DRAGON 32

SPACE SHUTTLE

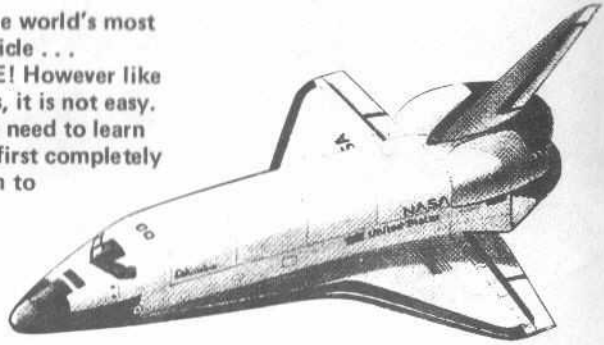
Flight Manual



© 1983

MICRODEAL

You are about to fly the world's most sophisticated flight vehicle . . . THE SPACE SHUTTLE! However like most worthwhile things, it is not easy. There is much that you need to learn before you make your first completely successful flight (launch to landing).



1. INTRODUCTION

A. WELCOME!

This flight manual was written to help YOU learn about the many requirements of a successful mission so you can earn your "WINGS" as soon as possible!

B. MISSION PLAN

Your PLAN is as follows. LAUNCH yourself successfully into orbit. FETCH a malfunctioning satellite by first PARKing next to it and then retrieving the device with your remote control ARM. After the satellite is safely stored, close the bay doors, fire retros and begin re-ENTRY. Fly into a final-approach window and perform a mock landing-flare. Then start your FINAL approach to the runway resulting in a safe LANDing, DEBRIEF your mission afterwards to find your successful phases of flight, your final touchdown data, the fuel and time used to complete your mission, and your mission score compared to the high score.

C. MISSION PHASES

The CAPITALIZED words in the above paragraph were used to emphasize the various parts of the simulation, which is divided into three distinct phases (LAUNCH, FETCH, LAND). The phase FETCH and LAND each have two sub-phases namely, PARK and ARM and ENTRY and FINAL, respectively. So then, there are actually five phases and sub-phases.

When you see these KEY WORDS on your instrument panel and in this flight manual, they will refer to one of these five portions of the simulation. The LAUNCH phase gets you into orbit. The FETCH phase is your chase and retrieval of the satellite (sub-phases PARK and ARM). After closing the bay doors and firing your retros you move into the ENTRY sub-phase of LAND which is your descent from orbit to a final approach window. Here you perform a mock-landing flare in preparation for your final approach. In the FINAL sub-phase of LAND you will control the shuttle's altitude, range to runway, drift, velocity, and pitch and roll attitudes. Hopefully all this control freedom will result in a safe landing and a complete mission.

D. ABORTS

All phases and sub-phases have success criteria (to be discussed later) and ABORT criteria or time limits except the ARM phase (the easiest of the five). You MUST complete the ARM phase to proceed to the LAND and ENTRY phases. If an ABORT occurs, a hi-lo warning tone and a flashing EVENT label (discussed shortly) will tell you which phase you just muffed and will automatically "auto-pilot" you into the next phase. You will receive no additional score, however.

E. CONTROL TIPS

Control inputs are ALWAYS noted by a single high tone. In some phases, a graphic square is also used. The simulation is controlled primarily with the RIGHT JOYSTICK. The FIRE BUTTON and KEYBOARD are also used in addition to the joystick in some phases.

The joystick has a substantial "dead--band" centre so that the stick's position is not critical. The contol is that of RATE. That is to say that when the stick is moved past the dead-band limit a flight condition is changed at the update rate of the simulator. This changing will not stop until the stick is re-centred. Since your joysticks have no self-centering springs, you will have to remember to centre it yourself. If in doubt or confused . . . CENTRE THE STICK! Then try again.

F. LOADING THE PROGRAM

To load type CLOADM then press "enter". The program will start automatically.

G. HIGH SPEED

The computer will ask the question CAN YOUR COMPUTER HANDLE DOUBLE SPEE D if your Dragon is capable of running at high speed type Y if not type N.

II DISPLAYS

A. LANDING SITE WEATHER

Glad you waited! This display is your landing site weather. The most important data shown are the WIND speed and direction, the ACTIVE RUNWAY heading and the cloud CEILING. These four will essentially determine how difficult it will be for you to land the shuttle. If you forget this information, don't worry, you will get a chance to see it again just before firing your retros for re-ENTRY. You will find that the winds will blow you from side to side which you will have to correct for by "banking into" the wind. The CEILING is the altitude at which you start your final approach. The lower the ceiling the more difficult it will be to land with adequate velocity. A 5 KFT CEILING is a real challenge, however perfect landings (see section IV) are possible at all CEILINGS. There will be a delay of approx. 10 seconds before your INSTRUMENTAL PANEL appears.

B. INSTRUMENT PANEL

Ah, the instrument panel! Looks busy? Well, ever seen the REAL thing? . . . That's BUSY! Please let me explain! The top quarter of the screen is the mission-status panel. Here you will find the mission PLAN, the STATUS label, the mission CLOCK, and the mission SCORE. The second quarter is the view out the shuttle window. The last half is the actual instrument display. Everything on your TV screen has been put into one of four categories, LABELS, DIGITAL READOUTS, INSTRUMENTS, and the VIEW OUT THE WINDOW. These are explained in the following four sub-headings:

1. Labels – The term LABEL refers to display elements which convey information by way of abbreviations or short descriptive words. Labels are NEVER numbers and may or may not change during flight. The labels which do not change are called STATIC LABELS. Labels which change during flight are called DYNAMIC LABELS.

a). STATIC LABELS are defined below:

PLAN – Shows the three phases of the simulation

RANGE and ALT – Indicate that the rangewise progress of the shuttle is plotted on the horizontal axis of the plotboard (extreme left instrument) and that the altitude is plotted on the vertical axis.

RJETS – Indicates that a graphic display of the reaction jet being fired is below. A white square appears to the right of the appropriate label. Display is active when the MODE label reads RJET or BOTH.

A-F– Forward or aft reaction jet is firing

L-R – Left or right reaction jet is firing

U-D – Up or down reaction jet is firing

ARM – Indicates that a graphic display of the commands to the remote control ARM is below. Display is active when the EVENT label reads ARM. A white graphic square appears to the right of the appropriate command.

RT – Horizontal right command

LT – Horizontal left command

UP – Vertical up command

DN – Vertical down command

b). DYNAMIC LABELS – are defined below:

STATUS – Indicates which of the three phases the simulator is in.

MODE – Indicates one of four shuttle CONTROL MODES (AERO-aerodynamic control; RJET – reaction jet control; BOTH – AERO + RJET; AUTO – auto-pilot control – no joystick control of flight path).

RH – Runway heading. Denoted by letters (N, NE, SE, S). Active during LAND.

EVENT – Short descriptive words or abbreviations which describe the current primary function, event or sub-phase.

EVENT LABELS:

COUNT	- countdown proceeding
IGN	- main engines running
ORBIT	- orbit achieved
ACQ	- satellite acquired; shuttle attempting to PARK
PARK	- shuttle parked by satellite
OPEN	- bay doors open or opening
ARM	- retrieving arm active
CLOSE	- bay doors closed or closing
RETRO	- forward rjets have caused de-orbit
ENTRY	- descent from orbit is in progress
BLKOUT	- communication blackout
FINAL	- shuttle on final approach

2. DIGITAL READOUTS

These displays communicate flight and mission-related data. Some displays update in "real time", others at the completion of each sub-phase. No more than three digital readouts are active at once. They are defined as follows:

CLOCK – Time into mission. Updates at the end of sub-phases

SCORE – Current mission score. Updates at the end of sub-phases

RTRW – Range to the beginning of the runway. Active when the EVENT label reads FINAL

ALT – Altitude of shuttle. Active when the EVENT label reads IGN; ENTRY; BLKOUT; FINAL

VEL – Velocity of shuttle. Active when the EVENT label reads IGN; ACQ; RETRO; ENTRY; BLKOUT; FINAL

RTT – Range to target (satellite). Active when the EVENT label reads ACQ

FUEL – Reaction jet fuel used. Updated at the end of sub-phases.

3. INSTRUMENTS

Three analog-type instruments are situated on the instrument panel. On the far left is the PLOTBOARD which displays the shuttle's range versus altitude progress. This instrument is active in the LAUNCH and LAND phases or when the EVENT label reads IGN, ENTRY and BLKOUT. The centre of the box or window in the upper left of the plotboard is the ideal rangewise location for the LAUNCH phase. Although altitude is also represented by this plot, always use the digital ALT readout to adjust your altitude.

The centre insturment is the pitch attitude or rate of climb indicator. It is active in the LAUNCH and LAND phases. From the top of the



meter to the bottom, the hash marks represent pitch attitudes + 90, + 45, 0, – 45, – 90 degrees, respectively. On FINAL approach the attitudes + 15, 0, – 15 – 30, – 45 give climb rates of + 75, – 30, – 135, – 230 and – 310 at a reference velocity of 400 f/s. These rates are proportioned to VELOCITY except the 0 degree attitude which always gives – 30 f/s. The 0 degree attitude is the pitch attitude required for a successful landing.

The far right instrument is the compass heading. It is also active during LAUNCH and LAND. West or North headings are not allowed because launches and orbits are always easterly.

4. THE VIEW OUT THE WINDOW

The view out the window changes with altitude and control input. Heading changes cause the scenery to shift left or right, as the shuttle climbs the clouds move downwards leaving first a cloudless sky then a star field as the shuttle approaches orbital altitude.

When the EVENT label reads ACQ, the view shows the target satellite with two parking windows on either side of the shuttle centreline. The satellite image grows as the shuttle closes to within 600 feet. If the shuttle passes the satellite, it will DISAPPEAR from view. Backing (or slowing) the shuttle down will eventually place the satellite out in front once again (RTT) 0) and the image will reappear.

Following the PARK event, the shuttle tail camera will display the shuttle bay area. The pilot may witness the opening and closing of the shuttle doors as well as the entire operation of the remote arm.

After successful retrieval, the camera is turned off and the shuttle is prepared for retro fire. After retro fire the shuttle starts its descent towards earth. A tracer of heat can be seen through the window during re-entry and radio blackout.

On FINAL approach the scene changes to a White Sands type desert approach with a mountainous background. The "heads up" display generates a shuttle image which graphically informs you of your roll attitude and lateral displacement off the runway centreline. As you close, the runway perspective

slowly grows until the shuttle's wheels are over the beginning of the runway. Touchdown is celebrated by a few notes from THE STARS AND STRIPES FOREVER. A CRASH "piles up" a broken shuttle on the desert floor.

C. DEBRIEF DISPLAY

Although not displayed now, a summary of your mission performance is available after a successful or crash landing. Pressing the "D" key will cause this data to appear. The upper portion of the DEBRIEF display is a list of the five phases and sub-phases. A red square just to the right of each phase indicates your range past the beginning of the runway, your drift off centreline, your touchdown velocity and pitch attitude, respectively. Negative values for R and AT imply that your were short of the runway and nose down when you crashed. A perfect landing is wings level; nose level; R = + 0; D = 0; V = 400. These requirements will be discussed in the next section (IV).

The lower part of the display are statistics on how well your overall mission went. Included are the fuel used, the time elapsed, your mission score and the high score for this series of flights.

III CONTROLS AND SUCCESS CRITERIA

A. LAUNCH

In this phase the ALT digital readout, plotboard, attitude and compass instruments are important. Headings are controlled by moving the joystick left and right. Altitude and pitch attitudes are controlled by moving the stick forward (nose DN) and back (nose UP). The keyboard and fire buttons are not used.

Note your heading – North; your attitude – + 90 degrees (straight up). Also note that the clouds have moved downwards and that your ALT and VEL readouts have substantially increased . . you are FLYING!

How about some control? Then move the joystick forward until you hear or see the DOWN response tone. Then CENTRE the stick IMMEDIATELY. Then PAUSE. Note your plotboard progress. You pitched over slightly. Sure enough, your attitude meter says you have nosed down 15 degrees to + 75 degrees. Now to change your heading. Move the stick to the right and hold it there for 5-6 control response tones then re-centre. Did you see those clouds (or stars) move to the left and the compass heading move to the East? Well, you have just performed all the necessary manoeuvres to achieve orbit. Here are your requirements:

GIVEN: Your boosters will shutdown at a velocity of 25200 f/s. The VEL display increments in 400 f/s steps. Pitch attitude + 90 (straight up). Northerly heading.

YOU MUST: (at shutdown) be IN THE BOX — closer to centre the better; NOSE LEVEL (0 deg); Heading should be EASTERLY within + or — 18 deg; ALT = 530000 + or — 5000 feet.

LIMITS: Pitch attitudes + 90 to — 15; Headings to those East of North.

Now fly into orbit until the EVENT label reads ACQ and the small target satellite appears out of your window.

B. PARK

You are now in the PARK sub-phase of the FETCH phase. Did you ABORT your way here? Then you have no score yet. But that's OK. Guess what? PARK is more difficult than LAUNCH primarily because you use the JOYSTICK, KEYBOARD and the FIRE BUTTON and control your velocity. The MODE label now reads RJET which means you are controlling only reaction jets. Your forward and aft thrusters are controlled by "up arrow" and "down arrow". "Up arrow" slows your velocity; "down arrow" increases it. The satellite is travelling at your insertion velocity (25200) thus RTT does not change from 4000 until you fire either a FWD or AFT thruster. The stick controls the direction you wish the SATELLITE to travel. JSK FWD = SAT UP; JSK BK = SAT DN; JSK RT/LT = SAT LT/RT

Press DN ARROW once and note that you increased VEL by 20 f/s and that RTT is decreasing in steps of 20 ft. Now move the stick to the left and or right until you hear ONE control response tone then CENTER THE STICK IMMEDIATELY. The satellite should be drifting right or left. Now stop it by putting in ONE opposite command and then CENTER THE STICK. It should have stopped. Now stop closing on the satellite by pressing (once) UP ARROW. Your VEL should read 25200 and RTT should not be changing. UP/DN control works in the same fashion as RT/LT.

You are strongly advised not to input more than one UP/DN/RT/LT command at a time until you get the feel of the control. OK, now that you have performed the manoeuvres, here are your requirements:

GIVEN: Shuttle in orbit, nose level, at 25200 f/s, on an easterly heading, at an altitude of 530000 ft (100 miles)

YOU MUST: Manoeuvre satellite to within 2 pixels of the centre of either parking box. RTT must be 0000. VEL = 25200. Press FIRE BUTTON to test for a successful PARK.

LIMITS: Satellite must be no more than 50 ft in front of the shuttle (you start at 4000 ft) and less than 200 ft behind it. Satellite is limited such that the largest image does not leave the window area. Note if you PASS the satellite, RTT will begin to increase and the satellite will DISAPPEAR. You have approx. 90 seconds to accomplish this phase. Time and thruster fire are counted against your TIME and FUEL score (Section V). So be efficient.

C. ARM

To enter the ARM phase press the "O" for OPEN . . . How about those doors, aye! Note the EVENT label reads ARM. The remote arm is now active. Forward stick is UP; Back is DOWN; Right and Left are RIGHT and LEFT.

GIVEN: Shuttle parked by the satellite. Flight control in AUTO-pilot.

YOU MUST: Put the FORKS of the arm phase press the "O" for

YOU MUST: Put the FORKS of the arm AROUND the bottom panel of the satellite to within 1 pixel vertically. The end of the arm should be on the centreline of the satellite to within 1 pixel horizontally. Press and hold briefly the FIRE BUTTON to TEST for attachment. Retract the satellite all the way down into the shuttle (doors will not shut if not all the way in). Press "C" to CLOSE the doors.

LIMITS: Control is limited so that the operator cannot hit the shuttle with the satellite. Time counts against you, but you have no limit and MUST SUCCESSFULLY COMPLETE this phase to proceed. Be speedy!

D. ENTRY

Once the satellite doors are closed a brief delay will occur while the shuttle's systems prepare for retros. Soon you will see the STATUS and EVENT labels read LAND and CLOSED, respectively. You are now ready for re-ENTRY. You may wish to press "W" to re-check the LANDING-SITE WEATHER and prepare yourself for what is ahead . . . the most difficult portion of the mission! Pressing "UP ARROW" will fire your RETROS (forward thrusters) causing you to lose velocity while the auto-pilot pitches your nose down. You are now in the ENTRY sub-phase of LAND. Control is the same as for the LAUNCH phase.

Notice the silence. You are not using your main engines. You are a glider. You will get one and only one chance to land the shuttle. So pay attention! Here's what's required:

GIVEN: Shuttle at 20000 f/s; Nose down at 45 degrees; VEL will delay to 800 at the end of the ENTRY sub-phase. The same instruments and displays are used as when in the LAUNCH phase.

YOU MUST: At VEL = 800; Your heading must be on the RH label value (N, NE, SE, S) + or – 18 degrees; Your NOSE must be LEVEL (as in a landing flare); and you must be INSIDE THE WINDOW in the lower left of the plotboard and ALT must be 10000 + or – 5000 feet.

LIMITS: Pitch attitude is limited to – 45 to + 15 degrees. Headings are limited to those of East or North.

HINT: Do not try to pull out at all until 30-40 KFT. Maintain – 15 degrees pitch attitude until you see 5-15 KFT on the ALT readout then pull out to 0 degrees. Experiment yourself. This ain't easy!

E. FINAL

Don't worry if you ABORTED to here! You will have more opportunities to get all these requirements straight. But if you did make it, congratulations!

Three digital displays will be active on this the FINAL sub-phase of LAND. They are ALT, RTRW and VEL. The only active instrument will be the PITCH-ATTITUDE instrument or rate of climb metre (centre). Please note the substantially slower update rate (approx 1 sec.). However, this rate is close to the shuttle's real response, so please ANTICIPATE your control commands!

GIVEN: VEL = 800 f/s; RTRW = 33000; ALT = CEILING: Wings level; Nose down at 15 degrees; Drift = + or 178 pixels off runway centreline; Winds as per the LANDING SITE WEATHER chart.

YOU MUST: In order to land; VEL = 280 ; Wings level (0 deg); Nose level (0 deg); Drift = shuttle wheels on the runway. RTRW increasing with time (shuttle PAST the beginning of the runway) but RTRW less than 10000 ft long of runway; See section V for a description of a "perfect" landing.

CONTROLS: Joystick only. JSK FORWARD = NOSE DOWN: JSK BACK BACK = NOSE UP: JSK RIGHT/LEFT = BANK RIGHT/LEFT: VELOCITY is controlled with pitch attitude.

LIMITS: Roll + and – 45 degrees; Pitch + to – 45 degrees; Drift = limited to window.

You are almost through one complete mission! After you successfully land or crash the program will wait for you to press the "D" key. When you are ready, press this key and refer back to Section III-E for details. You may replay by pressing "Y" as noted at the bottom of the DEBRIEF display. Now centre your stick, start the simulator and HAPPY LANDINGS! We will talk about your score after you land.

SCORING

A perfect score is 600. It is possible to earn 100 points for each of the first four sub-phases plus 200 additional points for a perfect landing and very low time and fuel use. Your TIME and FUEL score is added only after a successful landing. After all, if you crashed, who cares how much time or fuel you saved? Below in tabular form are the perfect conditions of each sub-phase, the total amount of possible points and the penalty rates for non-perfect flight conditions.

PHASE/SUB-PHASE	PERFECT CONDITIONS	PTS	PENALTY RATE
LAUNCH	req'ments if IV-A	40	–
	Centred in window	20	6.7 pts/pixel
	ALT = 530000	20	4 pts/1000 ft
	Heading = EAST	20	6.7 pts/6 deg.
PARK	Req'ments of IV-B	100	TIME and FUEL
ARM	Req'ments of IV-C	100	TIME
ENTRY	Req'ments of IV-D	40	–
	Centred in window	20	6.7 pts/pixel
	ALT = 10000	20	4 pts/1000 ft
	Heading = RH	20	6.7 pts/6 deg.
FINAL	Req'ments of IV-E	80	–
	RTRW = 0	20	2 pts/1000 ft
	VEL = 400	20	1.7 pts/10 f/s
	Drift = 0	20	.8 pts/pixel
	Ceiling = 5000 ft	20	2 pts/1000 ft
	FUEL 250 lbs	20	1,pt/60 lbs
	CLOCK	20	1 pt/10 min

ABORTED PHASE	PENALTY
LAUNCH	FUEL = + 1000 lbs
PARK	FUEL = + 500 lbs; CLOCK = + 150 min.
ARM	NONE! Cannot Abort
ENTRY	FUEL = + 1000 lbs.
FINAL	Forget all landing, TIME and FUEL scores Score does not change from ENTRY total

Well, THAT'S IT! Keep trying. Follow the instructions. Watch those instruments and digital readouts. Then correct the way you steer. Soon you will be (if not already) successfully completing missions with scores above 500.

MICRODEAL
41 TRURO ROAD, ST. AUSTELL,
CORNWALL, PL25 5JE. TEL: 0726 3456

