MICRODEAL

QL Flight Simulator

Manual

1.0 INTRODUCTION

Welcome to QL Flight. If you are impatient to get flying then follow the loading instructions in chapter 2, then to chapter 7 where “CIRCUIT” flying is described.
Ql Flight is not a game and has not been written to be a game, it is a true representation of a light aircraft and has been written by a pilot, tested by a pilot and hopefully will be used by existing pilots and student pilots alike. You do not have to have knowledge of flying our QL Flight but for the novice the book outlined in the hints and tips section would prove invaluable.

The Opening Screen

QL Flight (QLF) is a “view” oriented flight simulation for the SINCLAIR QL computer. “View” oriented means that the user (or pilot) may determine him or her position by actually viewing the surrounding landmarks as opposed to using instruments which sense navigational references. This is a major departure from “instrument only” simulations which can achieved through BASIC programs.
The aircraft modelled is an experimental, sport-trainer type and thereby lacks most of the instruments necessary for purely instrument capability. However, most of the instrument manoeuvres and procedures may be practised. The aircraft is a light-weight, single-wing aircraft with low wings and a “T”-tail. A nose wheel which is both steerable and retractable is also modelled. The pilot is seated in the nose section and is surrounded by a high-visibility (“babble”) windshield. Some acrobatics are possible including sustained inverted flight, aileron rolls, spins and stalls.
Instruments indicate: wheel brakes, gear position, flap position, fuel, elevator trim, stall, altitude, heading, indicated velocity, ground speed, rate of climb, engine speed, 2 min turn,

sideslip and pitch and roll altitudes. The engine may started and shutdown and there are refuelling stations.

2.0 LOADING

Before running the game for the first time we strongly recommend that you make at least one backup copy of the cartridge. To do this press the reset button and then Fl or F2 as normal. Now place the original cartridge in drive 1 and a blank cartridge in drive 2. Note that the blank cartridge in drive 2 need not be formatted and that any files already on it will be destroyed. Type in LOAD MDV1 BACKUP ancl press the enter key. When the backup program has loaded type RUN and press ENTER. After about ten minutes you will have a complete backup cartridge in drive 2. You can make further backup copie s in the same way either from the original cartridge or from any of your backup ~artridges. The backup cartridge is then placed in drive 1 and the orginal cartridge in drive 2 whenever you wish to use the program. Note that the program will load from either the original or any backup in drive l but if you are uslng a backup the original cartridge must replaced in drive 2 or the program will not run. The protection method used is very reliable and and the above method will work even when the original cartridge is yeal's old, damaged and unreadable!

3.0 GENERAL PROGRAM OPERATION

This section describes the operational "flow" of QLF in general. It
Details how the simulation sequences through its various phases and 1ow it is intialized (setup) and reset.

3.1 INITIAL DISPLAY

Initially the program goes through an opening display featuring an aircraft aileron roll. After the engine sound stops, the display may oe exlted by pressing the [ENTER] key. This sequence is never repeated and is followed by the DEFINE WORLDS phase.

3.2 DEFINE WORLDS

This portion of the program is entered after the initial display and after a CRASH or RESET of the simulation. This is the part of the program which allows the user to change or control the weather conditions in each of the nine worlds. Control is initiated by pressing the first letter of the first word in each of the controllable parameters. An example would be "w" for World Select. After pressing the "w" a white square will appear over the position of the previous world number. This is your prompt to enter your selection which should be a number between "1" and "9", all others are ignored. Pressing a "3" will draw World No.3 and allow the weather conditions to be changed in that world. The world displayed is the world in which changes to be made. It is also the world in which the simulation will begin until the "B" key (Begin in world) has been pressed and a new world number is specified. Initially, the DEFINE WORLD sequence starts in the middle world (No.5-the practice Field). After a CRASH or a RESET the world displayed is the one in which the CRASH or RESET occurred. The following is a description of the control keys in DEFINE WOLDS and the limits of their inputs:

KEY DEFINE WOLDS CONTROL DESCRIPTION

S - Allows user to set the SPEED of the wind in knots. Two digits must be entered from 00 to 29 knots. All other keys or numerical values are ignored.

F - Allows user to set the direction in degrees FROM which the wind is blowing. Three digits must be entered from 000 to 359.
All other keys or numerical values are ignored.

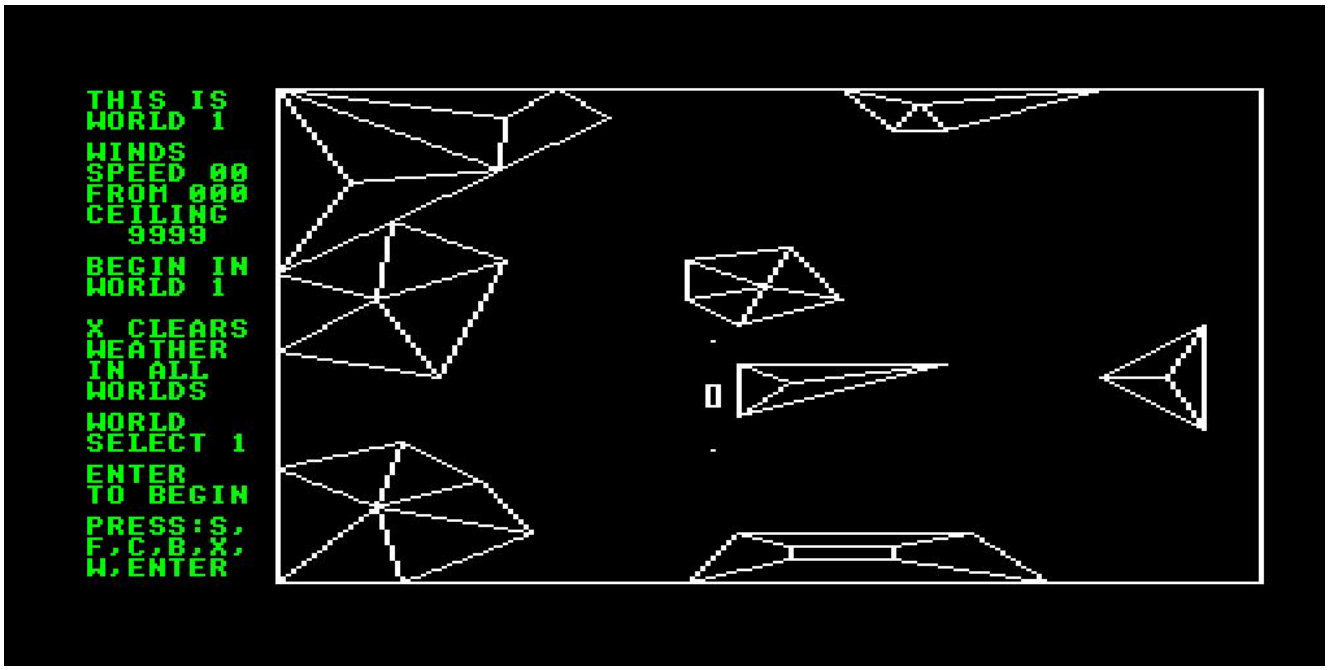
C - Allows the user to set the CEILING in feet below which the ground and other landmarks are visible through the aircraft windows. This parameter does not affect the RADAR view. Four digits must be entered from 0000 to 9999. All other keys or numerical values are ignored.

B - Allows the user to set the world in which the simulation will BEGIN. A single digit must be entred from I to 9. All other keys or numerical values are ignored. If unspecifyed, the simulation begins in the last displayed world before (ENTER) was pressed.

X - Allows the user to X-OUT or clear the weather conditions in all the worlds at once. A clear is defined as: SPEED 00: FROM 00: CEILING 9999. These are also the default values if the weather in a particular world is never specified.

W - Allows the user to select any of the nine WORLDS for the purposes of view or specification of weather conditions. Value is initially "5" and thererafter takes on the value of the world in which a CRASH RESET has just occurred.

ENTER –
Pressing this key exits the DEFINE WORLDS phase and transfers control to the fllght simulation with the parameters specified during the only exit. DEFINE WORLDS sequence. The ENTER key is the only exit.



THE DEFINE WORLDS SCREEN

3.3 FLIGHT SIMULATION

This is the heart of WORLDS OF FLIGHT and can only be entered from the DEFINE WORLDS phase. This initial starting position is always at the south end of the runway within the runway scene. In order to provide a much more realistic and detailed take-off and landing simulation, a separate runway scene has been provided. Although the locations of the runways are different in each world, the runway scenes are the same and oriented on a north-south heading. Shortly after take-off the scene transitions from the runway graphics to the appropriate world scene. As your flight path crosses the boundaries of your current world, a transltlon takes place into an adjacent world. The layout of the nine worlds is given by the following diagram:

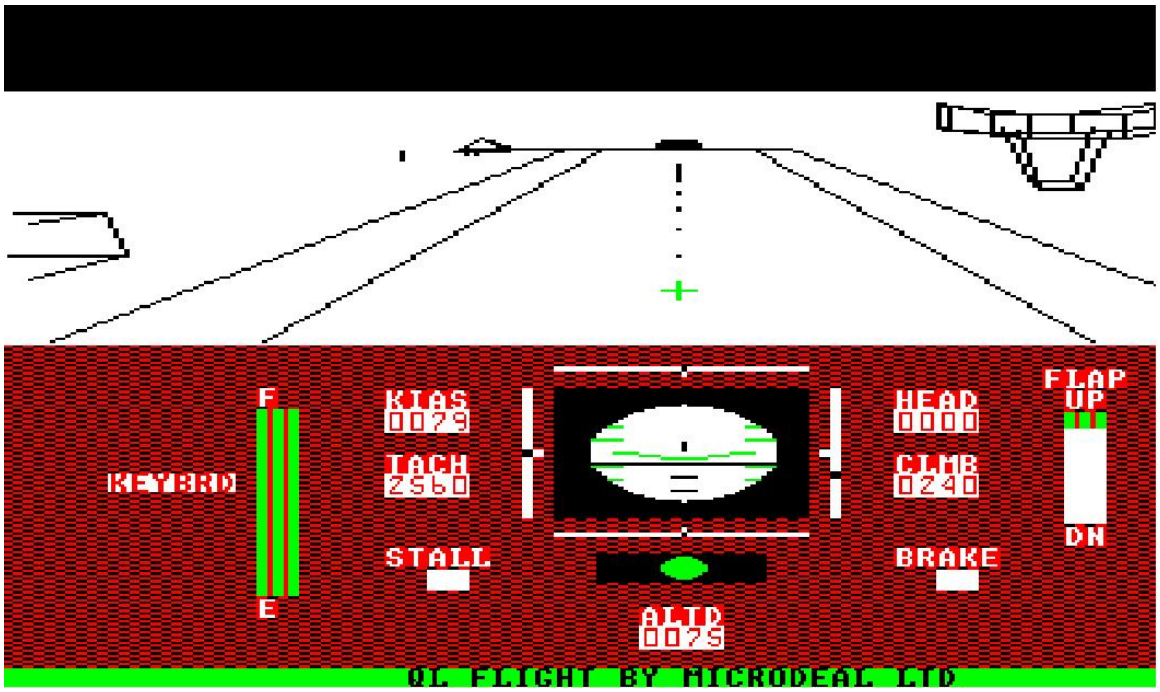
WORLD LAYOUT

No.1 MOUNTAIN WORLD No.l	**No.2** ARABIAN GULF	**No.3** PANAMA CITY
No.4 DAHLGREN VA.	**No.5** PRACTICE FlELD	**No.6** MOUNTAIN WORLD No.2
No.7 ISLAND BAY	**No.8** MOUNTAIN WORLD No.8	**No.9** POWER LINE RIVER

As the aircraft approaches the runway, the graphics will once again transition to the runway scene. The requirements for a transition to the runway scene are as follows:

- Altitude below the CEILING or 400 feet whichever is less
- Range-to-Runway threshhold 3888-4401 feet
- East-West Drift +-864-978 feet off runway centreline

It should be noted that the representation of the runway or airport before the transition to the runway scene is very simple, (two reference marks to aid the final approach and an elongated rectangle as the runway itself). Its sole purpose is to provide a "target" to the pilot relative to which he or she may make manoe uvres leading to final approach.



APPROACHING THE RUNWAY PRIOR TO LANDING

As with real aircraft, control inputs have been simulated not to cause instantiancous responses. Characteristic of all aircraft is a slowly oscillating but damped pitching motion called PHUGOID which occurs in response to an elevator or throttle control command. For instance, puppose you are flying along straight and level, then pull the elevator stick back. Assuming that you don't stall, the aircraft will first overshoot your new pitch attitude then undershoot it! This may continue for another cycle or so but it will eventually stop or "damp". You will see this happen in intervals, which is the update rate of the simulation.

3.4 FLIGHT TERMINATION

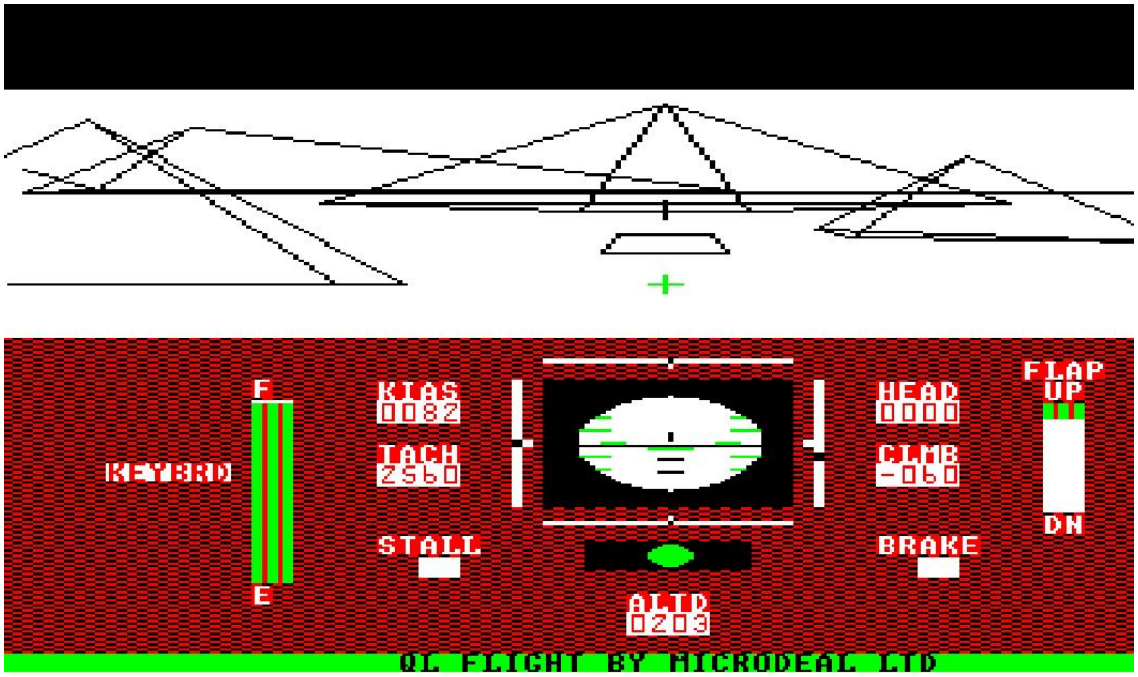
The simulation is running continuously unless the [P] or [ESC] keys are pressed. The [P] key completely "freezes" the entire simulation including the engine sound. Pressing the [P] key again, immediately causes resumption of the simulation. This feature may be used as many times as necessary. The [ESC] key totally RESETS the simulation and goes back to the DEFINE WORLDS sequence. A crash also causes a termination of the simulation preceeded by a violent explosion, a colour-filled screen and a data block in the upper left-hand corner indicating your impact coordinates, and the world in which you crashed. If you crashed in the runway scene, your coordinates may have negative values (see 8.0 MAPS). A crash is caused hy:

- AN OUT-OF-TOLERANCE LANDING
- A LANDING OR TAKE-OFF, OFF THE RUNWAY
- IMPACT WITH THE SCENERY (MOUNTAINS, 'fOWERS, ETC)

As before, pressing the [ESC) key causes a RESET from the CRASHED condition to the DEFINE WORLDS sequence where the worlds may be respecified and the FLIGHT SIMULATION re-entered.

4.0 UNDERSTANDING AND CONTROLLING THE GRAPHIC VIEWS

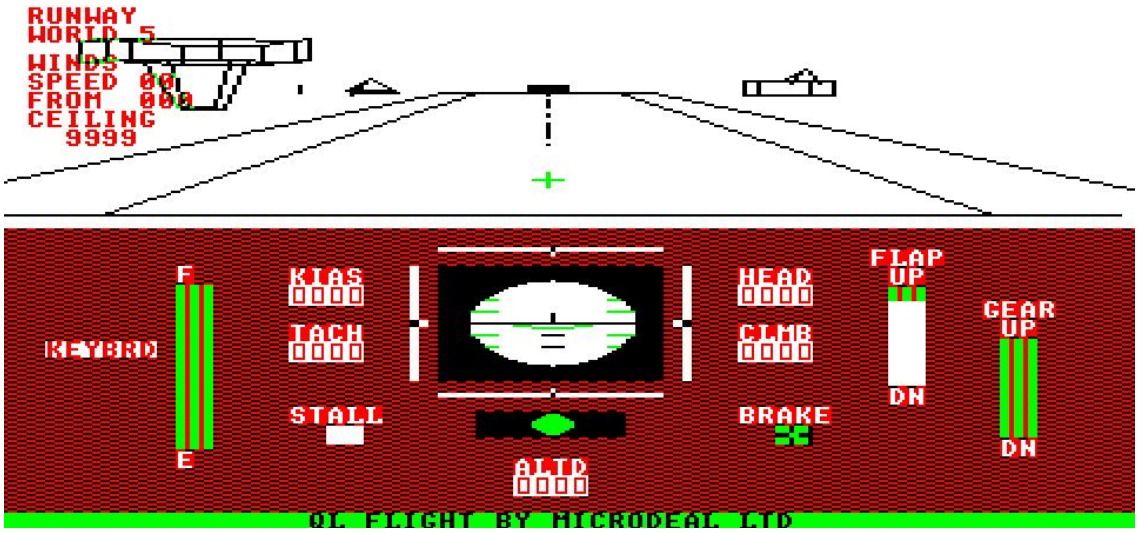
QLF uses "wire" (or line) graphics to represent the various worlds. This method minimizes the memory required for each world and maximizes the speed at which the 3-D scenes can be drawn. As a result of some of the techniques used, QLF also provides "flicker-free" animation of the graphic scenes. For a more detailed discussion of "wire graphics", the user is encouraged to refer to the Appendix under the title "Representation of Graphic Scenes".



SCENERY AS WIRE GRAPHICS

4.1 WIRE GRAPHICS

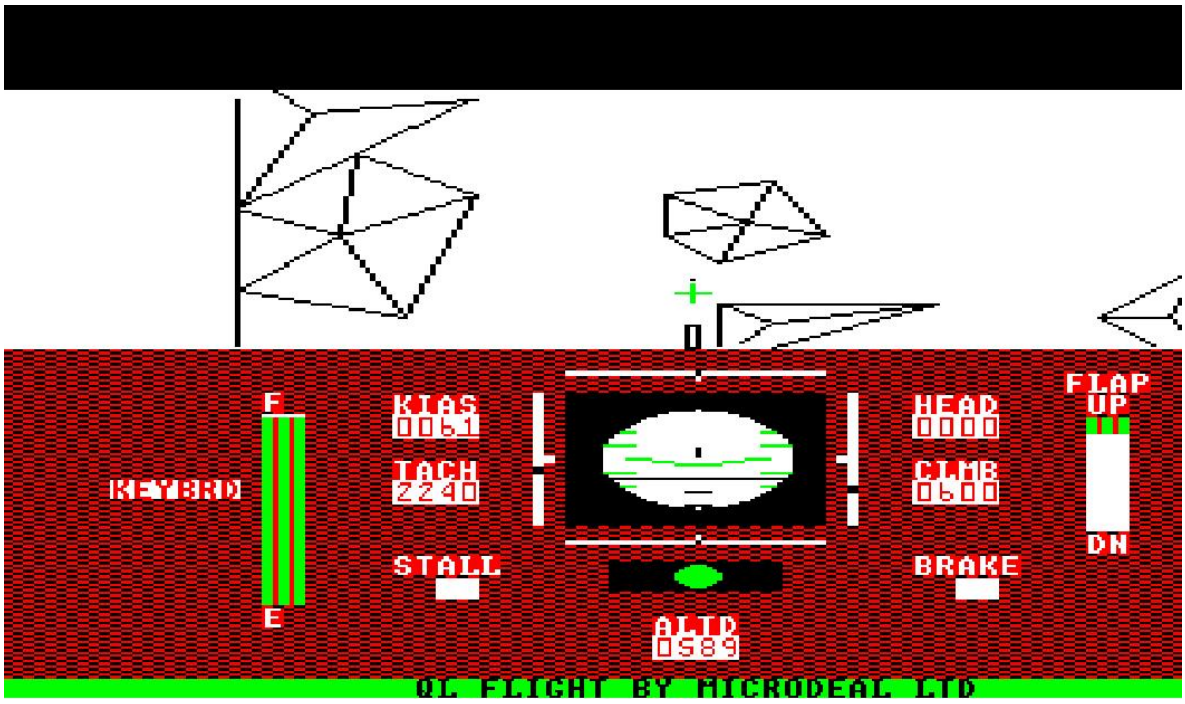
Wire graphics define only the outlines or contours of the objects they portray. To some, the "phantom" appearance of the objects represented in this fashion causes some visual difficulty in actually interpreting what they are supposed to be seeing. Yet, to others, the objects are obvious. All this is to say that it may take some "getting used to" before Home users begin to visually intepret the significance of every detail "seen" out of the windows. For these reasons, a signifcant help has been installed into the simulation which should substantially aid in determining one's position and understanding of his or her surroundings relative to this the aircraft the aircrafts orientation, or a PANORAMIC VIEW capability.



View of runway

4.2 PANORAMIC VIEW

The ability to "Pan-around" is the equivalent of rotating your head (your viewing angle) left to right and up and down. This feature is controlled by the arrow keys. The [ALT/UP ARROW] key rotates your view to straight ahead again, just in case you get disorientated. Your view is normaly depressed (pitched down) 8 degrees relative to the aircraft's pitch attitude. This is the natural look-down of the pilot's line of sight over the instrument panel. After the aircraft's altitude (climb angle+ angle of attack) exceeds an 8 degree pitch up, the forward looking view becomes AUTO-LEVELLING. This is the equivalent of pitching the pilot's head one degree downward for each degree the aircraft pitches upward past 8 degrees. Consequently the centre of the elevation view is never above the horizon. While this may be some what unrealistic (although the reisanaturat tendency to do it), the f ea ture allows the pilot to view at l east some of the horizon even in a steep climb rather than just sky. Once the craft pitches be low 8 degrees, the "pitching motion" of the scenery will return. Abov e 1500 feet at a maximum climb, even au to-levelling does not in sure a horizon as you f ly to the "edge " of a world, use the [DOWN ARROW] to get it back. The cross-hair in the centre of the straight ahead view indicates where the aircraft is headed. The cross-hair can be used to determine if the aircraft is above or below an object by incrementing the view UPWARD [UP ARROW] until the view stops moving downward in response to the key. This is where the AUTO-LEVELLING feature takes over and the resulting view represents a true elevation view relative to the scenery. Press the [ALT/UP ARROW] key to re-establish the normal 8 degree depression.



Radar View

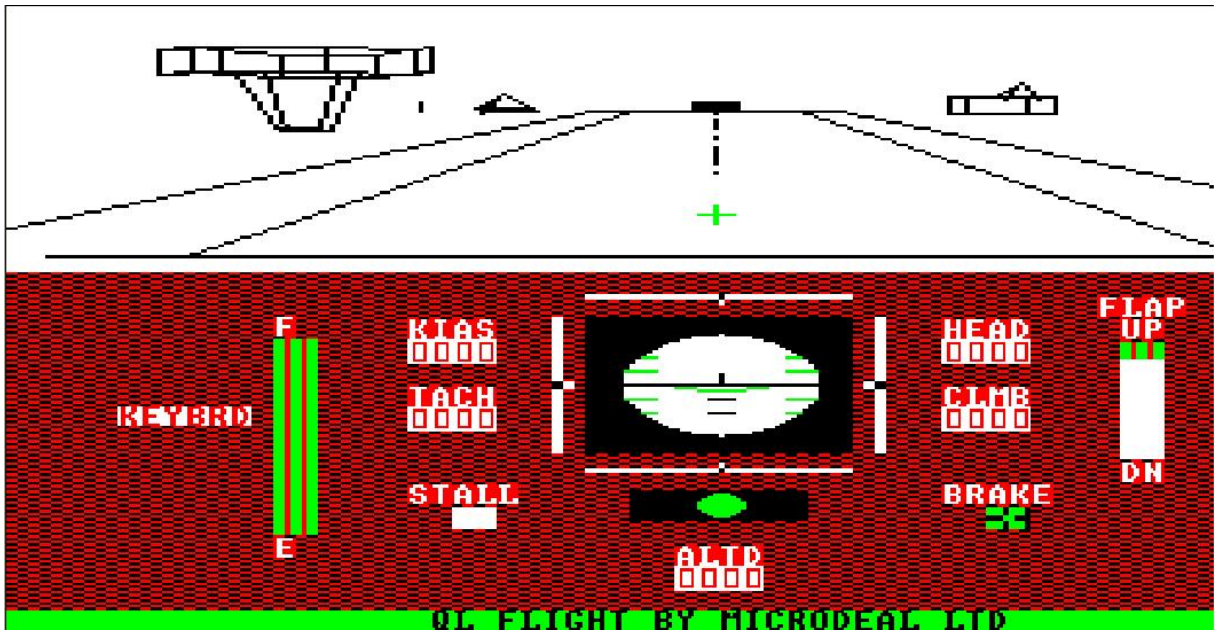
4.3 RADAR VIEWS

Another related feature is the "RADAR" which can be thought of as an overhead or "birds-eye" view (downward looking) of your world with a cross-hair at your exact position. In this view, the top portion of the "+" is pointing in your direction of travel or heading. The RADAR view is toggled (both entered and exited by [TABULATE]). lt also has a variable magnification [ZOOM] feature which is controlled by the [Z] and [X] keys. Both the PANORAMIC and RADAR views are available at any time during the simulation. Liberal use of these features is recommended, especially the RADAR feature. When flying instrument practice or above the cloud ceiling the RADAR vie w is the only precise check available on position (the clouds obscure the ground features out of the aircraft windows).
The following is a summary of the VIEW CONTROL functions:

UP ARROW	Elevate the vertical viewing angle 8 degrees
DOWN ARROW	Depress the vertical viewing angle 8 degrees
RIGHT ARROW	Move the horizontal viewing angle 90 degrees to the right
LEFT ARHOW	Move the horizontal viewing angle 90 degrees t o the left
ALT/UP ARROW	See the horizontal view straight ahead with an 8 degree depressed vertical viewing angle
TABULATE	Toggles the RADAR or overhead view. To exit press TABULATE again
[Z]	Enlarges (ZOOMS) the RADAR view by a factor of 2
[X]	Reduces the RADAR view by a factor of 2
[8]	"Inverts" the video of all graphic views. Press 8 to return to the original format.

NOTE: PANORAMIC views are relative to aircraft attitude.

5.0 THE INSTRUMENT PANEL AND FLIGHT CONTROLS



Instrument panel

5.1 INSTRUMENTS

In order to describe the instrument display, it is best that the instrument panel be visible. If it is not at this time, go through the loading process and exit the initial display. When World No.5 appears press the "S" key followed by a "05". Then press the "C" key and enter 5000. You have just set the wind speed at 5 knots and the ceiling to 5000 feet of World No.5. Now press [ENTER]. The instrument panel should appear. The instrument displays will n now be discussed starting from left to right.

5.1.1 ELEVATOR TRIM INDICATOR

This display indicates the position of the elevator trim. Trim intially being in the centre (0) position. Trim position is controlled by the buttons: [V]-Trim UP and [R] -Trim DOWN

5.1.2 FUEL GAUGE (FUEL)

This bar gauge indicates whow much fuel you have. The rate of fuel loss is proportional to the throttle prosition. At full throttle you have approximately 50 minutes of fuel in a full tank, when you run out. Your engine will shutdown, if you're on the ground then you're stuck without the abillty to move your aircraft. So you will have RESET' [ESC] the simulation unless you can coast to the re-fuelling area. If you run out of fuel in the air you'll have to perform a power-off landing and then roll to the re-fuel area (a next to impossible task!).

5.1.3 KNOTS OF INDICATED AIR SPEED (KIAS)

This instrument measures the speed of the wind flowing over the aircraft. This is a RELATIVE or INDICATED wind velocity NOT GROUND SPEED. If you have followed the suggested setup, this display should read 0005 knots because of the 5 knot wind that we previously set in. Now press the [A] key once and the digital display will "invert". This is your ground speed -0000. All aerodynamic forces on the aircraft depend on the INDICATED or RELATIVE velocity, NOT ground speed. This feature is purely a navigational aid. Don't ever ily by the white-on-black ("inverted") numbers! Press the [A] key again and the display will return to its normal black-on-white format.

5.1.4 ENGINE SPEED (TACH)

This is the engine tachometer. It measures engine speed in 80 rpm intervals. A different engine sound is heard every 320 rpm. Wide open throttle is 2560, idle is 640. The pressing of the [+] and [-] keys on the top row controls the throttle. The engine is STARTED by pressing the [I] for Ignition key. The engine is SHUTDOWN when on the ground by pressing the [S] key. The engine can't be shutdown in flight (why should you want to?) Try it now. Make sure the brake is set (black cross in a small box below CLMB readout), set it by pressing the [ENTER] key until the cross appears. Then start and shutdown the engine a few times and play with the throttle.

5.1.5 STALL INDICATION (STALL)

This little square indicates that a stall is occurring. A black cross appears along with a raspy, stall-warning tone. This tone occurs whenever the angle-of-attack builds up to 16 degrees. (See section 7.2.1. stalls). When a stall occurs the yoke centres itself.

5.1.6 ARTIFICIAL HORIZON

This is the instrument most familiar even to non-pilots. It visually conveys aircraft pitch and roll attitude. Your aircraft is represented by a coloured "W" which does not move. Your horizon is represented by a dark 1ine. This line translates up and down indicating changes in pitch attitude and rotates about the horizontal centreline of the instrument to indicate roll attitude. Note that although the representation of the aircraft does not move, the instrument nonetheless is attempting to portray your aircraft's attitude relative to the horizon as if you were actually ins1de the aircraft and looking out of the window. The short tick marks on the horizontal centre of the instrument but just below the horizon line are spaced every 10 degrees of pitch attitude and move with the horizon. They also indicate where the "ground" is relative to the horizon. When flying level but inverted for example, these marks appear in the upper portion of the instrument indicating that you are indeed upside down. The small tick marks located along the circumference of the instrument are also placed at every 10 degrees of pitch attitude, thus helping to determine a quantitative measure of your craft's pitch attitude.

5.1.7 SIDESLIP INDICATOR (Ball-Below Artificial Horizon)

This instrument indicates whether or not your aircraft's turns are coordinated. lt has been added for the sake of functional "correctness", however in a banked turn it has little or no dynamic effect on the turn itself. Since the consequences of uncoordinated turns (side forces on the pilot) cannot be simvlated, you will probably find little need to coordinate your turns (centre the ball), but if you would be perfect, apply rudder in the direction of the ball. In non-banking flight, the rudder may be used to skid-turn but this is not a standard producedure. For this very reason rudder "power" has been purposely made rather weak (can only produce a maximum of 2 deg/sec).

5.1.8 ALTIMETER (ALT)

Just below the sideslip indicator is the ALTIMETER. It always reads altitude above the ground or above ZERO absolute altitude. The runway is always at "0" altitude and all the various~ world features are also referenced to a "0" altitude base.

5.1.9 COMPASS (HEAD)

This compass reads relative to true North. It has one special feature. When bcnking Lo turn the heading readout goes to an "inverse" video display whenever the aircraft is in a 2 MINUTE TURN (3 deg/sec turn rate).

5.1.10 RATE-OF-CLIMB (CLMB)

This readout displays the aircrafts rate-of-climb or rate-of-decent in feet per minute. Decents are indicated with a minus sign. The readout has a dynamic range of -9999 feet per minute.

5.1.11 BRAKE INDICATOR (BRKE)

Just below the rate-of-climb indicator is a small square indication whether the wheel brakes are set. If set, a black cross appears in the box. Brakes are toggled on and off by the [ENTER] key while on the ground but may not be set while flying. These brakes enough to hold against a maximum throttle “run-up” and are the only positive way of completely stopping the aircraft once it is rolling.

5.1.12 FLAP INDICATOR (FLAP)

The flaps may be lowered to 60 degrees in 10 degree increments. This is denoted by an incremental lengthening of the bar gauge. The flaps are full down when not white is showing. The [W] key lowers the flaps; the [Y] key raises again.

5.1.13 GEAR INDICATOR (GEAR)

This gauge is very similar to the flaps gauge. It indicate the gear position. The minimum length with a single block showing indicates gear up, the maximum with no white showing – gear down. The [U] key raises the gear. The [D] lowers the gear. Gear may not be raised while on the ground.

5.1.14 RUDDER INDICATOR (Below the artificial horizon)

This indicator is set at the central position on initial startup and will move 2 places to the right or left by pressing the keys (C] or [M].

5.1.15 AILERON INDICATOR (Above artificial horizon)

This indicator shows the position of the yoke. Moving the yoke (one press of the [H] or [F] keys or one movement of joystick to the left or right) will put the aircraft into a banked turn. To centre the ailerons once the required amount of bank has been reached press the joystick fire button or press the [G] key.

5.1.16 ELEVATOR INDICATOR (To the right of the artificial horizon)

This indicator shows the position of the elevators which ·are controlled by forward and backward movement of the joystick or by the
[T] and (B] keys.

5.1.17 KEYBOARD/JOYSTICK INDICATOR

To the left of the fuel gauge the word JOYSTK or KEYBRD appears to tell you whether you are in joystick or keyboard mode. The simulation always starts in keyboard mode. Pressing either the [J] or [K] keys will switch you from one mode to the other.

5.2 FLIGHT CONTROLS

Real aircraft are flown by stick or yoke back pressure. The motion of the aircraft and back pressures that the pilot feels on his controls (elevator, ailerons and rudders) communicate what additional control inputs, if any, are needed. Without some elaborate and expensive control simulator to hook up to your home computer, stick feedback pressure is impossible to simulate. And as for the motion of the aircraft - FORGET IT! (Now you're talking millions of pounds). However, model aircraft enthusiasts fly without these feedbacks, although they can view the aircraft's altitude and usually have self-centering springs on their controls. So there is hope for joystick control even though some loss of realism is unavoidable.

5.2.1 KEYBOARD/JOYSTICK CONTROL

QLF was designed to offer the option of keyboard or Joystick control of the elevator and ailerons. The [K] key selects the keyboard (QLF always starts in this mode) whilst the [J] key selects the joystick. The joystick should be plugged into the CTRL2 socket.

5.2.2. THROTTLE

The [+] and (-] keys produce THROTTLE changes in small increments of 80 RPM. The [+] key opens the throttle, the [-] key closes it. Additional controls have been provided to give immediate full throttle and a cut of the throttle to idle speed. The full throttle control is provided by the [ ]] key and the cut of the throttle by the [[ ] key. Since this control provides well defined thrust characteristics, THROTTLE can and should be used to make SMALL ADJUSTMENTS in the RATE-OF-CLIMB of the aircraft. For example, suppose you are flying at 70 knots and climbing at 120 fpm and you want to level your flight at 10. You could

A) PUSH THE ELEVATOR stick forward but you may speed up since this is a course attitude control.
B) TRIM DOWN. This may work since the trim control is much finer elevator control but you may still speed up.
C) REDUCE THROTTLE (probably 160 rpm) and presto straight and level at 70 knots without ever touching the trim or the elevator.
Want to climb at 70 knots? [+] throttle up.
Want to dive at 70 knots? [-] throttle back.

5.2.3. ELEVATORS

These are controlled by forward and backward movement of the joystick or by the [T] and [B] keys. The degree of elevator movement is displayed on the small vertical bar gauge to the right of the artificial horizon. Extreme backward movement will almost always result in a stall whilst extreme forward movement results in heavy loss of height.The throttle should .be used to control the rate of descent or climb at a constant speed, however the combination of elevator and elevator trim (V R keys) controls the equilibrium velocity of the aircraft at a constant throttle setting. For example, assuming a wide-open throttle, the elevator stick would need to been early centred (trim at 0) with the aircraft "clean" (gear up-flaps up) to cruise straight and level at 90 knots (104 mph). Pushing the stJck slightly forward will cause a dive but no longer at 90 knots. As a result the engine may overspeed and the airspeed increase to over 100 knots. Pulling back on the stick will cause a climb but once again not at 90 knots; maybe 80, 10, 60 or even as slow as 50 knots. Since almost all manoeuvres are specified at a particular indicated velocity (KIAS), the elevator/trim combinati on becomes the primary control of airspeed at a constant throttle setting. For instance, suppose you are level at a 60 knot cruise, but would like to be straight and level at 90 knots. You must -do two things at once; open the throttle (cause a climb) and slowly push the stick forward (cancels the climb caused by throttle). Small adjustments can be made by the elevator trim to maintain level flight. When this is done, look at your airspeed, 88 to 92 knots in level flight.

5.2.4. AILERONS

The indicator above the artificial horizon shows the position of the yoke. Moving the yoke to the right (one press of the H key or one right movement of joystick) will move the ailerons and put the aircraft into a banked turn, once the correct turning rate has been reached centre the stick immedlately (Joyntick fire button or G key).The left right motion of the joystick or the [F) and [HJ keys cause a roll rate that is proportional to the degree of movement shown on the horizontal bar gauge. The extreme settings of this control should only be used when a large roll correctlon is necessary, for normal flight especially landings these extreme control zones should be avoided.

5.2.5. RUDDER

The [C] and [M] keys control the aire rafts rudder and nose wheel. The degree of movement is displayed on the bar gauge below the artifical horizon.When on the ground these keys control the nose wheel. In the air it controls the rudder. It has 2 large control zones to either side. While on the ground the nose wheel gives a 4 deg/sec turning rate in zone 1 and 8 deg/sec in the extreme zone. In the air the turning rates due to rudder are 1 and 2 deg/sec, respectively.

Note that the rudder lo the only way to steer the aircraft on the ground. The [0] key centres the rudder as well as the airleron both on the ground and in the air.

5.2.6. ELEVATOR TRIM

The ELEVATOR 'l'RIM is controlled by the [R] and [V] keys. The [V] key trims up 1 degree and the [R] key trims down 1 degree of elevator. An elevator trim range of +/-ll degrees is available.

5.2.7. ENGINE START

Pressing [I] starts the aircraft's ENGINE whilst on the gound. (You are not allowed to shut-down the engine in flight, so you won't need to restart it I)

5.2.8. FLAPS

The [N] key LOWERS the FLAPS in 10 degree increments, press and hold the [N] key until the bar gauge shows no white if you require full flaps. The [Y] key RAISES the FLAPS 10 degrees. Flaps affect aircraft trim.

5.2.9. GEAR

The [U] key starts to raise the landing gear. The [D] key starts to lower the gear. Gear position, like the flaps affect the aircraft's trim. Press and hold the key to fully raise or lower the gear.

5.3 AIRCRAFT PERFORMANCE

The following is a summary of the simulated aircraft's performance characteristics:

MAXIMUM CROSS WEIGHT	600	LBS
ENGINE HORSEPOWER	40	H.P.
FUEL CAPACITY	17.5	GALLON
BEST RATE OF CLIMB	1020	FPM @ 60 KTS
BEST CLIMB ANGLE	900	FPM @ 50 KTS
MAXIMUM CRUISE SPEED (CLEAN)	90	KNOTS
MAXIMUM DIVE SPEED (CLEAN)	120	KNOTS
(SIMULATION LIMITS THE ALLOWABLE DIVE ANGLE SO THAT AIRCRAFT STRUCTURAL LIMITS ARE NEVER EXCEEDED)		
SERVICE CEILING	8960	FEET
STALL SPEED (CLEAN)	46	KNOTS
STALL SPEED (GEAR AND FLAPS)	42	KNOTS
MINIMUM TAKEOFF ROLL	864	FEET
MINIMUM LANDING GROUND ROLL	506	FEET
FUEL CONSUMPTION RATE	21	GAL/HR
MAX.THROTTLE MAXIMUM RANGE ENDURANCE	109	Mi in 1.9 h @ 50 KTS @ LESS THAN 1500 FEET @ 960 RPM
MAXIMUM ROLL RATE		20 DEG/SEC

(AILERON POWER LIMITED BY SIMULATION FOR BETTER "FAST--ROLL" CONTROL)

INVERTED FLIGHT TIME SAME AS NORMAL FLIGHT

(FUEL AND OIL SYSTEM IS PRESSURIZED)

5.4 SPECIAL FEATURE CONTROLS

The following controls do not directly affect the flight of the aircraft. They are, however, special aids whlch are available to the pilot.

5.4.1 TWO MINUTE TURN

Although a standard 2 min. turn undicator is not present on the instrument panel, an indication of this standard turn is available by way of the compass (HEAD) readout. Whenever the aircraft is in a 2 min. turn the head readout will go into inverse video format.

5.4.2. THE "A" KEY-GROUND SPEED INDICATOR

GROUND SPEED (previously mentioned in 5.1.3) is not usually available on demand to small aircraft pilots, but since it is calculated by the simulation it has been made available. To obtain your ground speed in knots, press the [A] key and the KIAS readout will go to an inverse video format. The inverse video indicates that the speed reading is GROUND speed. Press the [A] key to return to the normal display format and Knots of Indicated Air Speed (KIAS).

5.4.3 THE [W] KEY-WEATHER INFORMATION

Pressing the [W] key will cause a data block to appear in the upper left of the ai rcraft wind ow. This data block id entifies the current world and its WEATHER CONDITIONS. This display automatically disappears after five seconds. World identification and weather inf ormation will also appear during a transition to another world or any transition to the runway scene. The data block accompanying the runway scene will identify itself as "RUNWAY" WORLD No.l to 9. So if you are confused as to which world you are in, or you have forgotten the wea t her info, just press the [W] key.

5.4.4. THE TAXI FEATURE

In order to provide for stable and controllable manoeuvres off the runway, a taxi feature has been added. It provides a steady 10 knot GROUND speed TAXI and allows the aircraft to move off the runway for the purposes of re-fuelling or just taxing around. This is how TAXI is performed:

* Set the brakes so that the GROUND SPEED is 0000
* Throttle back and maintain an idle of 6110 rpm
* Release the brake
* Steer with the rudder

As soon as the throttle is moved above 640 (dead idle) the simulation will assume that you are throttling up for take off and your craft MUST BE ON THE RUNWAY to avoid a CRASH.

5.4.5. THE [S] KEY -ENGINE SHUTDOWN

The [S] key shuts down your engine whilst on the ground. The key is ignored in flight.

5.4.6 THE [SPACEBAR]-REFUELING

Both ends of the runway have a refueling station. Each station consists of three refuellng locator marks and an adjacent fuel storage pyramid. To refuel, establish a TAXI and switch to the overhead or RADAR view (this is not required, it just makes it easier). Then manoeuvre with the rudder control (nose wheel) until your position cross-hair is heading inside of the three marks. Set the brakes so that your aircraft stops inside of the three locator marks. Now shut down your engine. When this is complete, press the [SPACEBAR] key and the refueling sound will be heard. If you are really low, it will take a while. Leave the other controls alone while refueling. Once you are full, restart your engine and be on your way.

6.0 NAVIGATION AND COLLISION AVOIDANCE

This section assumes that some pilots would like to know how the simulation handles navigation and that you would like to know what situations cause a CRASH.

6.1.1 LANDING REQUIREMENTS

The following conditions must exist at touchdown (ALT=000) in order to produce a successful landing which is accompanied by "WHEEL NOISE", otherwise a CRASH will result.

POSITION:	Completely ON THE RUNWAY at touchdown and DURING ROLL-OUT. In other words, stay on the runway until you have stopped.
GEAR POSITION:	Completely DOWN and locked.
DESCENT RATE:	Less than or equal to 360 feet per minute. 360 fpm is a HARD landing but survivable. HARDER landings are assumed to cause aircraft damage or a CRASH.
ROLL ALTITUDE:	Less than or equal to 16 degrees either way.
HEADING:	NOT restricted but remember when your nose wheel to:Juches you begin to turn on the nose wheel if your heading ls not 0 or 180. Generally a few degrees either way is NOT critical.

6.1.2 TAXI-ING AROUND THE AIRPORT

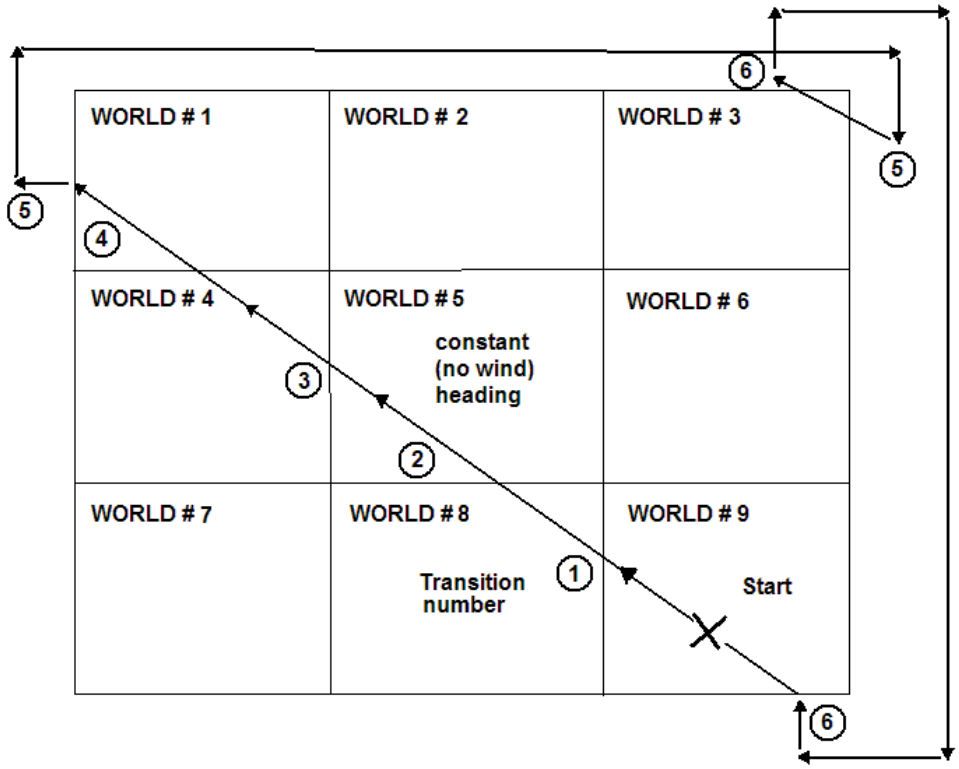
After establishing a TAXI you may use the rudder to steer about within the runway scene. You must avoid running into objects with height such as fuel tanks or the tower. The runway layout is detailed by MAP 8.10. The locator marks are labelled "NO CRASH" and will NOT cause a CRASH. This is a good time to practice using the various views so that you will become accustomed to how things appear as you pass them, (taking off while looking backwards is interesting!). For example, taxi straight up the runway and switch to RADAR view [TABULATE]. Note the cross-hair, it helps you determine when objects are directly ahead, directly beside or directly behind you. As the tower approaches directly to your left, switch back to fhe window view [TABULATE] and increment your view to the left once (90 degrees) [LEFT ARROW]. The tower should be going by. As it passes, increment to the left one more time (180 degrees) [LEFT ARROW] to see it as it moves behind you. A side note here. It is possible to taxi right out of the runway scene into the world scenes, although at 10 knots it wouldn't be fast. You must still avoid obstacles. Turning around and heading back to the runway will eventually get you back.

6.2 WITHIN A WORLD

Objects and scenery must always be avoided except in WORLD No.5 (The Practice Field). The MAPS in Section 8.0 are accurate enough to navigate by with a high degree of precision. Remember to compensate for the wind if you are really serious about flying over a particular point at a particular time.

6.3 WORLD TO WOLRD

When a WORLD boundary is crossed, a transition to another WORLD occurs. The outside boundaries wrap-around NORTH to SOUTH and EAST to WEST as described by Section 3.3. Navigation across multiple worlds is precise and repeatable since the worlds have truly common boundaries. So one may fly diagonally across World No.9, No.5 and No.l (fuel permitting) and eventually end up on the same heading back at your initial starting position in World No.9. This assumes of course that you did NOT set the winds in these worlds, (see figure below).



EXAMPLE TRANSWORLD FLIGHT PATH

If the weather conditions are different in the world you are transitioning to, you will instantaneously (upon transition) be flying in the new set of weather. This could greatly upset the trim of your aircraft, so be forwarned. Also, when approaching "transition", check closely the "lay of the land" in the world you will be entering; there may be mountains of slgnificant height on the borders. Without adequate altitude, you may transition SMACK INTO A MOUNTAIN. To be sure, once again, consult your MAPS (Section 8.0)

7.00 AIRCRAFT MANOEVRES

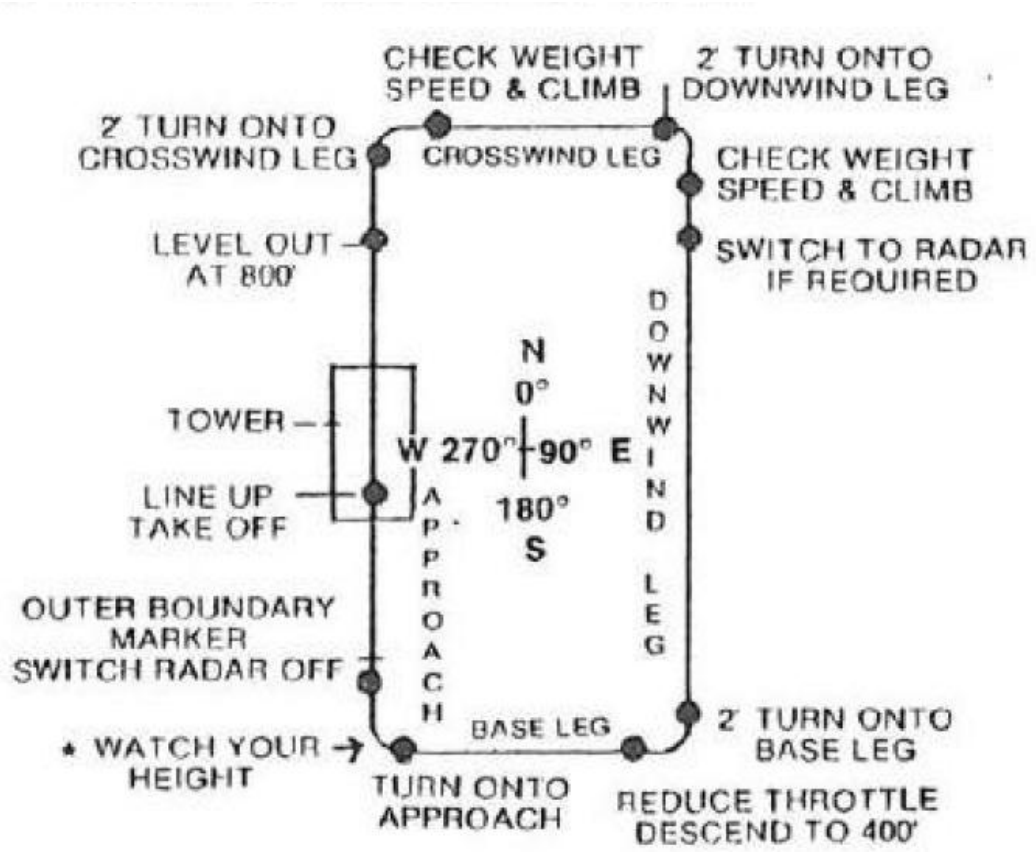
This section describes some suggested techniques for performing some rather basic aircraft manoeuvres and a few aerobatics. These are by no means the only way to do things nor are they necessarily the accepted ways, but they do work.

7.1 FLYING A CIRCUIT THEN LANDING

The student pilot, when learning to fly, must first fly between 8 and 10 hours of practice "circuits" to learn the basics of flying e.g. direction, stability, landing etc. As, with this simulation you can't have a qualified pilot instructor sitting next to you, by following the basics below you will be able to take off, fly a circuit then land again. It must be noted that many of the neccesities of real flying have been omitted such as pre-flight checks, pre-landing checks, radio information, raising of flaps/nosewheel etc.

7.1.1 DEFINE WORLDS

From Loading Screen press [ENTER) or from any other screen press [ESC), select WORLD 5 and ensure wind is 0 ceiling is 9999 by pressing [X) then press [ENTER] to go to runway scene.



7.1.2. STARTING AND ROLLING

Press the [UP ARROW] key if you prefer a view straight down the runway (Press Alt/up Arrow once up in the air to reset the display), now press the following keys:

[J] JOYSTICK	If you are using a joystick in port CTL2
[I] IGNITION	to start engine and bring revs up to 640
[L] SOUND	to switch off sound if required.
[ ]] FULL TIIRO'l"I'LE	to bring engine to full throttle (2560 rpm)
[N] FLAPS DOWN	press hold down until flaps are fully down

[ENTER] BRAKE to release brakes

7.1.3. TAKEOFF

The aircraft will now be moving down the runway, watch the airspeed indicator "KIAS" as soon as it reaches 60 pull back on the YOKE by either pulling back on the joystick or by pressing and holding down the [B] key. The gauge to the right of the artificial horizon should move down. Once the gauge is approx. midway between the centre position and the bottom of the gauge the aircraft should have lifted off and the ALTITUDE GAUGE "ALTD" should be above 0. Adjust your rate of climb by moving the yoke forward or back (Joystick or B/T keys) so that your airspeed is approximately 60.

7.1.4. LEVELLING OUT

Once you are near 800 feet on the ALTI'I'UDE METER, reduce throttle by pressing and holding the [-] key until the rate of climb "CLMB" is reading 0. You are now in straight and level flight.

7.1.5. CROSSWIND LEG

You must now turn very gently onto the CROSSWIND LEG which is a reading of 90 degree's. 'l'o do this move the YOKE (joystick to the right or H key pressed just once) and watch the heading "HEAD" indicator the moment this goes into inverse video (indicating a 2 minute turn) centre the YOKE with the joystick fire button or [G] key, wait until heading "HEAD" reads approx 80 degree's then move the YOKE on the opposite direction by pressing the [F] key once or moving the loystlck to the left once. The moment the centre black line in the drtifi cial horizon is straight, centre the YOKE again by pressing [G] key or pres sing the joystick fire button. The heading should read approx. 90 degree's. The above procedure should be practised to enable you to get the feel of turning the aircraft. You should also watch the aileron Indicator above the artificial horizon which will show you the amount of response to your key/joystick movements.

7.1.6. DOWNWIND LEG

Check your HEIGHT (approx 800) SPEED (approx 60) and CLIMB (0) press .he [TABULATE] key to determine your position by RADAR, press again if you wish to return to normal vision or leave on radar if required. (You will find lt easier during training to switch back to normal position when at the outer boundary marker). Now turn onto the DOWNWIND LEG (180 degree's approx.) by using the same procedure as in 5 above: Then check HEIGHT, SPEED and CLIMB.

7.1.7. BASE LEG

By using RADAR you should be able to see the runway passing on your sight. The DOWNWIND LEG gives you plenty of time to adjust your SPEED, HEIGHT and DIRECTION. Once past the southern end of the runway turn into the BASE LEG (270 degree's approx) by using turning procedure in 5 above. Then reduce throttle to give a CLIMB of -180. Return to level flight at approx 400 feet.

7.1.8. APPROACH

BEFORE you are at right angles to the runway, turn to the approach (0 degree's) and ensure the aircraft is heading directly for the outer BOUNDARY MARKER. RUDDER -left or right -can help to straighten the flight path ([C] or [M] keys).

7.1.9. LANDING

Try to be at approx 200 feet at the OUTER BOUNDARY MARKER and your "CLIMB" should be -180 approx, this with a heading of 0 will bring you down onto the runway. Adjust your height when approaching the runway by slight adjustments to THROTTLE ([+) or [-] key) or slight adjustments to YOKE ([T] or [B] key or joystick forward/back). As soon as the sound of the wheels touching the runway is heard apply the BRAKES [ENTER] and wait for the aircraft to stop.

7.1.10 HINTS AND TIPS

A) Take the aircraft up into the air and practice the 2 minute turn.

B) Use RADAR regularly until you are orientated and familiar with the surroundings.

C) Remember that turning reduces height, increase throttle slighly to retain height.

D) If you misjudge the approach hit full throttle [ ]] and circuit again,' this is normal pilot procedure. '

E) Don't expect to be able to land the aircraft on it's first attempt, it will probably take 3/4 hours practice, a trained pilot would require this amount of time for familiarisation with a new aircraft.

F) The above circuit instructions do not follow closely the regular rules of circuit flying but are aimed at giving the novice easy familarisation. Normal circuit flying rules inlude the following:

• Raise flaps and nosewheel after take-off
• Reduce revs after take-off to give a steady climb
• Climbing - turn into crosswind leg at 500'
• Nosewheel down towards end of downwind leg
• Close throttle on base leg, lower part flap and retrim
• Gliding turn onto approach.

G) Use PAUSE [P] OFTEN

H) Recommended reading is the book FLIGHT BRIEFING FOR PILOTS by N.H.BIRCH and A.E.BRAMSON published by PlTMAN. This book explains the basics of flying together with setting many excercises for the student pilot. This flight simulator reacts in a very simular fashion to the aircraft described in the book. Reading the book together with flying this simulator and performing the excercises qutlined in the book would bring the student pilot to "solo flight" at a very early stage and would certainly improve flying skills and competence.

7.2 AEROBATICS

All aerobatics should be performed with at least 1500 feet of altitude, 70 knots of airspeed and in a "cleared" portion of a world. The PRACTICE FIELD (WORLD N0.5) is a good place to try these because there is absolutely nothing to run into save the ground itself.

7.2.1 STALL

Stalls are caused by angles of attack at or above 16 degrees (plus or minus). Angle of attack is caused by ELEVATOR STICK and ELEVATOR TRIM Controls. When these two control inputs combine to give a +/-18 degree deflection or more a STALL will eventually develop. The reason a stall does not occur immediately, is because there is a RESPONSE LAG in both the control input and the aircraft's flight path turning rate, (the latter caused by inertia). A STALL will cause a counter-clockwise roling motion of the aircraft (due to engine torque) along with a rapid drop of the nose. As with most light aircraft, stall recovery is almost automatic assuming that adequate altitude exists. You may stall "proof" your aircraft by trimming down 2 degrees. In this way, extreme backward stick will not develop more than 16 degrees of elevator and thereby limit the angle of attack to less than its critical value. Take heed, however this condition could "bite" you if you fly inverted as forward stick will now stall EALIER.

7.2.2 AILERON ROLLS

Aileron rolls make use of the extreme limits of the AILERON yoke. Raise the nose a touchand then move the AILERON yoke to one of it's extreme limits. Try not to give elevator. When the altitude indicator is within 20 degrees of wings level, centre the yoke IMMEDIATELY. Now give gentle roll yoke until the wings are level. Re-adjust your trim if necessary.

7.2.3 INVERTED FLIGHT

Raise the nose slightly, then give extreme AILERON yoke. When your altitude indicator is within 20 degrees of upside down, centre the yoke IMMEDIATELY and push the elevator yoke forward - slightly to maintain level flight. Now make gentle rolls until your wings are level. Readjust your trim if necessary. Remember that elevator and rudder respond in a "BACKWARDS" fashion now, and of course your window views will also be inverted.

APPENDIX

1. REPRESENTATION OF GRAPHIC VIEWS

The graphic representation of scenery is obviously an important part of any flight simulation which professses to be "view-orientated". True 3-Dimensionalism requires that these scenes "grow" or expand as they are approached and that they appear in the proper perspectives from ALL aspects. The mathematics involved with this capability, coupled with the flight dynamics equations of motion, combine to produce a complex set of computional requirements. These computional restraints impact the simulation's speed. The technique selected for this program was one which creates the scenic views by way of "wire" (or line) graphics. Each world is defined as a series of points. These points are transformed into the aircraft's frame of reference and projected into the 2-dimensional plane of the craft's windows. The resulting points are then connected by lines and the lines limited or "clipped" to lie on the 2 hi-res graphic pages which make up the upper half of the TV screen. The main advantage of these methods is that they are MEMORY EFFICIENT and allow the potential for multiple worlds.

2. CONVERSION FACTORS

1 NAUTICAL MILE (NM) "' 6076 FEET
1 STATUTE MILE (Ml) "' 5280 FEET

GIVEN	MULTPLY BY	TO OBTAIN
NAUTICAL MILES (NM)	l.510	STATUTE MILES (Ml)
STATUTE MILES (Ml)	0.869	NAUTICAL MILES (Nl4)
KNOTS (NM/HOUR)	1.688	FEET PER SECOND (FT/SEC)
FEET PER SECOND	0.592	KNOTS
KNOTS	1.151	Mi/HOUR -M.P.H .
M. P.H. .	0.869	KNOTS

3. SUMMARY OF CONTROL COMANDS

***** DEFINE WORLDS CONTROL *****

[S]	SET WIND SPEED
[F]	SET WIND DIRECTION
[C]	SET CLOUD CEILING
[B]	SET BEGINNING WORLD
[X]	CLEAR WEATHER IN WORLD
[W]	WORLD SELECT [ENTER] EXIT TO SIMULATION

***** FLIGHT CONTROLS *****

[+]	INCREASE THROTTLE 1 NOTCH
[-]	DECREASE THROTTLE 1 NOTCH
[[ ]	MINIMUM THROT'TLE (TICK OVER)
[ ]]	MAXIMUM THROTTLE
[C]	RUDDER LEFT
[V]	RUDDER RIGHT
[T]	*ELEVATOR FORWARD [JOYSTICK FORWARD] ELEVATOR FORWARD
[B]	*ELEVATOR BACK [JOYSTICK BACK] ELEVATOR BACK
[F]	*AILERON TO LEFT [JOYS'l'ICK LEFT] AILERON TO LEFT
[H]	*AILERON TO RIGHT [JOYSTICK RIGHT] AILERON TO RIGHT
[G]	*AILERON + RUDDER CENTRED [JOYSTICK FIRE] AILERON + RUDDER CENTRED
	*OPTIONAL BY JOYSTICK CONTROL
[V]	TRIM UP
[R]	TRIM DOWN
[I]	IGNITION
[S]	STOP ENGINE
[N]	LOWER FLAPS
[Y]	RAISE FLAPS
[U]	RAISE GEAR (PRESS HOLD)
[D]	LOWER GEAR (PRESS HOLD)
[ENTER]	TOGGLES BRAKES ON/OFF

***** VIEW CONTROLS *****

[UP ARROW]	ELEVATE VIEW UP 8 DEGREE
[DOWN ARROW]	DEPRESS VIEW DOWN 8 DEGREE
[RIGHT ARROW]	ROTATE VIEW TO RIGHT 8 DEGREE
[LEFT ARROW]	ROTATE VIEW TO LEFT 8 DEGREE
[ALT + UPARROW]	CLEARS WINDOW VIEW TO STRAIGHT
[TABULATE]	TOGGLES RADAR VIEW
[Z]	ENLARGES (ZOOMS) RADAR VIEW
[X]	REDUCES RADAR VIEW
[8]	TOGGLES THE INVERSE GRAPHIC

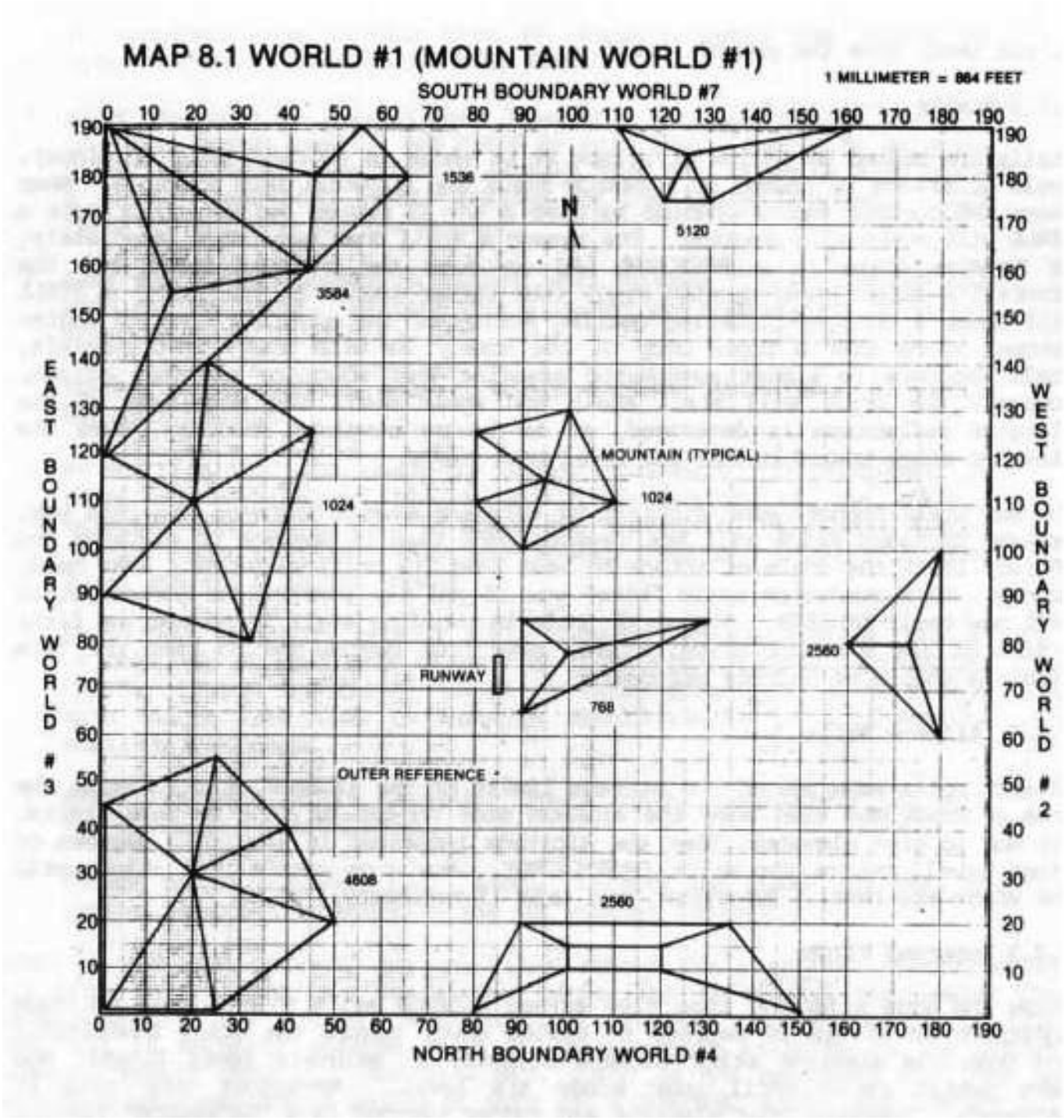
***** SPECIAL CONTROLS ****

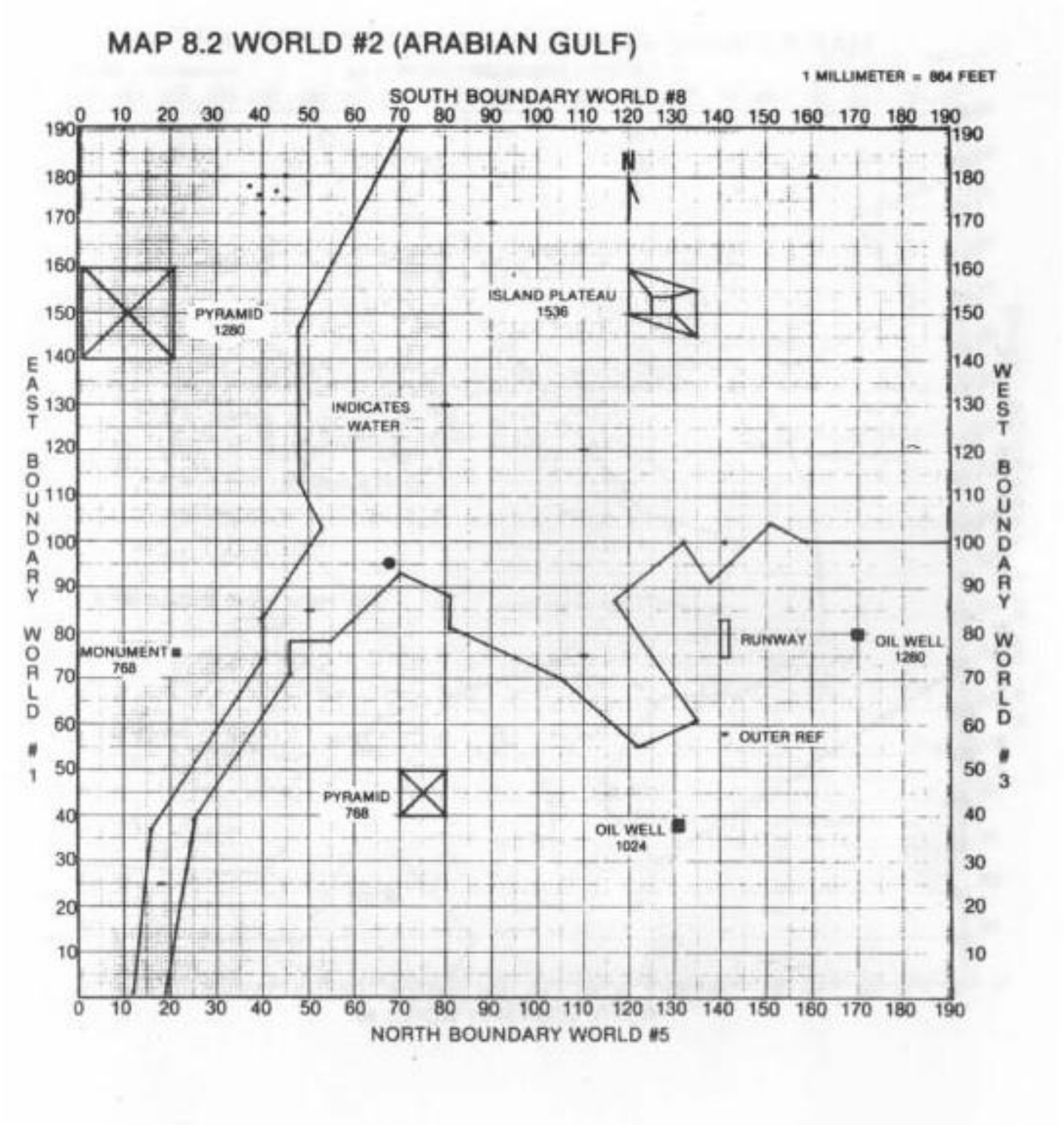
[A]	TOGGLE 'I'O GROUND SPEED
[L]	TOGGLE SOUND ON/OFF
[W]	WEATHER INFO
[SPACEBAR]	REFUEL

***** PROGRAM CONTROLS *****

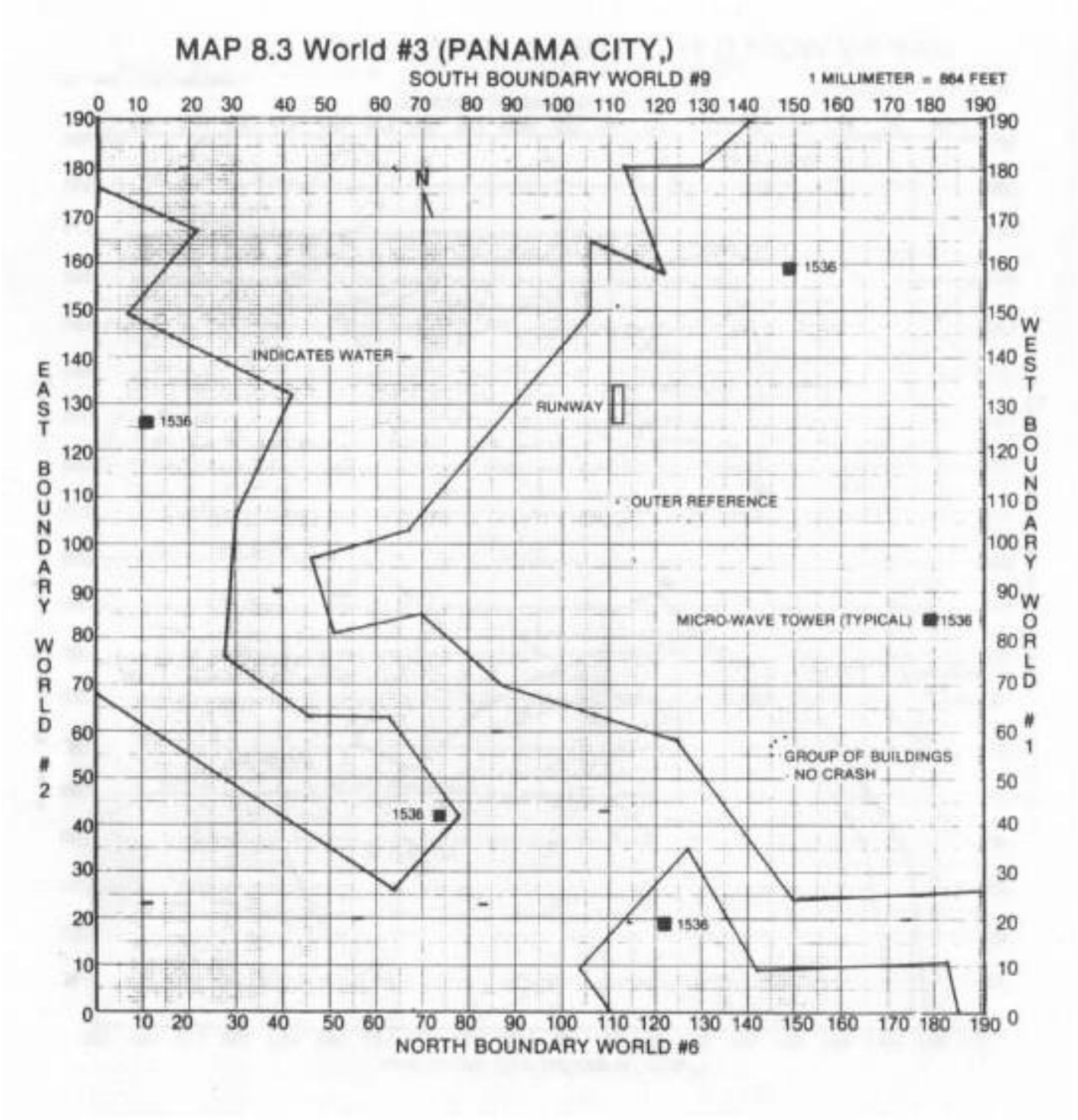
[P]	TOGGLES PAUSE SIMULATION
[ESC]	RESET SIMULATION VIEW

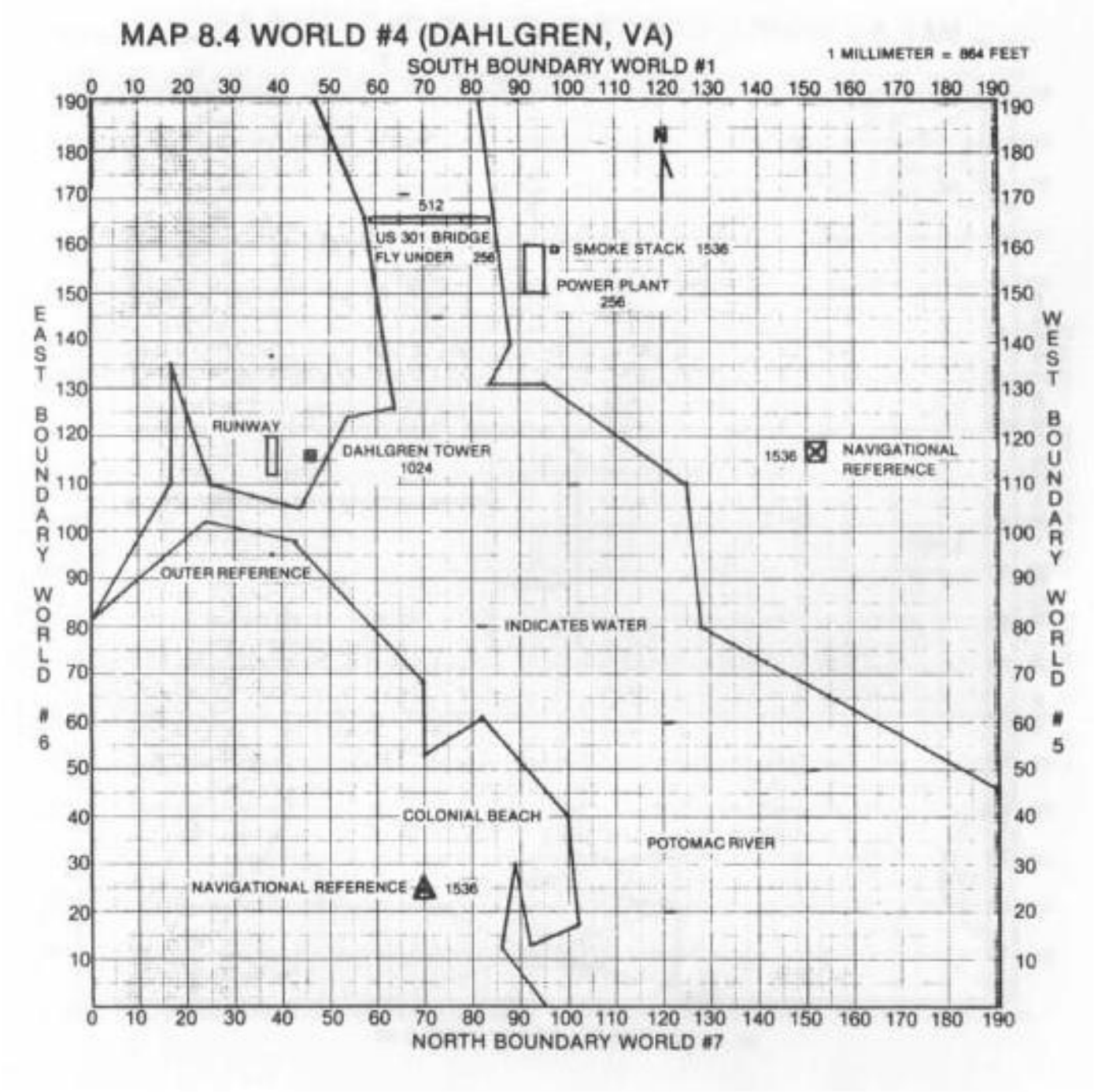
4. MAPS

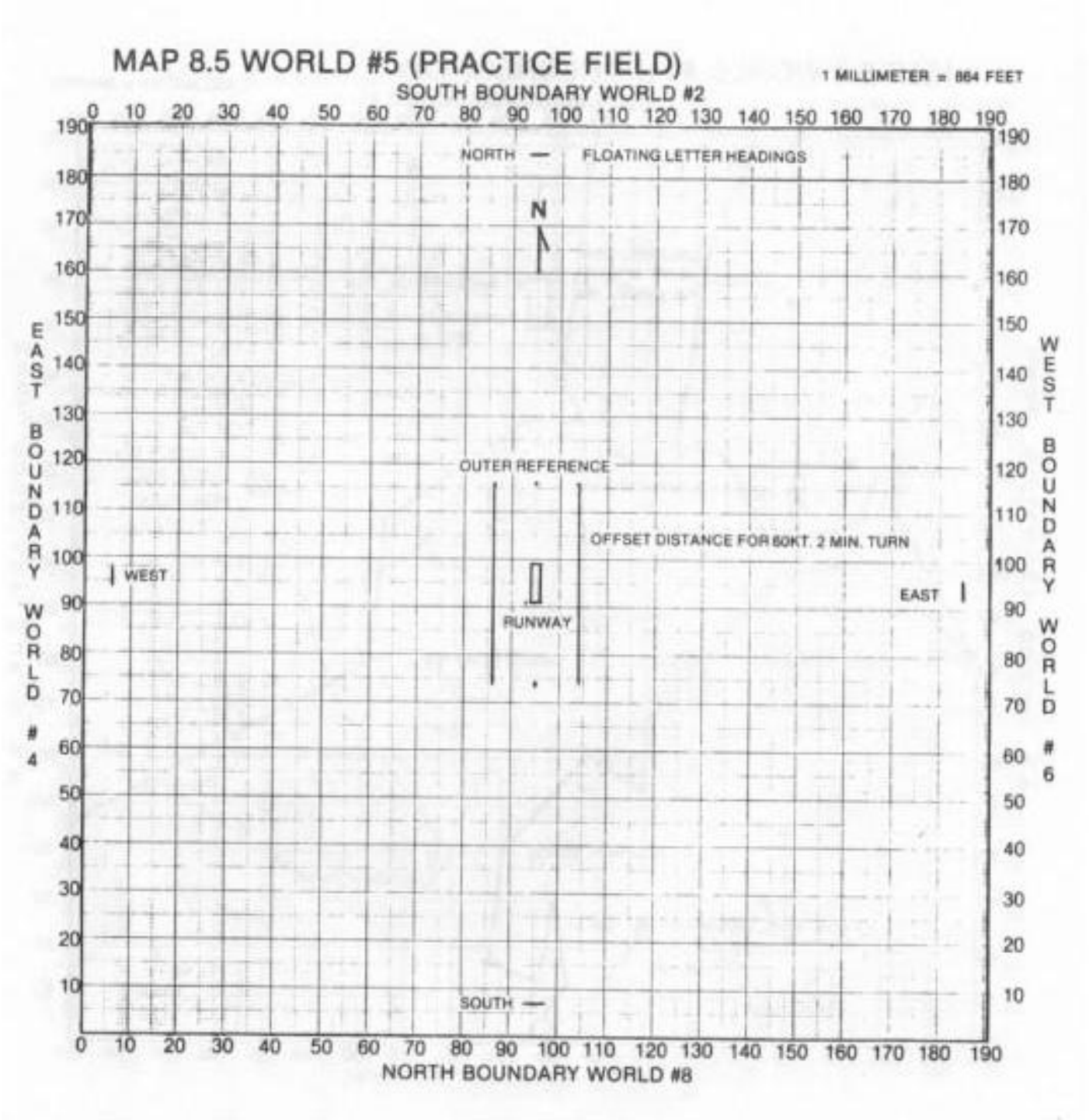

MAP 8.1 WORLD #1 (MOUNTAIN WORLD #1)
1 MILLIMETER = 864 FEET
SOUTH BOUNDARY WORLD #7
NORTH BOUNDARY WORLD #4
EAST BOUNDARY WORLD #3
WEST BOUNDARY WORLD #2
N
1536
5120
3584
1024
MOUNTAIN (TYPICAL)
1024
RUNWAY
768
2560
OUTER REFERENCE
4608
2560


MAP 8.2 WORLD #2 (ARABIAN GULF)
1 MILLIMETER = 864 FEET
SOUTH BOUNDARY WORLD #8
NORTH BOUNDARY WORLD #5
EAST BOUNDARY WORLD #1
WEST BOUNDARY WORLD #3
N
PYRAMID
1280
ISLAND PLATEAU
1536
INDICATES
WATER
MONUMENT
768
RUNWAY
OIL WELL
1280
OUTER REF
PYRAMID
768
OIL WELL
1024

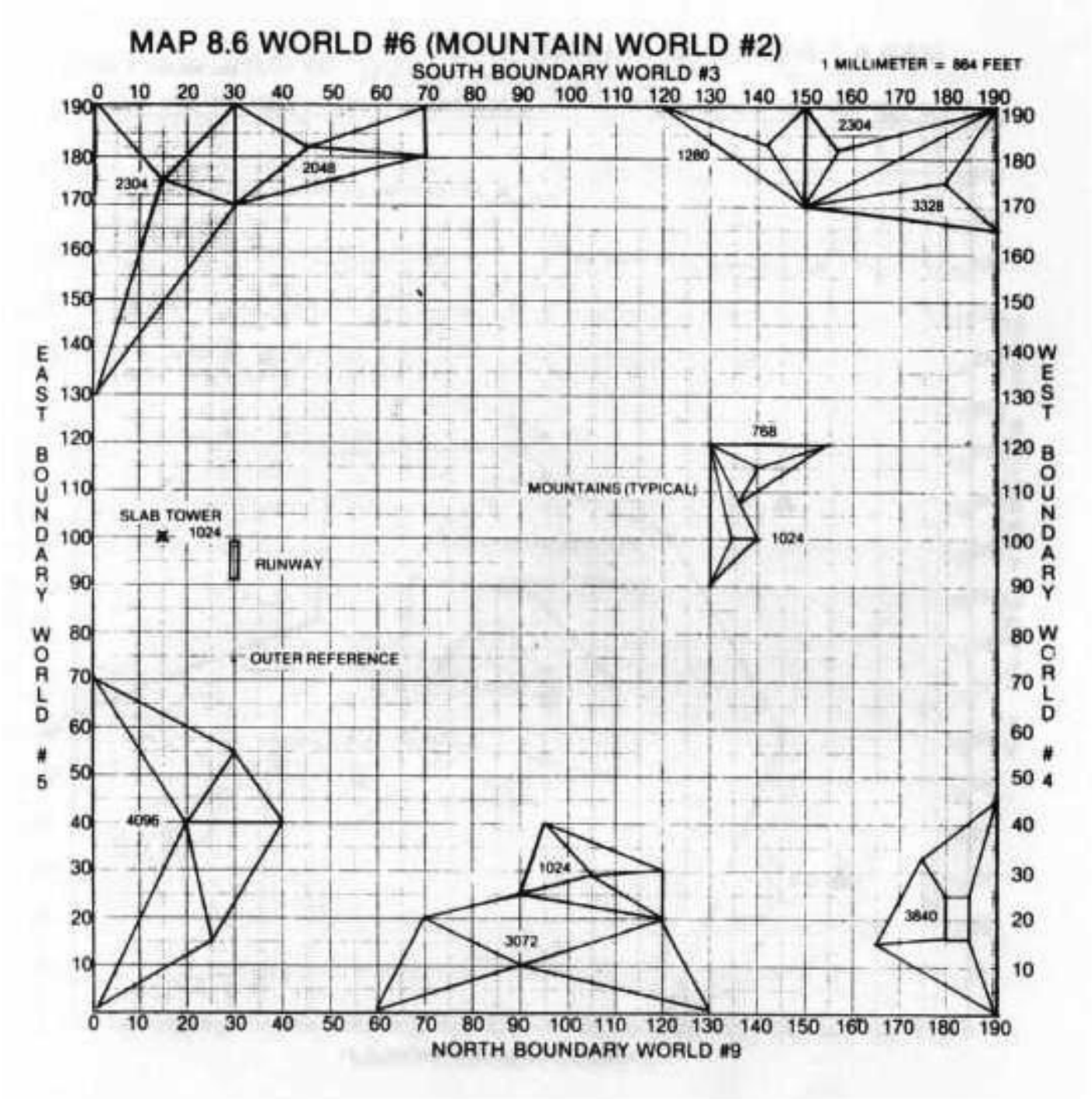
Microdeal


MAP 8.3 World #3 (PANAMA CITY,)
SOUTH BOUNDARY WORLD #9
1 MILLIMETER = 864 FEET
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190
N
1536
INDICATES WATER
RUNWAY
OUTER REFERENCE
MICRO-WAVE TOWER (TYPICAL) 1536
GROUP OF BUILDINGS
NO CRASH
EAST BOUNDARY WORLD # 2
WEST BOUNDARY WORLD # 1
NORTH BOUNDARY WORLD #6

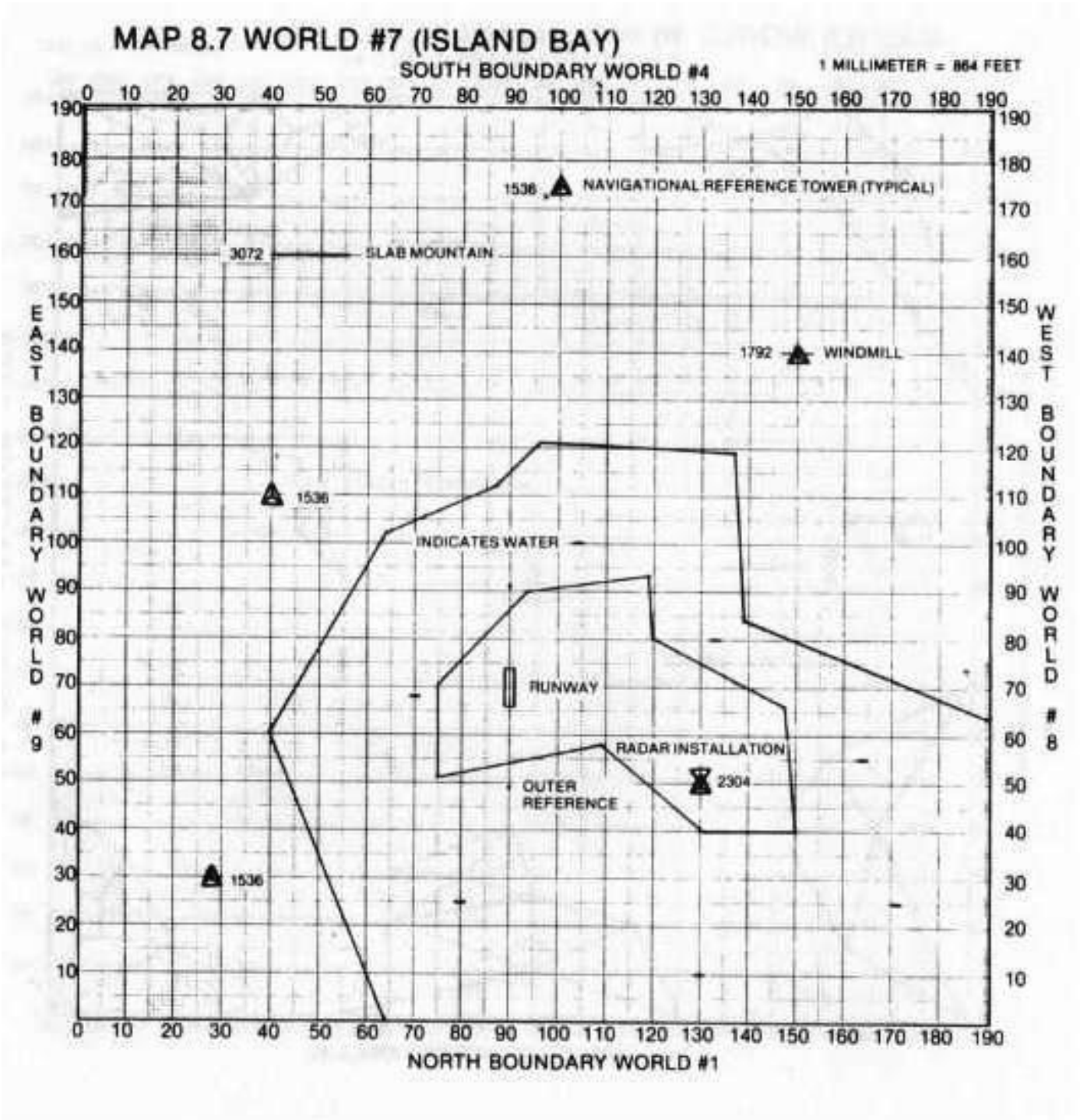

MAP 8.4 WORLD #4 (DAHLGREN, VA)
1 MILLIMETER = 864 FEET
SOUTH BOUNDARY WORLD #1
NORTH BOUNDARY WORLD #7
EAST BOUNDARY WORLD #6
WEST BOUNDARY WORLD #5
512
US 301 BRIDGE
FLY UNDER 256
SMOKE STACK 1536
POWER PLANT
256
RUNWAY
DAHLGREN TOWER
1024
1536 NAVIGATIONAL
REFERENCE
OUTER REFERENCE
INDICATES WATER
COLONIAL BEACH
POTOMAC RIVER
NAVIGATIONAL REFERENCE 1536

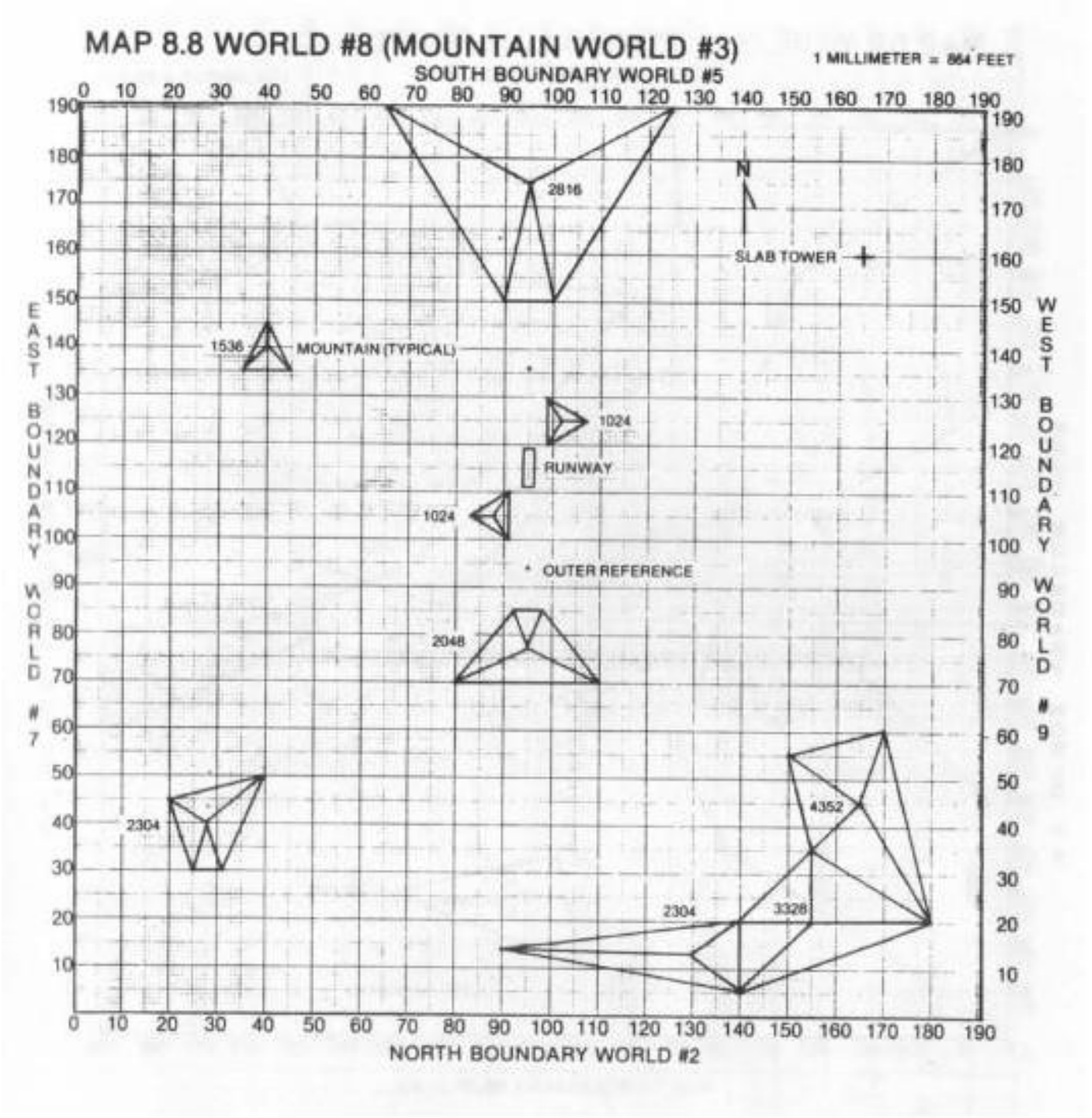

MAP 8.5 WORLD #5 (PRACTICE FIELD)
1 MILLIMETER = 864 FEET
SOUTH BOUNDARY WORLD #2
NORTH
FLOATING LETTER HEADINGS
N
OUTER REFERENCE
OFFSET DISTANCE FOR 60KT. 2 MIN. TURN
WEST
EAST
RUNWAY
SOUTH
EAST BOUNDARY WORLD # 4
WEST BOUNDARY WORLD # 6
NORTH BOUNDARY WORLD #8

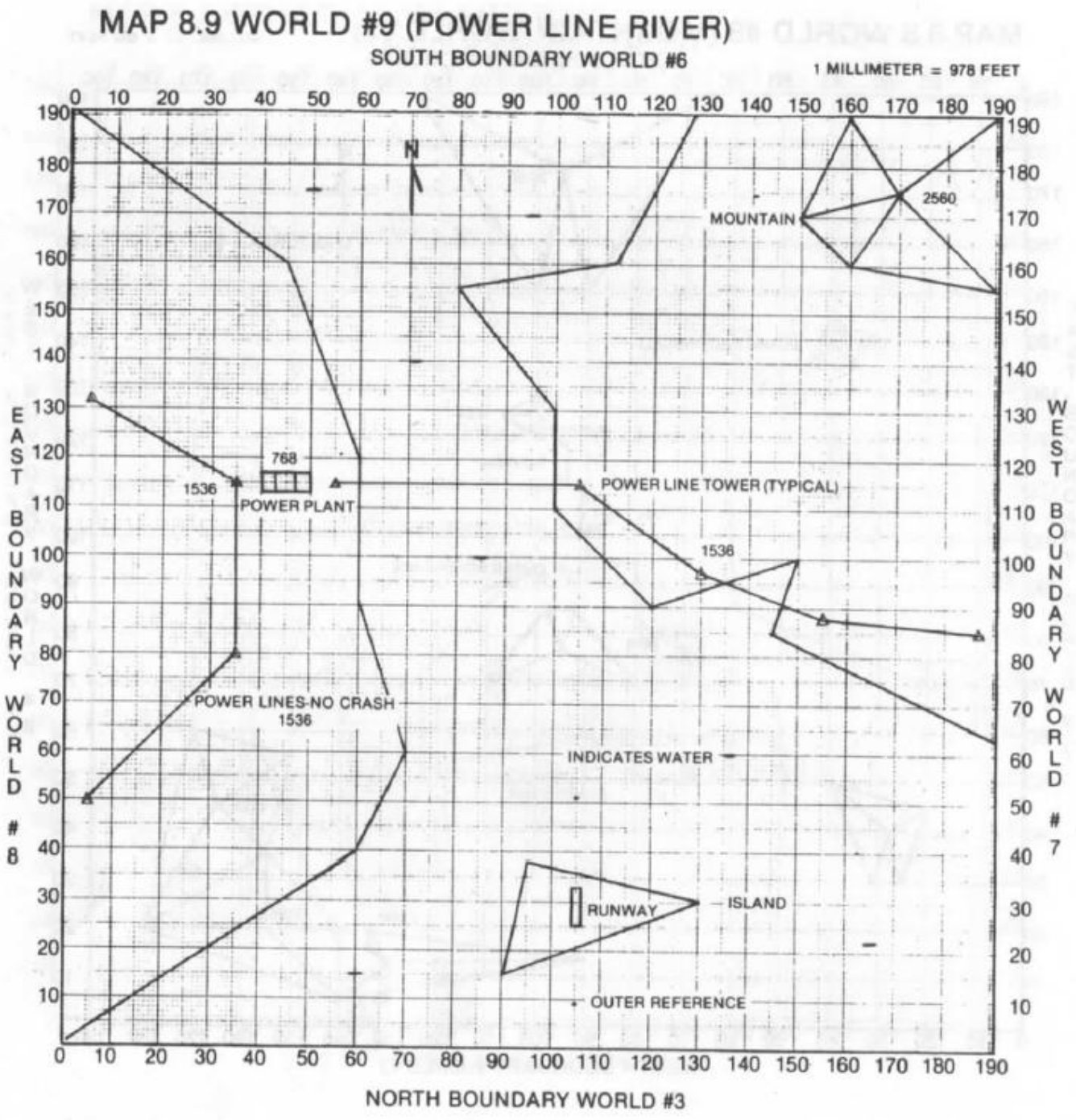
Microdeal

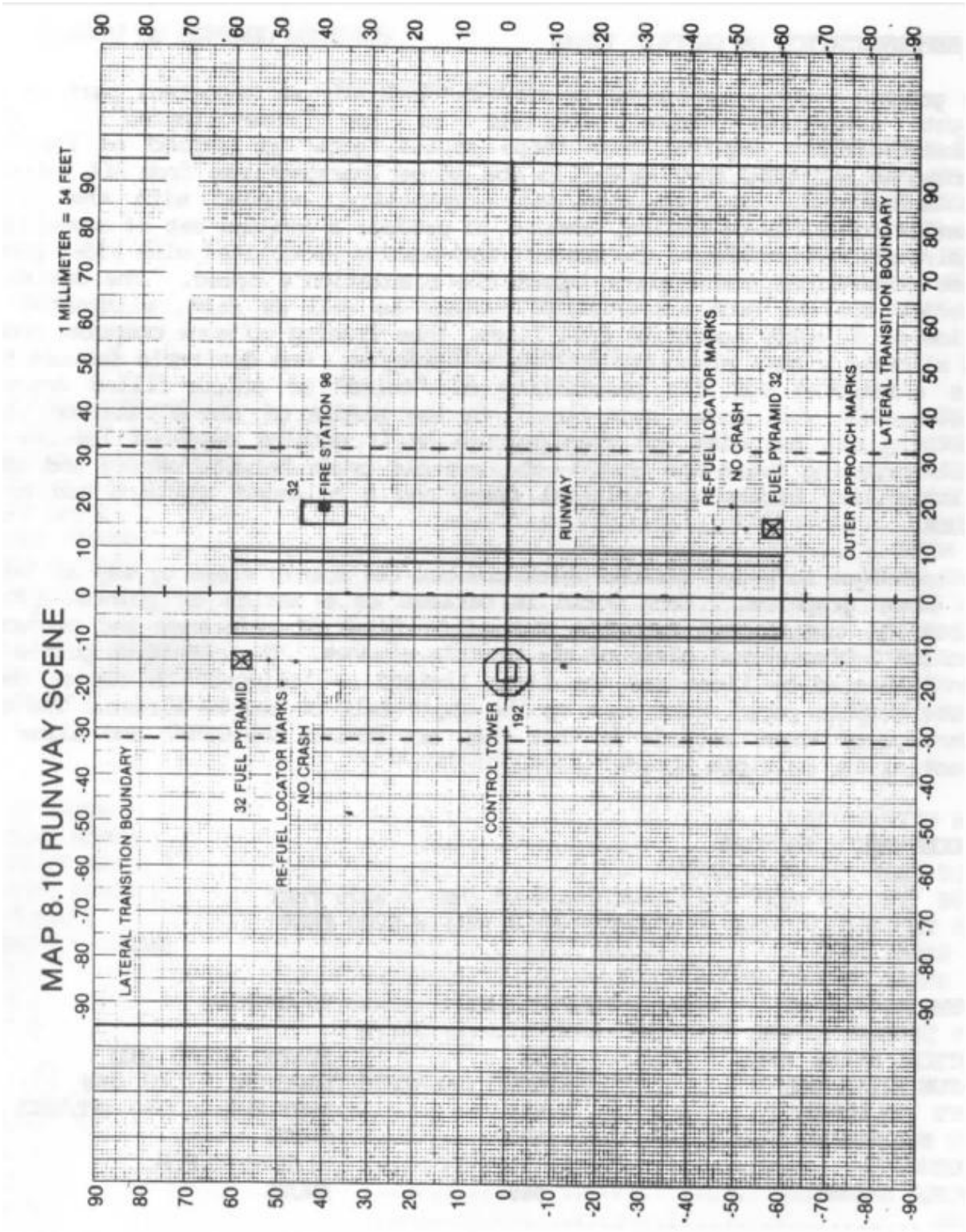

MAP 8.6 WORLD #6 (MOUNTAIN WORLD #2)
1 MILLIMETER = 864 FEET
SOUTH BOUNDARY WORLD #3
NORTH BOUNDARY WORLD #9
EAST BOUNDARY WORLD #5
WEST BOUNDARY WORLD #4
2304
2048
1280
2304
3328
768
MOUNTAINS (TYPICAL)
1024
SLAB TOWER
1024
RUNWAY
OUTER REFERENCE
4096
1024
3072
3840

Microdeal


MAP 8.7 WORLD #7 (ISLAND BAY)
SOUTH BOUNDARY WORLD #4
1 MILLIMETER = 864 FEET
1536 NAVIGATIONAL REFERENCE TOWER (TYPICAL)
3072 SLAB MOUNTAIN
1792 WINDMILL
1536
INDICATES WATER
RUNWAY
RADAR INSTALLATION
2304
OUTER REFERENCE
1536
EAST BOUNDARY WORLD # 9
WEST BOUNDARY WORLD # 8
NORTH BOUNDARY WORLD #1


MAP 8.8 WORLD #8 (MOUNTAIN WORLD #3)
1 MILLIMETER = 864 FEET
SOUTH BOUNDARY WORLD #5
NORTH BOUNDARY WORLD #2
EAST BOUNDARY WORLD #7
WEST BOUNDARY WORLD #9
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190
2816
N
SLAB TOWER
1536
MOUNTAIN (TYPICAL)
1024
RUNWAY
1024
* OUTER REFERENCE
2048
2304
4352
2304
3328

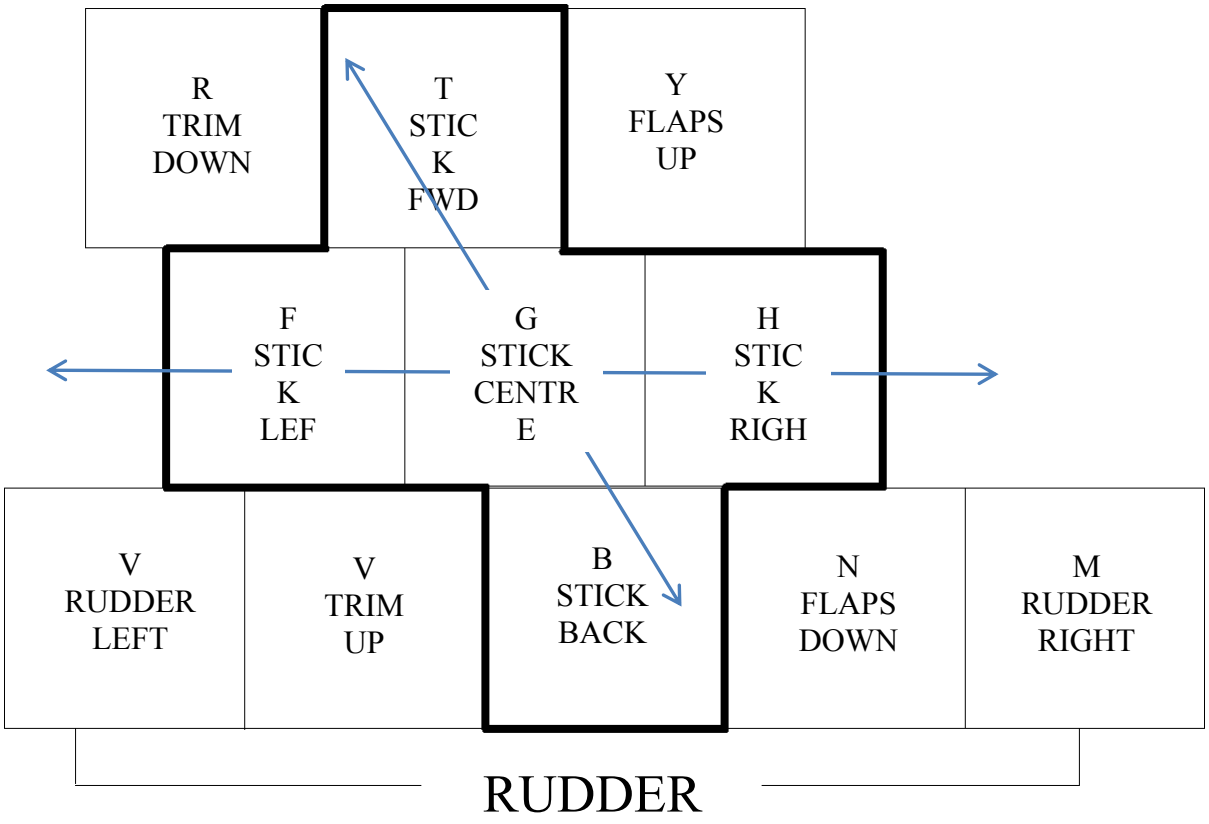

MAP 8.9 WORLD #9 (POWER LINE RIVER)
SOUTH BOUNDARY WORLD #6
1 MILLIMETER = 978 FEET
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190
N
MOUNTAIN
2560
768
1536
POWER PLANT
POWER LINE TOWER (TYPICAL)
1536
POWER LINES-NO CRASH
1536
INDICATES WATER
RUNWAY
ISLAND
OUTER REFERENCE
EAST BOUNDARY WORLD # 8
WEST BOUNDARY WORLD # 7
NORTH BOUNDARY WORLD #3


MAP 8.10 RUNWAY SCENE
1 MILLIMETER = 54 FEET
LATERAL TRANSITION BOUNDARY
32 FUEL PYRAMID
RE-FUEL LOCATOR MARKS
NO CRASH
32
FIRE STATION 96
CONTROL TOWER
192
RUNWAY
RE-FUEL LOCATOR MARKS
NO CRASH
FUEL PYRAMID 32
OUTER APPROACH MARKS
LATERAL TRANSITION BOUNDARY

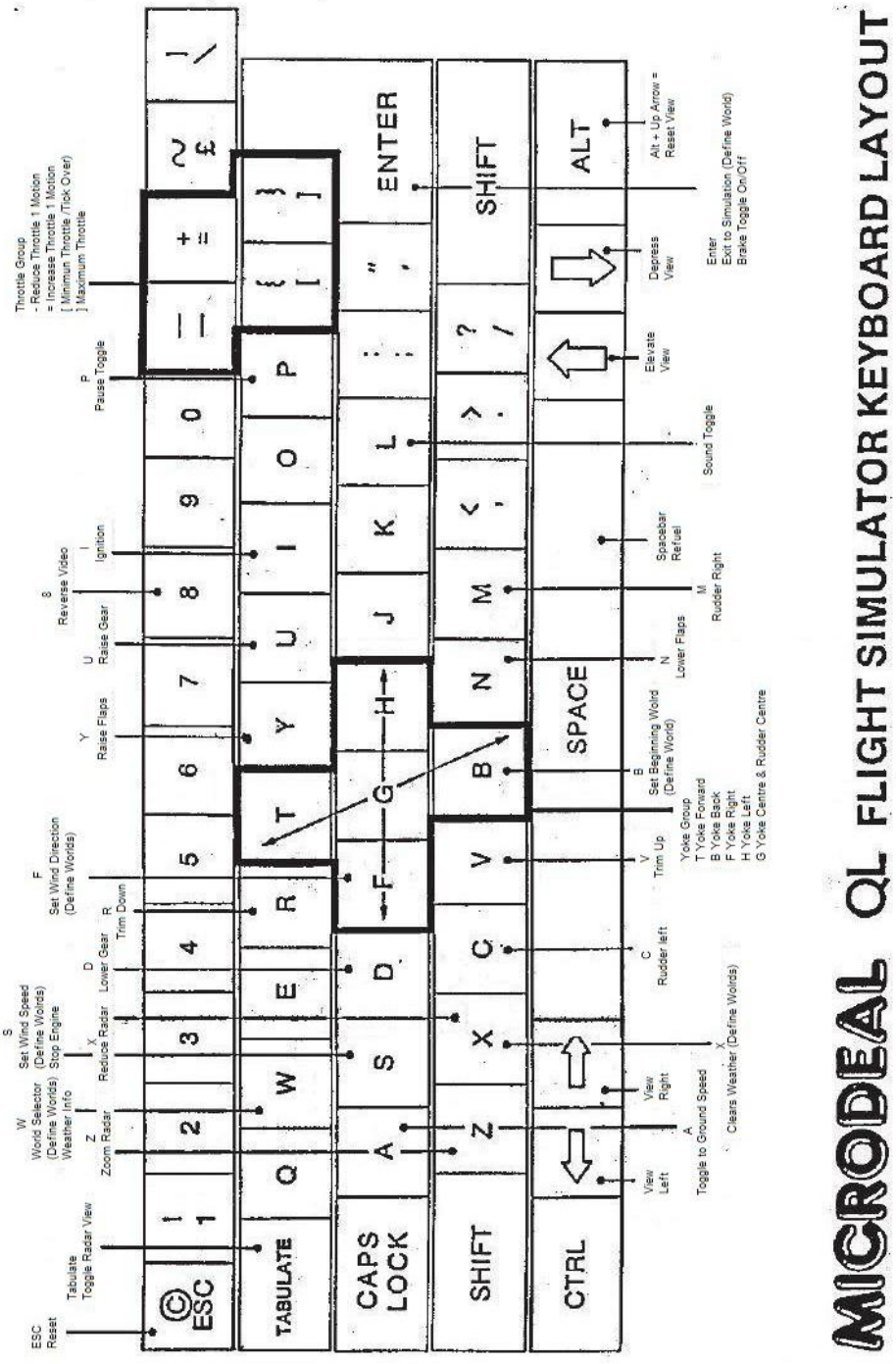
5. QUICK REFERENCE CARD

QL Flight Simulator Quick Reference Card

Brakes ON/OFF	[ENTER]	Throttle Down	[-]
Engine Ignition	[I]	Throttle Up	[+]
Engine Stop	[S]	Throttle Minimum	[
Flaps Down	[N]	Throttle Maximum	]
Flaps Up	[Y]	Trim Up	[V]
Gear Up	[U]	Trim Down	[R]
Gear Down	[D]	View Up 8 Degrees	[↑]
Pause Toggle	[P]	View Down 8 Degrees	[↓]
Radar Toggle	[TAB]	View Right	[→]
Radar Zoom In	[Z]	View Left	[←]
Radar Zoom Out	[X]	View Reset	[ALT ↑]
Refuel	[SPACE]	View Inverse Toggle	
Reset	[ESC]	Weather Info	
Rudder Left	[C]	Yoke Forward	[T]
Rudder Right	[M]	Yoke Back	[B]
Sound Toggle	[L]	Yoke Left	[F]
Speed Ground/Air Toggle	[A]	Yoke Right	[H]
		Yoke Centred	[G]



6.KEYBOARD**LAYOUT**



INDEX

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