SPACE SHUTTLE
A JOURNEY INTO SPACE

STEVE KITCHEN

CONTENTS

Space Shuttle—A Journey Into Space™ is dedicated to the men and women of the National Aeronautics and Space Administration (NASA), without whose kind assistance this software would not have been possible.

LOADING INSTRUCTIONS

1. Be sure that the EAR socket of the Spectrum is connected to the EAR socket of the tape recorder.
2. Place the cassette in the recorder and rewind to the beginning.
3. Type LOAD '' '' (using the J key for LOAD, and the P key and SYMBOL SHIFT for the '' quotes).
4. Pres the ENTER key.
5. Press PLAY on the recorder.
6. After several seconds, the program title should appear. After a minute or so, a full title screen will appear, surrounded by a moving, static-like background, and lasting approximately 3 minutes. If this loading sequence does not occur, adjust the volume on the recorder and repeat this entire procedure.

WHEN LOADING IS COMPLETE. . .

. . .the controller menu will appear. Press the numerical key that corresponds to your selection.

You are now ready to begin.

FLIGHT PREPARATIONS

MISSION PROFILE

It is the 101st Shuttle mission of the Space Transportation System. You are at the helm of the Space Shuttle Discovery. Approximately 210 nautical miles above the Earth is your target: an orbiting satellite with intentionally programmed gyroscope problems.

Your mission is to launch, rendevous, and dock with the satellite as many times as you can, using the minimum of fuel, then return safely to Earth. A word of caution: Each time you successfully dock, the satellite has been programmed to become even more erratic.

This is a total test of your piloting capabilities. You will be evaluated at the end of your flight.

EQUIPMENT CHECK

Indicator Switches are keys, **Q, A, S, F** and **M** on the keyboard. Use **Q** to check your stats (see ''STAT MESSAGES'' for description), **S** to check your speed, **A** to check altitude, **F** to check fuel and **M** to check M.E.T. (mission elapsed time).

Engines. There are three engine groups: The Main Engines, the Orbital Maneuvering System and the Reaction Control System (the latter group will automatically activate when the first two are off). To turn engines on, press **E** on the keyboard; to turn them off, press **X.**

Cargo Doors and Landing Gear are operated from the keyboard. **O** opens Cargo doors; **C** closes them. **U** brings up the landing gear; **D** lowers it.

Joystick Controller. A realistic directional hand controller. Forward and back moves Shuttle forward or back (X axis). Left and right controls your "plane" (left/right) movement (Y axis). With red button depressed, forward or back stick movement moves shuttle up or down (Z axis). See "Maneuvering in Space" for further explanation. Also, the red button has other uses in launch, orbit, and entry phases as described in those sections.

If you are using the keyboard only, follow the above paragraph, substituting **G** and **H** for left and right, and **Y** and **B** for up and down.
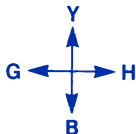
SYMBOL SHIFT functions as does the Joystick's red button.

FLIGHT SELECTION

There are three separate flight modes. Spend time with training flights #1 and #2 before taking on all the challenge of a real, unassisted Shuttle mission (flt. #3). Press **SYMBOL SHIFT** to select your flight mode. This can only be done before countdown is activated.

Flight #1 Autosimulator Flight mode #1 is a combination demonstration flight and autosimulator. The Shuttle flies an abbreviated mission. You do not use any of the console controls. In this flight mode, most aborts (see "Abort indicator") are ignored. As long as you don't touch any controls, the demonstration will continue. As soon as you operate a control, you will have to follow through, dock with the satellite, and land.

Flight #2 Simulator All astronauts spend thousands of hours practicing in ground-based simulators before flying an actual Shuttle mission. In this mode, experience the challenge and demands of a real mission with a couple of important exceptions: You will never use any fuel units, so take your time to complete a mission. Also, your onboard computers will greatly assist you during flight by compensating for less than perfect piloting skills. Most aborts are overriden, but your flight indicator (stat message) will alert you when you've erred.

Flight #3 STS 101 A full-fledged Shuttle Flight. All aborts are operative and flight conditions are quite realistic. Good luck!

FLIGHT EVALUATION

Abort Indicator If critical problems occur anytime during a flight, you may receive a "Launch Scrub" or "Mission Abort" signal. If this happens, your flight has ended, and you must check your Status to find out what went wrong.

4

Ranking If you safely land your Shuttle at Edwards Air Force Base in flight #3, your performance will be computer-evaluated. Your ranking will be determined by the number of successful dockings and the exact number of fuel units you have remaining at the end of your flight:

RANKING	DESCRIPTION	QUALIFICATIONS	
		(Dockings)	(Minimum fuel units)
Commander	Responsible for overall crew safety and flight execution.	6 or greater	7500
Pilot	Second in command, assists in all flight functions.	4.5	4500
Mission Specialist	Qualified to coordinate mission scientific objectives.	2.3	3500
Payload Specialist	Qualified to operate specific payloads and coordinate Shuttle housekeeping.	1	1

LAUNCH

OBJECTIVE

Launch your Space Shuttle and attain an altitude and orbit as close to the satellite's orbit as possible.

LAUNCH CHECKLIST

Launch Phases As you fire your enormous main engines and liftoff from the pad, you'll be going through 3 separate phases. The numbers 1, 2, 3 on your initial computer screen refer to: (1), firing of the SRB's (solid rocket boosters), which really shakes the shuttle, (2), maximum acceleration, and (3), approaching engine shut down. The X indicates MECO, (Main Engine Cut-Off).

Thrust Notice the two, long horizontal bars on the control panel on your screen. "T" stands for thrust. "C" stands for computer. The "C" arrow represents a signal from the onboard computer indicating the proper thrust needed during each phase of liftoff. You control "T" (thrust) using the red button on your Joystick or **SYMBOL SHIFT** on the keyboard. Always keep both "T" and "C" arrows aligned. Whenever the "T" arrow flashes, you are wasting fuel and should immediately increase or decrease thrust.

Hold Down Bolts Though your engines are firing, you won't leave the ground until MET + 3. The "Hold Down Bolts" will keep your Shuttle on the ground until MET + 3 to compensate for the mechanical strain on the Shuttle from firing your engines.

Trajectory/Plane In addition to regulating thrust, you'll also need to follow the proper trajectory (forward-back on Joystick; **Y** and **B** on keyboard), and constantly correct your plane (left-right on Joystick; **G** and **H** on keyboard).

Line Horn If you stray from the correct launch trajectory, you will waste fuel. To alert you when this is happening, a warning horn will sound. You'll find this feature helpful in avoiding an abort situation.

Separation A yellow flash at about 26 nautical miles will indicate Solid Rocket Booster separation (SRB SEP). Another flash shortly after MECO, (Main Engine Cut-Off), will alert you that the main External Tank has fallen away into the Indian Ocean (ET SEP).

LAUNCH SEQUENCE

1. Primary Engines Shutdown.
2. Cargo Door closed.
3. Landing Gear Up.
4. Activate Countdown (press **ENTER**).
5. At MET – 015 activate Main Engines.
6. At MET – 004 ignite engines by pressing the Joystick button or **SYMBOL SHIFT.** Match "T" arrow with "C" arrow during launch.
7. As Shuttle rises, watch both dots on the computer screen. You must follow the indicated launch trajectory *and* continually correct your "plane" by keeping your Shuttle centered in the small box at right:
   - Move Joystick forward to move dot left, backward to move dot right (or use **Y** and **B** on the keyboard).
   - Move Joystick left or right (or use keys **G** and **H**) to correct plane.
8. At about 205 nautical miles, quickly shutdown engines. The closer you come to the 210 altitude, the closer you'll be to the satellite's orbit.

Launch & Ascent Summary Flying the Shuttle into orbit is an extremely challenging task. Following a roller coaster path, you must match your thrust with the computer indicator, stay on the proper trajectory as plotted on the altitude display, and correct your plane as indicated in the small green box. Each area is critical. Incorrect trajectory will cost precious fuel and may abort your mission. A great elevation in the plane setting at MECO will make satellite docking difficult.

MECO

Plane

Shuttle

Launch Trajectory

TRACKING SCREEN

6
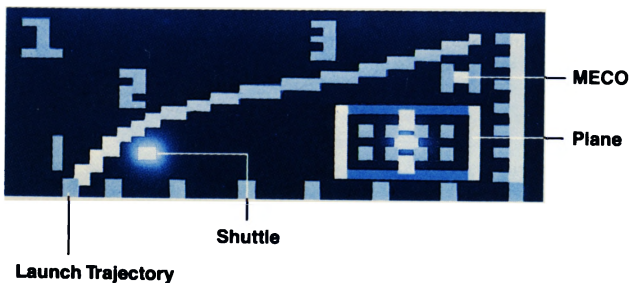
STABILIZING ORBIT

OBJECTIVE

Establish a stable orbit by adjusting Shuttle pitch to enable visual contact, and by opening Cargo Bay Doors for heat release.

STABLE ORBIT CHECKLIST

Nose Down Maneuver When the Shuttle first achieves orbit, the nose of the craft is pointed up out of the line of sight of the satellite. In order to dock, you must see the satellite. So it's necessary to bring the nose down, which is done by adjusting pitch (the up-down movement of the nose of the Shuttle).

Cargo Bay Doors One of your first tasks in orbit will be to open the Cargo Bay Doors. This is vital and must be accomplished within first orbit. The radiators that shed excess heat generated by the Shuttle are on the inner surfaces of these doors. If the doors remain closed, heat builds up within the vehicle, and a warning horn will sound. (You then have 30 seconds left to open Cargo Bay Doors.) If the doors aren't quickly opened, the mission will have to be aborted.

SEQUENCE TO STABILIZE ORBIT

1. Activate Primary Engines.
2. Push Joystick forward to set-28 pitch (or use **Y** key).
3. Shutdown Primary Engines.
4. Open Cargo Bay Doors.

STABLE ORBIT SUMMARY

Nose pitch down and Cargo Bay Door events must be performed on the first orbit revolution before any on-orbit operations can be attempted.

DOCKING: 210 NAUTICAL MILES IN SPACE

OBJECTIVE

Properly correct the speed and position (Z, Y, X axes) of your Shuttle to successfully rendezvous with the satellite.

DOCKING CHECKLIST

Maneuvering in Space There are two separate ways to maneuver your Shuttle in space. For major maneuvers (30 nautical miles or more) the Orbital Maneuvering System (OMS) can be used. This system (explained in a later section) takes a good deal of understanding and experience to use effectively. So, when first starting out, use the Reaction Control System (RCS). These clusters of rocket engines in the Shuttle's nose and tail can move the Shuttle about its three major axes X, Y, Z (called transitional) or about its yaw or pitch (rotational).

Shuttle Speed and Position Speed is just as important as position. Never allow your speed to drop below mach 17.0, or your altitude to fall below 195 nautical miles, or you'll burn up in the atmosphere! Your X motion to satellite is dependent upon your speed, not the RCS engines. To move toward satellite you must increase speed to greater than mach 23.9 (the satellite's speed). When you make your final approach to satellite, keep your speed close to mach 23.9.

Drifting As you move closer to the satellite, constantly go back and forth to check all axes. Settings continually shift, and the satellite movement is erratic.

"S" Curve On computer screen #2, the "S" line indicates both the Shuttle's and the satellite's ground track around the Earth. The flashing dot is your Shuttle, the solid dot is the satellite. Notice as you track the satellite, your X axis will suddenly change significantly as the satellite "wraps around" the tracking line. This is because the orbital tracking line wraps around the display as a real orbit would wrap around the Earth.

"S" Curve

Shuttle —

Equator —

Satellite —

GROUND TRACK SCREEN

One full Earth rotation
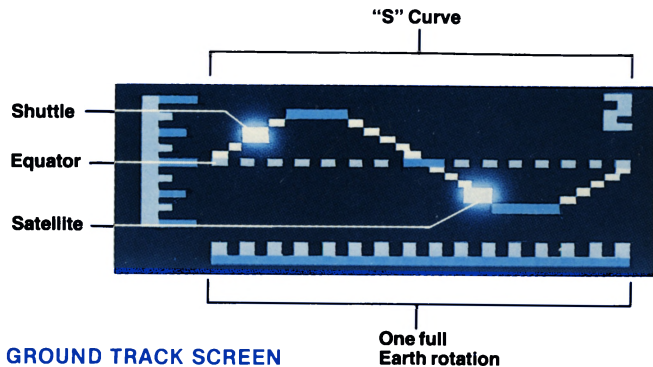
Docking Screen You'll use the "S" curve screen until you get fairly close to the satellite. Then, two smaller radar screens will appear. The left screen shows your Z axis, (up-down), and a wide view of your Y axis, (left-right). The right screen, which you'll use more, shows the X axis (left-right), and micro (close in) Y axis (up-down).

Multiple Dockings Every time you dock, you receive a "Rendevous" sign and a certain number of fuel units. However, each docking becomes more and more difficult. So, for each successive docking, you receive more fuel. After each docking, the satellite has been programmed to sail a good distance away from your Shuttle. Wait until it settles (x = +128 or −128) before beginning another docking procedure.

DOCKING SEQUENCE

Match the position of your Shuttle with that of the satellite's by correcting your Z, Y, and X axes, preferably *in that order.*

1. **Correct Z axis to 0:** Hold down red button and tap Joystick forward (or hold **SYMBOL SHIFT** and tap **Y** on keyboard). A negative number means the satellite is below you, so push the Joystick forward (or press **Y**) to dive. A positive number means the satellite is above you, so pull the Joystick back (or press **B**) to climb.

2. **Correct Y axis to 0:** Tap Joystick to the right (or tap **H**). A positive number means satellite is right of you, so push Joystick right (or press **H**) to line up with it. A negative number means it is left of you. Push Joystick left (or press **G**) to line up with satellite.

3. **Correct X axis:** Tap the Joystick back, or tap **B**. A positive number means the satellite is ahead of you. A negative number means it is behind you. To increase Shuttle speed, push Joystick forward, or press **Y.** To decrease speed, pull Joystick back, or press **B.** Press **S** to check Shuttle speed.

4. **Dock:** All axes must be adjusted to 0, and stabilized for 2 seconds, then you will receive a ''Rendevous'' signal, indicating you've docked.

DOCKING SUMMARY

You are attempting to dock with a satellite that is travelling at Mach 23.9 and 210 nautical miles above the Earth. You will either need to slow down or speed up to rendezvous (X axis). Also, you will need to be at the same altitude (Z axis), and position (Y axis). All of these maneuvers are inter-related—changing one can affect the others. And, in flight #3, the longer you take to dock, the more fuel you'll use! It is also better to tap the Joystick (or the keys) than hold them down (saves fuel).

Macro Y Axis   Z Axis   Micro Y Axis   X Axis

DOCKING SCREEN

9
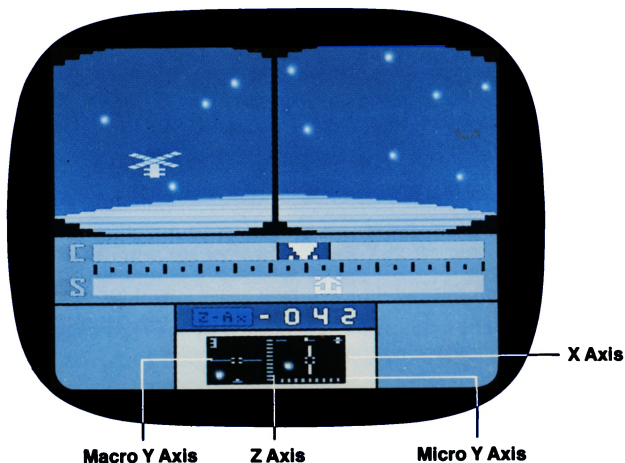
DEORBIT BURN

OBJECTIVE

To turn the Shuttle around, fire the engines, and decelerate to the proper speed.

DEORBIT CHECKLIST

Deorbit Burn Maneuver You must first turn the Shuttle around so that it is traveling tail-first. Then, in order to maintain the proper altitude, set your Z axis and pitch. Once completed, fire the engines to decelerate. (If the Z axis and pitch are not set properly, firing the engines will make your Shuttle climb or dive.) After the deorbit burn, the Shuttle must then be reoriented nose-forward to the proper attitude for reentry. Entering the atmosphere backwards will cause the Shuttle to burn-up.

Yaw Left-right rotation of the nose of the craft.

Satellite Interference Before attempting a deorbit burn, you *must* allow the satellite to pull a safe 128 nautical miles away from the shuttle. If you don't, your deorbit burn will be unsuccessful, and you'll never leave orbit!

SEQUENCE FOR DEORBIT BURN

1. Check X axis by tapping Joystick back. Wait until x = 128 miles *before* proceeding (x = + 128 or − 128).
2. Press **S** on the keyboard to check speed. Move Joystick forward or back (or press **Y** or **B**) to set speed at Mach 23.9.
3. Correct Z axis to 0.
4. Activate Primary Engines.
5. Turn Shuttle around by pushing Joystick left to set yaw at − 128.
6. Pull back or push Joystick forward to set pitch at − 004.
7. Display speed (SP/m), speed in Mach, using **S** on keyboard.
8. Ignite engines by pressing Joystick button or **SYMBOL SHIFT.** Hold down until speed = 19.0.
9. Reset yaw to exactly 0.

DEORBIT SUMMARY

Deorbit is one of the most critical phases of your flight.

Following completion of orbital operations, the Shuttle is oriented to a tail-first attitude, then decelerated to a necessary speed for reentry.

The orientation of the Shuttle is established by the RCS engines, and deceleration is provided by the larger OMS engines.

You begin to lose altitude once you've slowed the Shuttle down below the actual velocity needed to sustain your 210 mile orbit.

REENTRY

OBJECTIVE

To establish and maintain the correct pitch, yaw and speed; follow the correct trajectory; and properly manage heat build-up during reentry.

REENTRY CHECKLIST

Entry Interface This is the point in your flight where atmospheric entry officially begins. As the Shuttle descends, atmospheric drag dissipates tremendous energy, generating a great deal of heat. This heat quickly builds up (portions of the vehicle's exterior reach 1,540°C). Pitch and speed must be correct to properly utilize the Shuttle's Thermal Protection System.

Terminal Area Energy Management After entry interface, you must closely follow the proper descent trajectory in order to maintain enough altitude and speed to reach the final touchdown point. This process of conserving your energy by maintaining the correct position, altitude, velocity and heading is called Terminal Area Energy Management (TAEM).

Loss of Signal During reentry, the Shuttle superheats the gas of the upper atmosphere, creating flashes of color outside your window. Heat strips electrons from the air around the Shuttle, enveloping it in a sheath of ionized air that blocks all communication with the ground. So, at 160 miles, you will experience a temporary partial loss of signal (LOS). Keep a close eye on your radar at this point. You will receive intermittent signals which you need to use to correct your course and plane.

Descent Screens On your reentry screen, "X" indicates cut-off of your OMS engines (deorbit burn). "T" indicates the Terminal Area Energy Management Phase. "L" indicates your transition to final landing approach. The small box at left is your plane indicator.

REENTRY SEQUENCE

1. Pull back Joystick (or press **B**) to set +24 pitch for proper reentry altitude.
2. Close Cargo Bay Doors.
3. Follow reentry course on computer screen. Move Joystick forward or back to go left or right, respectively (or use **Y** or **B**). Moving your Joystick left or right (or keys **G** or **H**), at this time, centers the plane.

REENTRY SUMMARY

There are three important stages to Reentry: Entry interface, TAEM and LOS. Position, altitude, velocity and heading must all be exact to both properly manage the tremendous heat buildup and correctly position your shuttle for the Final Approach.

OMS Cutoff

Plane Indicator **Shuttle** **TAEM Stage**
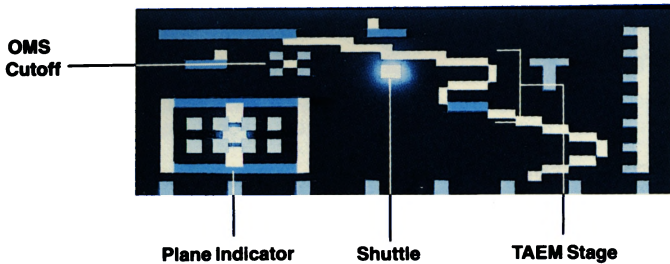
REENTRY SCREEN

LANDING: EDWARDS AIRFORCE BASE, CALIFORNIA

OBJECTIVE

Properly following the final approach course, maintain the correct pitch and descent rate to safely land.

LANDING CHECKLIST

Final Approach As you leave the reentry phase and enter your final approach, the first thing you'll see are the mountains around Edwards Air Force Base. You'll hear two sonic booms caused by your craft and the chase planes. At this point, your Shuttle is a glider.
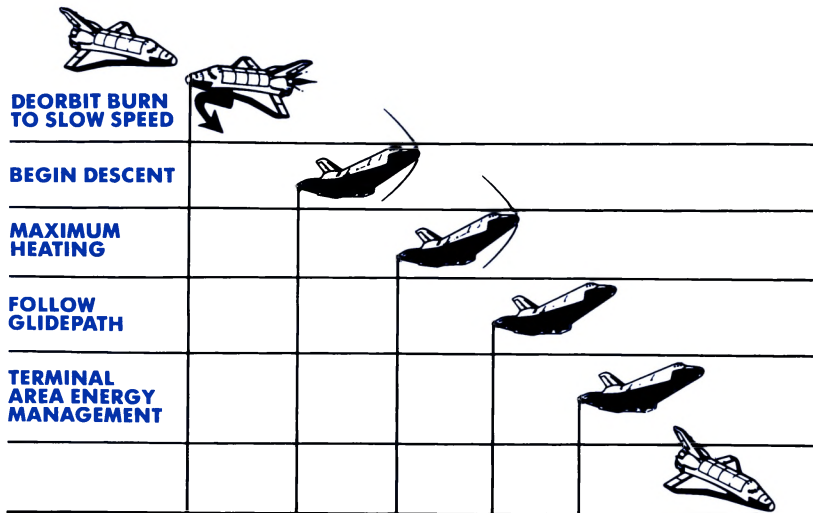
In order to maintain enough altitude and speed to reach the touchdown point, you'll need to make an extreme right turn which will leave you lined up with the runway entry point.

Landing Screens Now, closely watch all your flight instruments on the front control panel. At this point events happen quickly. You will need to keep your nose pulled up to slow descent while constantly watching altitude and range. Lines on the left screen box, (Altitude Direction Indicator) indicate the ideal trajectory or path and your upper and lower safe limits. The right box is your Horizontal Situation Indicator. It shows your position relative to the runway.

Range Range is the distance from the edge of the runway to your Shuttle. So, when range is negative, you're above the runway.

Surface Conditions Since you're in the desert, crosswinds can become a real problem. Compensate by constantly moving Joystick left-right and forward-back (or use keys **G, H, Y** or **B**) to maintain the proper trajectory and descent rate until touchdown. Just because you're close to home — don't let up on your concentration.

RETURNING TO EARTH

DEORBIT BURN TO SLOW SPEED

BEGIN DESCENT

MAXIMUM HEATING

FOLLOW GLIDEPATH

TERMINAL AREA ENERGY MANAGEMENT

TURN TO BEGIN FINAL APPROACH

BEGIN TO PULL NOSE UP

PREPARE TO DROP GEAR

WHEELS DOWN

TOUCHDOWN

LANDING SEQUENCE

1. As soon as you see the mountains, make a right turn. Line up Shuttle on runway using radar screen.
2. Follow final approach course on both computer screens. Left screen: Keep dot centered between the two arched lines. Right screen: Keep dot centered on straight runway approach line. To lower the nose (quicken descent), push Joystick forward, or press **Y** on keyboard. To raise the nose (slow descent), pull Joystick back, or press **B.** Move Joystick left or right, or use keys **G** or **H** to keep dot centered.
3. Press Joystick button, or **SYMBOL SHIFT,** to display altitude. Release button (or key) to display range.
4. When range goes negative, you're over the runway, just seconds from touchdown, so drop landing gear NOW.
5. Push Joystick forward, or press **Y,** to lower nose.
6. When Shuttle hits runway, its nose will pop up, so keep the Joystick pushed forward (or hold down **Y**) to keep the nose down until you hear the thud of the front landing gear.

LANDING SUMMARY

During the final approach, descent speed is critical. You will be conducting a series of "flares" (nose-up maneuvers) that reduce speed which is necessary for landing. So, not only will you need to center the Shuttle on the runway, but also you must maintain the proper pitch at the same time. Sounds are important during this phase. Use them to monitor your progress. In addition tothe sonic boom as you break through the atmosphere, you'll hear a constant beeping effect which will increase in speed the closer you get to the runway, a high-pitched warning horn after you've passed over the runway (a signal to put your landing gear down), landing gear lowered, and (main gear) tires screech when you've touched down.
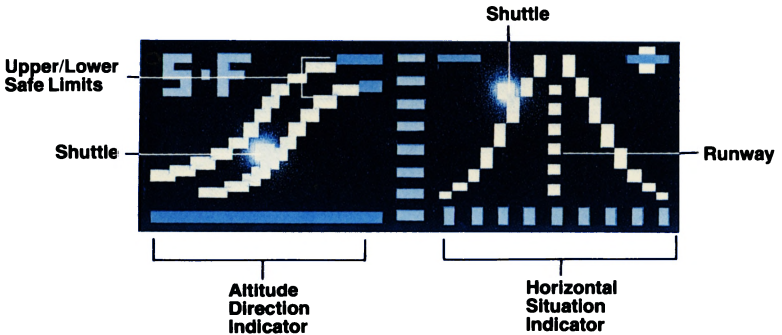

FINAL APPROACH SCREEN

ORBITAL MECHANICS

You've successfully launched your Shuttle into orbit. Now, it's time to dock with the satellite. Whether you're making position corrections using the OMS or RCS engines, remember that every action you take may affect your axis (X, Y, Z) or altitude. For example, if your pitch is − 028 (nose-down) and you perform an OMS burn to correct your X axis, your altitude will drop because you're actually pointed towards Earth.

Try and picture the position of the Shuttle in your mind as you're orbiting. Use the diagram below to help you visualize Shuttle positioning. And remember: minimum speed is Mach 17.0 and minimum altitude is 195 nautical miles, or your orbit will destabilize and the vehicle will burn up in the atmosphere.
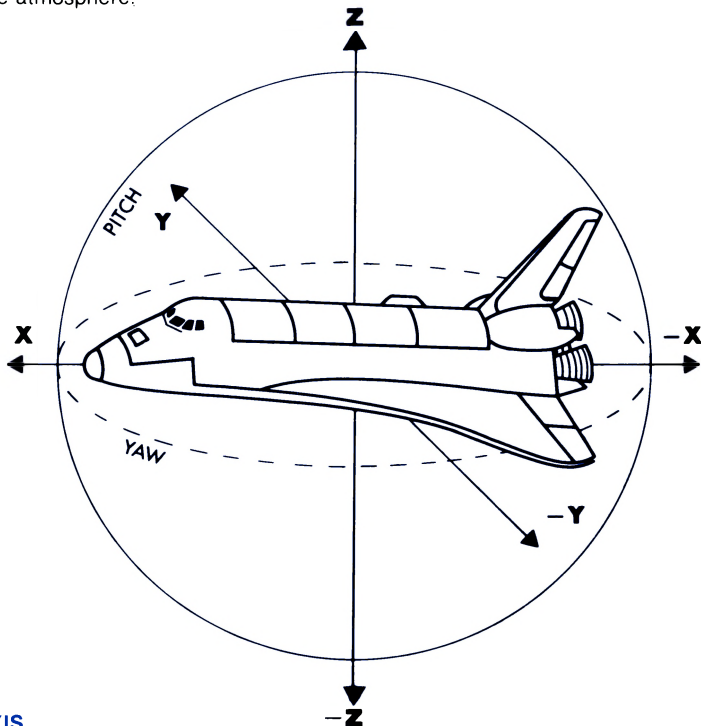
AXIS
Z = Vertical distance to earth
Y = Left and right distance to satellite
X = Forward and back distance to satellite
PITCH = Up-down of the nose of the craft
YAW = Left-right rotation of the nose of the craft

ORBITAL MANEUVERING SYSTEM

For smaller, precise adjustments, you'll want to achieve orbital maneuvers with your Reaction Control System (RCS) engines. They're easier to use. However, time means fuel. Housekeeping fuel—used to keep the various electrical equipment and life support systems of the Shuttle operating— is constantly being expended. So, it's imperative you make your orbital corrections as efficiently and quickly as possible. This is where your OMS engines can be a great aid. When making major maneuvers (30 nautical miles or more) use your 12,000-pound-thrust OMS engines. However, since using the powerful OMS engines can dramatically affect altitude, *read the following instructions carefully.*

X AXIS CORRECTIONS USING OMS ENGINES

When flying forward on X (0 Yaw) using your OMS engines, your altitude will drop faster if your pitch is zero or negative. When flying backwards on X (− 128 Yaw) using your OMS engines, your altitude will rise if your pitch is positive or zero, and your altitude will not be affected by the OMS burn if your pitch is negative.

Sequence
- Set pitch to correct value.
- Set display to "X" axis, speed, or altitude.
- Set yaw to − or + 128.
- Push red button, or **SYMBOL SHIFT,** to fire engines.
- Restore yaw and pitch to correct values.

Y AXIS CORRECTIONS USING OMS ENGINES

As you perform a Y OMS burn, you'll see your Y indicator change. If you forgot to change your pitch to 0, your altitude will change. A positive pitch will make you fall. A negative pitch will force you to rise. A non-zero pitch also burns extra fuel.

Sequence
- Set pitch to correct value.
- Set yaw to − or + 64.
- Push red button, or **SYMBOL SHIFT,** to fire engines.
- Restore yaw and pitch to correct value.

OMS Summary In other words, when correcting either X jor Y axis using your OMS engines, *altitude may be affected.* Taking this into account, it is possible to make both Z (vertical) *and* X or Y corrections, all in the same maneuver—if very skillfully done.

PROBLEMS AND SOLUTIONS

LAUNCH PROBLEMS

PROBLEM: MET-15 does not appear. Screen only comes up STAT.

SOLUTION: Check switches. Primary and Backup Engines must be shut down. Cargo Doors must be closed. Try again.

PROBLEM: "Launch Scrub."

SOLUTION: You're igniting your engines prior to or too long after MET-004. Wait for launch systems to recycle and concentrate on firing as close to (but not before) MET-004 as possible.

PROBLEM: Line horn continually sounds during launch.

SOLUTION: Keep dot (your Shuttle) slightly on the low side of the trajectory line to maintain proper course.

STABILIZING ORBIT PROBLEMS

PROBLEM: Initial orbit position too low, or speed too slow.

SOLUTION: You're shutting off your engines before proper altitude is achieved. Cut-off your main engines as close to 205 miles as possible.

PROBLEM: "Mission Abort" signal as soon as you shut down engines.

SOLUTION: Dependent upon your Abort number, either: speed/altitude were too low to sustain orbit; you were far off the trajectory line at MECO; you shut down your engines too early, or your orbit insertion angle was incorrect. Either you were very far off the trajectory line or your plane (right-left position) was incorrect.

PROBLEM: Once in orbit, Y axis is off badly.

SOLUTION: Plane (right-left) was not centered at MECO.

PROBLEM: Once in orbit, Z is off badly.

SOLUTION: You shut down your engines too early. Remember, your Z axis is directly related to your altitude. The lower your altitude, the more negative your Z axis. A Z-15 axis equals an altitude of 196.0 nautical miles. When Z axis equals 0, altitude is 210 nautical miles, the altitude of the orbiting satellite.

PROBLEM: Once in orbit, X is badly off.

SOLUTION: Trajectory was not centered at MECO.

DOCKING PROBLEMS

PROBLEM: Although axes are adjusted, satellite is never sighted and docking screens never appear.

SOLUTION: Check your pitch and yaw. If pitch is not − 28 (Shuttle nose-down), you'll never be in line of sight of satellite. If yaw is + or − 17 or greater, you'll also be out of line of sight (Shuttle line of sight will be too far left or right). With Z and Y axes adjusted to 0, docking screens should appear when the satellite is at X + or − 16, assuming pitch is − 28 and yaw = 0.

PROBLEM: Conducting OMS burn sends Shuttle into dramatically high or low altitudes.

SOLUTION: Check your pitch. *Always* make sure your pitch is 0 before conducting an OMS burn unless you intentionally wish to adust your altitude during burn.

PROBLEM: Axes all adjusted. Satellite spotted. But, you can't dock.

SOLUTION: Check your speed. The satellite always travels at Mach 23.9. So, if you're having trouble docking, adjust Shuttle speed + or − 1 Mach.

REENTRY PROBLEMS

PROBLEM: After conducting a successful Deorbit Burn, you still aren't losing altitude for reentry.

SOLUTION: The Satellite may be interfering. Wait unitl it is at least 128 miles (x axis) away before conducting a deorbit burn. Also, make sure your altitude is 210 (z axis 0) and, speed mach 23.9 before attempting burn.

PROBLEM: Burn up during reentry.

SOLUTION: If your pitch is greater than + 24, your Shuttle cannot be protected by its special insulation. If pitch is less than + 24, you'll skip into space. If yaw does not equal 0, you'll spin out. And if your Cargo Bay Doors are left open, ycur Shuttle will also burn up.

LANDING PROBLEMS

PROBLEM: Mission Abort as soon as you break through the cloud covering.

SOLUTION: You *cannot* be off course (Klaxon horn is on) during the last few seconds of your reentry (screen). This will place you in the wrong position for Final Approach — altitude and speed will be adversely affected! So, stay right on course at the end of reentry — don't let up.

PROBLEM: You crash into the desert floor.

SOLUTION: This is probably a result of improper use of your Altitude Direction Indicator (ADI). The ADI is your left computer screen during landing. It tracks your altitude and descent. Always keep the Shuttle above the lower of its two lines.

Moving the Joystick forward or back, or pressing key **Y** or **B,** helps do this by raising or lowering the nose of the Shuttle (quickens or slows descent).

Importantly, as soon as you drop landing gear, drag will cause the nose to flare up. So, when landing gear is dropped, push and hold Joystick forward, or press **Y,** to bring and keep nose down.

STAT MESSAGES

If you're encountering a problem, or just want to check your status, hold your Status Switch down (**Q**) until ''STAT'' appears. Then, use the following guide. Operational messages are prelaunch alerts. However, Mission Abort messages mean you've made a catastrophic mistake (Flights #2, #3 only) and must relaunch. For further explanations for some of these messages, see ''Problems & Solutions.''

MESSAGE NUMBER	MESSAGE OR ACTION NEEDED
(Prelaunch-Non Abort)	
0	All clear.
4	Shutdown Primary Engines.
24	Raise Landing Gear and shutdown Primary Engines.
44	Shutdown Primary Engines and close Cargo Bay Doors.
64	Raise Landing Gear, shutdown Primary Engines and close Cargo Bay Doors.
20	Raise Landing Gear.
40	Close Cargo Bay Doors.
60	Raise Landing Gear and close Cargo Bay Doors.

MESSAGE NUMBER	MESSAGE OR ACTION NEEDED
	(Inflight-Mission Abort)
0	All clear
1000	Not lined up with runway on touchdown
7000	Altitude too low to sustain orbit (below 195)
7500	Altitude too high (255 miles maximum)
9500	Speed/altitude too low to attain orbit at MECO
1500	Touchdown too early (hit desert)
2000	Touchdown too late (run off runway)
3000	Nose gear not down at end of runway
3500	Not on course at beginning of banking turn (Klaxon horn is on)
4000	Landing gear not down at touchdown
8500	Cargo bay doors not open during orbit (overheat)
5000	Cargo bay doors not closed or landing gear down at ascent or entry interface
8000	Speed too low to sustain orbit (below M 17)
5500	Pitch greater than 24 on reentry into atmosphere (skip into space)
6000	Pitch greater than 24 on entry interface (burn up)
6500	Yaw not 0 on entry interface
9000	Orbit insertion angle incorrect at MECO
9900	Out of fuel

MESSAGE NUMBER	MESSAGE OR ACTION NEEDED
	(After safely landing)
1–99	Number of dockings. Also may appear as the last digit of a Mission Abort stat.

20

FLIGHT NOTES FROM DESIGNER, STEVE KITCHEN

Steve Kitchen is a master software designer, engineer and inventor. He was involved in the development of digital watches, the first handheld electronic games and electronic calculators.

''Ever since I can remember, the Space Program has meant something very special to me. Every time a mission took off, so did my imagination.

''That's why designing a home video version patterned after the real Space Shuttle seemed so appealing — yet challenging. It was quite a task to achieve maximum accuracy in my work. But I can assure you, the Space Shuttle software you now have is quite true to real life.

''So, don't be discouraged if you don't achieve Commander on your first flight. There are plenty of skills and a whole lot of knowledge you need to master first. I strongly suggest you fly Space Shuttle with a friend as co-pilot — functioning as navigator and assistant.

''Learn and understand this manual. The knowledge you gain will not only help with my program but, who knows, may get you a seat on the next real trip into orbit.''

Steve Kitchen (signature)

GLOSSARY

APOGEE: The highest point of an earth ORBIT.

ALTITUDE: Vertical height from Earth's mean surface (sea level).

ATITUDE: The position of the vehicle; for example, flying tail-first with cargo bay toward the Earth.

AXIS: A line through a body about which it rotates.

CONFIGURE: To set equipment to certain specifications.

DEORBIT BURN: The firing of a RETRO-ROCKET to slow the spacecraft to a speed lower than that required to maintain ORBIT. On the Orbiter, this is accomplished with the orbiter maneuvering system (OMS) engines.

GLIDESCOPE: The angle at which you descend in the Orbiter or other glider with respect to the ground.

KILOMETER: 1000 meters, or 0.621 of a mile.

MACH: The term used to describe the speed of objects relative to the speed of sound (about 690 mph). For example, Mach 2 is twice the speed of sound. The Shuttle travels through space (in orbit) at approx. 22 mach or 17,000 mph.

ORBIT: A balance between a body's inertia, or tendency to fly off into space, and the gravitational attraction of a central object.

PITCH: Up-down rotation of the nose of the craft (see Roll and Yaw).

RANGE: Distance to edge of runway.

RETRO-FIRE: To fires engines in the direction of motion in order to reduce forward velocity. In orbit, this permits gravity to pull you downward.

ROLL: To rotate about an axis from front to back (nose to tail) of the Orbiter. To the pilot, a roll is like a cartwheel (see Pitch and Yaw).

RENDEZVOUS: To meet in space and orbit together.

ROTATION: Movement of the Orbiter around its three principal axes producing Pitch, Yaw, or Roll.

TRAJECTORY: Flight Path.

YAW: Left-Right rotation of the nose of the craft (see Pitch and Roll).

ACRONYMS

AX: Axis
ALT: Altitude
DAP: Digital Auto Pilot
FLT: Flight
MET: Mission Elapsed Time
MECO: Main Engine Cut-Off
OMS: Orbital Maneuvering Systems
RCS: Reaction Control System
RNG: Range
SRB: Solid Rocket Booster
SPIM: Speed in Mach
SSME: Space Shuttle Main Engine
STS: Space Transportation System
TAEM: Terminal Area Energy Management

Who are you?? We'd love to know!!
Fill out the form below, and mail it, in a stamped envelope to the address
below. Feel free to include a letter describing your software interests as
well. In either case, we'll keep you informed of upcoming innovations from
the Activision designers.

ACTIVISION (UK) INC.
15 Harley House
Marylebone Road
Regent Park,
London N.W.1 5HE, UK

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