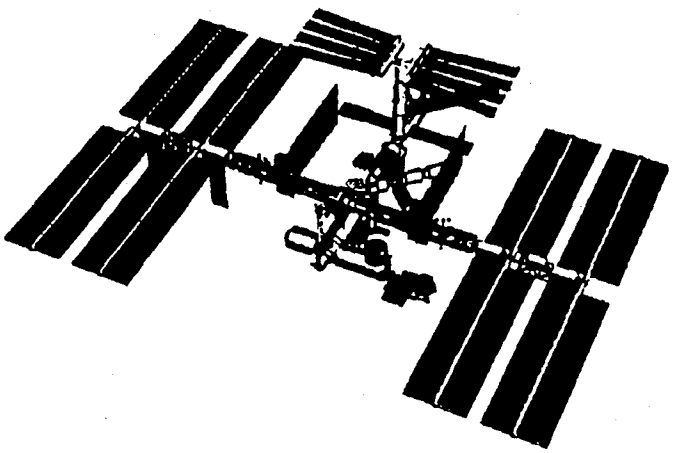
NASA Facts

National Aeronautics and
Space Administration

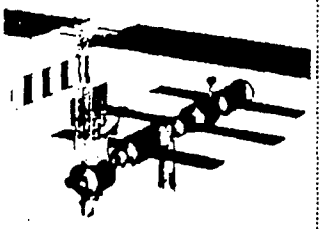
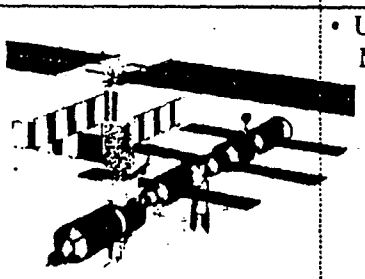
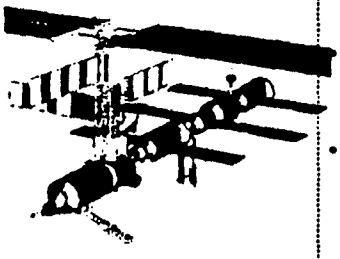
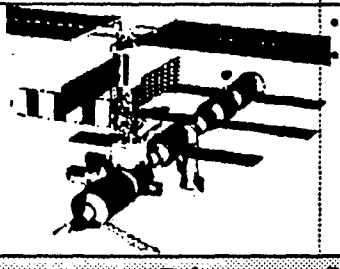
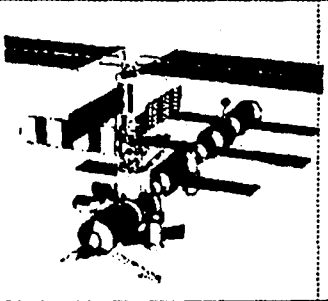
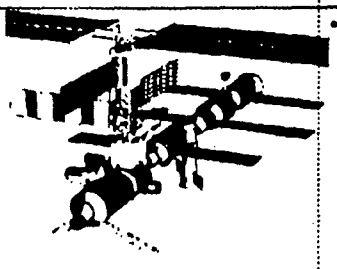
Lyndon B. Johnson Space Center
Houston, Texas 77058

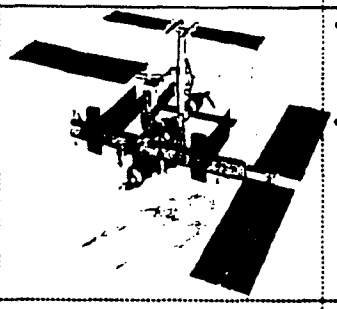
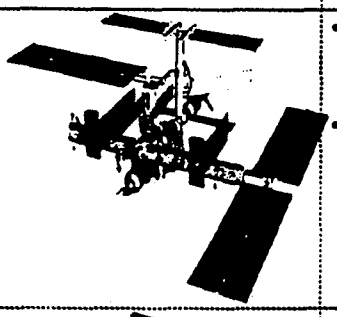
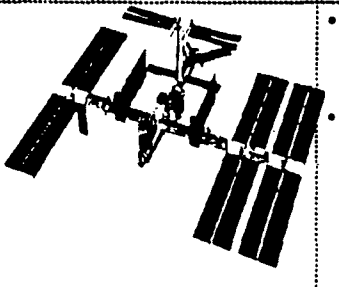
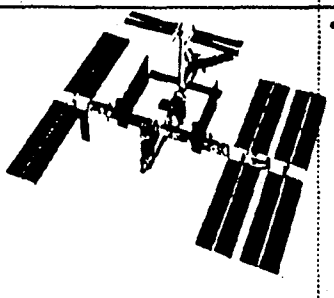
International Space Station **June 1998**

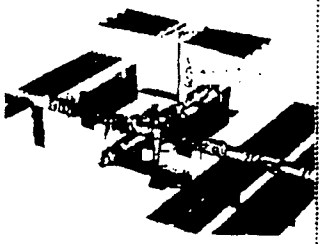
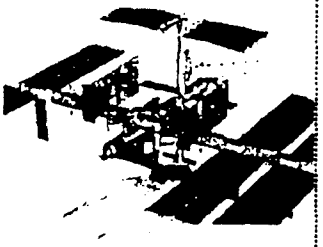
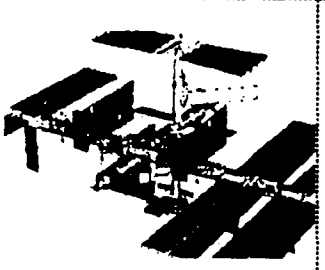
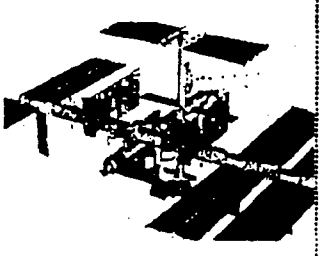
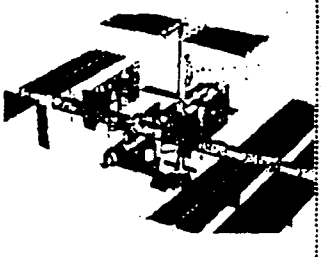
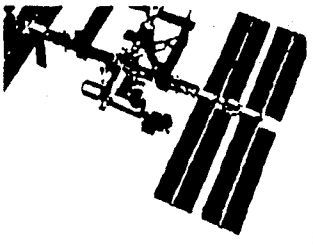
INTERNATIONAL SPACE STATION ASSEMBLY SEQUENCE (5/31/98: Revision D)

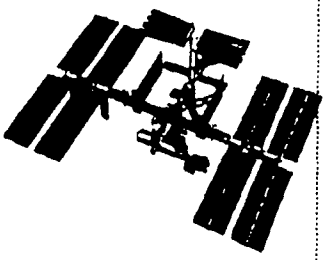


Note: Some issues in this assembly sequence remain under review and will be resolved at a Space Station Control Board meeting in September 1998. Missions with open issues are noted in italics.

Date	Flight	Launch Vehicle	Configuration	Element(s)	Rationale
Aug 1999	4A	US Space Shuttle (STS-97)		• Integrated Truss Structure P6 • Photovoltaic Module • Radiators	• Provides first US solar power with solar arrays and batteries, called photovoltaic (PV) module. • First PV module installed temporarily on Z1 truss until after 13A when can be moved to P5 truss. • Two radiators provide early cooling, called photovoltaic (PV) Thermal Control System (TCS) radiators. Also, S-band communications system is activated for voice and telemetry.
Oct 1999	5A	US Space Shuttle (STS-98)		• U.S. Laboratory Module	• Provides initial US user capability. • Launched with 5 system racks already installed inside of the module. • Control Moment Gyroscopes are activated with delivery of electronics in lab, providing electrically powered attitude control.
Dec 1999	6A	US Space Shuttle (STS-99)		• MPLM (U.S. Lab outfitting) Ultra High Frequency (UHF) antenna • Space Station Remote Manipulator System (SSRMS)	• Italian-built Multi-Purpose Logistics Module (MPLM) carries 6 system racks and 2 storage racks to be installed in U.S. Lab. • UHF antenna provides space-to-space communications capability for US-based spacewalks. • Delivers Canadian SSRMS (station mechanical arm) needed to perform assembly operations on later flights.
Jan 2000	7A	US Space Shuttle (STS-100)		• Joint Airlock • High Pressure Gas Assembly	• Airlock provides station-based Extravehicular Activity (EVA) spacewalking capability for both US and Russian spacesuits. • High pressure gas assembly supports spacewalk operations and augments the Service Module gas resupply system.
			Phase II Complete		
Mar 2000	4R	Russian Soyuz Rocket		• Docking Compartment Module-1 (DCM-1)	• Provides additional egress, ingress location for Russian-based spacewalks and a Soyuz docking port.
Mar 2000 some flight details still under review	*7A.1*	*US Space Shuttle (STS-102)*		• *MPLM*	• *U.S. stowage racks and International Standard Payload Racks (ISPRs) carried in MPLM.*

Date	Flight	Launch Vehicle	Configuration	Element(s)	Rationale
April 2001 *some flight details still under review*	*3R*	*Russian Proton Rocket*		• *Universal Docking Module*	• *Provides docking locations for Russian Research Modules and a Docking Compartment (DC2) delivered on Flight 5R. The module also provide additional life support systems capabilities.*
May 2001	12A	US Space Shuttle (STS-111)		• Second port truss segment (ITS P3/P4) • Solar array and batteries	• Delivers second port truss segment (P3/P4 truss) to attach to first port truss segment (P1 truss). • Central cooling radiators, delivered earlier on flights 9A and 11A, are deployed from first starboard (S1 truss) port (P1) truss segments. • Exterior attachments for Brazilian Unpressurized Logistics Carriers (ULCs) are delivered.
May 2001 *some flight details still under review*	*5R*	*Russian Soyuz Rocket*		• *Docking Compartment 2 (DC2)*	• *Provides an improved Russian airlock.*
June 2001	12A.1	US Space Shuttle (STS-112)		• Third port truss segment (ITS P5) • Multi-Purpose Logistics Module	• Delivers third port truss segment (P5 truss) to attach to second port truss segment (P3/P4 truss).
June 2001	13A	US Space Shuttle (STS-113)		• Second starboard truss segment (ITS S3/S4) • Solar array set and batteries (Photovoltaic Module)	• The second starboard truss segment (S3/S4 truss) is attached along with a third set of solar arrays. • Four external attachment sites for truss-mounted exterior experiments and research are delivered.
Sep 2001	10A	US Space Shuttle (STS-114)		• Node 2	• The second of three station connecting modules, Node 2, attaches to end of U.S. Lab and provides attach locations for the Japanese laboratory, European laboratory, the Centrifuge Accomodation Module and later Multi-Purpose Logistics Modules • Primary docking location for the Shuttle will be a pressurized mating adapter attached to Node 2.

Date	Flight	Launch Vehicle	Configuration	Element(s)	Rationale
Aug 2002	14A	US Space Shuttle (STS-120)		• Cupola • Science Power Platform (SPP) Solar Arrays • Service Module Micrometeroid and Orbital Debris Shields (SMMOD)	• Cupola with eight windows provides station crev with direct viewing capability for some robotics operations, spacewalks and experiments. • Two additional Russian Science Power Platform (SPP) Solar Arrays complete the arrays on the SPP. SPP arrays and exterior debris shielding foi Service Module (SMMOD) are carried on Brazilian-provided Unpressurized Logistics Carrier (ULC).
Aug 2002	8R	Russian Soyuz Rocket		• Research Module 1	• Delivers first of two Russian laboratories providing experiment and research facilities.
Sep 2002	UF-5	US Space Shuttle (STS-121)		• Multi-Purpose Logistics Module • Express Pallet	• Provides for experiment delivery, resupply and changeout. • Multi-Purpose Logisitcs Module carries inside experiment equipment racks. • Express Pallet carries external experiment equipment.
Oct 2002	20A	US Space Shuttle (STS-122)		• Node 3	• Delivers third node as conecting module for station (Node 3) to be attached underneath Unity node (Node 1). • Inside of Node 3 are 2 avionics racks and 2 life support system racks. • Node 3 provides attachment points for the U.S. Habitation Module, U.S. Crew Return Vehicle, pressurized mating adapter, and any future station additions.
Nov 2002 some flight details still under review	*10R*	*Russian Soyuz Rocket*		• *Research Module 2*	• *Delivers a second Russian laboratory to house experiments and research facilities.*
Nov 2002 target date, flight details still under review	*17A*	*US Space Shuttle (STS-123)*		• *Multi-Purpose Logistics Module* • *Node 3, U.S. Lab racks*	• *Delivers racks for Node 3 that allow expansion of station crew from three members to up to six members.* • *Outfits Node 3 with racks carried in MPLM: 2 life support system racks; 2 flight crew equipment racks (waste collection system and galley) and 3 Crew Health Care System racks.* • *For U.S. Lab, delivers 1 systems rack, 1 stowage rack and experiment racks.*

Date	Flight	Launch Vehicle	Configuration	Element(s)	Rationale
Jan 2004	16A	US Space Shuttle (STS-131)		• U.S. Habitation Module	• Delivers U.S. Habitation Module to enhance crew accomodations and provide for a station crew with as many as seven members.

NOTES:

- ***Additional Progress, Soyuz, possible H-II Transfer Vehicle and Automated Transfer Vehicle flights for crew transport, logistics and resupply are not listed.***

5/9/99

International Space Station Assembly Sequence

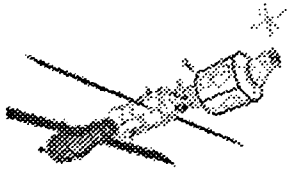
1A/R

Control Module

2A

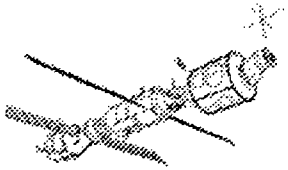
Node 1 and Pressurized Mating Adapters 1 and 2

1R



Service Module

2A.1



Logistics Flight (Spacehab)

3A

Integrated Truss Structure (ITS) Z1, PMA-3, Comm., Control Moment Gyros

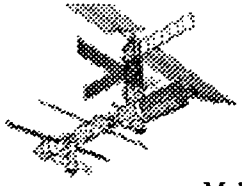
2R

Soyuz

4A

ITS P6 (Power and Thermal)

5A

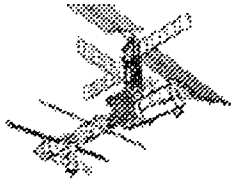


U.S. Lab

6A

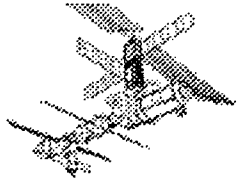
Multi-Purpose Logistics Module (MPLM) (Lab outfitting flight), Comm., and Space Station Remote Manipulating System

7A



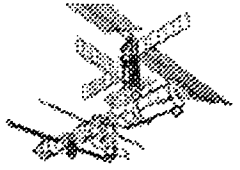
Joint Airlock and High Pressure Gas Assembly

7A.1



Logistics Flight (MPLM)

4R



Docking Compartment 1

UF1

Payload Racks (MPLM) and Power

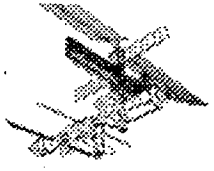
8A

ITS S0 and Mobile Transporter

UF2

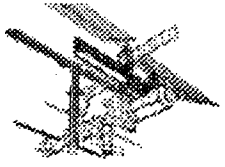
Payload & Lab System Racks (MPLM)

9A



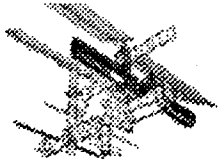
ITS S1Thermal

9A.1



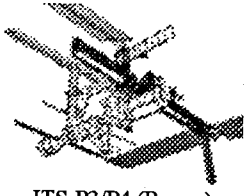
Russian Science Power Platform with 4 Arrays

11A



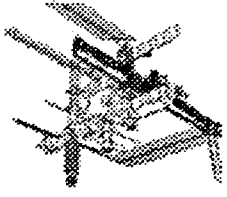
ITS P1 (Thermal)

12A



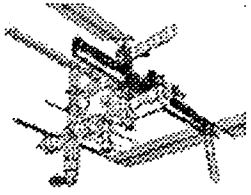
ITS P3/P4 (Power)

3R



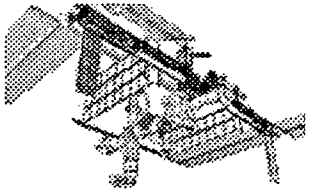
Universal Docking Module

5R



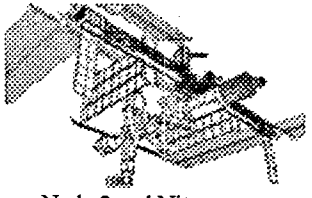
Docking Compartment 2

13A



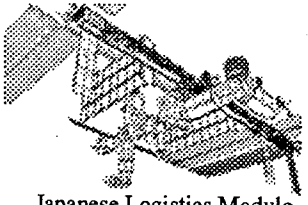
ITS S3/S4 (Power)

10A



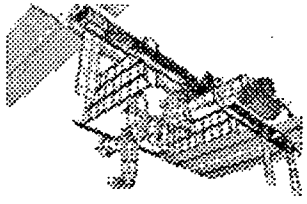
Node 2 and Nitrogen Tank Assembly

1J/A



Japanese Logistics Module, ITS P5, High Pressure O2 tanks

1J



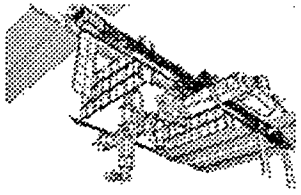
Japanese Lab

A=American flights R=Russian flights UF=Utilization Flight J=Japanese flights E=European flights

5/4ay

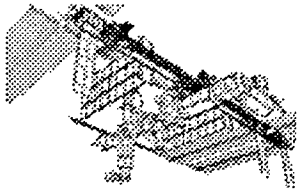
International Space Station Assembly Sequence

UF3



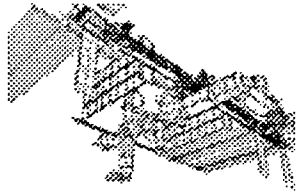
Payload Racks (MPLM)

UF4



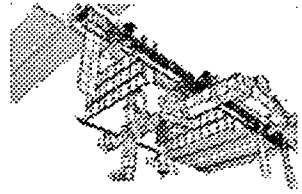
Attached Payload Sites

2J/A



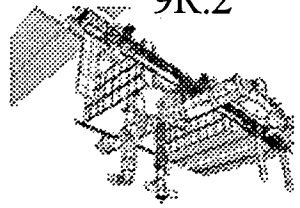
Japanese External Facility, Power

9R.1



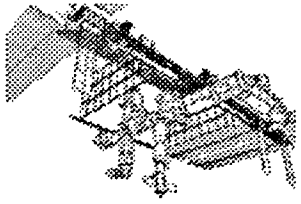
Docking and Stowage Module-1

9R.2



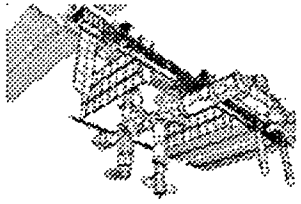
Docking and Stowage Module-2

14A



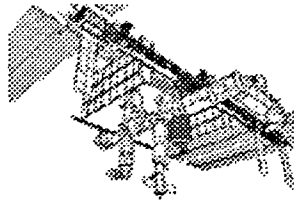
Cupola and 4 Science Power Platform Arrays

UF5



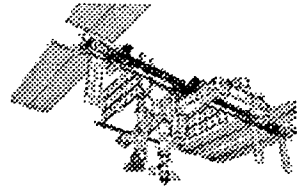
Payload Racks (MPLM)

20A



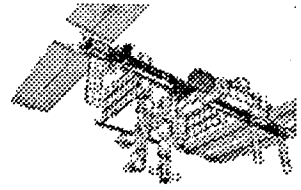
Node 3

8R



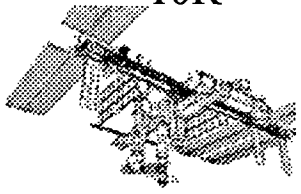
Research Module 1

1E



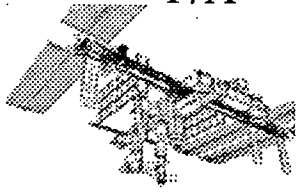
European Lab

10R



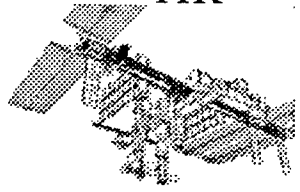
Research Module 2

17A



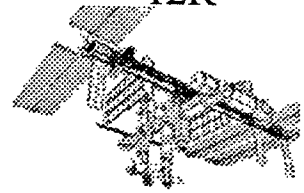
Outfitting Flight

11R



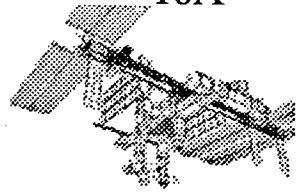
Life Support Module 1

12R



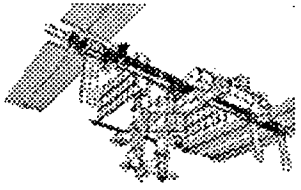
Life Support Module 2

18A



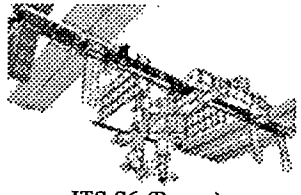
Crew Return Vehicle

19A



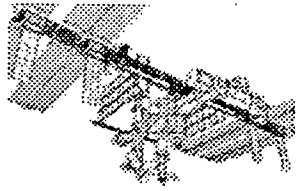
Outfitting Flight, Crew Quarters

15A



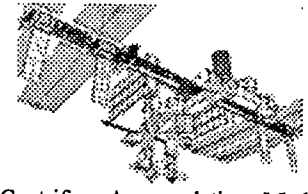
ITS S6 (Power)

UF6



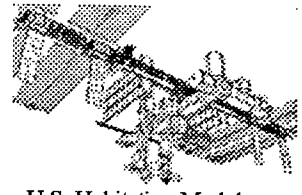
Payload Racks (MPLM)

UF7



Centrifuge Accomodations Module

16A



U.S. Habitation Module

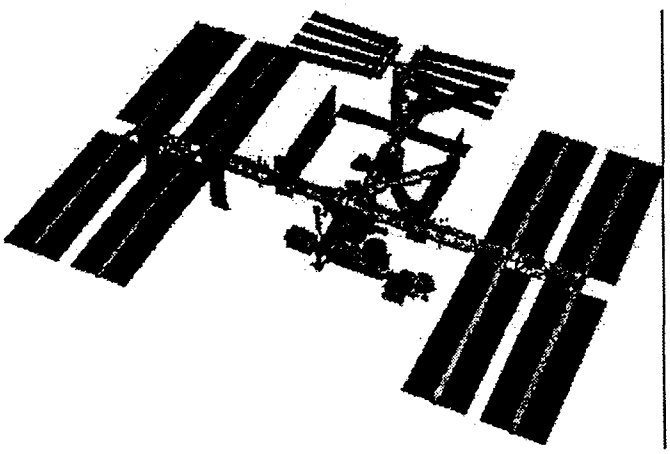
A=American flights R=Russian flights UF=Utilization Flight J=Japanese flights E=European flights

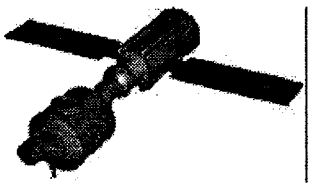
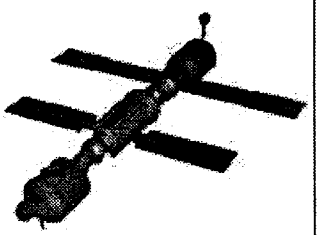
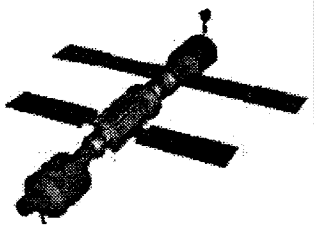
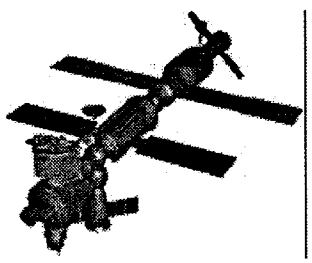
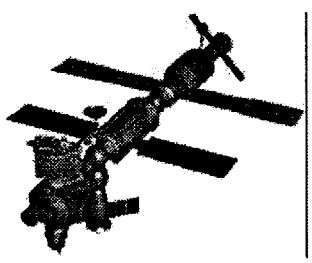
NASA Facts

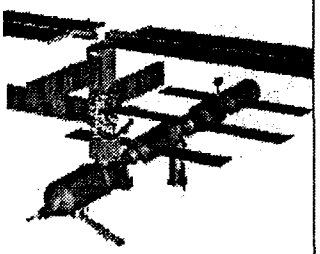
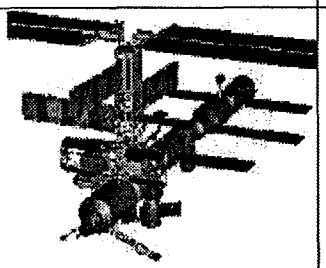
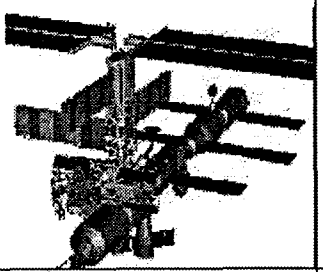
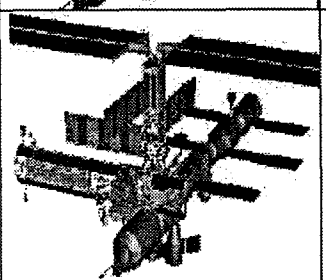
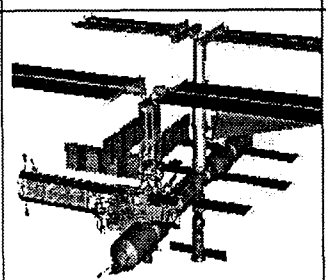
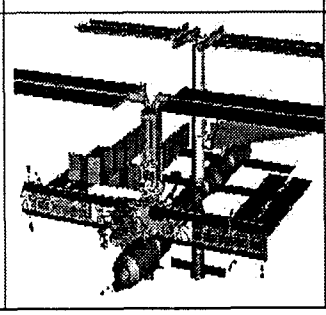
National Aeronautics and
Space Administration
Lyndon B. Johnson Space Center

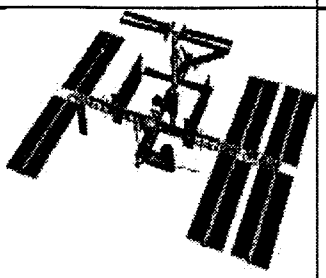
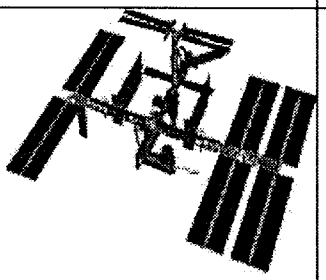
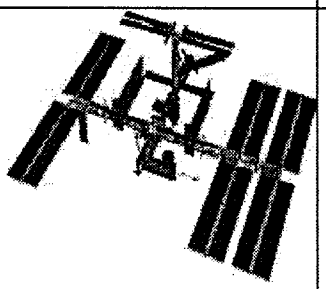
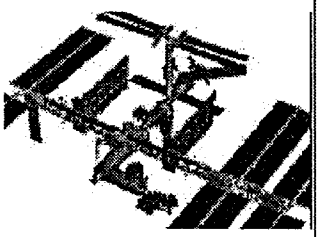
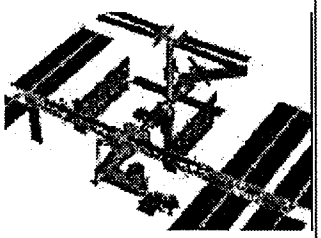
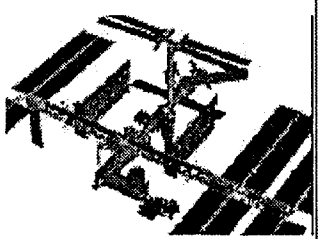
International Space Station June 1997

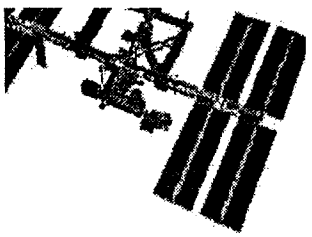
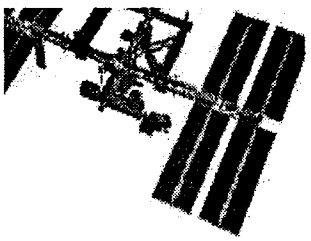
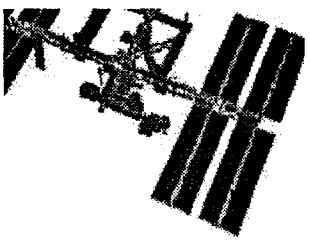
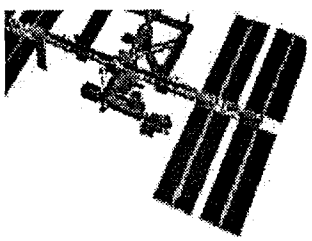
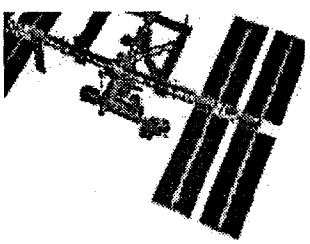
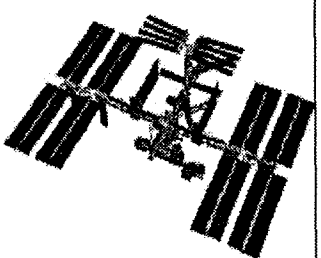
INTERNATIONAL SPACE STATION ASSEMBLY SEQUENCE (9/30/97 Rev C)



Date	Flight	Launch Vehicle	Configuration	Element(s)	Rationale
June 1998	1A/R	Russian		• Functional Cargo Block (FGB)	• FGB is a self-supporting active vehicle. • It provides propulsive control capability and power through the early assembly stages. • It provides fuel storage capability. • It provides rendezvous and docking capability to the Service Module.
July 1998	2A	US Orbiter		• Node 1 • Pressurized Mating Adapters -1 & -2	• Launched passive with PMA-1, PMA-2 and 1 stowage rack. • PMA-1 provides the interfaces between US and Russian elements. PMA-2 provides a Shuttle docking location. • Eventually, Node 1's six ports will provide connecting points for the Z1 truss; U.S. lab; airlock; cupola; Node 3; and the early MPLM as well as the FGB.
Dec 1998	1R	Russian		• Service Module	• Primary Russian element. It provides Environmental Control & Life Support System (ECLSS) functions to all elements. • Primary docking for Progress-type resupply vehicles • Provides propulsive attitude control and reboost capability
Dec 1998	2A.1	US Orbiter		• Spacehab Double Cargo Module	• Logistics and resupply cargo
Jan 1999	3A	US Orbiter		• Integrated Truss Structure (ITS) Z1 • PMA-3 • Ku-band • Control Moment Gyros (CMGs)	• ITS Z1 allows the temporary installation of the P6 Photovoltaic (PV) module to Node 1 for early US based power • Ku-band communication system supports early science capability on 6A • CMGs provide non-propulsive attitude control when activated on 5A • PMA-3 provides a Shuttle docking for the P6 PV Module on 4A and Lab installation on flight 5A
Jan 1999	2R	Russian		• Soyuz	• Establishes first station manning with three-person crew • Provides assured crew return capability without the Orbiter present

Date	Flight	Launch Vehicle	Configuration	Element(s)	Rationale
Jan 2000	UF-1	US Orbiter		• MPLM (ISPRs) • PV Module batteries	• Provides payload utilization delivering US Lab ISPR racks; two storage racks
Feb 2000	8A	US Orbiter		• ITS S0 • Mobile Transporter (MT)	• ITS S0 provides attachment and umbilicals between pressurized elements and permanent truss-mounted distributed system/utilities • Airlock spur provides an EVA translation path from the airlock to the truss • The MT which provides the truss translation capability for the Mobile Servicing System is also delivered
Mar 2000	UF-2	US Orbiter		• MPLM (ISPRs) • MBS • Lab Sys.	• Provides additional payloads • MBS provides truss based SSRMS capability • Three additional stowage racks are delivered
June 2000	9A	US Orbiter		• ITS S1 • CETA Cart A	• Delivers the starboard US Central Thermal Control System • Radiators remain stowed until power system is activated on flight 12A • Provides second string of S-band capability • The CETA Cart provides EVA crew translation capability along the truss
July 2000	9A.1	US Orbiter		• SPP with four solar arrays	• Delivery of the Russian power/control mast with four solar arrays providing additional Russian power • Delivers European Robotic Arm (ERA)
Oct 2000	11A	US Orbiter		• ITS P1 • CETA Cart B	• Delivers the port US central thermal control system • Radiators remain stowed until power system is activated on flight 12A • The CETA Cart provides EVA crew translation capability along the truss

Date	Flight	Launch Vehicle	Configuration	Element(s)	Rationale
Aug 2001	1J	US Orbiter		• JEM PM	• Japanese Experiment Module is delivered & activated (four JEM sys. racks) • JEM RMS is delivered & activated
Sep 2001	UF-3	US Orbiter		• MPLM (ISPRs)	• Provides for payload resupply and/or changeout
Jan 2002	UF-4	US Orbiter		• Express Pallet • SLP (SPDM, ATA, HP Gas)	• Express Pallet transports external payloads • Special Purpose Dexterous Manipulator ("Canada Hand") provides robotics maintenance capability • Spacelab Palllet (SLP) carries Special Purpose Dexterous Manipulator ("Canada Hand") which provides robotics maintenance capability; Ammonia Tank Assembly (ATA); and High Pressure Gas O2 tank.
Feb 2002	2J/A	US Orbiter		• JEM EF • ELM ES • PV Module Batteries	• Delivers JEM exposed experimental facilities • PV batteries complete battery complements on PV modules P4 & S4
Feb 2002	9R.1	Russian		• Docking & Stowage Module-1	• Mounted to the FGB nadir port • Provides additional on-orbit stowage and a Soyuz docking location
May 2002	9R.2	Russian		• Docking & Stowage Module- 2	• Mounted to Docking and Stowage Module-1 • Provides additional on-orbit stowage and a Soyuz docking location

Date	Flight	Launch Vehicle	Configuration	Element(s)	Rationale
Nov 2002	17A	US Orbiter		• MPLM • Node, Lab racks	• Outfits Node 3 with 4 racks – 2 Environmental Control and Life Support System racks and 2 Flight Crew Equipment racks (waste collection system and galley) • Three Crew Health Care System racks delivered • Delivers 1 U.S. Lab rack, 1 stowage rack, ISPRs
Jan 2003	11R	Russian		• Life Support Module 1 (LSM1)	• Life Support Module provides oxygen regeneration capability & other life support functions
Mar 2003	12R	Russian		• Life Support Module 2 (LSM2)	• Second Life Support Module provides oxygen regeneration capability & other life support functions
Mar 2003	18A	US Orbiter		• CRV 1	• Crew Return Vehicle attached to the station provides additional 4-person crew return capability added to already existing 3-person Soyuz crew return capability
Apr 2003	19A	US Orbiter		• MPLM	• Delivers 4 crew quarters racks to be placed in Node 2 and provide for transition to 6-person crew • Delivers 6 U.S. stowage racks
Jul 2003	15A	US Orbiter		• PV Module S6	• Fourth U.S. truss-based PV module completing the major power system elements • Starboard MT/CETA rails