

Expedition One Crew Brings the Station to Life



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Expedition One Press Kit

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Mission Overview

Expedition One Crew Brings the Station to Life

A new chapter in human space flight history will unfold with the launch of the first permanent occupants of the new International Space Station (ISS), the Expedition One crew. Scheduled for liftoff Oct. 31 at approximately 2:53 a.m. EST (7:53 GMT) on a Russian Soyuz rocket from the Baikonur Cosmodrome in Kazakhstan, Expedition Commander William Shepherd (Capt., USN), Soyuz Commander Yuri Gidzenko (Lt. Col., Russian Air Force) and Russian Flight Engineer Sergei Krikalev will dock to the ISS two days later to begin a pioneering four-month mission to prepare the facility for future scientific research.

Shepherd will become the second American to be launched in a Soyuz capsule for his fourth flight into space, following in the footsteps of Dr. Norm Thagard, who was launched on March 14, 1995, as part of the Mir 18 crew to become the first American to live and work aboard the Mir Space Station. Shepherd will be responsible for the overall success and safety of the shakedown mission. Gidzenko, who previously spent 179 days in space as Commander of the Mir, is making his second trip into space, responsible for the launch and docking of the Soyuz to the ISS. Krikalev, with 484 days in space to his credit on four previous flights, will be Flight Engineer during launch and will take the major responsibility for most Station systems. He will become the first person to visit the ISS twice, having flown on the Space Shuttle *Endeavour* in December 1998 to mate the Zarya and Unity modules in the initial ISS assembly flight.



Shepherd and Krikalev have trained for almost five years for this historic mission. Gidzenko joined the crew in 1997.

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The Expedition One crew members will return to Earth next February aboard the Space Shuttle *Discovery* at the completion of the STS-102 mission, which will bring the second resident crew to the ISS to begin scientific research in earnest following the delivery of the U.S. Laboratory *Destiny* a month earlier.

During their four months on board the Station, Shepherd, Gidzenko and Krikalev will host three visiting Shuttle crews, which will bring the large U.S. photovoltaic arrays to augment ISS power capability, the U.S. Laboratory *Destiny*, which will be the centerpiece for scientific research in the future, and the first science racks for *Destiny*, along with a variety of other key hardware. In addition to activating those systems, the Expedition One crew will unload three unmanned Russian Progress resupply vehicles, which will automatically link up to the Station's Russian module docking ports during the crew's visit.

In their first weeks on board, the Expedition One crew members will activate critical life support systems and unpack Station components, clothing, laptop computers, office equipment, cables and electrical gear left behind for them by previous Shuttle crews which conducted logistic supply flights to the new complex over the past two years. By "moving in" to their new home, Shepherd, Gidzenko and Krikalev will set the stage for a continuous human presence in space by international researchers for at least the next 15 years.

The Expedition One mission will embark from the same launch pad at the Baikonur Cosmodrome from which Yuri Gagarin was launched almost 40 years ago to become the first human to fly in space. A three-stage, 310-ton Soyuz rocket will lift the crew members to a preliminary orbit about 10 minutes after launch, enabling Gidzenko to begin a series of rendezvous maneuvers, which will lead to the capsule's docking to the aft port of the Zvezda Service Module around 4:20 a.m. EST on Nov. 2.

Ninety minutes after docking, Shepherd will open the hatch to Zvezda and the crew members will enter the complex for the first time. Their first tasks will include the activation of a food warmer in Zvezda's galley, the setup of their sleeping quarters and initial communications checks with both Mission Control in Houston and the Russian Mission Control Center in Korolev, outside Moscow.

The crew will communicate with both teams of flight controllers, using Russian communications gear in Zvezda and the Zarya module, and the S-band Early Communication gear in the U.S. Unity Module, which has been used for the past two years to allow U.S. flight controllers to command ISS systems and read Station system data when Russian ground station coverage is not available.

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In the ensuing days, Shepherd, Gidzenko and Krikalev will activate computers in Zvezda which will control ISS functions, the Vozdukh air purification system, the Elektron oxygen generation system, a water supply system which generates drinking water as the byproduct of the Elektron's operation and Station exercise equipment, which was installed during the STS-106 mission in September. During its stay on the Station, the crew will also outfit the Crew Health Care System (CheCS), an on-board medical center stocked with medicine and implements which would be used to treat an ill or injured crew member.

Shortly before the end of the year, Gidzenko and Krikalev will conduct an "internal" space walk in Zvezda's transfer compartment in Russian Orlan spacesuits, depressurizing the conical area at the forward end of the Service Module to transfer a docking cone from the port at which Zvezda linked up to Zarya, to the Zvezda's lowermost, or nadir, docking port. This will enable the linkup of the Russian Docking Compartment to that nadir port next spring. Shepherd is also cross-trained to perform the space walk, although he plans to monitor the activity from inside Zvezda.

The crew will use Greenwich Mean Time (GMT) as its time reference during the flight, designed to provide the best combination of communications coverage for both U.S. and Russian flight control teams as the ISS orbits the Earth every 90 minutes in an orbit inclined 51.6 degrees to either side of the Equator.

A typical Expedition One crew day will begin with an electronic tone wake-up call at about 12:01 a.m. Eastern time. After about two hours to read morning mail uplinked by U.S. flight controllers and a chance to clean up and have breakfast, the crew will begin its daily work which will be scheduled to provide a lunch break at midday. The crew will complete its workday by mid-afternoon with a daily planning session with the flight control teams for the following day's activities. Dinner would precede an 8 ½ to 9-hour sleep period.

The crew plans to conduct at least two tagups each day with U.S. flight controllers using the slow-scan Internet-style video capability associated with the on-board Early Communications System. Russian television will be sparse initially, but will increase as time passes with the delivery of internal television equipment for Zvezda aboard a Russian Progress resupply craft in mid-November. The U.S. KU-band communications equipment housed in the Z1 Truss structure, which was installed on the Station during the STS-92 mission, will not be activated until the second resident crew arrives early next year.

Although science activities will be somewhat modest for the Expedition One crew, there will be a schedule of experiments focusing on material and life sciences planned for its four-month mission. Those experiments include:

- Protein Crystal Growth - Enhanced Gaseous Nitrogen (PCG-EGN): The identification of molecular structures that may lead to development of new drugs, the shortening of development time and the improvement of our understanding of disease states.

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- Education - Seed Growth Kit (EDU-SGK): An educational experiment to demonstrate to schoolchildren the germination capability and growth of seeds in space. Video will be downlinked and videotaped for discussion.
- Earth Knowledge Acquired by Middle Schools (EarthKAM): An educational experiment to take high-resolution electronic images of the Earth, downlink them to schools and discuss the images with children. Students will develop research projects and specify Earth photography targets for use in their projects
- Crew Earth Observations (CEO): The crew will photograph Earth features of geological, meteorological or other interest.
- Middeck Active Control Experiment II (MACE-II): Launched on STS-106, MACE- II will validate the design for future microgravity payloads by investigating particular materials' resistance to weightlessness.
- Spatial Differences in CO2 Concentration: An experiment to determine carbon dioxide (CO2) concentrations in various locations and under different environmental conditions.
- Interim Resistive Exercise Device (IRED) Operational Use and Impact to ISS Environment: The crew will view exercise equipment operation during regularly scheduled sessions, verify that resistive exercise in the Unity module is not raising carbon dioxide and temperature levels and collect real-time crew input regarding resistive equipment operations during a scheduled exercise period.
- Treadmill Vibration Isolation System (TVIS) Feasibility of Using Different Subject Load Device Settings: An experiment to evaluate the heart rate and comfort levels of crew members during nominal aerobic treadmill usage to counteract the effects of a microgravity environment. A secondary objective is to document the effect of aerobic exercise countermeasures in the ISS environment.
- TVIS Stability While Running/Walking During Scheduled Aerobic Exercise: An experiment to assess whether the treadmill is providing the expected stability with respect to the impact of exercise on ISS structures. A secondary objective is to document the effect of aerobic exercise countermeasures in the ISS environment.
- TVIS Subject Load Device Effect on Locomotion and Heart Rate: An experiment to determine how crew members respond to various speeds and loads, document the motions of the knee and rear foot area, and document the crew member's heart rate responses. A secondary objective is to document the effect of aerobic exercise countermeasures in the ISS environment.

Several other Russian experiments will be flown to the ISS aboard visiting Progress vehicles involving research in the fields of biotechnology, biomedical research, geophysical research and engineering.

EXPEDITION ONE AT A GLANCE

Each month during their stay aboard the ISS, the Expedition One crew members will be busy with a variety of tasks regarding the assembly of the Station and the enhancement of their living and working quarters. Here is a month-by-month overview of their mission:

November:

- Soyuz Launch and Docking to ISS
- Zvezda Systems Activation
- Zvezda Outfitting
- Second Progress Resupply Ship Launch and Docking
- Progress Unloading
- Experiments
- STS-97 Launch

December:

- Second Progress Undocking
- STS-97 Docking and U.S. Solar Arrays Installation
- Solar Arrays Checkout
- STS-97 Undocking
- EVA # 1 Preparation
- Internal EVA to Move Zvezda Docking Probe
- Third Progress Resupply Ship Launch and Docking
- Experiments

January:

- Solar Arrays Checkout
- Experiments
- Progress Unloading
- Third Progress Undocking
- STS-98 Launch and Docking
- U.S. Destiny Laboratory Installation and Activation
- STS-98 Undocking
- Soyuz Repositioning from Zvezda Aft Docking Port to Zarya Nadir Port
- U.S. Destiny Laboratory Checkouts

February:

- Fourth Progress Resupply Ship Launch and Docking
- Progress Unloading
- U.S. Laboratory Destiny Checkouts
- Expedition One Crew Packs for Return to Earth
- STS-102 Launch and Docking
- Expedition One / Expedition Two Crew Handover
- STS-102 Undocking
- Expedition One Crew Returns to Earth with STS-102 Crew

Crew Profile



The first crew of the International Space Station pose aboard a Black Sea freighter following water survival training recently. From left, they are Flight Engineer and Russian Cosmonaut Sergei Krikalev; International Space Station Commander and U.S. Astronaut Bill Shepherd; and Soyuz Commander and Russian Cosmonaut Yuri Gidzenko.



The Expedition One crew pays its respects at the grave of Soviet cosmonaut Yuri Alekseyevich Gagarin (1934-1968). Entombed at Red Square, the visit to Gagarin's gravesite is customary in Russia prior to a space flight.



William Shepherd

William Shepherd (Capt., USN), 51, is the Commander for the first Expeditionary mission to the International Space Station (ISS). Named to lead the first crew to live aboard the Station in January, 1996, Shepherd will be responsible for the overall safety and success of the crew's planned four-month stay on orbit. Shepherd is making his fourth trip into space, having previously flown on three Shuttle missions. From March 1993 until his assignment to this crew, Shepherd served as Deputy Space Station Program Manager in charge of the redesign of the project. He will be in charge of the outfitting of both the U.S. and Russian modules comprising the Station during this phase of flight and the activation of Station hardware which will be delivered to the ISS during three visiting Shuttle assembly missions. Shepherd will have primary responsibility for the systems in the U.S. Laboratory "Destiny" once it is attached to the Station in January.



Yuri Gidzenko

Yuri Gidzenko (Lt. Col., Russian Air Force), 38, is the Soyuz Commander for the first Expedition crew to the International Space Station. Gidzenko is making his second trip into space, following his command of the Mir Space Station during a 179-day mission in 1995-1996 which saw a Shuttle crew deliver the Docking Module to the Russian outpost. Gidzenko will be responsible for all systems of the Soyuz capsule from launch through docking to the Station and would be responsible for guiding the Soyuz capsule to a landing should it be needed as an emergency vehicle to return the crew home in the event of a problem on orbit. Gidzenko will join crewmate Sergei Krikalev for the one planned spacewalk during the four-month mission to reposition a docking probe in the Zvezda Service Module.



Sergei Krikalev

Sergei Krikalev, 42, will serve as Flight Engineer for the first Expedition crew to the International Space Station (ISS). One of the world's most experienced space travelers, Krikalev has spent 484 days in space on his previous four space flights, including two Shuttle missions. He has conducted seven space walks and will become the first person to visit the ISS twice, having been a member of Endeavour's crew which conducted the first assembly flight to the Station to mate the Zarya and Unity modules in December, 1998 during the STS-88 mission. Krikalev will assist Soyuz Commander Yuri Gidzenko during the launch and docking phase of the flight and will be responsible for the systems in the Russian modules during the four-month mission. Krikalev will join Gidzenko for the one planned spacewalk during Expedition One to reposition a docking probe in Zvezda Service Module.

Soyuz

The Soyuz Launcher

The Soyuz is one of the world's most reliable - and frequently used - launch vehicles. More than 1,500 launches have been made with Soyuz launchers to orbit satellites for telecommunications, Earth observation, weather, and scientific missions, as well as for manned flights.

The basic Soyuz vehicle is considered a three-stage launcher in Russian terms, and is composed of:

A lower portion consisting of four boosters (first stage) and a central core (second stage).

An upper portion, consisting of the third stage, payload adapter and payload fairing.

Liquid oxygen and kerosene are used as propellants in all three Soyuz stages.

The First Stage Boosters

The first stage's four boosters are assembled laterally around the second stage central core. The boosters are identical and cylindrical-conic in shape with the oxygen tank located in the cone-shaped portion and the kerosene tank in the cylindrical portion.

An NPO Energomash RD 107 engine with four main chambers and two gimbaled vernier thrusters is used in each booster. The vernier thrusters provide three-axis flight control.

Ignition of the first stage boosters and the second stage central core occur simultaneously on the ground. When the boosters have completed their powered flight during ascent, they are separated and the core second stage continues to function.

First stage booster separation occurs when the pre-defined velocity is reached, which is about 118 seconds after liftoff.

The Second Stage

An NPO Energomash RD 108 engine powers the Soyuz second stage. This engine differs from those of the boosters by the presence of four vernier thrusters, which are necessary for three-axis flight control of the launcher after the first stage boosters have separated.

An equipment bay located atop the second stage operates during the entire flight of the first and second stages.

The Third Stage

The third stage is linked to the Soyuz second stage by a latticework structure. When the second stage's powered flight is complete, the third stage engine is ignited. Separation of the two stages occurs by the direct ignition forces of the third stage engine.

A single-turbopump RD 0110 engine from KB KhA powers the Soyuz third stage.

The third stage engine is fired for about 240 seconds, and cutoff occurs when the calculated velocity increment is reached. After cutoff and separation, the third stage performs an avoidance maneuver by opening an outgassing valve in the liquid oxygen tank.

Launcher Telemetry Tracking & Flight Safety Systems

Soyuz launcher tracking and telemetry is provided through systems in the second and third stages. These two stages have their own radar transponders for ground tracking. Individual telemetry transmitters are in each stage. Launcher health status is downlinked to ground stations along the flight path. Telemetry and tracking data are transmitted to the mission control center, where the incoming data flow is recorded. Partial real-time data processing and plotting is performed for flight following and initial performance assessment. All flight data is analyzed and documented within a few hours after launch.

Baikonur Cosmodrome launch operations

Soyuz missions use the Baikonur Cosmodrome's proven infrastructure, and launches are performed by trained personnel with extensive operational experience.

Baikonur Cosmodrome is located in the Republic of Kazakhstan in Central Asia between 45 degrees and 46 degrees North latitude and 63 degrees East longitude. Two launch pads are dedicated to Soyuz missions.

Final Launch Preparations

The assembled launch vehicle is moved to the launch pad on a horizontal rail car. Transfer to the launch zone occurs the day before launch, during which the vehicle is erected and a launch rehearsal is performed that includes activation of all electrical and mechanical equipment.

On launch day, the vehicle is loaded with propellant and the final countdown sequence is started at three hours before the liftoff time.

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Soyuz SL-4 Characteristics

FIRST STAGE DATA - BLOCKS B, V, G, D	
Engine	RD-107
Propellants	LOX/Kerosene
Thrust (tons)	102
Burn time (sec)	122
Specific impulse	314
Length (meters)	19.8
Diameter (meters)	2.68
Dry mass (tons)	3.45
Propellant mass (tons)	39.63
SECOND STAGE DATA, BLOCK A	
Engine	RD-108
Propellants	LOX/Kerosene
Thrust (tons)	96
Burn time (sec)	314
Specific impulse	315
Length (meters)	28.75
Diameter (meters)	2.95
Dry mass (tons)	6.51
Propellant mass (tons)	95.7
THIRD STAGE DATA, BLOCK I	
Engine	RD-461
Propellants	LOX/Kerosene
Thrust (tons)	30
Burn time (sec)	240
Specific impulse	330
Length (meters)	8.1
Diameter (meters)	2.66
Dry mass (tons)	2.4
Propellant mass (tons)	21.3
PAYLOAD MASS (tons)	6.8
SHROUD MASS (tons)	4.5
LAUNCH MASS (tons)	309.53
TOTAL LENGTH (meters)	49.3

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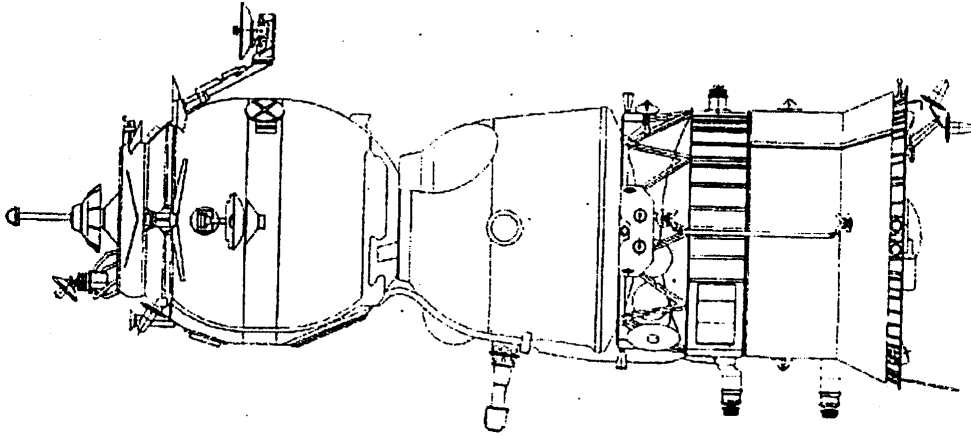
Flight 2R Mission Overview

- Mission Objective:
 - Initial Permanent Manning of ISS
- Expedition One Duration:
 - 117 days
- 2R Soyuz Vehicle Duration:
 - 188 days
- Increased Stage Functionality:
 - Transportation of Initial Crew to ISS
 - Emergency Return Capability for Crew
 - Contingency capability to perform translation maneuvers
 - Activation of essential ISS systems

Flight 2R Cargo Manifest

- Flight 2R Crew
 - William Shepherd
 - Yuri Gidzenko
 - Sergei Krikalev
- Russian Hardware
 - Vozdukh Equipment
 - FGB Cables
 - Sony Camcorder and Accessories
- US Hardware
 - Crew Dosimeter
 - Flight 2R Commemorative Kit

Soyuz TM Characteristics

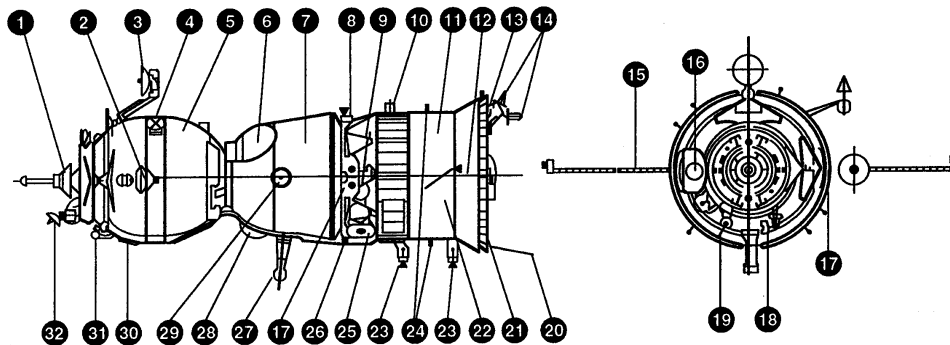


· Initial Mass	7000 Kg
· Crew - Normal/With Cargo Container	3/2
· Docking Altitude	Up to 425 Km
· Deorbit Altitude	Up to 460 Km
· Propellant	Up to 840 Kg
· Orbital Life	200 Days
· Cargo - Ascent/Descent (3 crew) Up to	30/50 Kg

Soyuz Flight 2R Program

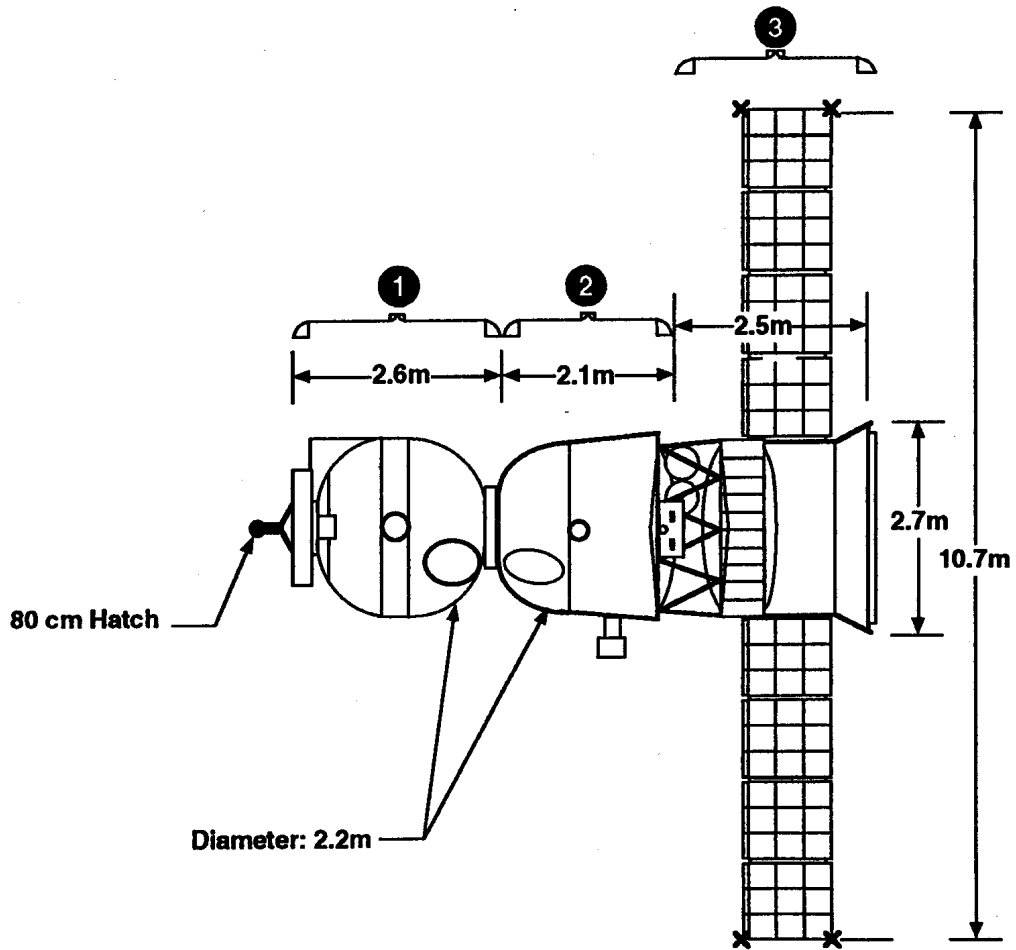
- Day 1 - Launch & insertion of Soyuz
- Checkout of docking mechanism
- Test of Kurs and MCS
- First rendezvous maneuvers
- Day 2 - Second rendezvous maneuvers
- Progress 1P departs from SM aft port
- Day 3 - Third rendezvous maneuvers
- ISS maintains inertial attitude hold for SM aft port docking
- Approach, berthing, & docking

Soyuz TM Overview (1987-present)



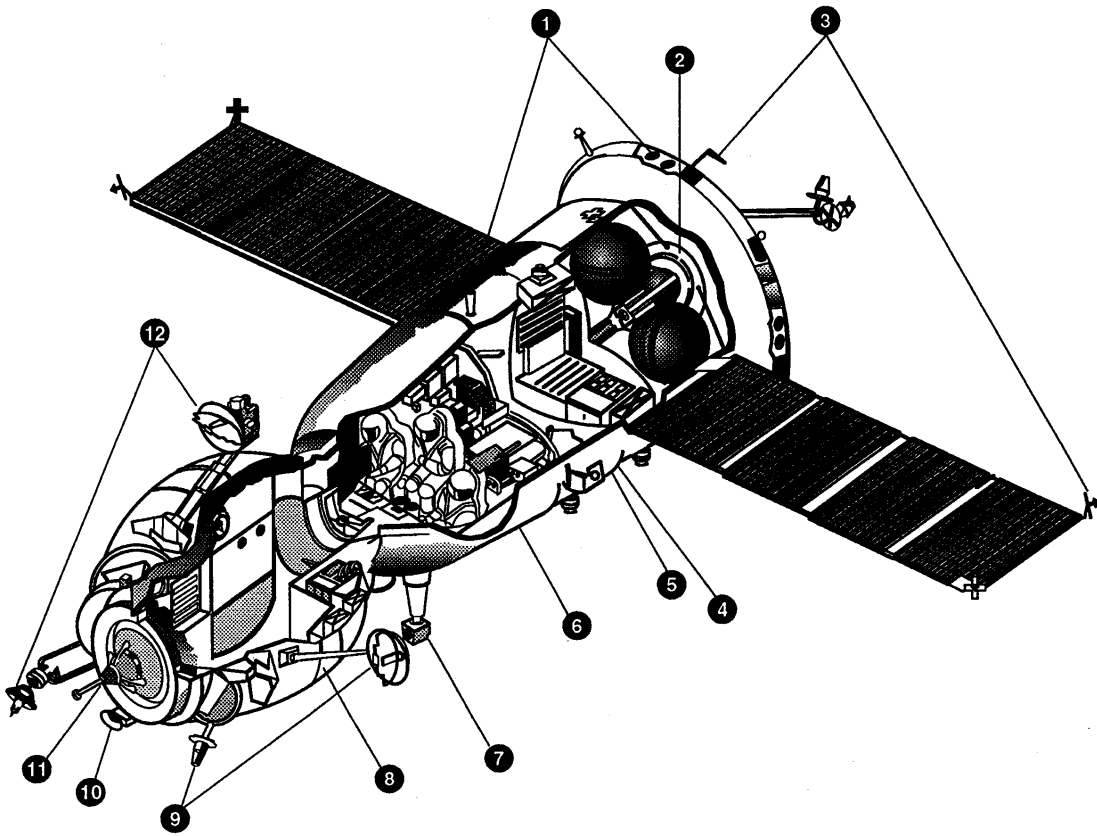
- 1 Docking probe
- 2 Approach system high-gain antenna
- 3 Approach system auto-tracking antenna
- 4 TV antenna
- 5 Orbital module
- 6 Parachute container
- 7 Descent module
- 8 Command link omni-directional antenna
- 9 Adapter
- 10 Solar sensor
- 11 Instrument unit
- 12 Hanged thermal control cold radiator
- 13 Telemetry antenna
- 14 Approach system omni-directional antenna
- 15 Solar arrays
- 16 Blister window
- 17 Attitude control thrusters
- 18 Directional light
- 19 TV camera
- 20 Voice communication antenna
- 21 Berthing/attitude control thrusters
- 22 Service module
- 23 Infrared vertical optical sensor unit
- 24 Command link antenna array element
- 25 Orbit control antenna
- 26 Berthing/Attitude control thrusters
- 27 Optical sight
- 28 Descent control thrusters unit
- 29 Descent module window
- 30 Orbit module window
- 31 Approach system omni-directional antenna
- 32 Approach system pointing antenna

Soyuz TM Components and Overall Dimensions



- 1 Orbital module
- 2 Descent module
- 3 Instrument module

Soyuz TM Features



- 1 Berthing/attitude control thrusters
- 2 Rendezvous and orbit correction thrusters
- 3 Radio antenna
- 4 Instrument service module
- 5 Orbital flight instruments
- 6 Descent module
- 7 Optical sight
- 8 Orbital module
- 9 Rendezvous system antenna
- 10 External TV camera
- 11 Docking probe
- 12 Rendezvous system antenna

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Prelaunch Countdown Timeline

T- 34 Hours	Booster is prepared for fuel loading
T- 6:00:00	Batteries are installed in booster
T- 5:30:00	State commission gives go to take launch vehicle
T- 5:15:00	Crew arrives at site 254
T- 5:00:00	Tanking begins
T- 4:20:00	Spacesuit donning
T- 4:00:00	Booster is loaded with liquid oxygen
T- 3:40:00	Crew meets delegations
T- 3:10:00	Reports to the State commission
T- 3:05:00	Transfer to the launch pad
T- 3:00:00	Vehicle 1 st and 2 nd stage oxidizer fueling complete
T- 2:35:00	Crew arrives at launch vehicle
T- 2:30:00	Crew ingress through orbital module side hatch
T- 2:00:00	Crew in reentry vehicle
T- 1:45:00	Reentry vehicle hardware tested; suits are ventilated
T- 1:30:00	Launch command monitoring and supply unit prepared
	Orbital compartment hatch tested for sealing
T- 1:00:00	Launch vehicle control system prepared for use; gyro instruments activated
T - :45:00	Launch pad service structure halves are lowered
T- :40:00	Reentry vehicle hardware testing complete; leak checks performed on suits
T- :30:00	Emergency escape system armed; launch command supply unit activated
T- :25:00	Service towers withdrawn
T- :15:00	Suit leak tests complete; crew engages personal escape hardware auto mode
T- :10:00	Launch gyro instruments uncaged; crew activates on-board recorders
T- 7:00	All prelaunch operations are complete
T- 6:15	Key to launch command given at the launch site
	Automatic program of final launch operations is activated
T- 6:00	All launch complex and vehicle systems ready for launch
T- 5:00	Onboard systems switched to onboard control
	Ground measurement system activated by RUN 1 command
	Commander's controls activated
	Crew switches to suit air by closing helmets
	Launch key inserted in launch bunker
T- 3:15	Combustion chambers of side and central engine pods purged with nitrogen
T- 2:30	Booster propellant tank pressurization starts
	Onboard measurement system activated by RUN 2 command
	Prelaunch pressurization of all tanks with nitrogen begins

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T- 2:15	Oxidizer and fuel drain and safety valves of launch vehicle are closed
	Ground filling of oxidizer and nitrogen to the launch vehicle is terminated
T- 1:00	Vehicle on internal power
	Automatic sequencer on
	First umbilical tower separates from booster
T- :40	Ground power supply umbilical to third stage is disconnected
T- :20	Launch command given at the launch position
	Central and side pod engines are turned on
T- :15	Second umbilical tower separates from booster
T- :10	Engine turbopumps at flight speed
T- :05	First stage engines at maximum thrust
T- :00	Fueling tower separates
	Lift off

Ascent/Insertion Timeline

T- :00	Lift off
T+ 1:10	Booster velocity is 1640 ft/sec
T+ 1:58	Stage 1 (strap-on boosters) separation
T+ 2:00	Booster velocity is 4921 ft/sec
T+ 2:40	Escape tower and launch shroud jettison
T+ 4:58	Core booster separates at 105.65 statute miles
	Third stage ignites
T+ 7:30	Velocity is 19,685 ft/sec
T+ 9:00	Third stage cut-off
	Soyuz separates
	Antennas and solar panels deploy
	Flight control switches to Kaliningrad Mission Control

Orbital Insertion to Docking Timeline

FLIGHT DAY 1 OVERVIEW	
Orbit 1	Post insertion: Deployment of solar panels, antennas and docking probe
	- Crew monitors all deployments
	- Crew reports on pressurization of OMS/RCS and ECLSS systems and crew health. Entry thermal sensors are manually deactivated
	- Ground provides initial orbital insertion data from tracking
Orbit 2	Systems Checkout: IR Att Sensors, Kurs, Angular Accels, "Display" TV Downlink System, OMS engine control system, Manual Attitude Control Test
	- Crew monitors all systems tests and confirms onboard indications
	- Crew performs manual RHC stick inputs for attitude control test
	- Ingress into HM, activate HM CO2 scrubber and doff Sokols
	- A/G, R/T and Recorded TLM and Display TV downlink
	- Radar and radio transponder tracking
	Manual maneuver to +Y to Sun and initiate a 2 deg/sec yaw rotation. MCS is deactivated after rate is established.
Orbit 3	Terminate +Y solar rotation, reactivate MCS and establish LVLH attitude reference (auto maneuver sequence)
	- Crew monitors LVLH attitude reference build up
	- Burn data command upload for DV1 and DV2 (attitude, TIG Delta V's)
	- Form 14 preburn emergency deorbit pad read up
	- A/G, R/T and Recorded TLM and Display TV downlink
	- Radar and radio transponder tracking
	Auto maneuver to DV1 burn attitude (TIG - 8 minutes) while LOS
	- Crew monitor only, no manual action nominally required
	DV1 phasing burn while LOS
	- Crew monitor only, no manual action nominally required
Orbit 4	Auto maneuver to DV2 burn attitude (TIG - 8 minutes) while LOS
	- Crew monitor only, no manual action nominally required
	DV2 phasing burn while LOS
	- Crew monitor only, no manual action nominally required
	Crew report on burn performance upon AOS
	- HM and DM pressure checks read down
	- Post burn Form 23 (AOS/LOS pad), Form 14 and "Globe" corrections voiced up

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	- A/G, R/T and Recorded TLM and Display TV downlink
	- Radar and radio transponder tracking
	Manual maneuver to +Y to Sun and initiate a 2 deg/sec yaw rotation. MCS is deactivated after rate is established.
	External boresight TV camera ops check (while LOS)
	Meal
Orbit 5	Last pass on Russian tracking range for Flight Day 1
	Report on TV camera test and crew health
	Sokol suit clean up
	- A/G, R/T and Recorded TLM and Display TV downlink
	- Radar and radio transponder tracking
Orbit 6-12	Crew Sleep, off of Russian tracking range
	- Emergency VHF2 comm available through NASA VHF Network
FLIGHT DAY 2 OVERVIEW	
Orbit 13	Post sleep activity, report on HM/DM Pressures
	Form 14 revisions voiced up
	- A/G, R/T and Recorded TLM and Display TV downlink
	- Radar and radio transponder tracking
Orbit 14	Configuration of RHC-2/THC-2 work station in the HM
	- A/G, R/T and Recorded TLM and Display TV downlink
	- Radar and radio transponder tracking
Orbit 15	THC-2 (HM) manual control test
	- A/G, R/T and Recorded TLM and Display TV downlink
	- Radar and radio transponder tracking
Orbit 16	Lunch
	- A/G, R/T and Recorded TLM and Display TV downlink
	- Radar and radio transponder tracking
Orbit 17 (1)	Terminate +Y solar rotation, reactivate MCS and establish LVLH attitude reference (auto maneuver sequence)
	RHC-2 (HM) Test
	- Burn data uplink (TIG, attitude, delta V)
	- A/G, R/T and Recorded TLM and Display TV downlink
	- Radar and radio transponder tracking
	Auto maneuver to burn attitude (TIG - 8 min) while LOS
	Rendezvous burn while LOS
	Manual maneuver to +Y to Sun and initiate a 2 deg/sec yaw rotation. MCS is deactivated after rate is established.
Orbit 18 (2)	Post burn and manual maneuver to +Y Sun report when AOS
	- HM/DM pressures read down
	- Post burn Form 23, Form 14 and Form 2 (Globe correction) voiced up
	- A/G, R/T and Recorded TLM and Display TV downlink
	- Radar and radio transponder tracking
Orbit 19 (3)	CO2 scrubber cartridge change out

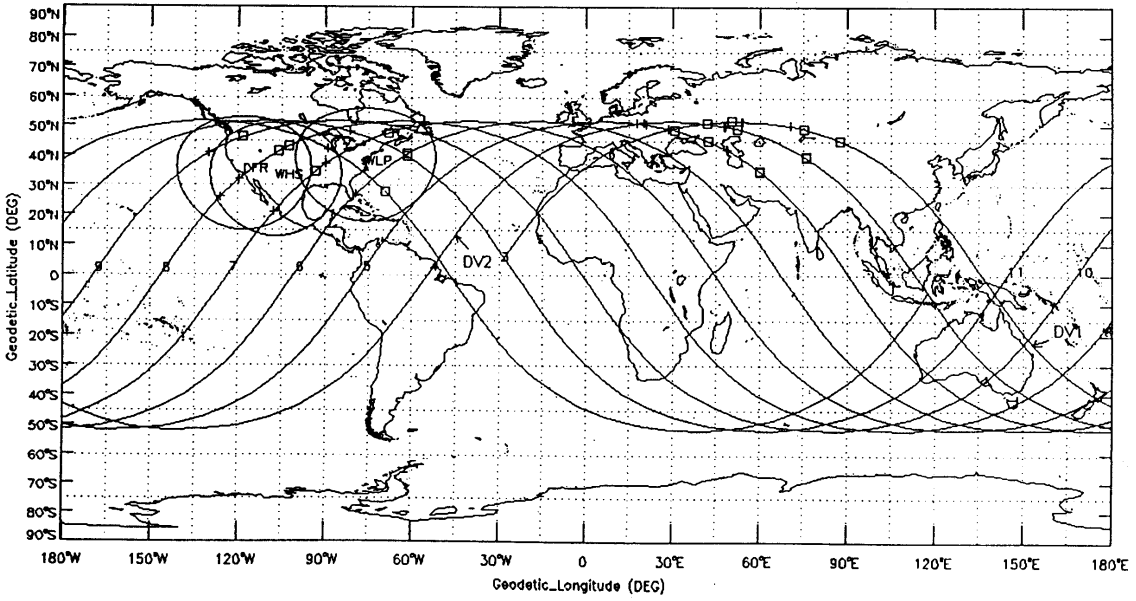
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	Free time
	- A/G, R/T and Recorded TLM and Display TV downlink
	- Radar and radio transponder tracking
Orbit 20 (4)	Free time
	- A/G, R/T and Recorded TLM and Display TV downlink
	- Radar and radio transponder tracking
Orbit 21 (5)	Last pass on Russian tracking range for Flight Day 2
	Free time
	- A/G, R/T and Recorded TLM and Display TV downlink
	- Radar and radio transponder tracking
Orbit 22 (6) - 27 (11)	Crew sleep, off of Russian tracking range
	- Emergency VHF2 comm available through NASA VHF Network
FLIGHT DAY 3 OVERVIEW	
Orbit 28 (12)	Post sleep activity
	- A/G, R/T and Recorded TLM and Display TV downlink
	- Radar and radio transponder tracking
Orbit 29 (13)	Free time, report on HM/DM pressures
	- Read up of predicted post burn Form 23 and Form 14
	- A/G, R/T and Recorded TLM and Display TV downlink
	- Radar and radio transponder tracking
Orbit 30 (14)	Free time, read up of Form 2 "Globe Correction," lunch
	- Uplink of auto rendezvous command timeline
	- A/G, R/T and Recorded TLM and Display TV downlink
	- Radar and radio transponder tracking
FLIGHT DAY 3 AUTO RENDEZVOUS SEQUENCE	
Orbit 31 (15)	Don Sokol spacesuits, ingress DM, close DM/HM hatch
	- Active and passive vehicle state vector uplinks
	- A/G, R/T and Recorded TLM and Display TV downlink
	- Radio transponder tracking
Orbit 32 (16)	Terminate +Y solar rotation, reactivate MCS and establish LVLH attitude reference (auto maneuver sequence)
	Begin auto rendezvous sequence
	- Crew monitoring of LVLH reference build and auto rendezvous timeline execution
	- A/G, R/T and Recorded TLM and Display TV downlink
	- Radio transponder tracking

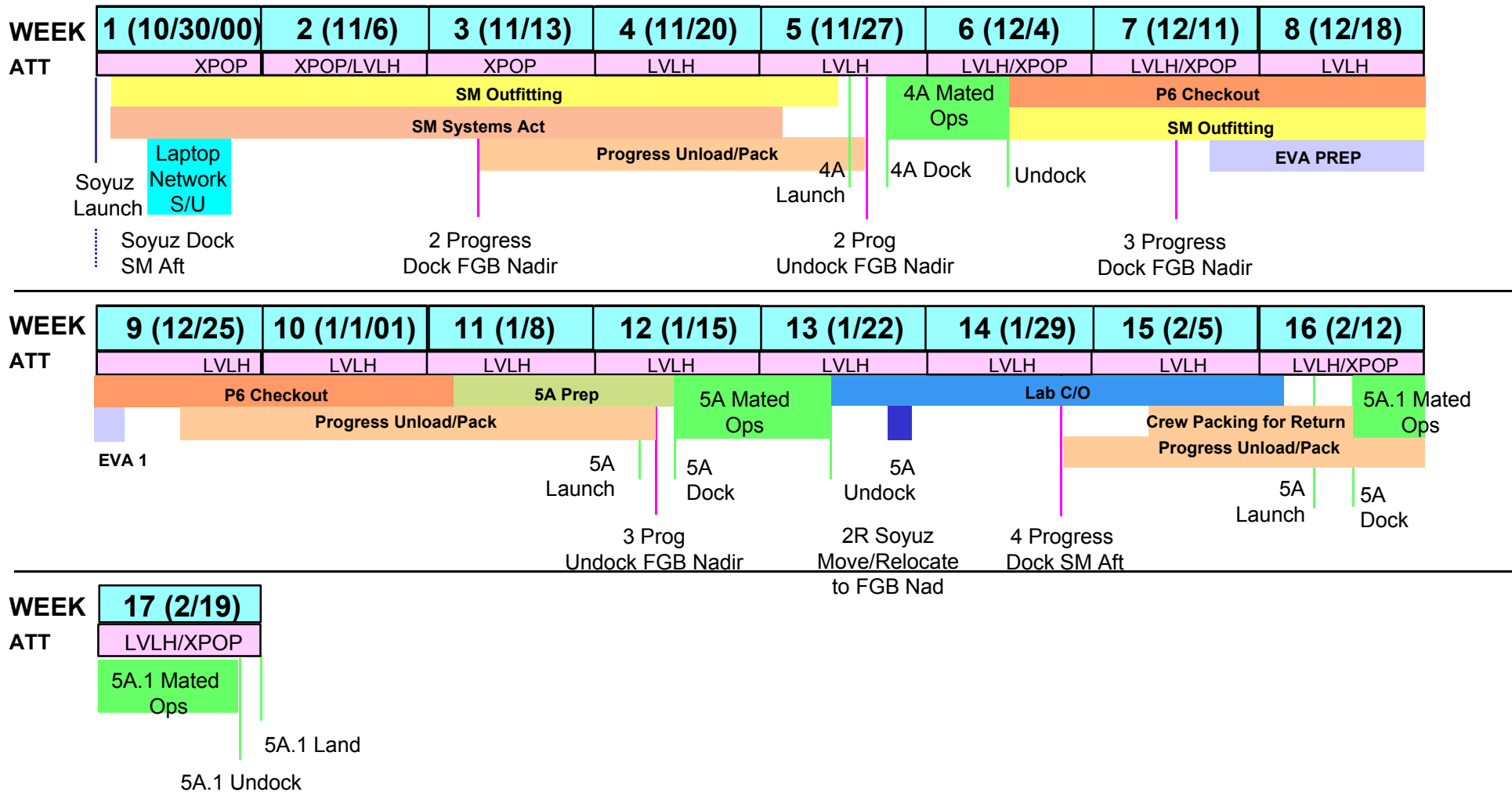
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FLIGHT DAY 3 FINAL APPROACH AND DOCKING	
Orbit 33 (1)	Auto Rendezvous sequence continues, flyaround and station keeping
	- Crew monitor
	- Comm relays via SM through Altair established
	- Form 23 and Form 14 updates
	- Fly around and station keeping initiated near end of orbit
	- A/G (gnd stations and Altair), R/T TLM (gnd stations), Display TV downlink (gnd stations and Altair)
	- Radio transponder tracking
Orbit 34 (2)	Final Approach and docking
	- Capture to "docking sequence complete" 20 minutes, typically
	- Monitor docking interface pressure seal
	- Transfer to HM, doff Sokol suits
	- A/G (gnd stations and Altair), R/T TLM (gnd stations), Display TV downlink (gnd stations and Altair)
	- Radio transponder tracking
FLIGHT DAY 3 STATION INGRESS	
Orbit 35 (3)	Station/Soyuz pressure equalization
	- Report all pressures
	- Open transfer hatch, ingress station
	- A/G, R/T and playback telemetry
	- Radio transponder tracking

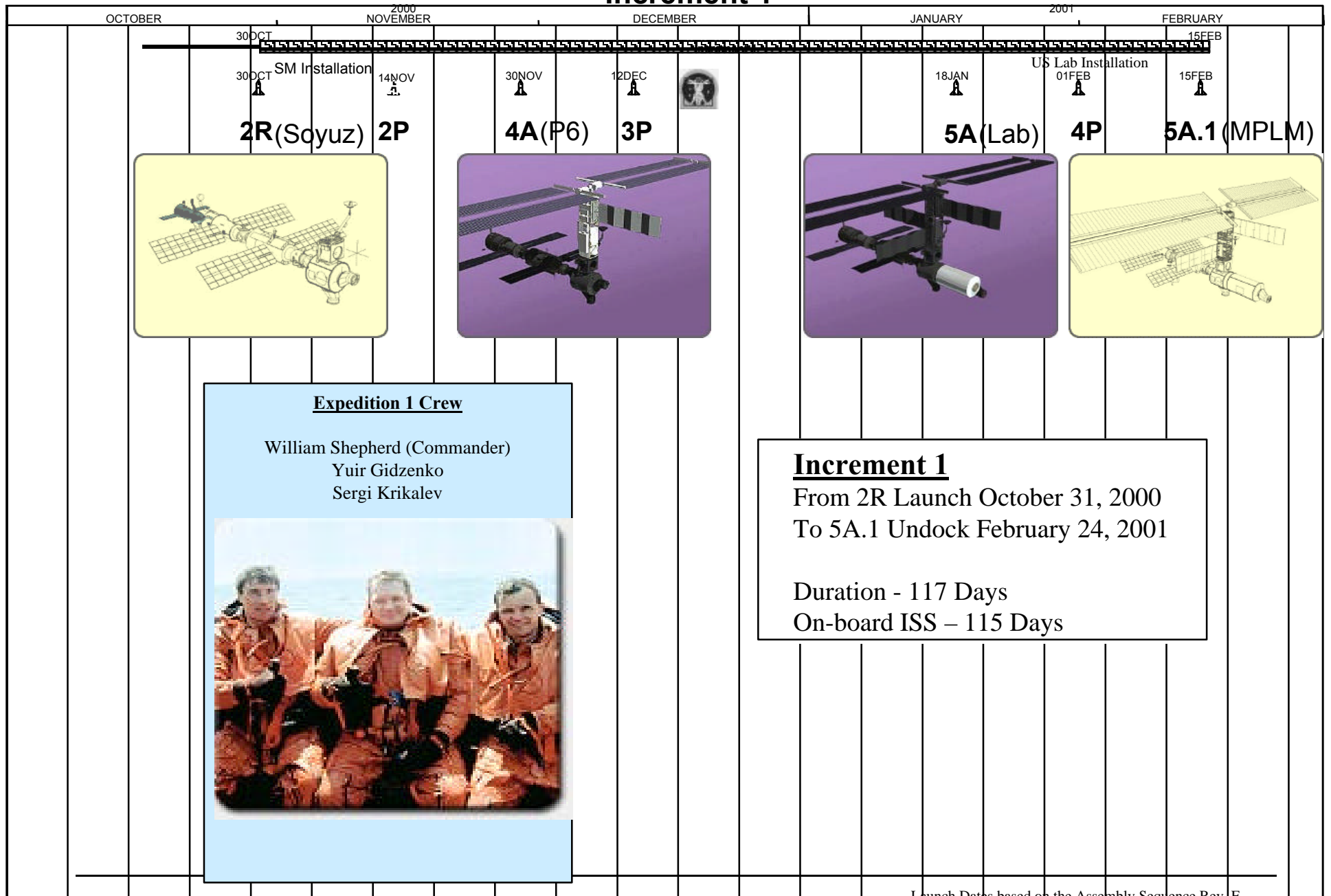
Typical Soyuz Ground Track



Increment 1 Activity Overview

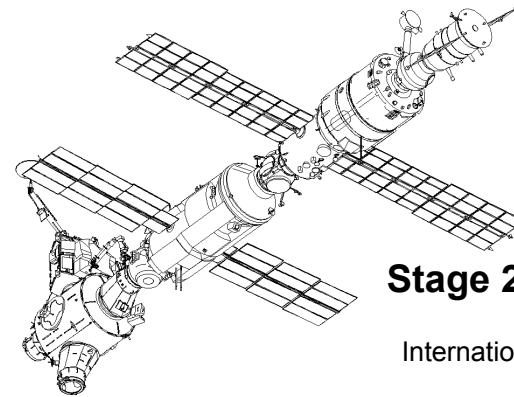


Increment 1



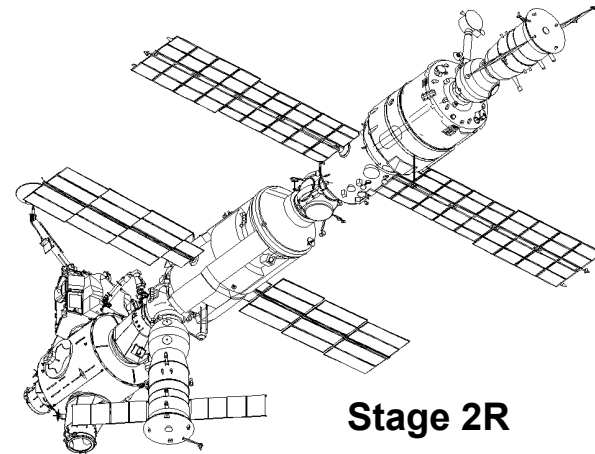
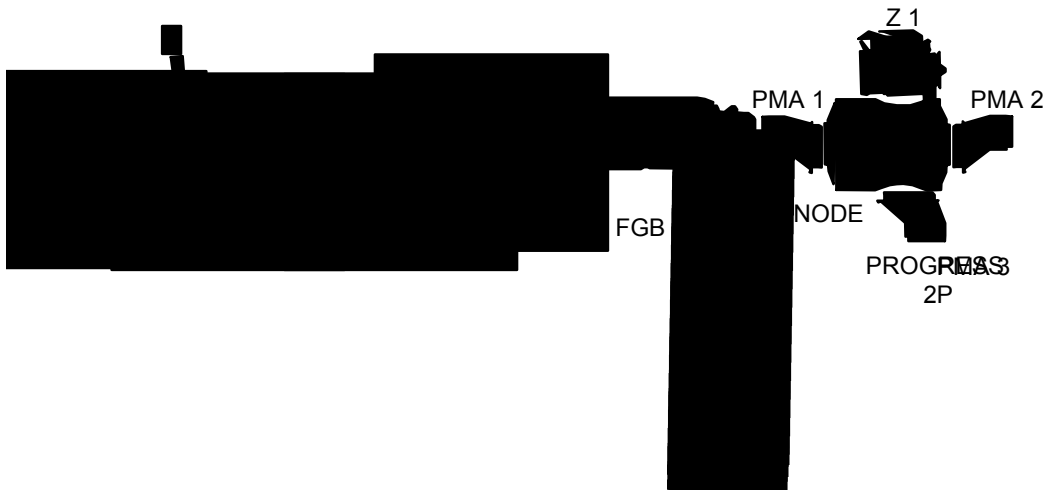
Launch Dates based on the Assembly Sequence Rev. F

Increment 1 Configurations



Stage 2R

11/1/2000
 Three-Person Permanent
 International Human Presence Capability
 Soyuz (1S) TM docked



Stage 2R

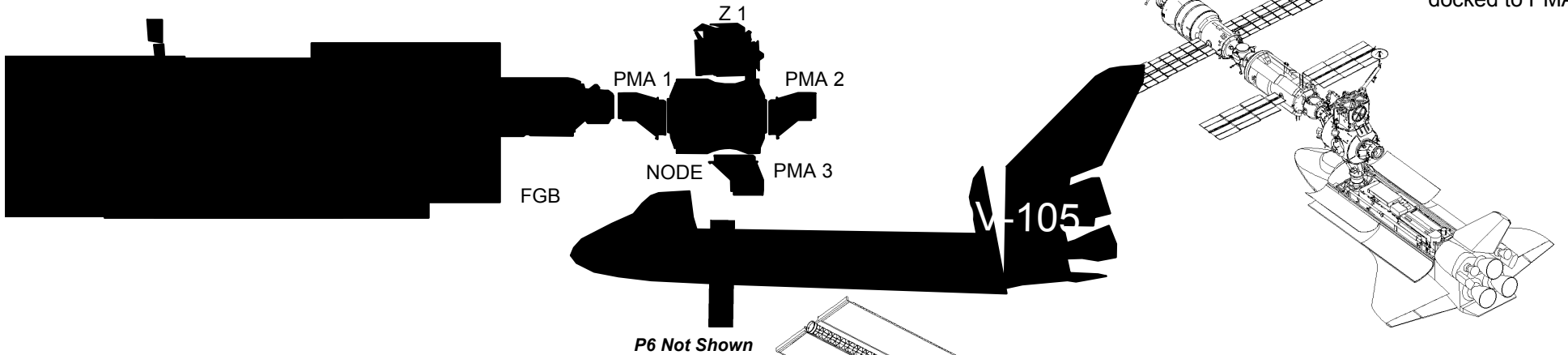
11/16/2000
 Progress 2P Arrival



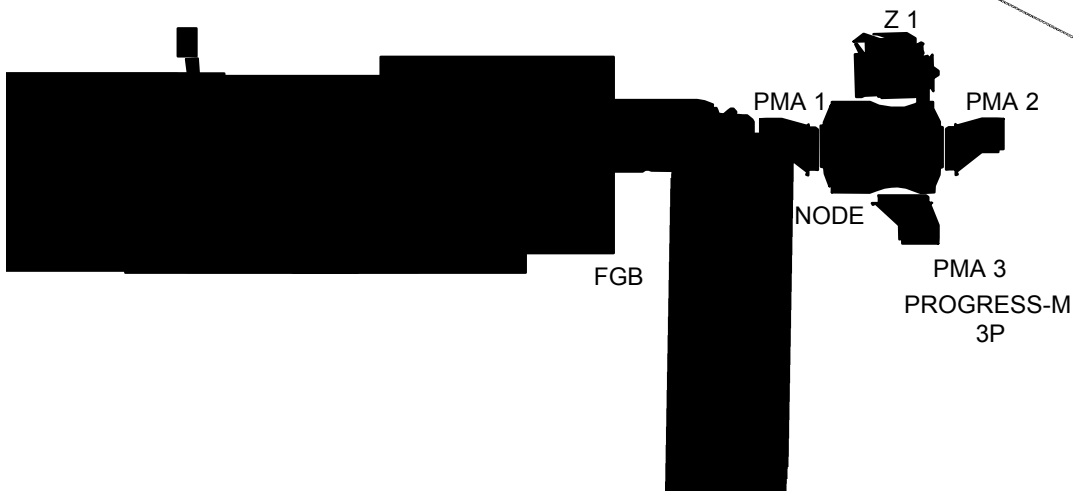
Increment 1 Configuration

Flight 4A 12/2/2000

Flight 4A with Orbiter
STS-105/Endeavor
docked to PMA 3.



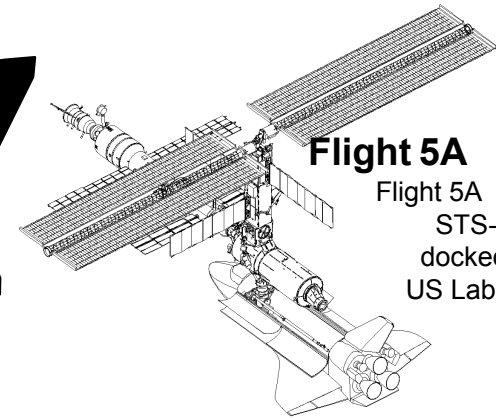
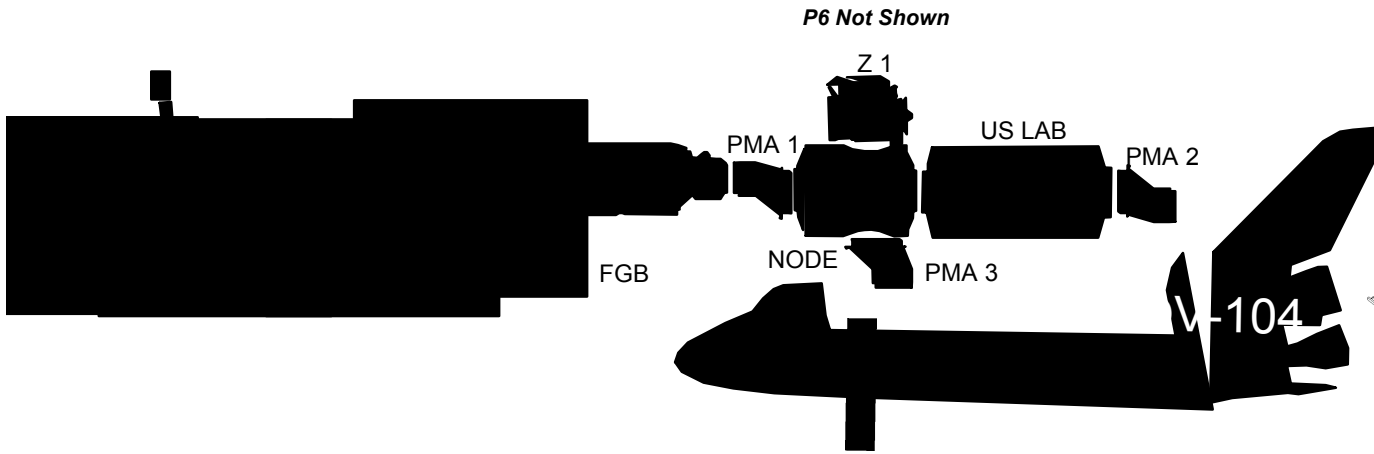
P6 Not Shown



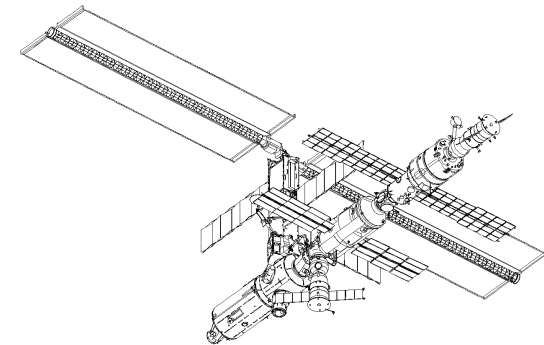
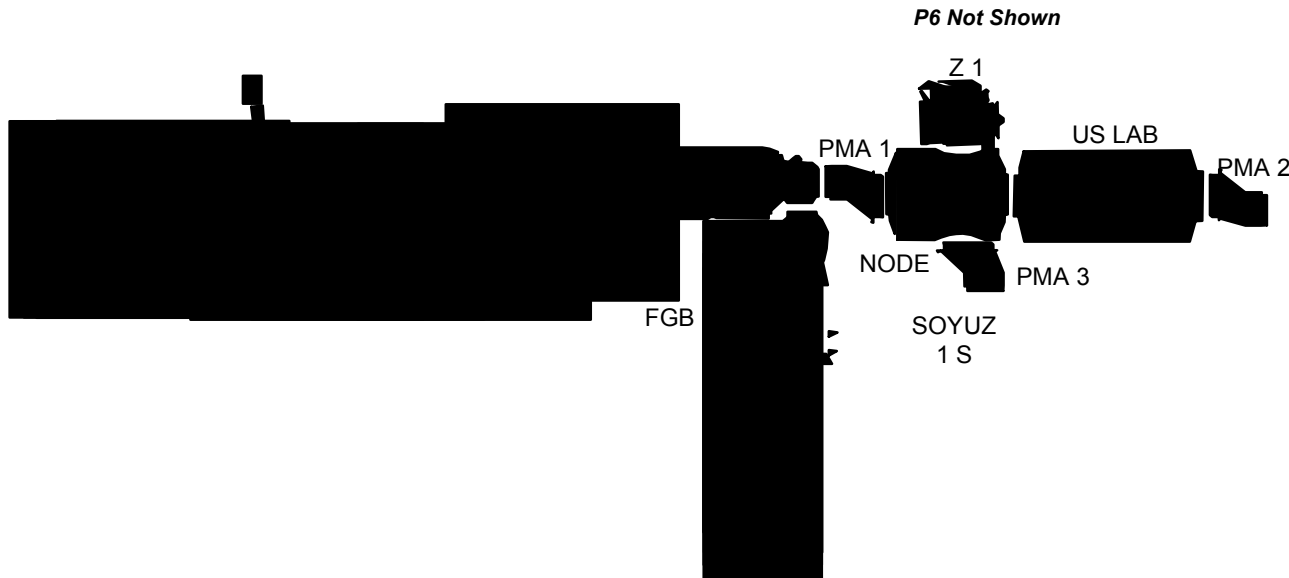
Stage 4A 12/14/2000

Progress-M 3P docked

Increment 1 Configuration

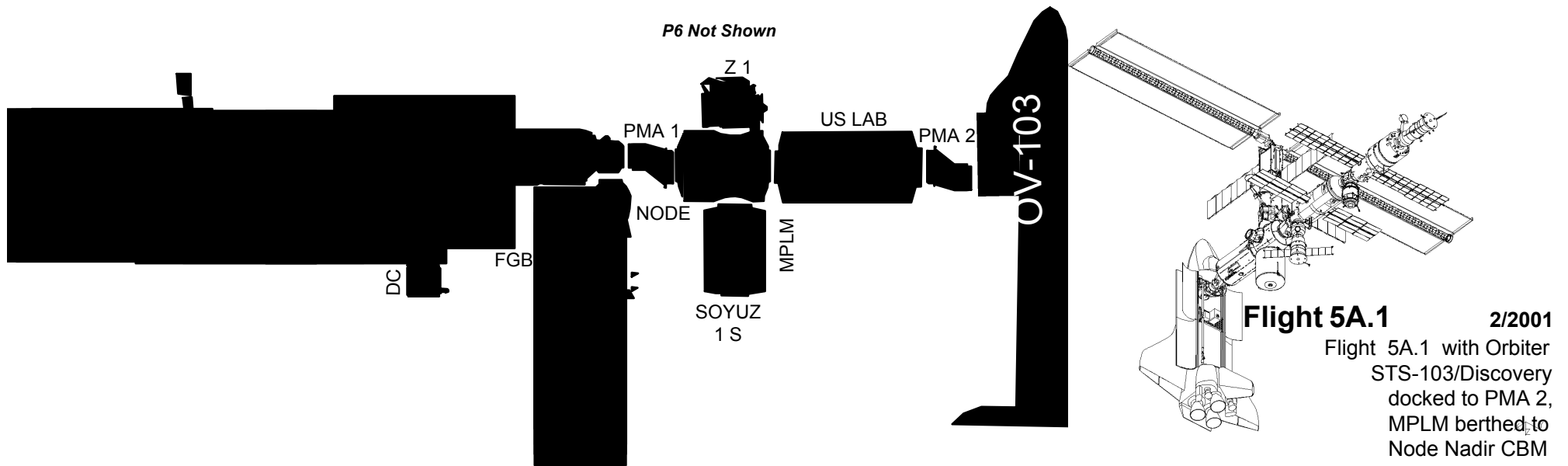


Flight 5A 1/20/2001
 Flight 5A with Orbiter STS-104/Atlantis docked to PMA 3, US Lab and PMA 2 moved



Stage 5A 2/2001
 Progress-M1 4P docked
 Soyuz Re-docked to FGB Nadir Port

Increment 1 Configuration



Stage and Flight Objectives

Stage 2R (2R-4A)

1. Dock 1 Soyuz TM to the Zvezda aft
2. Activate Zvezda systems and outfitting
3. Progress M1 docked to the Zarya nadir port (transfer cargo and prop)
4. Provide EVA capability from the Zvezda transfer compartment.
5. Perform reboost as required.
6. 2 Progress departure prior to 4A docking

Flight 4A

1. Install and activate P6 solar array (Shuttle crew) to deliver power from USOS to RS
2. Establish S-Band low rate communications.
3. Obtain full access to Unity
4. Perform IMAX/ICBC3D activities

Stage and Flight Objectives

Stage 4A (4A-5A)

1. Perform orbit checkout and monitor P6
2. 3 Progress M1 docked to the Zarya nadir port (transfer cargo and prop)
3. Perform Zvezda outfitting and RS logistics and maintenance.
4. Perform RS EVA to transfer docking cone to the Zvezda nadir port for 4R launch.
5. Perform US Payloads: MACE II, Education (Seeds) and Crew Earth Observations

Russian Payloads to be performed through Increment 1:

Glycoproteide-K, Mimetic-K, Biodegradation, Bioecology, Bioemulsion, Sprut, Paradont, Cardio, Prognoz, Bradoz, Massoperenos, Relaxation, Uragan (Hurricane), Molniya-SM, Identification, Meteoroid, Tensor, IZGIB (Curve), Privyazka (Incorporation), Iskazheniye (Distortion), Plasma crystal-3, SPD, Global Time System (GTS).

Stage and Flight Objectives

Flight 5A

1. Install and activate US Lab, Destiny
2. Provide power distribution and high rate S-Band communication capability..
3. Provide active thermal control and environmental control to USOS.
4. Transfer of command and data handling from Unity to Destiny.
5. Transfer of vehicle attitude control from Zvezda to Destiny.
6. Move Pressurized Mating Adapter(PMA)2 to Destiny to support 5A.1 docking

Stage 5A (5A-5A.1)

1. Relocate 1 Soyuz TM from Zvezda aft to Zarya nadir
2. Dock 4 Progress M1 to the Zvezda aft port.
3. Perform Zvezda outfitting and RS logistics and maintenance.
4. Perform IMAX3D, Russian payloads and US payloads (Crew Earth Observation and EarthKAM)

2R Stage Mission Priorities

1. Deliver first ISS crew on 1 Soyuz TM.
 2. Activate all ISS systems needed for crew life support.
 3. Dock 2 Progress M1 to the Zarya Nadir Port
 4. Perform critical ISS outfitting tasks
-
- American and Russian food warmers
 - Vozdukh system
 - Central post workstation No. 1
 - Elektron-VM system
 - Air conditioner 1
 - Toilet (???) (compressor-M)
 - Teleoperator control system & TV
 - U. S. EPCS/SSC/OCA lan network
 - Air flow sensors in the Zvezda (6 units)
 - Condensate water processor
 - Zvezda audio subsystem (CTTC)
 - Onboard computer system
 - Russian medical equipment
 - CHeCS (Ambulatory Medical Pack (AMP), the Advanced Life Support Pack (ALSP), and Crew Contamination Protection Kit (CCPK))
 - Treadmill Vibration Isolation System (TVIS)
 - Interim Resistive Exercise Device (IRED)
 - Gas analyzer hardware
 - Thermal control system
 - Onboard measurement TLM subsystem
 - Second thermal control system
 - Zarya message acquisition system
 - Air flow sensors in the Zarya (3 units)
 - Satellite navigation equipment
 - Zarya hatch protective covers

2R Stage Mission Priorities

5. 2 Progress M1 cargo and propellant transfer.
6. Replace the Zvezda onboard computer system software version.
7. Perform reboost of ISS (as required).
8. Perform other ISS outfitting tasks
 - IMS baseline ISS inventory.
 - Equipment launch restraint removal.
 - ISS Ham radio setup in the Zarya
9. Zarya free drift modification.
10. Undock 2 Progress M1 from Zarya nadir port. Undocking must occur on the first set of Russian ground site passes after 4A Shuttle launch.
11. Perform on orbit checkout of ISS systems.
12. Perform CHeCS and Periodic Fitness Evaluation
13. Perform air quality monitoring
14. Perform acoustics monitoring
15. Perform Zvezda airlock and Orlan suit checkout, and training prior to 4A EVA #1.

Benefits

Why build the International Space Station?

When studying sound, you go into a quiet room. When studying light, you go into a dark room. When studying the effects of gravity, you'd like to go into an "anti-gravity" room. Since there's no such thing on Earth, we have the International Space Station.

By flying around the Earth at about 17,500 mph, the station and everything in it remain in orbit, a continuous free fall around the planet. In orbit, forces are balanced and the effects of gravity are essentially removed. The result is microgravity, one of the unique aspects of the ISS environment that holds the hope of new discovery. The ISS thus allows long-term exposure to a world nearly unexplored.

Gravity affects everything. From our bodies, to the materials we use to build cars and buildings, to the flames we use to heat our homes, our world is controlled by gravity. For as long as we have curiously investigated our surroundings, we have been limited, until recently, to accepting gravity as a given in all our studies. History shows that changing what once were constants can lead to revolutionary discoveries.

The 19th Century saw temperature and pressure controlled in new ways to harness steam power and revolutionize the way we live. The 21st Century offers the hope of controlling gravity's effects to understand why things behave the way they do. Observing and understanding this behavior is key to new discoveries in many scientific disciplines and using that knowledge is key to the betterment of life on Earth.

The Space Station Mir gave us a platform for long-term microgravity research, and important knowledge about how to live and work in space. Like all research, we must proceed one step at a time. As we open one door, answering one question, we are faced with the opportunity of more doors, more questions.

The ISS is the next step in that journey of discovery, and represents a quantum leap in our capability to conduct research on orbit. In space, electrical power is key to the quantity and quality of research. When complete, the ISS's enormous solar arrays will supply 60 times more power for science than did Mir. This, coupled with the large space available for experiments, will provide scientists with unprecedented access to this unique environment.

Aboard the ISS, and through interaction from the ground, scientists will explore basic questions in the fields of biotechnology, biomedical research and countermeasures, fluid physics, fundamental biology, materials science, combustion science, fundamental physics, Earth science and space science. Space-based research will be supported by research on the ground, with selection of only those experiments requiring the microgravity environment selected for flight on the ISS.

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In addition to serving as a research laboratory, the ISS will sustain and strengthen U.S. leadership in other areas. It will provide opportunity to enhance U.S. economic competitiveness and create new commercial enterprises. Companies can use ISS research to build profit-based businesses.

The ISS will maintain the U.S. leadership in space exploration that has inspired a generation of Americans and people throughout the world. Tied in with other NASA assets, the ISS will serve as a virtual classroom in space to the benefit of educators and students alike. Live educational events and programs like EarthKAM (with students operating a camera on the ISS beginning next fall to investigate changes on Earth, will motivate students to understand their world.

Education and inspiration will couple to maintain U.S. economic leadership by raising a new generation of science, math, and technology savvy children that will invent 21st century products and services. Finally, the ISS will serve as a testbed and springboard for further exploration of space. We will learn how the human body responds to the long-term exposure to space, and how to best prepare for the next major human steps into the solar system.

Research on the International Space Station

Early Research Disciplines:

Biomedical Research and Countermeasures: Researchers seek to understand and control the effects of the space environment on space travelers (e.g. muscle atrophy, bone loss, fluid shifts, etc.).

- **Long term Benefits:** enhance the safety of space travel; develop methods to keep humans healthy in low-gravity environments; advance new fields of research in the treatment of diseases.

Fundamental Biology: Scientists study gravity's influence on the evolution, development, growth, and internal processes of plants and animals. Their results expand fundamental knowledge that will benefit medical, agricultural, and other industries.

- **Long term Benefits:** advance understanding of cell, tissue, and animal behavior; use of plants as sources of food and oxygen for exploration; improved plants for agricultural and forestry.

Biotechnology: Microgravity allows researchers to grow three-dimensional tissues that have characteristics more similar to tissues in the body than has ever been previously available and to produce superior protein crystals for drug development.

- **Long term Benefits:** culture realistic tissue for use in research (cancerous tumors, organ pieces); provide information to design a new class of drugs to target specific proteins and cure specific diseases.

Fluid Physics: The behavior of fluids is profoundly influenced by gravity. Researchers use gravity as an experimental variable to explain and model fluid behavior in systems on Earth and in space.

- **Long term Benefits:** improved spacecraft systems designs for safety and efficiency; better understanding of soil behavior in Earthquake conditions; improved mathematical models for designing fluid handling systems for, powerplants, refineries and innumerable other industrial applications.

Additional Research Disciplines (later in the life of ISS):

Advanced Human Support Technology: Researchers develop technologies, systems, and procedures to enable safe and efficient human exploration and development of space.

- **Long term Benefits:** reduce the cost of space travel while enhancing safety; develop small, low power monitoring and sensing technologies with applications in environmental monitoring in space and on Earth; develop advanced waste processing and agricultural technologies with applications in space and on Earth.

Materials Science: Researchers use low gravity to advance our understanding of the relationships among the structure, processing and properties of materials. In low gravity, differences in weight of liquids used to form materials do not interfere with the ability to mix these materials opening the door to a whole new world of composite materials.

- **Long term Benefits:** advance understanding of processes for manufacturing semiconductors, metals, ceramics, polymers, and other materials; determine fundamental physical properties of molten metal, semiconductors, and other materials with precision impossible on Earth.

Combustion Science: The removal of gravity allows scientists to simplify the study of complex combustion (burning) processes. Since combustion is used to produce 85 percent of Earth's energy, even small improvements in efficiency and reduction of soot production (a major source of pollution on earth) will have large environmental and economic benefits.

- **Long term Benefits:** enhance efficiency of combustion processes; enhance fire detection and safety on Earth and in Space; improve control of combustion emissions and pollutants.

Fundamental Physics: Scientists use the low gravity and low temperature environment to slow down reactions allowing them to test fundamental theories of physics with degrees of accuracy that far exceed the capacity of Earthbound science.

- **Long term Benefits:** challenge and expand theories of how matter organizes as it changes state (important in understanding superconductivity); test fundamental theories in physics with precision beyond the capacity of Earth-bound science; potential for improved magnetic materials.

Earth Science and Space Science: Space Station will be a unique platform with multiple exterior attach points from which to observe the Earth and the Universe.

- **Long term Benefits:** Space Scientists will use the location above the atmosphere to collect and search for cosmic rays, cosmic dust, antimatter and “dark” matter. Earth Scientists can obtain global profiles of aerosols, ozone, water vapor, and oxides in order to determine their role in climatological processes and take advantage of the longevity of ISS to observe global changes over many years.

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Media Assistance

NASA Television Transmission

NASA Television is available through the GE2 satellite system which is located on Transponder 9C, at 85 degrees west longitude, frequency 3880.0 MHz, audio 6.8 MHz.

The schedule for television transmissions from the orbiter and for mission briefings will be available during the mission at Kennedy Space Center, FL; Marshall Space Flight Center, Huntsville, AL; Dryden Flight Research Center, Edwards, CA; Johnson Space Center, Houston, TX; and NASA Headquarters, Washington, DC. The television schedule will be updated to reflect changes dictated by mission operations.

Status Reports

Status reports on countdown and mission progress, on-orbit activities and landing operations will be produced by the appropriate NASA newscenter

Briefings

A mission press briefing schedule will be issued before launch. During the mission, status briefings by a flight director or mission operations representative and when appropriate, representatives from the payload team, will occur at least once each day. The updated NASA television schedule will indicate when mission briefings are planned.

Internet Information

Information is available through several sources on the Internet. The primary source for mission information is the NASA Human Space Flight Web, part of the World Wide Web. This site contains information on the crew and its mission and will be updated regularly with status reports, photos and video clips throughout the flight. The NASA Shuttle Web's address is:

<http://spaceflight.nasa.gov>

General information on NASA and its programs is available through the NASA Home Page and the NASA Public Affairs Home Page:

<http://www.nasa.gov>

or

<http://www.nasa.gov/newsinfo/index.html>

Shuttle Pre-Launch Status Reports

<http://www-pao.ksc.nasa.gov/kscpao/status/stsstat/current.htm>

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Information on other current NASA activities is available through the Today@NASA page:

<http://www.nasa.gov/today/index.html>

The NASA TV schedule is available from the NTV Home Page:

<http://spaceflight.nasa.gov/realdata/nasatv/schedule.html>

Resources for educators can be found at the following address:

<http://education.nasa.gov>

Access by Compuserve

Users with Compuserve accounts can access NASA press releases by typing "GO NASA" (no quotes) and making a selection from the categories offered.

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The following video products are available and provide additional information and insight into the development of the International Space Station

International Space Station Video Progress Report – October 2000

Reference Master# 619221

JSC#1852

TRT: 7:16

Producer: Streeter

10/23/00

This Progress Report recaps the work completed on the station, showing real station hardware in space. Included are Zarya and Unity, the first station components and the two flights that brought logistics to these modules. Next, the video shows the launch of Zvezda and explains the importance of this first living quarters on the station. We get to see the actual Zvezda module in orbit with video from the STS-106 logistics mission. Also included is actual on-orbit video from STS-92, the mission that delivered the Z1 truss and PMA3.

The video shifts gears and explains what's next for the station- introducing the audience to Expedition 1, the first station crew. Animation illustrates how future components will allow the station to grow in both size and power- creating the largest spacecraft ever built.

ISS-IAF Conference Video

Ref. Master 618957

TRT: 7:30

Producer: Streeter

6/19/00

This "video wallpaper" is a complete rundown of the ISS program set to music. Actual video of ISS assembly and outfitting missions is squeezed into a box while titles below describe the flight, date and hardware particular to that mission. Includes flights from 1998-2000, up to STS-106, to outfit the Service Module Zvezda. Animation carries the video to assembly complete.

ISS General Resource Reel, August 2000

Reference Master: 618987

JSC# 1846

Runtime: 50:44

Producer: Streeter

This latest edition includes ISS Animation of the complete station, then continues with actual video of station missions, starting with the launch of Zarya and continuing with STS-88 (first assembly mission 2A), STS-96 (station mission 2A.1) and STS-101 (2A.2A). Footage includes spacewalks, work inside the station and fly-around views.

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New to the tape is actual footage of **Zvezda launch, Zvezda docking** and **docking of the Russian Progress** supply vehicle to the space station. The tape continues with animation of future missions and actual video of future station hardware including: **Z-1 truss and PMA3**, solar panels, long spacer, **U.S. Lab (Destiny)**, Multi-Purpose Logistics Modules **Leonardo and Raffaello**, **Canadian Space Station Robot Arm**, Airlock, Japanese Experiment module and Hab module. The tape also includes training video of the first station crew, Expedition 1 and the latest assembly sequence animation.

Replaces ISS General Resource Reel July 2000 Reference Master: 618326 JSC# 1833

Expedition 1 Resource Reel August 2000

08/01/00

Ref. Master: 619005

TRT: 1hour, 15minutes

Producers: Baird/Streeter

Update to the Expedition 1 Resource Reel, featuring animation of the Soyuz spacecraft that will deliver the crew to the station. Deorbit training inside the Shuttle mockup at JSC, Underwater training at both the Russian Hydrolab in Star City, and the Neutral Buoyancy Lab at JSC. The tape continues with training in the Soyuz mockup in Russia, Shepherd inside the Service Module Zvezda Trainer, archive footage of a historic Soyuz rocket launch with a Soyuz capsule in space, crew training in the Black Sea, archive footage of Shepherd touring early Service Module, water shuttle survival training at JSC, touring inside the MCC in Houston, touring training facilities at JSC, and training with computer systems. The tape finishes with archive shots of Shepherd, Krikalev and Gidzenko past shuttle and Mir flights, winter survival training, food tasting in the JSC food lab and EVA tool training.

Replaces Expedition 1 Resource Reel August 1998 JSC#1756

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