 5 Autolanding (a demonstration mode and as you will see later, a useful tutor on landing techniques). If you wish to abandon a flight, you may return to the main menu by pressing and holding the < Space > (Break) key. If you wish to leave the computer in mid-flight, press key < A > (Stop). Press Key < Z > (adjacent to < A >) to resume.

Whilst the aircraft is in flight you will hear a simulated engine sound which varies with the speed of the engine. You can switch this sound on and off by pressing and holding Key < S > (Sound). (The sound does not work when a Kempston joystick is connected to a 16K Spectrum).

4. FLYING NIGHTFLITE 2

4.1 Basic Controls/Training Mode

Whilst learning to control Nightflite 2 it is suggested that you load the program, select Mode 6 Training and attempt the various manoeuvres described in this section. Mode 6 starts with the aircraft flying straight and level at a safe altitude, and to enable you to learn to control the aircraft without the risk of crashing, all the normal aircraft limitations are ignored. If at any time you cannot return the aircraft to a straight and level attitude press Key < Space > and then reselect Mode 6.

4.1.1 Banking and Turning

On board the aircraft is an instrument called a magnetic compass which gives a readout of the heading of the aircraft, i.e. the direction the aircraft is pointing, relative to North, measured in compass degrees in a clockwise direction. e.g. a heading of 090 (90°) means that the aircraft is pointing east. (N.B. By convention due North is described as 360° and not 0°.) The heading readout is marked "HDG" and is positioned on the right side of the control panel.

To turn the aircraft we have to lean it in the required direction (called 'banking' the aircraft). The more the aircraft is banked the faster will be the rate of turn. (Nightflite 2 is always aerodynamically balanced and so there is no separate rudder control.)

To assist in judging whether the wings are banked, there is an instrument called an Artificial Horizon (a red and blue square marked 'AH' on the left centre of the control panel). On this instrument the position of the small black aircraft shape in relation to the blue/red border is the same as the 'real' aircraft's relationship with the horizon.

To turn to the right press Key < 8 > (→), or if you have a Kempston joystick position it with the fire buttons away from you, push the stick to the right, and hold it for one second. The aircraft shape on the AH will remain still, but the "horizon" will tilt low on the left and high on the right. You will also see that the HDG increases slowly. To stop the turn you must level the wings again by pressing Key < 5 > (←) (or joystick left) and holding it until the aircraft on the AH has its wings level again. Note that once you have done this the HDG remains constant. Now try a turn to the left by pressing key < 5 > again and you will see that the AH "horizon" tilts the other way and heading decreases. Practice turning until you can achieve any heading you desire.

4.1.2 Raising and Lowering the Nose

Level the wings again and look at the control panel. At the top right is an instrument marked "ASI" (Air Speed Indicator). This shows the speed at which the aircraft

is passing through the air in miles per hour. At the top left the Altimeter marked "ALT" shows the height in feet that the aircraft is flying above the ground. Below ALT the "VSI" (Vertical Speed Indicator), shows the rate at which the aircraft is climbing (positive numbers) or descending (negative numbers) in feet per minute.

Press key < 7 > (↑) or pull the joystick straight back towards you to raise the aircraft nose and hold it for one second. The aircraft on the AH will be above the horizon, the VSI positive and ALT increasing but the ASI will decrease (rather like travelling uphill: if you raise the nose you lose speed). Note that Speed and VSI changes do not happen instantly. It may take several seconds for them to arrive at their stable values. Beware of this when you are flying the aircraft.

To stop climbing return the nose to its position on the horizon by pushing Key .< 6 > (↓) (or joystick forward). VSI should return to 0 and ASI to 110. Now try a descent by putting the nose below the horizon. Observe the descent on VSI and ALT and see that ASI has increased (like travelling downhill).

4.1.3 Engine Speed

Level the nose again and notice the "RPM" (revolutions per minute) indicator on the bottom right of the control panel. It reads 2200 (the maximum RPM is 2500). The higher the RPM, the faster you use up your FUEL (bottom left of the panel). Should you run out of fuel the engine will reduce to minimum RPM of 800.

Increase the RPM by pressing Key < K > (+), (or using the joystick, depress the fire button and whilst keeping it depressed push the stick forward), and hold it for about one second. As the RPM increases, so does the ASI, and the VSI shows that the aircraft is climbing. Reduce power to 2200 RPM using Key < J > (—) (or joystick fire button depressed and stick back) and the VSI returns to 0 and ASI to 110.

Notice it is possible to climb or descend either by altering the nose position or by altering RPM, but the effect on the ASI is opposite for RPM to that of nose adjustments.

4.1.4 Effect of Banking on VSI

Return the aircraft to straight and level flight (RPM = 2200, VSI = 0, ASI = 110) and turn in either direction. Notice that while the aircraft is banked, VSI shows that it is also descending. This feature of the turning manoeuvre can be countered either by simultaneously applying power or pulling the nose up on entering a turn. Practice turning with a minimum height loss, as there are times while flying Nightflite 2 over the mountains when this becomes important.

When you have mastered all the controls explained so far you can direct all aspects of the aircraft's position and condition. Practice controlling speed and rate of descent to enable you to arrive at the runway in the right condition to land safely.

4.2 Gear, Flap and Stalling

The undercarriage ("GEAR") must be lowered before landing but it must not be lowered at a speed above 90 mph because extra wind resistance will damage the aircraft causing a crash.

In order to keep an aircraft flying safely through the air, its wings must be passing through the air at a certain minimum speed to ensure a smooth flow of air. If the speed is below the minimum speed, the flow of air is disrupted and the wing no longer produces enough lift (upwards force) to keep the aircraft flying. Very high rates of descent can occur. This condition is called a stall.

To help the approach and landing at low speeds, a device is fitted to the aircraft called flaps which can be lowered or raised in 10° increments to a maximum of 40°. The flaps have the effect of reducing the minimum speed of air over the wing that results in a loss of lift. The speed below which the aircraft will stall is 60 mph, with FLAPS up (i.e. 0°) and this progressively reduces to 52 mph with FLAPS fully down (40°). The flaps may not be lowered at a speed in excess of 80 mph or like the GEAR structural damage will occur causing a crash.

To observe the effects of gear, flap and stalling, reselect Mode 6. Reduce RPM to 1800 and raise the nose to obtain a VSI of 0 again so that the aircraft is flying straight and level but at a slower speed.

Wait until the ASI stabilises at 70 mph. Now lower the GEAR by pressing Key < G > (Gear) (joystick fire button depressed, left and forward with stick). Note that the ASI reduces slightly due to the wind resistance caused by the GEAR being lowered. (N.B. Gear down is indicated at the bottom left of the screen. When the GEAR is safely down you see three green lights.) Raise the GEAR again by pressing Key < H > (adjacent to G) (joystick — fire button depressed, left and back with stick). Note that the three green lights go out.

Now slowly raise the nose. Initially the aircraft climbs and its speed reduces. Continue raising the nose until the ASI drops below 60 mph so that the aircraft stalls. You will hear a stall warning beep and see that there is a flashing light marked STALL at the bottom of the screen (above the STALL speed the light is steady green). Note that the VSI is now accelerating to a high

rate of descent. To recover from the stall you must regain a speed above the stall speed by either lowering the nose or by raising RPM or both.

Reselect Mode 6, reduce RPM to 180 and raise the nose to obtain VSI = 0. Wait for the ASI to stabilise at 70 mph. Press Key < F > (flap) (joystick — fire button depressed stick right and forward) to lower the flaps and hold it until you can see the FLAP indicator showing 40°. Note that the ASI reduces due to the increased wind resistance. Now raise the aircraft nose again but notice the lower stall speed. Recover from the stall and keep practicing until you can stall and recover with a minimal height loss. Key < D > raises the flap (next to Key F).

Stalling speed increases in a turn — the greater the angle of bank, the higher the stalling speed. One further structural limit is the overall airframe maximum speed, VNE (Velocity Never Exceeded) which is 140 mph.

4.3 The Landing

The runway is short and the faster you touch down, the greater the distance required to bring the aircraft to a halt. The correct technique therefore, is to touch down at low speed as close to the beginning of the runway as possible. You must touchdown with a rate of descent less than 300 feet per minute to avoid a crash (and with a rate of descent less than 150 feet per minute to obtain a "good landing").

To achieve this, pilots use a manoeuvre called "flare out", in which the nose of the aircraft is raised in the last stage of approach to reduce the rate of descent and the speed. If you should happen to stall over the runway and you are low enough you will still achieve a good landing. After landing you must bring the aircraft to a halt by reducing the RPM to minimum (800) and applying the brakes and holding them on using Key < B > (Brakes).

Run Mode 5 autolanding and observe the flare out. You will also see the view out of the cockpit window, which consists of a runway with approach lights and various lights from surrounding hamlets. Note that the autopilot sets a slow speed before commencing the flare out and that the brakes are applied immediately *after* touchdown. (Hear each tyre squeak as it hits the runway.) When you feel that you wish to take over an approach, press and hold Key < Enter > and wait for a one second beep after which you will be in control. (You need do nothing to the heading as the aircraft will remain exactly on centreline and there is no wind to blow you off course.) Before landing, ensure that you have selected GEAR and FLAP down. (Although with practise you may be able to land without the use of FLAP, to start with, use it!)

Once you have landed the joystick controls (Keys 5 to 8 or the joystick) become ineffective. You retain directional control over the aircraft by use of nose-wheel steering. To steer left press Key < R > (<), right use Key < T > (>). In the auto-landing mode you will not require these controls as the aircraft will remain on the centre line unless you change the heading from 270°, however try some taxiing manoeuvres after a successful landing to prepare yourself for future occasions where you may not have landed on the centreline (and note the changing aspect of the runway lights).

Once you have brought the aircraft to a halt, or crashed the aircraft if you have been unsuccessful, scan the control panel to see if you can identify whatever fault may have caused the crash, if applicable. Now press < Enter > to obtain a Nightflite 2 Debrief with details of your flight, the result and any faults, signed by the author of Nightflite 2. For a list of possible faults, see section 6.

Press Key < M > to obtain a map display showing the mountains (in green), VOR and NDBs (which will be introduced later) and the runway which is the small black rectangle about one third the way up from the bottom of the screen in the centre. You will also see a series of dots representing the path that the aircraft has taken (this may be a little unclear if you have taken over an autolanding run due to the short distance involved, but in the normal mode it is clearer) This map can also be selected from the menu page at which time it shows the position of every light that can be seen out of the window.

If you have a Sinclair printer connected and you wish to have a copy of the debrief form, press Key < C > . (If the printer is not connected, nothing will happen if < C > is pressed.) To return to the main menu press < R >

4.4 Navigation

There are several instruments. The simplest is the "ADF" (Automatic Direction Finder) which is the white circular dial in the centre of the control panel. It points to an NDB (Non-Direction Beacon) on the ground such that the needle's direction relative to straight up is the same as the beacon's position relative to straight ahead of the aircraft, e.g. if the needle points to the right, the beacon is to the right, etc.

There are two NDBs, marked "n" on the map, situated four miles from touchdown in each landing direction. You may select which of the two beacons is displayed by pressing Key < E > (East) for the eastern beacon or Key < W > (West) for the western beacon. (Obviously the needle will point in different directions for each, as they will be at different relative angles to the aircraft.) The current selection is shown as ADF E or ADF W.

The ILS (Instrument Landing System) is displayed to the right of the ADF. It is the main navigational aid in the landing phase and it reads a pair of radio beams, one in line with the centreline of the runway and one in line with a safe angle down which you can fly (the glide path). Two needles are shown, one vertical and one horizontal. The vertical needle shows the aircraft position relative to the runway centreline. If the needle is to the right of centre then you must 'fly right' to get to it and vice versa. The horizontal needle shows the aircraft position relative to the glide path in a similar way. If the needle is above the centre you are below the glide path and must "fly up" and vice versa. Thus if you keep the needles crossed in the centre of the instrument you will fly down the intersection of the two radio beams to find the runway.

To observe the use of the ILS select Mode 4 Autopilot final. The aircraft starts off at just over 9 miles from touchdown on heading 270° parallel to the runway centreline. The ILS will give either a fly left or fly right signal. The autopilot responds by turning 30° in the correct direction into a heading which will eventually intercept the centreline. The aircraft starts off above the glide slope and the autopilot compensates by reducing power to start the descent. Once near the centreline the computer turns to intercept the centreline heading and then constantly adjusts the heading by small amounts to ensure that the aircraft stays on centre. When the glide slope needle is also centred the autopilot increases the power setting to slow down the rate of descent and then keeps the aircraft there by further adjustments of the power as necessary.

Note the movement of the ADF pointer. Initially when the aircraft is on heading 270° the pointer shows the beacon is ahead and to one side of the aircraft. As the aircraft turns, the relative position of the beacon changes. At four miles from touchdown the pointer swings around as the aircraft passes over the NDB.

Now fly an approach yourself by selecting Mode 1 and choosing the direction and degree of difficulty you require. (Pilots generally elect to land into wind as the wind slows the aircraft's speed down over the ground. Like walking the wrong way on an escalator, it is slower than walking the right way.) You will be positioned about 9 miles from touchdown, on a heading parallel to the runway heading (either 270° or 090° depending on W or E operation). The mountains marked on the map affect the approach to the runway. If you drift too far north, you will fly into them. In the Easterly landing direction, you commence the approach over the mountains. They extend up to 2000 ft and so you must ensure that you stay above this height until you are six miles from touchdown. The DME (Distance Measuring Equipment) situated on the bottom right of the control panel, gives a readout in miles of the distance from touchdown.

The higher the number that you select for your degree of difficulty, the stronger the wind, the lower the visibility (i.e. the range at which you will see any lights) and the lower the cloudbase. When above the cloud you will see no lights at all. Difficulty 5 gives you a zero cloudbase and you will see no lights until you have landed (even then you will not see many due to the poor visibility). One thing to watch on the higher modes is the effect of the wind on landing. Whilst in the air, you will have to vary the heading to keep on centreline by pointing into the wind (to prevent a wind from one side or the other blowing you off course). However, once on the ground the wind ceases to be effective and the aircraft will steer in the direction of the heading (i.e. possibly pointing at the side of the runway). This is when nosewheel steering becomes important, to keep the aircraft on the runway.

Having selected the degree of difficulty the control panel will be displayed and the flight starts. Notice that the WEATHER is printed at the bottom of the screen. Surface wind is shown as two numbers separated by a slash. The first number is the direction from which the wind is blowing in compass degrees (e.g. 240 is a wind from the South West) and the second number is the wind speed in mph.

On difficulty level zero, a small copy of the main map reproduced in the same place as the ILS, may be selected in flight by pressing and holding Key < M > (Map). It shows the mountains in green and the position of the NDBs, VORs, airfield and aircraft shown as dots.

4.5 More Navigation

The VOR (VHF Omni-Directional Range) is a beacon which produces radio beams similar to the ILS centre-line which radiate from the VOR like the spokes of a wheel (each spoke is called a "radial"). It is displayed in the same place as the ILS and the Map by pressing Key < V > (VOR). You can select the radial depending upon which direction you wish to approach the VOR, by continuing to press Key < V > . e.g. If you wish to approach the VOR from due South you would do so with a heading of due North (360°) thus you select radial 360. Once selected, the VOR radial works in the same way as the ILS centreline (i.e. if the needle is to the left, fly left). There are two VORs lying to the North of the mountains. As for the ADF you select the one to be displayed using Keys < E > and < W > (East and West).

You can also use the radials to find your position by determining the radial to which you are nearest by trial and error for each VOR and calculating where they cross but be careful of the signal that is given out on the opposite side of the VOR from the selected radial as this will be reversed. When the VOR is displayed the DME shows distances from the VOR and not from touchdown.

4.6 Other Modes

Mode 2 Take Off starts with the aircraft lined up on the centre of the runway with RPM 2200. To take off successfully you must either increase the engine RPM or lift the nose at precisely the right moment because the runway is only just long enough. The joystick controls will not function until the airflow over the wing is at a fairly high speed and the aircraft will not fly until the speed is greater than the stall. After take off do not allow your aircraft to accelerate beyond the gear limit speed before raising the Gear.

In Mode 3 (Random Position), you start at 3000 ft somewhere on the map and you must find your way to the airfield on any route you choose. In Modes 2 and 3 you start with the VOR display. To select the ILS when ready press and hold Key < I > (ILS).

At times when you have some distance to fly with little to do or if you should wish to hurry the flight it is possible to accelerate the program by a factor of four by omitting the window display. Key 0 (Black) switches off the visuals and accelerates the flight. Key 9 (Graphics) resumes normal speed and visuals.

4.7 Two Final Challenges

It will take you a long time to master all the aspects of Nightflite 2 but if you are able to land the aircraft consistently at level 5 (i.e. in poor visibility in a strong wind) why not try:

i) covering the instrument display and landing the aircraft by watching the window display only
ii) cutting the engine speed to 800 RPM to simulate loss of fuel. It is just possible to land safely if you keep the nose down (so as to avoid stalling) until the very last moment.

CONTROL KEYS

System Controls

Key	*Function*
Space (Break)	Abandon any flight. Go to Menu page.
A (Stop)	Hold the flight.
Z (Adjacent to A)	Resume the flight.
Enter	Take control from autopilot.
S (Sound)	Switch Sound on and off.
0 (Black)	High speed. No visuals.
9 (Graphics)	Resume normal speed and visuals.

Aircraft Controls

Function	*Effect*
5 (←) Bank left	Turn left or stop right turn, VSI —
6 (↓) Nose up	VSI —, ASI +
7 (↑) Nose down	VSI +, ASI —
8 (→) Bank right	Turn right or stop left turn, VSI —
K (+) RPM increases	ASI +, VSI +
J (—) RPM decreases	ASI —, VSI —
G (Gear) Gear down	ASI —
H (next to G) Gear up	ASI +
F (Flap) Flap down	ASI—, stall speed lowered
D (next to F) Flap up	ASI+, stall speed raised
B (Brakes) Brakes on	ASI — (only after landing)
W (West) Western Facilities	ILS, VOR, NDB and approach lights to West of airfield
E (East) Eastern Facilities	ILS, VOR, NDB and approach lights to East of airfield
R (<) Taxi left	Steer left on runway
T (>) Taxi right	Steer right on runway
I (ILS) ILS display on	DME measures from touchdown
V (VOR) VOR display on	DME measures from VOR
M (MAP) MAP display on	DME unaltered

6. AIRCRAFT LIMITATIONS

Landing: A rate of descent less than 150 fpm wings level and main undercarriage first (i.e. not nose down) will result in a "GOOD LANDING"

The following faults will result in a safe but "ROUGH" landing:

i) A rate of descent greater than 150 fpm but less than 300 fpm:
   Fault Report = Heavy landing
ii) Wings banked by two inputs or less
   Fault Report = One mainwheel first
iii) Nose down
   Fault Report = Nosewheel first
iv) Rolling off the runway at less than 10 mph
   Fault Report = Off runway slow

The following faults will result in a "CRASH":

i) A speed in excess of 140 mph
   Fault Report = VNE exceeded
ii) A speed in excess of 80 mph with the flaps down
   Fault Report = Flap limit exceeded
iii) A speed in excess of 90 mph with gear down
   Fault Report = Gear limit exceeded
iv) Landing with a rate of descent in excess of 300 fpm
   Fault Report = VSI too high
v) Landing with gear up
   Fault Report = Gear not down
vi) Landing with the wings banked by more than two inputs
   Fault Report = Wingtip grounded
vii) Landing with the brakes on
   Fault Report = Brakes on landing
viii) Landing or hitting the ground not on the runway
   Fault Report = Crash not on runway
ix) Running off the runway at a speed higher than 10 mph
   Fault Report = Careered off runway
x) Hitting the mountain
   Fault Report = Flew into mountains.

SALES OFFICE:
60A St. Mary's Street,
Wallingford,
Oxon. OX10 0EL.
Tel: (0491) 36307