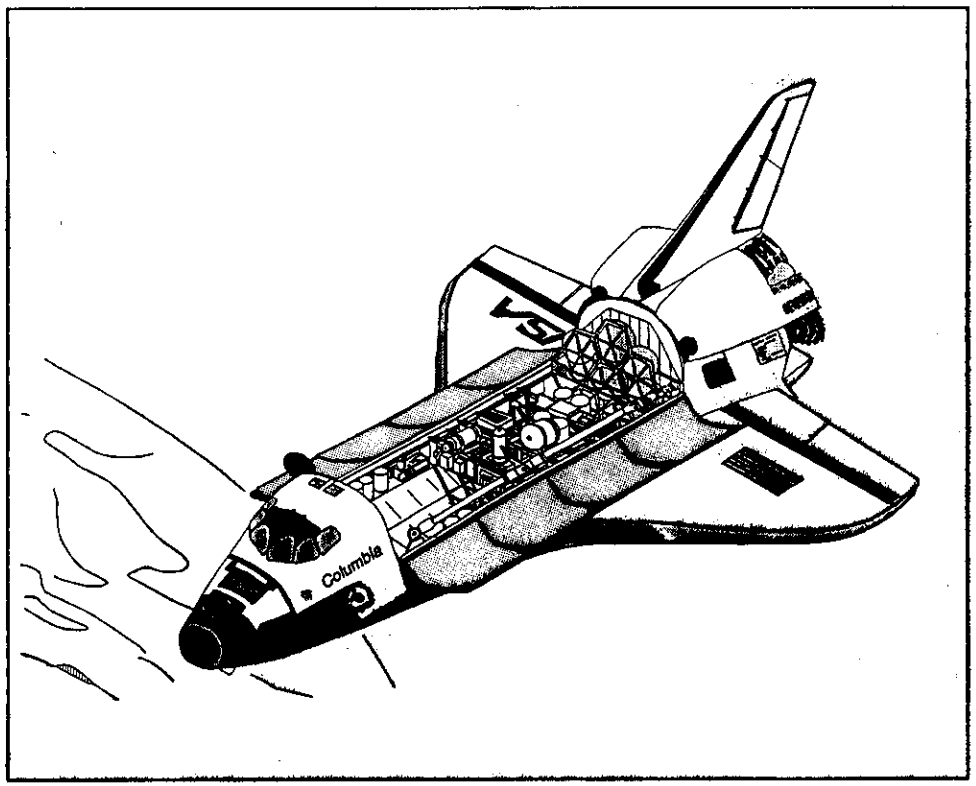

STS-62

MISSION TIME LINE

March 1994

Rockwell

Office of Media Relations
Space Systems Division

PUB 3546-V Rev 2-94

CONTENTS

T - (MINUS) HR:MIN:SEC	EVENT
03:00:00	The orbiter closeout crew goes to the launch pad and prepares the orbiter crew compartment for flight crew ingress.
03:00:00 Holding	Begin 2-hour planned hold. An inspection team examines the ET for ice or frost formation on the launch pad during this hold.
03:00:00 Counting	Two-hour planned hold ends.
02:55:00	Flight crew departs Operations and Checkout (O&C) Building for launch pad.
02:25:00	Flight crew orbiter and seat ingress occurs.
02:10:00	Postingress software reconfiguration occurs.
02:00:00	Checking of the launch commit criteria starts at this time.
02:00:00	The ground launch sequencer (GLS) software is initialized.
01:50:00	The solid rocket boosters' (SRBs') hydraulic pumping units' gas generator heaters are turned on and the SRBs' aft skirt gaseous nitrogen purge starts.
01:50:00	The SRB rate gyro assemblies (RGAs) are turned on. The RGAs are used by the orbiter's navigation system to determine rates of motion of the SRBs during first-stage flight.
01:35:00	The orbiter accelerometer assemblies (AAs) are powered up.
01:35:00	The orbiter reaction control system (RCS) control drivers are powered up.
01:35:00	The flight crew starts the communications checks.
01:25:00	The SRB RGA torque test begins.
01:20:00	Orbiter side hatch is closed.
01:10:00	Orbiter side hatch seal and cabin leak checks are performed.
01:01:00	IMU preflight align begins. Flight crew functions from this point on will be initiated by a call from the orbiter test conductor (OTC) to proceed. The flight crew will report back to the OTC after completion.
01:00:00	The orbiter RGAs and AAs are tested.
00:50:00	The flight crew starts the orbiter hydraulic auxiliary power units' (APUs') water boilers preactivation.
00:45:00	Cabin vent redundancy check is performed.
00:45:00	The GLS mainline activation is performed.
00:40:00	The eastern test range (ETR) shuttle range safety system (SRSS) terminal count closed-loop test is accomplished.

T - (MINUS) HR:MIN:SEC	EVENT
00:40:00	Cabin leak check is completed.
00:32:00	The backup flight control system (BFS) computer is configured.
00:30:00	The gaseous nitrogen system for the orbital maneuvering system (OMS) engines is pressurized for launch. Crew compartment vent valves are opened.
00:26:00	The ground pyro initiator controllers (PICs) are powered up. They are used to fire the SRB hold-down posts, liquid oxygen and liquid hydrogen tail service mast (TSM), and ET vent arm system pyros at lift-off and the SSME hydrogen gas burn system prior to SSME ignition.
00:25:00	Simultaneous air-to-ground voice communications are checked. Weather aircraft are launched.
00:22:00	The primary avionics software system (PASS) is transferred to the BFS computer in order for both systems to have the same data. In case of a PASS computer system failure, the BFS computer will take over control of the shuttle vehicle during flight.
00:21:00	The crew compartment cabin vent valves are closed.
00:20:00	A 10-minute planned hold starts.
Hold 10 Minutes	All computer programs in the firing room are verified to ensure that the proper programs are available for the final countdown. The test team is briefed on the recycle options in case of an unplanned hold.

T - (MINUS) HR:MIN:SEC	EVENT
	The landing convoy status is again verified and the landing sites are verified ready for launch.
	The IMU preflight alignment is verified complete.
	Preparations are made to transition the orbiter on-board computers to Major Mode (MM)-101 upon coming out of the hold. This configures the computer memory to a terminal countdown configuration.
00:20:00	The 10-minute hold ends.
Counting	Transition to MM-101. The PASS on-board computers are dumped and compared to verify the proper on-board computer configuration for launch.
00:19:00	The flight crew configures the backup computer to MM-101 and the test team verifies the BFS computer is tracking the PASS computer systems. The flight crew members configure their instruments for launch.
00:18:00	The Mission Control Center-Houston (MCC-H) now loads the on-board computers with the proper guidance parameters based on the prestated lift-off time.
00:16:00	The MPS helium system is reconfigured by the flight crew for launch.
00:15:00	The OMS/RCS crossfeed valves are configured for launch.

T - (MINUS) HR:MIN:SEC	EVENT
	All test support team members verify they are "go for launch."
00:12:00	Emergency aircraft and personnel are verified on station.
00:10:00	All orbiter aerosurfaces and actuators are verified to be in the proper configuration for hydraulic pressure application. The NASA test director gets a "go for launch" verification from the launch team.
00:09:00	A planned 10-minute hold starts.
Hold 10 Minutes	NASA and contractor project managers will be formally polled by the deputy director of NASA, Space Shuttle Operations, on the Space Shuttle Program Office communications loop during the T-minus-9-minute hold. A positive "go for launch" statement will be required from each NASA and contractor project element prior to resuming the launch countdown. The loop will be recorded and maintained in the launch decision records.
	All test support team members verify that they are "go for launch."
	Final GLS configuration is complete.
00:09:00 Counting	The GLS auto sequence starts and the terminal countdown begins.
	From this point, the GLSs in the integration and backup consoles are the primary control until T-0 in conjunction with the on-board orbiter PASS redundant-set computers.
00:09:00	Operations recorders are on. MCC-H, Johnson Space Center, sends a command to turn these recorders on. They record shuttle system performance during ascent and are dumped to the ground once orbit is achieved.
00:08:00	Payload and stored prelaunch commands proceed.
00:07:30	The orbiter access arm (OAA) connecting the access tower and the orbiter side hatch is retracted. If an emergency arises requiring flight crew activation, the arm can be extended either manually or by GLS computer control in approximately 30 seconds or less.
00:06:00	APU prestart occurs.
00:05:00	Orbiter APUs start. The orbiter APUs provide pressure to the three orbiter hydraulic systems. These systems are used to move the SSME engine nozzles and aerosurfaces.
00:05:00	ET/SRB range safety system (RSS) is armed. At this point, the firing circuit for SRB ignition and destruct devices is mechanically enabled by a

T - (MINUS) HR:MIN:SEC	EVENT
	motor-driven switch called a safe and arm device (S&A).
00:04:30	As a preparation for engine start, the SSME main fuel valve heaters are turned off.
00:04:00	The final helium purge sequence, purge sequence 4, on the SSMEs is started in preparation for engine start.
00:03:55	At this point, all of the elevons, body flap, speed brake, and rudder are moved through a preprogrammed pattern. This is to ensure that they will be ready for use in flight.
00:03:30	Transfer to internal power is done. Up to this point, power to the space vehicle has been shared between ground power supplies and the on-board fuel cells. The ground power is disconnected and the vehicle goes on internal power at this time. It will remain on internal power through the rest of the mission.
00:03:25	The SSMEs' nozzles are moved (gimbaled) through a preprogrammed pattern to ensure that they will be ready for ascent flight control. At completion of the gimbal profile, the SSMEs' nozzles are in the start position.
00:02:55	ET liquid oxygen prepressurization is started. At this point, the liquid oxygen tank vent valve is closed and the ET liquid oxygen tank is pressurized to its flight pressure of 21 psi.
00:02:50	The gaseous oxygen arm is retracted. The cap that fits over the ET nose cone to prevent ice buildup on the oxygen vents is raised off the nose cone and retracted.
00:02:35	Up until this time, the fuel cell oxygen and hydrogen supplies have been adding to the on-board tanks so that a full load at lift-off is assured. This filling operation is terminated at this time.
00:02:30	The caution/warning memory is cleared.
00:01:57	Since the ET liquid hydrogen tank was filled, some of the liquid hydrogen has turned into gas. In order to keep pressure in the ET liquid hydrogen tank low, this gas was vented off and piped out to a flare stack and burned. In order to maintain flight level, liquid hydrogen was continuously added to the tank to replace the vented hydrogen. This operation terminates, the liquid hydrogen tank vent valve is closed, and the tank is brought up to a flight pressure of 44 psia at this time.
00:01:15	The sound suppression system will dump water onto the mobile launcher platform (MLP) at ignition in order to dampen vibration and noise in the space shuttle. The firing system for this dump, the sound suppression water power bus, is armed at this time.
00:01:00	The SRB joint heaters are deactivated.
00:00:55	The SRB MDM critical commands are verified.

T - (MINUS) HR:MIN:SEC	EVENT
00:00:47	The liquid oxygen and liquid hydrogen outboard fill and drain valves are closed.
00:00:40	The external tank bipod heaters are turned off.
00:00:38	The on-board computers position the orbiter vent doors to allow payload bay venting upon lift-off and ascent in the payload bay at SSME ignition.
	The SRB forward MDM is locked out.
00:00:37	The gaseous oxygen ET arm retract is confirmed.
00:00:31	The GLS sends "go for redundant set launch sequence start." At this point, the four PASS computers take over main control of the terminal count. Only one further command is needed from the ground, "go for main engine start," at approximately T minus 9.7 seconds. The GLS in the integration console in the launch control center still continues to monitor several hundred launch commit criteria and can issue a cutoff if a discrepancy is observed. The GLS also sequences ground equipment and sends selected vehicle commands in the last 31 seconds.
00:00:28	Two hydraulic power units in each SRB are started by the GLS. These provide hydraulic power for SRB nozzle gimbaling for ascent first-stage flight control.
	The orbiter vent door sequence starts.

T - (MINUS) HR:MIN:SEC	EVENT
00:00:21	The SRB gimbal profile is complete. As soon as SRB hydraulic power is applied, the SRB engine nozzles are commanded through a preprogrammed pattern to assure that they will be ready for ascent flight control during first stage.
00:00:21	The liquid hydrogen high-point bleed valve is closed.
	The SRB gimbal test begins.
00:00:18	The on-board computers arm the explosive devices, the pyrotechnic initiator controllers, that will separate the T-0 umbilicals, the SRB hold-down posts, and SRB ignition, which is the final electrical connection between the ground and the shuttle vehicle.
00:00:16	The sound suppression system water is activated.
00:00:15	If the SRB pyro initiator controller (PIC) voltage in the redundant-set launch sequencer (RSLS) is not within limits in 3 seconds, SSME start commands are not issued and the on-board computers proceed to a countdown hold.
00:00:13	The aft SRB MDM units are locked out. This is to protect against electrical interference during flight. The electronic lock requires an unlock command before it will accept any other command.
	SRB SRSS inhibits are removed. The SRB destruct system is now live.

T - (MINUS) HR:MIN:SEC	EVENT
00:00:12	The MPS helium fill is terminated. The MPS helium system flows to the pneumatic control system at each SSME inlet to control various essential functions.
00:00:10	LPS issues a "go" for SSME start. This is the last required ground command. The ground computers inform the orbiter on-board computers that they have a "go" for SSME start. The GLS retains hold capability until just prior to SRB ignition.
00:00:09.7	Liquid hydrogen recirculation pumps are turned off. The recirculation pumps provide for flow of fuel through the SSMEs during the terminal count. These are supplied by ground power and are powered in preparation for SSME start.
00:00:09.7	In preparation for SSME ignition, flares are ignited under the SSMEs. This burns away any free gaseous hydrogen that may have collected under the SSMEs during prestart operations. The orbiter goes on internal cooling at this time; the ground coolant units remain powered on until lift-off as a contingency for an aborted launch. The orbiter will redistribute heat within the orbiter until approximately 125 seconds after lift-off, when the orbiter flash evaporators will be turned on.
00:00:09.5	The SSME engine chill-down sequence is complete and the on-board computers command the three MPS liquid hydrogen prevalves to open. (The MPS's three liquid oxygen prevalves were opened during ET tank loading to permit engine chill-down.) These valves allow liquid hydrogen and oxygen flow to the SSME turbopumps.
00:00:09.5	Command decoders are powered off. The command decoders are units that allow ground control of some on-board components. These units are not needed during flight.
00:00:06.6	The main fuel and oxidizer valves in each engine are commanded open by the on-board computers, permitting fuel and oxidizer flow into each SSME for SSME start. All three SSMEs are started at 120-millisecond intervals (SSME 3, 2, then 1) and throttle up to 100-percent thrust levels in 3 seconds under control of the SSME controller on each SSME.
00:00:04.6	All three SSMEs are verified to be at 100-percent thrust and the SSMEs are gimbaled to the lift-off position. If one or more of the three SSMEs does not reach 100-percent thrust at this time, all SSMEs are shut down, the SRBs are not ignited, and an RSLS pad abort occurs. The GLS RSLS will perform shuttle and ground systems safing. Vehicle bending loads caused by SSME thrust buildup are allowed to initialize before SRB ignition. The vehicle moves towards ET including ET approximately 25.5 inches.

T - (MINUS) HR:MIN:SEC	EVENT
00:00:00	The two SRBs are ignited under command of the four on-board PASS computers, the four hold-down explosive bolts on each SRB are initiated (each bolt is 28 inches long and 3.5 inches in diameter), and the two T-0 umbilicals on each side of the spacecraft are retracted. The on-board timers are started and the ground launch sequence is terminated. All three SSMEs are at 104-percent thrust. Boost guidance in attitude hold.
00:00	Lift-off.

STS-62 MISSION HIGHLIGHTS TIME LINE

T + (PLUS) DAY/ HR:MIN:SEC	EVENT
	DAY ZERO
0/00:00:07	Tower is cleared (SRBs above lightning rod tower).
0/00:00:10	180-degree positive roll maneuver (right-clockwise) is started. Pitch profile is heads down, wings level.
0/00:00:19	Roll maneuver ends.
0/00:00:31	All three SSMEs throttle down from 104 to 67 percent for maximum aerodynamic load (max q).
0/00:00:51	Max q occurs.
0/00:00:57	All three SSMEs throttle to 104 percent.
0/00:02:06	SRBs separate.
	When chamber pressure (Pc) of the SRBs is less than 50 psi, automatic separation occurs with manual flight crew backup switch to the automatic function (does not bypass automatic circuitry). SRBs descend to approximately 15,400 feet, and the nose cap is jettisoned and drogue chute is deployed for initial deceleration.
	At approximately 6,600 feet, drogue chute is released and three main parachutes on each SRB provide final deceleration prior to splashdown in Atlantic Ocean, where the SRBs are recovered for reuse on another mission. Flight control system switches from SRB to orbiter RGAs.
0/00:04:04	Negative return. The vehicle is no longer capable of return-to-launch-site abort at Kennedy Space Center runway.
0/00:07:00	Single engine press to main engine cutoff (MECO).
0/00:08:24	All three SSMEs throttle down to 67 percent for MECO.
0/00:08:31	MECO occurs at approximate velocity 25,884 feet per second, 44 by 158 nautical miles (51 by 182 statute miles).
0/00:08:39	Zero thrust.

Editor's Note: This time line lists selected highlights only. For full detail, please refer to the NASA Mission Operations Directorate STS-62 Flight Plan, Ascent Checklist, Postinsertion Checklist, Deorbit Prep Checklist, and Entry Checklist.

On every shuttle mission, some day-to-day replanning takes place to adjust crew and event time lines according to unforeseen developments or simply to optimize the use of time in orbit. Each day's replanning effort will produce an execute plan defining the approach for the next day's activities in space and on the ground.

T + (PLUS) DAY/ HR:MIN:SEC	EVENT
0/00:08:49	ET separation is automatic with flight crew manual backup switch to the automatic function (does not bypass automatic circuitry). The orbiter forward and aft RCSs, which provide attitude hold and negative Z translation of 11 fps to the orbiter for ET separation, are first used. Orbiter/ET liquid oxygen/liquid hydrogen umbilicals are retracted. Negative Z translation is complete. In conjunction with this thrusting period, approximately 1,700 pounds of liquid hydrogen and 3,700 pounds of liquid oxygen are trapped in the MPS ducts and SSMEs, which results in an approximate 7-inch center-of-gravity shift in the orbiter. The trapped propellants would sporadically vent in orbit, affecting guidance and creating contaminants for the payloads. During entry, liquid hydrogen could combine with atmospheric oxygen to form a potentially explosive mixture. As a result, the liquid oxygen is dumped out through the SSME combustion chamber nozzles, and the liquid hydrogen is dumped out through the right-hand T-minus-zero umbilical overboard fill and drain valves.
	MPS dump terminates.
	APUs shut down.
	MPS vacuum inerting occurs.
	— Remaining residual propellants are vented to space vacuum, inerting the MPS.
	— Orbiter/ET umbilical doors close (one door for liquid hydrogen and one door for liquid oxygen) at bottom of aft fuselage, sealing the aft fuselage for entry heat loads.
	— MPS vacuum inerting terminates.
0/00:42	OMS-2 thrusting maneuver is performed, approximately 2 minutes, 12 seconds in duration, at 208 fps, 160 by 163 nautical miles.
0/00:51	Commander closes all current breakers, panel L4.
0/00:53	Mission specialist (MS), payload specialist (PS) seat egress.
0/00:54	Commander and pilot configure GPCs for OPS-2.
0/00:57	MS configures preliminary middeck.
0/00:59	MS configures aft flight station.
0/01:02	MS unstows, sets up, and activates PGSC.
0/01:05	MS configures for payload bay door operations.
0/01:06	Pilot activates payload bus (panel R1).
0/01:08	Commander and pilot don and configure communications.
0/01:12	Pilot maneuvers vehicle to payload bay door opening attitude, biased negative Z local vertical, positive Y velocity vector attitude.
0/01:17	Commander activates radiators.

T + (PLUS) DAY/ HR:MIN:SEC	EVENT
0/01:28	MS opens payload bay doors.
0/01:36	Mission Control Center (MCC), Houston (H), informs crew to "go for orbit operations."
0/01:37	Commander and pilot seat egress.
0/01:39	Commander and pilot clothing configuration.
0/01:40	MS/PS clothing configuration.
0/01:52	Commander begins post-payload bay door operations and radiator configuration.
0/01:55	MS/PS remove and stow seats.
0/01:56	Commander starts ST self-test and opens door.
0/01:57	MS configures and activates WCS.
0/01:58	MS activates switch configuration/galley.
0/01:59	MS stows escape pole.
0/02:01	Pilot activates auxiliary power unit steam vent heater, panel R2, boiler controller/heater, 3 to A, power, 3 to ON.
0/02:05	Commander configures vernier controls.
0/02:08	MS checks Zeno ascent power is on.
0/02:10	Commander, pilot configure controls for on orbit.
0/02:15	Pilot maneuvers to IMU alignment attitude.

T + (PLUS) DAY/ HR:MIN:SEC	EVENT
0/02:17	MS performs on-orbit initialization.
0/02:19	Pilot enables hydraulic thermal conditioning.
0/02:24	MS resets caution/warning (C/W).
0/02:28	Pilot plots fuel cell performance.
0/02:30	Commander performs IMU alignment using star tracker.
0/02:30	MPESS activation.
0/02:30	EDO activation.
0/02:35	SAMS 1 and 2 activation (USMP).
0/02:35	OAST-2 activation.
0/02:40	Ku-band antenna deployment.
0/02:45	AADSF activation (USMP).
0/02:50	Ku-band antenna activation.
0/02:55	Zeno activation (USMP).
0/02:55	AADSF initiation (USMP).
0/03:00	MEPHISTO activation (USMP).
0/03:05	IDGE activation (USMP).
0/03:10	RMS power-up.
0/03:15	APCG unstow.

T + (PLUS) DAY/ HR:MIN:SEC	EVENT
0/03:25	TES checkout (OAST).
0/03:55	SAMS recorder is activated.
0/04:04	SAMS (USMP) and OARE calibration.
0/04:35	SAMS recorder is deactivated.
0/04:35	RMS power-up.
0/04:50	RMS checkout.
0/05:05	APCG TES activation.
0/06:10	DEE operations.
0/06:15	SKIRT activation (OAST).
0/06:35	GBA activation.
0/06:45	GBA begin GAP set 1.
0/06:48	SKIRT roll (OAST).
0/07:00	CGBA initiation.
0/07:00	GBA begin GAP sets 4-15.
0/07:45	RMS power-down.
0/07:55	SSBUV/A activation.
0/08:00	Crew begins presleep activities.
0/10:35	SSBUV/A begins outgassing.
0/11:00	Crew begins sleep period.
0/11:00	EISG ground-commanded checkout (OAST).
0/19:00	Crew begins postsleep activities.
0/20:55	MEPHISTO hold (USMP).
0/22:00	DTO 664.
0/22:00	CPCG activation.
0/22:00	CGBA initiation—GAP sets 16-21.
0/22:20	Priority Group B power-down.
0/22:30	SSBUV/A instrument activation.
0/22:30	PSE daily operations.
0/22:30	DTO 670 ergometer setup.
0/23:05	BDS-A operations.
0/23:30	SSBUV/A calibration begins.
	MET DAY ONE
1/00:00	DSO 623 LBNP setup.
1/01:00	SSBUV/A calibration ends.
1/01:15	SSBUV/A begins Earth viewing.
1/01:50	TES activation (OAST).
1/02:00	MEPHISTO restart (USMP).

T + (PLUS) DAY/ HR:MIN:SEC	EVENT
1/02:25	LBNP preparation.
1/03:10	LBNP ramp operations.
1/03:10	LDCE activation (open LDCE 7 and 8).
1/04:00	LBNP egress.
1/04:40	DSO 326.
1/04:45	LBNP preparation.
1/05:25	LBNP ramp operations.
1/05:50	PAO opportunity.
1/06:15	LBNP egress.
1/06:30	LBNP temporary stow.
1/06:40	APCG check.
1/06:45	DTO 664.
1/07:00	Crew begins presleep activities.
1/10:00	Crew begins sleep period.
1/18:00	Crew begins postsleep activities.
1/18:00	DSO 612.
1/21:00	PSE daily operations.
1/21:30	PSE refills.
1/21:30	DTO 664.
1/21:45	STA setup (MODE).
1/21:50	BDS-A operations.
1/22:00	TES deactivation (OAST).
1/22:15	STA operations (MODE).
1/22:35	PAO opportunity.
1/23:00	DSO 611.
1/23:00	DSO 492.
	MET DAY TWO
2/00:45	DSO 612.
2/01:30	MEPHISTO hold (USMP).
2/02:00	STA operations (MODE).
2/02:00	DSO 326.
2/04:30	STA stow (MODE).
2/05:40	APCG check.
2/05:45	DTO 664.
2/06:00	MEPHISTO restart (USMP).
2/06:00	Crew begins presleep activities.
2/08:00	DTO 656.

T + (PLUS) DAY/ HR:MIN:SEC	EVENT
2/09:00	Crew begins sleep period.
2/17:00	Crew begins postsleep activities.
2/17:00	DSO 612.
2/18:45	DTO 656.
2/20:00	PSE daily operations.
2/20:30	DTO 664.
2/20:30	STA setup (MODE).
2/20:55	BDS-A operations.
2/21:00	STA operations (MODE).
2/21:10	PAO opportunity.
2/21:30	DSO 492.
2/22:15	APE-B operations.
2/23:00	DSO 326.
2/23:30	STA stow (MODE).
	MET DAY THREE
3/01:00	Pilot, MS2 off duty half day.
3/02:15	MEPHISTO hold (USMP).
3/03:10	MDA close.
3/04:10	APCG check.
3/04:45	DTO 664.
3/05:00	Crew begins presleep activities.
3/05:00	MEPHISTO restart (USMP).
3/05:45	MDA open.
3/06:55	DTO 656.
3/08:00	Crew begins sleep period.
3/16:00	Crew begins postsleep activities.
3/16:00	DSO 612 and DSO 492.
3/17:45	DTO 656.
3/18:45	LBNP preparation.
3/19:00	Commander, MS1 and MS3 off duty half day.
3/19:25	LBNP ramp operations.
3/20:15	LBNP egress.
3/20:30	LBNP preparation.
3/21:10	LBNP ramp operations.
3/22:00	LBNP egress.
3/22:15	LBNP temporary stow.
3/23:15	MEPHISTO hold (USMP).

T + (PLUS) DAY/ HR:MIN:SEC	EVENT
	MET DAY FOUR
4/00:00	PSE daily operations.
4/00:00	STA setup (MODE).
4/00:00	MEPHISTO restart (USMP).
4/00:30	PAO opportunity.
4/00:30	STA operations (MODE).
4/00:35	MEPHISTO hold (USMP).
4/00:45	CGBA operations.
4/00:50	BDS-A operations.
4/02:15	DSO 326.
4/02:30	GBA end GAP set 1.
4/02:45	STA stow (MODE).
4/02:45	GBA begin GAP set 2.
4/03:30	DTO 664.
4/04:00	Crew begins presleep activities.
4/04:00	MEPHISTO restart (USMP).
4/05:55	DTO 656.
4/07:00	Crew begins sleep period.
4/15:00	Crew begins postsleep activities.
4/15:00	DSO 612.
4/16:45	DTO 656.
4/18:00	PSE daily operations.
4/18:30	PSE refills.
4/18:30	DTO 664.
4/18:55	BDS-A operations.
4/19:00	STA setup (MODE).
4/19:30	STA operations (MODE).
4/22:45	MEPHISTO hold (USMP).
4/23:00	STA operations (MODE).
4/23:00	PAO opportunity.
4/23:20	DSO 326.
4/23:45	EISG operations (OAST).
	MET DAY FIVE
5/02:10	STA stow (MODE).
5/03:10	DTO 664.
5/03:20	APCG check.
5/03:40	Crew begins presleep activities.

T + (PLUS) DAY/ HR:MIN:SEC	EVENT
5/03:45	MEPHISTO restart (USMP).
5/05:35	DTO 656.
5/06:40	Crew begins sleep period.
5/14:40	Crew begins postsleep activities.
5/14:40	DSO 612 and DSO 492.
5/16:45	DTO 656.
5/17:40	PSE daily operations.
5/18:10	STA setup (MODE).
5/18:10	DTO 664.
5/18:35	BDS-A operations.
5/18:40	STA operations (MODE).
5/20:30	DSO 326.
5/21:45	MEPHISTO hold (USMP).
5/22:30	STA operations (MODE).
5/22:45	MEPHISTO restart (USMP).
5/23:05	PAO opportunity.
5/23:15	MEPHISTO hold (USMP).

T + (PLUS) DAY/ HR:MIN:SEC	EVENT
	MET DAY SIX
6/00:30	MDA close.
6/01:45	STA stow (MODE).
6/02:30	DLS setup (MODE).
6/02:30	APCG check.
6/03:00	DLS activation (MODE).
6/03:05	DTO 664.
6/03:15	MDA open.
6/03:20	MEPHISTO restart (USMP).
6/03:20	Crew begins presleep activities.
6/05:05	DLS deactivation (MODE).
6/06:20	Crew begins sleep period.
6/12:22	140 hours of AADSF sample translation completed (USMP).
6/14:20	Crew begins postsleep activities.
6/15:20	DLS activation (MODE).
6/17:20	DTO 664.
6/17:20	LBNP preparation.
6/17:50	DLS deactivation (MODE).

T + (PLUS) DAY/ HR:MIN:SEC	EVENT
6/18:00	BDS-A operations.
6/18:00	LBNP ramp operations.
6/18:50	STA setup (MODE).
6/18:50	LBNP egress.
6/18:50	PSE daily operations.
6/19:00	DSO 326.
6/19:05	LBNP preparation.
6/19:20	STA operations (MODE).
6/19:30	LDCE deactivation close LDCE 7.
6/19:35	SSBUV/A Earth view termination.
6/19:45	LBNP ramp operations.
6/20:00	LDCE activation (open LDCE 6).
6/20:35	LBNP egress.
6/20:50	LBNP temporary stow.
6/21:40	DSO 611.
6/23:00	MEPHISTO hold (USMP).
6/23:00	STA operations (MODE).
6/23:10	PAO opportunity.
6/23:30	CGBA termination GAP sets 4-9.
	MET DAY SEVEN
7/01:45	STA stow (MODE).
7/02:25	DTO 664.
7/02:30	DLS activation (MODE).
7/02:40	APCG check.
7/03:00	Crew begins presleep activities.
7/03:00	MEPHISTO restart (USMP).
7/04:50	DLS deactivation (MODE).
7/06:00	Crew begins sleep period.
7/14:00	Crew begins postsleep activities.
7/15:00	DLS activation (MODE).
7/17:00	DLS deactivation (MODE).
7/17:00	PSE daily operations.
7/17:30	PSE refills.
7/17:35	STA setup (MODE).
7/17:40	DTO 664.
7/18:00	BDS-A operations.
7/18:05	STA operations (MODE).

T + (PLUS) DAY/ HR:MIN:SEC	EVENT
7/18:45	DTO 667.
7/20:00	GBA end GAP set 2.
7/20:15	GBA begin GAP set 3.
7/20:45	DSO 326.
7/21:45	MEPHISTO hold (USMP).
7/22:00	STA operations (MODE).
7/23:20	PAO opportunity.
	MET DAY EIGHT
8/00:05	LDCE deactivation (close LDCE 6 and 8).
8/01:15	STA stow (MODE).
8/02:00	DLS activation (MODE).
8/02:30	DTO 664.
8/02:40	APCG check.
8/03:00	MEPHISTO restart (USMP).
8/03:00	Crew begins presleep activities.
8/04:45	DLS deactivation (MODE).
8/06:00	Crew begins sleep period.
8/14:00	Crew begins postsleep activities.
8/15:00	DLS activation (MODE).
8/17:00	Crew off duty half day.
8/21:00	MEPHISTO hold (USMP).
8/21:20	DTO 664.
8/21:50	PSE daily operations.
8/22:00	MEPHISTO restart (USMP).
8/22:15	BDS-A operations.
8/23:00	MEPHISTO hold (USMP).
8/23:00	Crew press conference.
8/23:45	DSO 326.
	MET DAY NINE
9/02:30	DLS disk change (MODE).
9/02:45	DTO 664.
9/03:00	MEPHISTO restart (USMP).
9/03:10	Crew begins presleep activities.
9/04:45	DLS deactivation (MODE).
9/06:00	Crew begins sleep period.
9/14:00	Crew begins postsleep activities.
9/15:00	DLS activation (MODE).

T + (PLUS) DAY/ HR:MIN:SEC	EVENT
9/15:15	MEPHISTO cool-down (USMP).
9/16:30	SAMS 1 check (USMP).
9/16:45	OMS-3 burn, 157 by 140 nmi (first of two firings to lower Columbia's orbit for certain OAST-2 operations).
9/16:50	SAMS recorder deactivation (USMP).
9/17:15	SAMS 1 recorder on (USMP).
9/17:30	OMS-4 burn, 140 by 139 nmi (completes lowering of Columbia's orbit for OAST-2 operations).
9/17:35	SAMS recorder deactivation (USMP).
9/17:45	DTO 664.
9/18:00	PSE daily operations.
9/18:15	BDS-A operations.
9/18:30	PSE refills.
9/18:40	RMS power-up.
9/18:55	DEE operations.
9/19:25	DSO 326.
9/20:45	SKIRT roll (OAST).
9/21:15	DEE operations.
9/23:10	EISG roll (OAST).
9/23:35	DEE operations.
	MET DAY TEN
10/00:30	SSBUV/A begins calibration.
10/01:00	DEE operations.
10/02:00	SSBUV/A ends calibration.
10/02:05	DLS disk change (MODE).
10/02:15	DTO 664.
10/02:15	Maneuver RMS to extended park position.
10/02:30	CGBA terminate GAP sets 10-15.
10/02:30	SSBUV solar view initiation.
10/02:40	PAO opportunity.
10/02:40	APCG check.
10/03:00	Crew begins presleep activities.
10/03:30	SSBUV/A solar view termination.
10/03:30	RMS power-down.
10/04:30	DLS deactivation (MODE).
10/06:00	Crew begins sleep period.
10/14:00	Crew begins postsleep activities.
10/15:00	DLS activation (MODE).

T + (PLUS) DAY/ HR:MIN:SEC	EVENT
10/16:30	AADSF furnace cool-down (USMP).
10/16:30	DTO 664.
10/16:55	PSE daily operations.
10/17:00	DSO 324 PRCS fire.
10/17:25	LBNP preparation.
10/17:30	RMS power-up.
10/17:45	DEE operations.
10/18:05	LBNP ramp operations.
10/19:00	LBNP egress.
10/19:10	DSO 326.
10/19:15	LBNP preparation.
10/19:55	LBNP ramp operations.
10/20:00	PAO opportunity.
10/20:45	LBNP egress.
10/21:05	BDS-A operations.
10/21:30	SSBUV/A calibration initiation.
10/22:45	LBNP temporary stow.
10/22:55	DEE operations.

T + (PLUS) DAY/ HR:MIN:SEC	EVENT
10/23:00	SSBUV/A ends calibration.
	MET DAY ELEVEN
11/01:00	DEE operations.
11/01:35	RMS maneuver to extended park position.
11/02:15	SSBUV/A view initiation.
11/02:25	DTO 667.
11/02:30	DLS disk change (MODE).
11/02:40	APCG check.
11/02:45	DTO 664.
11/03:00	Crew begins presleep activities.
11/03:30	SSBUV/A solar view termination.
11/03:45	SSBUV/A Earth view initiation.
11/04:10	EISG operations (OAST).
11/04:45	DLS deactivation (MODE).
11/06:00	Crew begins sleep period.
11/14:00	Crew begins postsleep activities.
11/14:00	DSO 610.
11/15:00	DLS activation (MODE).
11/15:15	SSBUV/A Earth view termination.

T + (PLUS) DAY/ HR:MIN:SEC	EVENT
11/17:00	AADSF deactivation (USMP).
11/17:00	RMS precradle.
11/17:00	DTO 664.
11/17:30	BDS-A operations.
11/18:08	OMS-5 burn, 138 by 105 nmi (further lowers one side of Columbia's orbit for OAST-2 operations).
11/18:25	PSE daily operations.
11/18:55	PSE refills.
11/19:15	LDCE activation, open LDCE 8.
11/19:25	DSO 611.
11/19:30	EISG operations (OAST).
11/19:45	LDCE activation, open LDCE 6.
11/20:15	LDCE deactivation, close LDCE 6.
11/20:25	DEE operations.
11/20:40	LDCE activation, open LDCE 7.
11/20:50	DSO 326.
11/22:30	DEE operations.

T + (PLUS) DAY/ HR:MIN:SEC	EVENT
	MET DAY TWELVE
12/00:30	PAO opportunity.
12/01:30	LDCE deactivation, close LDCE 7 and 8.
12/01:45	GBA end GAP set 3.
12/02:00	CGBA data transfer.
12/02:15	DEE closeout.
12/02:30	DLS deactivation (MODE).
12/02:30	DTO 667.
12/02:40	DLS stow (MODE).
12/02:45	DTO 664.
12/02:45	APCG check.
12/03:00	Crew begins presleep activities.
12/03:30	SSBUV/A Earth view initiation.
12/06:00	Crew begins sleep period.
12/14:00	Crew begins postsleep activities.
12/15:00	SSBUV/A Earth view termination.
12/15:40	SSBUV/A solar view initiation.
12/16:30	SSBUV/A solar view termination.
12/16:45	SSBUV/A calibration begins.

T + (PLUS) DAY/ HR:MIN:SEC	EVENT
12/17:00	CPCG deactivation.
12/17:00	FCS checkout.
12/18:00	RCS hot fire.
12/18:15	LBNP preparation.
12/18:15	SSBUV/A calibration termination and data transfer.
12/18:55	LBNP soak operations.
12/19:00	RMS power-down.
12/19:15	PSE daily operations.
12/20:00	SSBUV/A deactivation.
12/21:10	AMOS PRCS test.
12/22:25	CGBA termination, GAP sets 16-21.
12/23:25	LBNP egress.
12/23:30	APCG TES deactivation.
12/23:40	LBNP stow.
	MET DAY THIRTEEN
13/00:00	Cabin stow.
13/01:30	Ku-band antenna stow.
13/02:10	Ergometer stow.
13/03:00	Crew begins presleep activities.
13/06:00	Crew begins sleep period.
13/14:00	Crew begins postsleep activities.
13/14:00	DSO 612.
13/17:00	DTO 664.
13/17:00	MEPHISTO deactivation (USMP).
13/17:00	DSO 603.
13/17:05	IDGE deactivation (USMP).
13/17:10	Zeno deactivation (USMP).
13/17:15	DSO 326.
13/17:15	Priority Group B power-up.
13/17:20	SAMS 1 and 2 deactivation (USMP).
13/17:30	MPESS deactivation.
13/17:35	DSO 603.
13/17:40	OAST deactivation.
13/17:50	EDO deactivation.
13/18:00	Crew begins deorbit preparation.
13/18:03	CRT timer setup.
13/18:06	Commander initiates cold soak.

T + (PLUS) DAY/ HR:MIN:SEC	EVENT
13/18:15	Stow radiators, if required.
13/18:33	Commander configures DPS for deorbit preparation.
13/18:36	Mission Control Center updates IMU star pad, if required.
13/18:45	MS configures for payload bay door closure.
13/18:56	MCC-H gives "go/no-go" command for payload bay door closure.
13/19:06	Maneuver vehicle to IMU alignment attitude.
13/19:25	IMU alignment/payload bay door operations.
13/19:48	MCC gives the crew the go for OPS 3.
13/19:55	Pilot starts repressurization of SSME systems.
13/19:59	Commander and pilot perform DPS entry configuration.
13/20:08	MS deactivates ST and closes ST doors.
13/20:10	All crew members verify entry payload switch list.
13/20:25	All crew members perform entry review.
13/20:27	Crew begins fluid loading, 32 fluid ounces of water with salt over next 1.5 hours (2 salt tablets per 8 ounces).
13/20:40	Commander and pilot configure clothing.
13/20:55	MS/PS configure clothing.
13/21:06	Commander and pilot seat ingress.
13/21:08	Commander and pilot set up heads-up display (HUD).
13/21:10	Commander and pilot adjust seat, exercise brake pedals.
13/21:18	Final entry deorbit update/uplink.
13/21:24	OMS thrust vector control gimbal check is performed.
13/21:25	APU prestart.
13/21:40	Close vent doors.
13/21:44	MCC-H gives "go" for deorbit burn period.
13/21:50	Maneuver vehicle to deorbit burn attitude.
13/21:53	MS/PS ingress seats.
13/22:00	First APU is activated.
13/22:06	Deorbit burn.
13/22:09	Initiate post-deorbit burn period attitude.
13/22:13	Terminate post-deorbit burn attitude.
13/22:21	Dump forward RCS, if required.
13/22:29	Activate remaining APUs.

T + (PLUS) DAY/ HR:MIN:SEC	EVENT
13/22:34	Entry interface, 400,000 feet altitude.
13/22:39	Automatically deactivate RCS roll thrusters.
13/22:44	Automatically deactivate RCS pitch thrusters.
13/22:48	Initiate first roll reversal.
13/22:54	Initiate second roll reversal.
13/22:55	TACAN acquisition.
13/22:57	Initiate air data system (ADS) probe deploy.
13/22:58	Initiate third roll reversal.
13/23:00	Begin entry/terminal area energy management (TAEM).
13/23:00	Initiate payload bay venting.
13/23:02	Automatically deactivate RCS yaw thrusters.
13/23:05	Begin TAEM/approach/landing (A/L) interface.

GLOSSARY

A/G	air-to-ground
AA	accelerometer assembly
AADSF	Advanced Automated Directional Solidification Furnace (USMP)
ACS	active cooling system
ADACS	attitude determination and control system
ADS	air data system
AFB	Air Force base
AFD	aft flight deck
AG	airglow
A/L	approach and landing
AMOS	Air Force Maui Optical Site
AOS	acquisition of signal
APC	autonomous payload controller
APCG	Advanced Protein Crystal Growth
APCS	autonomous payload control system
APE-B	Auroral Photography Experiment B
APU	auxiliary power unit
ASE	airborne support equipment
BDS-A	Bioreactor Demonstration System A
BFS	backup flight system
BHPS	boiling heater power supply
CCD	charge-coupled device
CCTV	closed-circuit television
CDMS	command and data management subsystem
CGBA	Commercial Generic Bioprocessing Apparatus
COAS	crewman optical alignment sight
CP	condenser profile
CPCG	Commercial Protein Crystal Growth
CRIM	commercial refrigerator/incubator module
CRT	cathode ray tube
CRYOTP	Cryogenic Two-Phase (OAST)
C/W	caution/warning
DACA	data acquisition and control assembly
DA	detector assembly
DACS	data acquisition and control system
DAP	digital autopilot
DC	detector controller
DEE	dexterous end effector
DLS	dynamic load sensor (MODE)
DOD	Department of Defense
DPS	data processing system
DSO	detailed supplementary objective
DTO	development test objective
EAFB	Edwards Air Force Base
ECLSS	environmental control and life support system
ECT	Emulsion Chamber Technology (OAST)
EDO	extended-duration orbiter
EDOMP	extended-duration orbiter medical project
EHF	extremely high frequency
EISG	Experimental Investigation of Spacecraft Glow (OAST)
ELV	expendable launch vehicle
EMP	enhanced multiplexer/demultiplexer pallet
EMU	extravehicular mobility unit
EOM	end of mission
EPS	electrical power system
EPS	electrical power subsystem
ESA	European Space Agency
ESS	equipment support section
ET	external tank
ETR	Eastern Test Range

EV	extravehicular
EVA	extravehicular activity
FC	fuel cell
FCP	fuel cell power plant
FCS	flight control system
FDF	flight data file
FES	flash evaporator system
FF	flight forward
FPA	fluid processing apparatus
fps	feet per second
FRCS	forward reaction control system
FSTV	fast-scan TV
FTS	force torque sensor
GAS	getaway special experiment
GBA	getaway special bridge assembly
GLS	ground launch sequencer
GN&C	guidance, navigation, and control
GPC	general-purpose computer
GPS	Global Positioning System
GSE	ground support equipment
GSFC	Goddard Space Flight Center
HAINS	high-accuracy inertial navigation system
HRM	high-rate multiplexer
HUD	heads-up display
IDGE	Isothermal Dendritic Growth Experiment (USMP)
IFM	in-flight maintenance
IMU	inertial measurement unit
I/O	input/output
IR	infrared
ITEPC	inter-Mars tissue equivalent proportional counter (DSO 485)
IUS	inertial upper stage
IV	intravehicular
JSC	Johnson Space Center
KCA	Ku-band communications adapter (DTO 679)
KEAS	knots equivalent air speed
KSC	Kennedy Space Center
LBNP	lower body negative pressure
LCD	liquid crystal display
LDCE	Limited-Duration Space Environment Candidate Material Exposure
LES	launch escape system
LPS	launch processing system
LRU	line replaceable unit
MCC-H	Mission Control Center—Houston
MCP	microchannel plate
MDM	multiplexer/demultiplexer
MECO	main engine cutoff
MEE	magnetic end effector
MEPHISTO	Material pour L'Etude des Phenomenes Interessant la Solidification sur Terre et en Orbite (USMP)
MET	mission elapsed time
MILA	Merritt Island
MLP	mobile launcher platform
MM	major mode
MOD	Mission Operations Directorate
MODE	Middeck Zero-Gravity Dynamics Experiment
MPM	manipulator positioning mechanism
MPS	main propulsion system
MS	mission specialist
MSFC	Marshall Space Flight Center
NASA	National Aeronautics and Space Administration

NCC	corrective combination maneuver
NH	differential height adjustment that adjusts the altitude of orbiter's orbit
nm	nanometer
nmi	nautical miles
NOR	Northrup Strip
NSR	coelliptic maneuver that circularizes orbiter's orbit
O&C	operations and checkout
OAA	orbiter access arm
OARE	Orbital Acceleration Research Experiment (DTO 910)
OAST	Office of Aeronautics and Space Technology
OCP	Office of Commercial Programs
OG	orbiter glow
OMS	orbital maneuvering system
OPF	orbiter processing facility
OTC	orbiter test conductor
PAO	public affairs officer
PASS	primary avionics software system
PC	proportional counter
PCIS	passive cycle isolation system
PCMMU	pulse code modulation master unit
PCS	pressure control system
PCU	power control unit
PDI	payload data interleaver
PDU	playback/downlink unit
PGSC	payload and general support computer
PI	payload interrogator
PIC	pyro initiator controller
PILOT	portable in-flight landing operations trainer (DTO 667)
PLBD	payload bay door
PMCU	payload measurement and control unit
POCC	Payload Operations Control Center
PRCS	primary reaction control system
PRD	payload retention device
PRLA	payload retention latch assembly
PRSD	power reactant storage and distribution
PS	payload specialist
PSE	Physiological Systems Experiment
PTI	preprogrammed test input
P/TV	photo/TV
RAAN	right ascension of the ascending node
RAM	random-access memory
RCRS	regenerable carbon dioxide removal system
RCS	reaction control system
RF	radio frequency
RGA	rate gyro assembly
RMS	remote manipulator system
ROEU	remotely operated electrical umbilical
RPM	revolutions per minute
RSS	range safety system
RTLS	return to launch site
S&A	safe and arm
SA	solar array
SAF	Secretary of the Air Force
SAMPIE	Solar Array Module Plasma Interaction Experiment (OAST)
SAMS	Space Acceleration Measurement System
SDA	sealed door assembly
SHF	superhigh frequency
SKIRT	Spacecraft Kinetic Infrared Test (OAST)
sm	statute miles
SPASP	small payload accommodations switch panel
SRB	solid rocket booster
SRM	solid rocket motor
SRSS	shuttle range safety system

SSBUV/A	Shuttle Solar Backscatter Ultraviolet A
SSME	space shuttle main engine
SSP	standard switch panel
SSPP	Shuttle Small Payload Project
SSPP	solar/stellar pointing platform
SSTV	slow-scan TV
ST	star tracker
STA	structural test article
STS	Space Transportation System
SURS	standard umbilical retraction/retention system
TAEM	terminal area energy management
TAGS	text and graphics system
TAL	transatlantic landing
TDRS	Tracking and Data Relay Satellite
TDRSS	Tracking and Data Relay Satellite System
TEPC	tissue equivalent proportional counter
TES	Thermal Energy Storage (OAST)
TFL	telemetry format load
TI	thermal phase initiation burn
TIG	time of ignition
TIPS	thermal impulse printer system
TPS	thermal protection system
TRAC	targeting and reflective alignment concept
TSM	tail service mast
TT&C	telemetry, tracking, and communications
TV	television
TVC	thrust vector control
UHF	ultrahigh frequency
USMP	United States Microgravity Payload
VBAR	along the velocity vector
VRCS	vernier reaction control system
VTR	videotape recorder
WCCS	wireless crew communication system
WCS	waste collection system
Zeno	Critical Fluid Light Scattering Experiment (USMP)