

MEMORANDUM OF UNDERSTANDING
BETWEEN THE
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
OF THE UNITED STATES OF AMERICA
AND THE
EUROPEAN SPACE AGENCY
CONCERNING COOPERATION ON THE
CIVIL INTERNATIONAL SPACE STATION

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The National Aeronautics and Space Administration (hereinafter "NASA")

and

the European Space Agency (hereinafter "ESA"),

Considering the Agreement among the Government of the United States of America, Governments of Member States of the European Space Agency, the Government of Japan and the Government of Canada on Cooperation in the Detailed Design, Development, Operation and Utilization of the Permanently Manned Civil Space Station signed on September 29, 1988, as superseded by the Agreement among the Government of Canada, Governments of Member States of the European Space Agency, the Government of Japan, the Government of the Russian Federation, and the Government of the United States of America concerning Cooperation on the Civil International Space Station, (hereinafter "the Intergovernmental Agreement") and particularly Article 4 thereof,

Considering the Memorandum of Understanding between the European Space Agency and the United States National Aeronautics and Space Administration on Cooperation in the Detailed Design, Development, Operation and Utilization of the Permanently Manned Civil Space Station (hereinafter "the 1988 MOU") signed on September 29, 1988,

Considering the Memorandum of Understanding between NASA and the Ministry of State for Science and Technology of Canada (MOSST) on Cooperation in the Detailed Design, Development, Operation and Utilization of the Permanently Manned Civil Space Station which was signed on September 29, 1988, and recognizing that upon its establishment on March 1, 1989, the Canadian Space Agency (CSA) assumed responsibility for the execution of the Canadian Space Station program,

Considering the Memorandum of Understanding between NASA and the Government of Japan (the GOJ) on Cooperation in the Detailed Design, Development, Operation and Utilization of the Permanently Manned Civil Space Station signed on March 14, 1989, and recognizing that the GOJ has designated the Science and Technology Agency (STA) in that Memorandum of Understanding as its Cooperating Agency, as provided for in Article 4 of the Intergovernmental Agreement,

Recognizing the Joint Invitation extended to the Government of the Russian Federation at the Occasion of the Intergovernmental Meeting of the Space Station Partners in Washington, D.C., on December 6, 1993, and further recognizing the acceptance of the invitation by the Government of the Russian Federation on December 17, 1993,

Considering the Interim Agreement between NASA and the Russian Space Agency (RSA) for the Conduct of Activities Leading to Russian Partnership in the Detailed Design, Development, Operation and Utilization of the Permanently Manned Civil Space Station, which entered into force on June 23, 1995,

Recalling the terms of the Resolution concerning decisions on the Agency's programmes and finances, adopted on October 25, 1995, by the ESA Council meeting at ministerial level,

Recognizing that NASA and ESA, NASA and the GOJ, NASA and CSA, and NASA and RSA have prepared Memoranda of Understanding in conjunction with their Governments' negotiation of the Intergovernmental Agreement,

Convinced that this cooperation among NASA, ESA, the GOJ, CSA and RSA (hereinafter the "partners") implementing the provisions established in the Intergovernmental Agreement will further expand cooperation through the establishment of a long-term and mutually beneficial relationship and will further promote cooperation in the exploration and peaceful use of outer space,

Have agreed as follows:

Article 1

Purpose and Objectives

1.1. The purpose of this Memorandum of Understanding (MOU) is, pursuant to Article 4 of the Intergovernmental Agreement and on the basis of genuine partnership, to establish arrangements between NASA and ESA (hereinafter "the Parties") implementing the provisions of the Intergovernmental Agreement for peaceful purposes, in accordance with international law. In drafting this MOU, the Parties intended it to be consistent with the provisions of the Intergovernmental Agreement. This MOU will be subject to the provisions of the Intergovernmental Agreement. It defines the nature of the genuine partnership, including the respective rights and obligations of the Parties to this MOU. Arrangements implementing provisions of this MOU, as agreed pursuant to Article 4.2 of the Intergovernmental Agreement, are subject to this MOU. Such implementing arrangements include amendments to any existing arrangements that may be agreed between the Parties in the course of their Space Station cooperation under this MOU

1.2. The specific objectives of this MOU are:

- to provide the basis for cooperation between NASA and ESA in the detailed design, development, operation and utilization of the permanently inhabited civil international Space Station for peaceful purposes, in accordance with international law;
- to detail the roles and responsibilities of NASA and ESA taking into account the roles and responsibilities of the GOJ, CSA and RSA, in the detailed design, development, operation and utilization of the Space Station and also to record the commitments of NASA and ESA to each other and to the GOJ, CSA and RSA;
- to establish the management structure and interfaces necessary to ensure effective planning and coordination in the conduct of the detailed design, development, operation and utilization of the Space Station,

- to provide a basis for cooperation that maximizes the total capability of the Space Station to accommodate user needs and that ensures that the Space Station is operated in a manner that is safe, efficient and effective for both Space Station users and Space Station operators; and
- to provide a general description of the Space Station and the elements comprising it.

Article 2

General Description of the Space Station

2.1. NASA, ESA, the GOJ, CSA and RSA will join their efforts, under the lead role of NASA for overall management and coordination, to create an integrated international Space Station. NASA and RSA, drawing on their extensive experience in human space flight, will produce elements which serve as the foundation for the international Space Station. ESA and the GOJ will produce elements that will significantly enhance the Space Station's capabilities. CSA's contribution will be an essential part of the Space Station.

2.2. The Space Station will be a unique permanently inhabited multi-use facility in low Earth orbit, comprised of flight elements provided by all the partners and Space Station-unique ground elements to support the operation and utilization of the elements on orbit.

2.3. The Space Station will enable its users to take advantage of human ingenuity in connection with its low-gravity environment, the near-perfect vacuum of space and the vantage point for observing the Earth and the rest of the Universe. Specifically, the Space Station and its evolutionary additions could provide for a variety of capabilities, for example:

- a laboratory in space, for the conduct of science and applications and the development of new technologies;
- a permanent observatory in high-inclination orbit from which to observe Earth, the Solar System and the rest of the Universe;
- a transportation node where payloads and vehicles are stationed, assembled, processed and deployed to their destination;
- a servicing capability from which payloads and vehicles are maintained, repaired, replenished and refurbished;
- an assembly capability from which large space structures and systems are assembled and verified;
- a research and technology capability in space, where the unique space environment enhances commercial opportunities and encourages commercial investment in space;
- a storage depot for consumables, payloads and spares, and

- a staging base for possible future missions, such as a permanent lunar base, a human mission to Mars, robotic planetary probes, a human mission to survey the asteroids, and a scientific and communications facility in geosynchronous orbit.

Article 3

Space Station Elements

3.1 The Space Station will consist of elements provided by the partners comprising both flight elements and Space Station-unique ground elements. The elements are summarized in the Annex to the Intergovernmental Agreement and are further elaborated in this Article. Their requirements are defined and controlled in appropriate program documentation as provided for in Article 7

3.2. NASA Space Station Flight Elements: NASA will design, develop and provide on orbit the following flight elements including subsystems, the U.S. Extravehicular Activity (EVA) system, flight software and spares as required:

- one permanently attached Habitation Module with complete basic functional outfitting to support habitation for four crew members, including primary storage of crew provisions and the health maintenance system;
- one permanently attached multipurpose Laboratory Module, located so as to contain the optimum microgravity environment of the Space Station payload accommodations, with complete basic functional outfitting, including accommodations for International Standard Payload Racks and provisions for storage of NASA spares and secondary storage of crew provisions;
- one permanently attached Centrifuge Accommodation Module, with complete basic functional outfitting, a centrifuge rotor, and accommodations for International Standard Payload Racks which will contain a glovebox and specimen habitats;
- three Nodes which provide pressurized volume for crew and equipment and connections between Space Station pressurized elements;
- Truss Assembly which provides Space Station structure for attaching elements and systems;
- four accommodation sites for external payloads attached to the Space Station Truss Assembly;
- Solar Photovoltaic Power Modules and associated power distribution and conditioning equipment which serve as the primary Space Station electrical power source, providing an average of 75 kW;

- one FGB Energy Block, a self-sufficient orbital transfer vehicle which contains propulsion, guidance, navigation and control, communications, electrical power, thermal control systems and stowage capacity (hereinafter "FGB");

- one airlock for purposes of crew and equipment transfer with the capability to accommodate U.S. and Russian space suits;

- crew rescue vehicle with capabilities to support the rescue and return of a minimum of four crew;

- logistics carriers which provide the delivery of water, atmospheric gases and crew supplies and delivery and return of dry cargo, including crew supplies, logistics and scientific equipment; and

- one Mobile Transporter which will serve to provide translation capability for the Mobile Servicing Center.

3.3. ESA Space Station Flight Elements: ESA will design, develop and provide on orbit the following flight elements including subsystems, flight software and spares as required:

- one European pressurized laboratory permanently attached to the Space Station, with complete basic functional outfitting, including accommodations for International Standard Payload Racks and accommodations for external payloads, and provisions for storage of ESA spares and secondary storage of crew provisions;

- logistics carriers which provide system operations support, user logistics and on-orbit supply; and

- orbital transfer vehicles which provide thrust capability for orbit adjustments (reboost)

3.4. The GOJ, CSA and RSA Space Station Flight Elements: As reflected in the MOU between NASA and the GOJ, in the MOU between NASA and CSA and in the MOU between NASA and RSA:

3.4 a. The GOJ Space Station Flight Elements: the GOJ will design, develop and provide on orbit the following flight elements including subsystems, flight software and spares as required:

- one Japanese Experiment Module (JEM), a permanently attached multipurpose research and development laboratory, consisting of a pressurized module, an Exposed Facility and at least two Experiment Logistic Modules, and including a scientific equipment airlock, the JEM remote manipulator and IVA control/monitoring of the JEM Remote Manipulator System (JEM-RMS), with complete basic functional outfitting, including accommodations for International Standard Payload Racks and provisions for storage of the GOJ spares and secondary storage of crew provisions; and

- logistics carriers which provide system operations support, user logistics and on-orbit supply.

3.4.b. Canadian Flight Elements: The Canadian elements will be developed to play the predominant role in satisfying the following functions for the Space Station.

- attached payload servicing (external);
- Space Station assembly;
- Space Station maintenance (external);
- transportation on Space Station;
- deployment, retrieval and berthing; and
- EVA support.

3.4.b.1. CSA will design, develop and provide the following flight elements, including subsystems, flight software and spares as required:

- The Space Station Remote Manipulator System (SSRMS);
- The Mobile Remote Servicer Base System (MBS); and
- One Special Purpose Dexterous Manipulator (SPDM).

The SSRMS, the MBS and the NASA-provided Mobile Transporter comprise the Mobile Servicing Center (MSC). The MSC together with the SPDM comprise the Mobile Servicing System (MSS).

3.4.c. RSA Space Station Flight Elements: RSA will design, develop and provide on orbit the following flight elements including subsystems, the RSA Extravehicular Activity (EVA) system, flight software and spares as required:

- Service Module providing a capability for attitude control and reboost with complete basic functional outfitting to support habitation of three crew members;
- two Life Support Modules to accommodate additional equipment to support Space Station crew and supplement the life support functions present in the Service Module;
- two Docking Compartments to support EVA for assembly and operations;
- Universal Docking Module, which includes gyrodynes to provide docking and pressurized access to the Russian elements and a capability to support research activities;
- Science Power Platform which will provide an average of 19 kW and which includes Autonomous Thrusting Facilities, power distribution and conditioning equipment, accommodation sites for external payloads and a remote manipulator system;

- two Research Modules with a complete set of equipment to support research activities;
- Soyuz TM vehicle to provide on-orbit shelter, crew rescue and emergency crew return functions in accordance with technical capabilities of one permanently docked Soyuz TM vehicle;
- Progress vehicle to provide Space Station reboost capabilities and delivery of infrastructure elements, propellant, water, atmospheric gases and delivery and return of dry cargo, including crew supplies, logistics and scientific equipment, and
- Docking and Stowage Module to accommodate additional stowage and support Soyuz docking.

3.5. Space Station-unique ground elements will be provided by NASA, ESA and the other partners. These elements will be adequate to support the detailed design and development (including assembly and verification), the continuing operation and the full international utilization of each partner's flight elements listed above. The requirements for these elements will be defined and controlled in appropriate program documentation as provided for in Article 7.

3.5.a. NASA will provide the following Space Station-unique ground elements: equipment required for specialized or unique integration or, as the case may be, for launch or return to Earth; ground support equipment (GSE) and flight support equipment (FSE) including necessary logistics; engineering support centers and user support centers; test equipment, mock-ups, simulators, crew training equipment, software and any facilities necessary to house these items; the Space Station Control Center (SSCC); the Payload Operation Integration Center (POIC), the Space Station Training Facility (SSTF); Space Station verification and test facilities; subsystem test beds; and elements related to logistics support and to software development, integration, test and verification.

3.5.b. ESA will provide the following Space Station-unique ground elements: equipment required for specialized or unique integration or, as the case may be, for launch or return to Earth; GSE and FSE including necessary logistics; operations control centers, engineering support and user support centers; and test equipment, mock-ups, simulators, crew training equipment, software and any facilities necessary to house these items.

3.5.c. As reflected in the MOU between NASA and the GOJ, in the MOU between NASA and CSA, and in the MOU between NASA and RSA, the GOJ, CSA and RSA will provide the following Space Station-unique ground elements: equipment required for specialized or unique integration or, as the case may be, for launch or return to Earth; GSE and FSE including necessary logistics; operations control centers, including in the case of RSA, Mission Control Center-Moscow (MCC-M), engineering support centers and user support centers; and test equipment, mock-ups, simulators, crew training equipment, software and any facilities necessary to house these items.

Article 4

Access to and Use of the Space Station

4.1. NASA and ESA will each assure access to and use of their Space Station flight elements listed in Article 3.

4.2 The partners' utilization of flight elements listed in Article 3 will be equitable, as provided in the allocation commitments set forth in Article 8 of this MOU and of the corresponding MOU between NASA and the GOJ, the MOU between NASA and CSA and the MOU between NASA and RSA. Beyond these allocation commitments, the capabilities of the Space Station will be made available to the partners subject to specific arrangements between the relevant partners.

4.3 In accordance with the procedures in Article 8, NASA and ESA will each assure access to and use of their Space Station-unique ground elements referred to in Article 3.5 by each other and the other partners in order to support fully the utilization of the flight elements in accordance with the Consolidated Operations and Utilization Plan provided for in Article 8.1.c. As provided in Article 8, NASA and ESA will each also assure access to and use of their Space Station-unique ground elements by each other and the other partners for system operations support.

4.4. As requested by either Party for its detailed design and development activities, access to and use of the Space Station-unique ground elements provided by either Party will be granted on a space-available basis and subject to specific arrangements

Article 5

Major Program Milestones

5.1. The Space Station programs of NASA and ESA each include detailed design and development. The NASA and ESA programs also include Space Station operation and utilization. Because of the extended period required to assemble the Space Station, the detailed design and development activities will overlap the operation and utilization activities. After the completion of detailed design and development which includes assembly of the Space Station and one year of initial operational verification (hereinafter "detailed design and development"), mature operations and utilization will begin.

5.2. Major target milestones for the Space Station are as follows:

- First NASA-provided Space Station Element June 1998 (launched by RSA)
- Permanent Human Presence Capability Jan 1999 (habitation and crew rescue capability for three crew)
- Launch of the NASA-provided Laboratory Module May 1999
- Launch of the ESA-provided European pressurized laboratory Oct 2002

- First ESA-provided logistics/reboost operational mission March 2003

- Assembly Complete Dec 2003

(assembly of all permanently attached elements listed in Article 3)

- Initiation of Mature Operations and Utilization Dec 2004

5.3. NASA and ESA will develop, maintain and exchange coordinated implementation schedules. These schedules, including the dates for the above milestones, the delivery dates for the ESA-provided elements and the NASA-provided elements, and the assembly sequence for all elements of the Space Station, will be updated as necessary and formally controlled as described in Article 7

Article 6

Respective Responsibilities

6.1.a. While undertaking the detailed design and development of the Space Station elements described in Articles 3.2 and 3.5.a, and within the scope of the Parties' responsibilities established elsewhere in this MOU, NASA will:

1. provide overall program coordination and direction;
2. perform overall system engineering and integration which includes integrated risk management activities and perform system engineering and integration and risk management for NASA-provided elements consistent with these responsibilities;
3. establish, in consultation with the other partners, overall verification, safety and mission assurance requirements and plans; and develop verification, safety and mission assurance requirements and plans for the NASA-provided elements that meet or exceed these overall requirements and plans, which address the elements in Articles 3.2 and 3.5 a;
4. confirm that the ESA verification, safety and mission assurance requirements and plans for the elements described in Articles 3.3 and 3.5.b developed by ESA in accordance with Article 6.2.a.3, meet or exceed the overall Space Station verification, safety and mission assurance requirements and plans;
5. provide regular progress and status information on NASA Space Station program activities and plans;
6. establish with the other partners, integrated traffic plans for access to the Space Station in accordance with Articles 7, 8, 11 and 12;

7 provide, as applicable, program information, systems requirements information and technical interface information necessary for the integration of ESA-provided elements described in Article 3.3 and, as applicable, Article 3.5.b into the Space Station and/or the coordinated operation and utilization of ESA-provided elements;

8. develop, with ESA, the agreed documentation described in Article 7.2;

9. perform ground integration tests as necessary to assure on-orbit compatibility and perform verification and acceptance tests for the flight elements in Article 3.2 and accommodate ESA representation at such tests as necessary for NASA and ESA to fulfill their respective responsibilities under this MOU;

10 conduct overall Space Station preliminary design reviews, critical design reviews, design certification reviews, safety and mission assurance reviews, operations readiness reviews and flight readiness reviews in order for NASA to certify, following the certifications at element level provided by NASA and the other partners, that all Space Station elements to be launched on the Space Shuttle are acceptable for launch, on-orbit assembly and orbital operations; or, if to be launched by Ariane 5, are acceptable for on-orbit assembly and orbital operations; and accommodate ESA representation as necessary for NASA and ESA to fulfill their respective responsibilities under this MOU;

11. conduct for the elements it provides design reviews, as set forth in the documents described in Article 7.2, which will include reviews of safety and mission assurance; and accommodate ESA and other partners' participation as necessary for NASA and ESA to fulfill their respective responsibilities under this MOU;

12. support, as appropriate, and provide information necessary for ESA to conduct the reviews identified in Article 6.2.a.9;

13. deliver on orbit the ESA-provided European pressurized laboratory including its initial outfitting in accordance with Article 12 and the assembly sequence controlled in appropriate program documentation as provided for in Article 7; assemble on-orbit and verify interfaces of Space Station flight elements, including the flight elements and, as applicable, Earth-to-orbit vehicles that NASA, ESA, the GOJ, and CSA provide, with assistance from ESA for ESA-provided elements, and assist in the assembly and interface verification of RSA-provided elements, in accordance with agreed assembly, activation and verification plans;

14. assist in the on-orbit activation and performance verification of the flight elements provided by the partners in accordance with agreed assembly, activation and verification plans;

15. for each NASA-provided flight element, provide necessary ground and flight support equipment and initial spares; and perform qualification and acceptance tests of this equipment according to Space Station program requirements and interfaces as set forth in the documents described in Article 7.2;

16. establish in Europe and accommodate in the United States agreed liaison personnel as provided in Article 7.3;

17. participate with ESA and the other partners in Space Station management mechanisms as provided in Articles 7 and 8, including the development of the Operations Management Plan and the Utilization Management Plan;

18. work with ESA and the other partners to ensure that the Space Station Composite Utilization Plan described in Article 8.3.g.2 can be accommodated as described in Article 8 by the elements provided by NASA, ESA and the other partners. In addition, NASA will work with ESA in order that NASA, CSA, and any other partner may establish the capabilities to distribute data to their respective users of the European pressurized laboratory directly from the NASA Tracking and Data Relay Satellite System (TDRSS) space network, and, as agreed between NASA and ESA for NASA users of the European pressurized laboratory, from the European Data Relay Satellite (EDRS) space network. NASA will also work with ESA in order that NASA, ESA, and any other partner may process their respective user commands to the European pressurized laboratory through the TDRSS space network and, as agreed by NASA and ESA for NASA users of the European pressurized laboratory, through the EDRS space network;

19. establish in consultation with ESA and the other partners, information format and communication standards for a technical and management information system, and establish and maintain a computerized technical and management information system. This system is to work in conjunction with a compatible ESA computerized information system in accordance with the principles outlined in the documents described in Article 7.2;

20. provide or arrange for provision of crew rotation in accordance with the documents described in Articles 7, 8 and 9, and implementing arrangements, to support Space Station crew flight opportunities as described in Article 11. Specific assignments of crew members to specific vehicles will be made in accordance with the traffic planning process described in Article 8;

21. provide or arrange for provision of crew rescue capability;

22. arrange with RSA for provision of RSA-generated electrical power and augment RSA-generated electrical power, in accordance with agreed power transfer schedules, and provide electrical power to RSA on a contingency basis thereafter, to maintain essential RSA-provided flight element core systems, as agreed;

23. develop an architecture for the end-to-end data transmission between the Space Station data source and the data user; establish and maintain a software integration, test and verification capability for NASA-provided elements and for the program, including necessary hardware and Space Station software standards to be established by NASA in consultation with ESA and the other partners, in accordance with the documents described in Article 7.2;

24. develop and maintain flight and ground software related to elements it provides in accordance with Space Station software standards described in Article 6.1.a.23;

25. develop an integrated logistics support system for the NASA-provided Space Station flight elements and a logistics management capability for the Space Station as a whole, including resupply, on-board maintenance and inventory integration, in accordance with the documents described in Article 7.2;

26. provide spares for the NASA-provided elements as required to support assembly and initial operational verification;

27. provide operations support and logistics support for the NASA-provided flight elements; and

28. develop and provide to the System Operations Panel described in Article 8 baseline operations plans and maintenance plans for the NASA-provided elements describing routine systems capabilities and defining maintenance requirements, including logistics requirements, necessary for sustaining their functional performance.

6.1.b. Beginning upon the initiation of Space Station operations and utilization, and within the scope of the Parties' responsibilities established elsewhere in this MOU, NASA will:

1. participate in Space Station management mechanisms and development of documentation as provided in Articles 7 and 8, and in the sharing of Space Station operations responsibilities as provided in Article 9;

2. provide sustaining engineering, spares, operations support, and training for the Space Station elements it provides;

3. maintain overall systems engineering, integration, risk management, and operations support capability for Space Station operations and utilization;

4. provide integrated logistics support for the NASA-provided Space Station flight elements and integrate logistics management for the Space Station as a whole including resupply, on-board maintenance, and inventory integration;

5. work with ESA and the other partners to prepare and implement plans for the integration and operation of user activities in the Space Station Consolidated Operations and Utilization Plan described in Article 8; and, using the capabilities provided for in Article 6.1.a.18, NASA, CSA, and any other partner may distribute data to their respective users of the European pressurized laboratory directly from the TDRSS space network and, as agreed between NASA and ESA for NASA users of the European pressurized laboratory, from the EDRS space network. NASA will also work with ESA in order that NASA, CSA, and any other partner may process their respective user commands to the European pressurized laboratory through the TDRSS space network and, as agreed between NASA and ESA for NASA users of the European pressurized laboratory, through the EDRS space network;

6. provide logistics flights for the NASA-provided elements, for the Space Station as a whole, and for the elements provided by other partners, in accordance with Articles 9 and 12;

7. establish, maintain and operate the Space Station Control Center (SSCC), and the Payload Operations Integration Center (POIC); engineering support centers for the NASA-provided elements, and user support centers as provided in Articles 3 and 8;

8. establish, maintain and operate in the United States the Space Station Training Facility (SSTF) and additional training facilities to accommodate specific training for NASA-provided elements and integrated flight crew and ground controller multi-segment training;

9. integrate ESA-provided simulators, training materials and documentation for ESA-provided elements into the SSTF to support multi-segment training;

10. provide in the United States for NASA, ESA and other partners' crew members and ground controllers specific training for NASA-provided elements and multi-segment training, consistent with the agreed upon overall Space Station training flow and curriculum and in accordance with the documents described in Article 7.2. The fidelity of this training will be sufficient to ensure the capability to perform all anticipated tasks;

11. support training at other partners' facilities as agreed, consistent with the overall Space Station training flow and curriculum;

12. maintain with the other partners, integrated traffic plans for access to the Space Station in accordance with Articles 7, 8, 11 and 12;

13. develop and maintain with ESA, together with the partners, crew health and medical care policies and procedures and support provision of Space Station crew health in accordance with Article 11;

14. maintain the software integration, test and verification capability for the NASA elements and for the program including hardware and software standards for the support of Space Station operations;

15. maintain its flight and ground software in accordance with the Space Station software standards described in Article 6.1.a.23;

16. deliver or arrange for delivery of on-orbit propellant for reboost and propulsive attitude control as agreed; and

17. provide or arrange for provision of reboost, propulsive and non-propulsive attitude control as agreed.

6.2.a. While undertaking the detailed design and development of the Space Station elements described in Articles 3.3 and 3.5.b, and within the scope of the Parties' responsibilities established elsewhere in this MOU, ESA will:

1. perform system engineering and integration for the ESA-provided elements consistent with NASA's overall system engineering and integration responsibilities,

2. design the European pressurized laboratory to be compatible with the Space Shuttle and with the use of TDRSS and EDRS;
3. develop, in consultation with NASA, verification, safety and mission assurance requirements and plans for the ESA-provided elements that meet or exceed the overall Space Station verification, safety, and mission assurance requirements and plans established in Article 6.1.a 3, which address the elements in Articles 3.3 and 3.5.b;
4. provide regular progress and status information on the relevant ESA manned space program activities and plans;
5. provide, as applicable, program information, systems requirements information, and technical interface information necessary to understand the impact of the ESA-provided elements described in Article 3.3 and, as applicable, Article 3.5.b on the Space Station configuration and/or on the coordinated operation and utilization of the Space Station, and necessary to integrate those elements into the Space Station;
6. develop, with NASA, the agreed documentation described in Article 7.2;
7. perform interface verification tests as necessary to assure on-orbit compatibility and perform verification and acceptance tests for the flight elements in Article 3.3, and accommodate NASA representation at such tests as necessary for NASA and ESA to fulfill their respective responsibilities under this MOU,
8. maintain, and provide to NASA on request, ground and on-orbit verification test procedures and results as necessary to assess that the ESA-provided elements comply with overall Space Station program requirements and interface requirements as set forth in the documents described in Article 7.2;
9. conduct for the elements it provides design reviews, as set forth in the documents described in Article 7.2 which will include reviews of safety and mission assurance, and for any Space Station elements to be launched by Ariane 5, conduct reviews in order for ESA to certify, following the certifications at element level provided by ESA and the other partners, that such Space Station elements are acceptable for Ariane 5 launch, and accommodate NASA and other partners' participation as necessary for NASA and ESA to fulfill their respective responsibilities under this MOU;
10. participate in, as appropriate, and provide information necessary for NASA to conduct the reviews identified in Article 6.1.a 10;
11. participate in, as appropriate, and provide information necessary for NASA to conduct the reviews identified in Article 6.1 a.11;
12. following detailed design and development of the European pressurized laboratory, arrange for the on-orbit delivery of the European pressurized laboratory including its initial outfitting in

accordance with Article 12 and in accordance with the assembly sequence controlled as described in Article 7;

13. deliver on orbit the other ESA-provided elements listed in Article 3.3, in accordance with Article 12 and in accordance with the assembly sequence controlled as described in Article 7;

14. assist in the on-orbit assembly and interface verification of the ESA-provided flight elements in accordance with agreed assembly, activation and verification plans;

15. activate on orbit and verify performance of the ESA-provided flight elements, with assistance from NASA, in accordance with agreed assembly, activation and verification plans;

16 support establishment of integrated traffic plans for access to the Space Station identified in Article 6.1.a.6,

17. for each ESA-provided flight element, provide necessary ground and flight support equipment and initial spares; and perform qualification and acceptance tests of this equipment according to Space Station program requirements and interfaces as set forth in the documents described in Article 7.2;

18. establish in the United States and accommodate in Europe agreed liaison personnel as provided in Article 7.3;

19. participate with NASA and the other partners in Space Station management mechanisms as provided in Articles 7 and 8, including the development of the Operations Management Plan and the Utilization Management Plan;

20. work with NASA and the other partners to ensure that the Space Station Composite Utilization Plan described in Article 8.3.g.2 can be accommodated as described in Article 8 by the elements provided by NASA, ESA and the other partners; and support and provide information necessary for NASA, CSA, and any other partners to establish the capabilities to distribute data and to process user commands as described in Article 6.1.a.18;

21. establish and maintain, in accordance with the principles outlined in the documents described in Article 7.2, a compatible computerized technical and management information system to work in conjunction with the NASA computerized information system referred to in Article 6.1.a.19;

22. establish and maintain the necessary hardware and software for software production and support the NASA software integration, test, and verification capability for the ESA-provided elements;

23. develop and maintain flight and ground software related to elements it provides; for the ESA-provided flight elements, the development and maintenance of this software will be in accordance with Space Station software standards described in Article 6.1.a.23;

24. develop an integrated logistics support system for the ESA-provided Space Station flight elements and support development of NASA's logistics management capability for the Space Station as a whole including resupply, on-board maintenance and inventory integration in accordance with the documents described in Article 7 2;

25. provide spares for the ESA-provided elements as required to support initial operational verifications, including assembly for the European pressurized laboratory;

26. provide operations support and logistics support for the ESA-provided flight elements; and

27. develop and provide to the System Operations Panel described in Article 8 baseline operations plans and maintenance plans describing routine systems capabilities and defining maintenance requirements, including logistics requirements, necessary for sustaining the functional performance of the ESA-provided flight elements.

6.2.b. Beginning upon the initiation of Space Station operations and utilization, and within the scope of the Parties' responsibilities established elsewhere in this MOU, ESA will:

1. participate in Space Station management mechanisms and development of documentation as provided in Articles 7 and 8, and in the sharing of Space Station operations responsibilities as provided in Article 9;

2. provide sustaining engineering, spares, operations support and training for the Space Station elements it provides;

3. provide integrated logistics support for the ESA-provided Space Station flight elements and support NASA's logistics management for the Space Station as a whole including resupply, on-board maintenance and inventory integration;

4. work with NASA and the other partners to prepare and implement plans for the integration and operation of user activities in the Space Station Consolidated Operations and Utilization Plan described in Article 8 and support and provide information necessary for NASA, CSA, and any other partners to establish the capabilities to distribute data and to process user commands as described in Article 6.1.b.5;

5. provide logistics flights in accordance with Articles 9 and 12, and implementing arrangements, for the ESA-provided elements, for the elements provided by NASA and other partners, and for the Space Station as a whole;

6. support implementation of integrated traffic plans for access to the Space Station as identified in Article 6.1.b.12;

7. develop and maintain with NASA, together with the other partners, crew health and medical care policies and procedures, and support provision of Space Station crew health in accordance with Article 11;

8 establish, maintain and operate in Europe operations control centers, engineering support for the ESA-provided flight elements and user support centers, as provided in Articles 3 and 8;

9. provide simulators, training materials, and documentation for ESA-provided elements to be integrated by NASA in the United States to support multi-segment training;

10. provide in Europe for ESA, NASA and other partners' crew members and ground controllers specific training for ESA-provided elements, consistent with the agreed upon overall Space Station training flow and curriculum and in accordance with the documents described in Article 7.2. The fidelity of this training will be sufficient to ensure the capability to perform all anticipated tasks;

11. support training at other partners' facilities as agreed, consistent with the overall Space Station training flow and curriculum;

12 maintain flight and ground software related to elements it provides, for the ESA-provided flight elements, the maintenance of this software will be in accordance with Space Station software standards described in Article 6.1.a.23;

13. deliver on orbit propellant for reboost and propulsive attitude control as agreed; and

14. provide reboost and propulsive attitude control as agreed.

6.3. Notwithstanding the foregoing responsibilities outlined in this Article, and within the scope of the Parties' responsibilities established elsewhere in this MOU, with regard to the second and third Nodes described in Article 3 2, ESA will provide goods and services for NASA as follows, as set forth in implementing arrangements.

1. ESA will provide the Node 2 primary and secondary structure and outfitting using NASA-supplied subsystems and equipment;

2. ESA will provide the Node 3 primary and secondary structure and outfitting using ESA-procured subsystems and equipment (with the exception of the Direct Current to Direct Current Converter Units); and

3 ESA will supply laboratory support equipment for the NASA-provided user accommodations and other goods and services.

Article 7

Management Aspects of the Space Station Program Primarily Related to Detailed Design and Development

7.1 Management/Reviews

7.1.a. NASA and ESA are each responsible for the management of their respective Space Station detailed design and development activities consistent with the provisions of this MOU. This Article establishes the management mechanisms to coordinate the respective Space Station detailed design and development activities of NASA and ESA, to establish applicable requirements, to assure safe operations, to establish the interfaces between the Space Station elements, to review decisions, to establish schedules, to review the status of activities, to report progress and to resolve issues and technical problems as they arise

7.1.b. The NASA/ESA Program Coordination Committee (PCC), co-chaired by designated NASA and ESA representatives, will meet periodically throughout the lifetime of the program or promptly at the request of either Party to review the Parties' respective detailed design and development activities. The Co-Chairmen will together take those decisions necessary to assure implementation of the cooperative detailed design and development activities related to Space Station flight elements and to Space Station-unique ground elements provided by the Parties, including, as appropriate, activities related to design changes of the Parties' flight elements during mature operations and utilization. In taking decisions regarding detailed design and development, the NASA/ESA PCC will consider operation and utilization impacts, and will also consider detailed design and development recommendations from the Multilateral Coordination Board described in Article 8.1.b. However, decisions regarding operation and utilization activities will be taken in accordance with Article 8. The Co-Chairmen will each designate their respective members and will decide on the location of meetings. If the Co-Chairmen agree that a specific detailed design and development issue or decision requires consideration by another partner at the PCC level, the NASA/ESA PCC may meet jointly with the NASA/GOJ PCC, and/or the NASA/CSA PCC and/or the NASA/RSA PCC.

7.1.c. Bilateral/Multilateral Program Reviews will be held as necessary at which the designated representatives of NASA, ESA, and the other partners as appropriate will report progress and discuss the status of their detailed design and development program activities. The Bilateral Program Reviews will be held as mutually agreed and will be co-chaired by NASA and ESA. The Multilateral Program Reviews will meet as necessary at the request of any partner and will be organized by NASA. Less formal status reviews and technical meetings will be held as necessary; representatives of the partners will attend these reviews and meetings.

7.1.d. Space Station requirements, configuration, including assembly sequence, integrated traffic planning, allocations of housekeeping resources for design purposes, and definition of element interfaces through the completion of assembly and initial operational verification and any related Space Station configuration activities will be controlled by the Space Station Control Board (SSCB) chaired by NASA. ESA will be a member of the SSCB, and of such subordinate boards thereof as may be agreed, attending and participating when ESA decides it is appropriate and whenever these boards consider items which affect the ESA-provided elements, interfaces between the NASA-provided and the ESA-provided elements, interfaces between the ESA-provided elements and the Space Shuttle, interfaces between the ESA-provided elements and other partner-provided elements, or the accommodation on the Space Station of the Composite Utilization Plan (CUP) and the Composite Operations Plan (COP) described in Article 8. Decisions by the SSCB Chairman may be appealed to the NASA/ESA PCC, although it is the duty of the SSCB Chairman to make every effort to reach consensus with ESA and the other

partners rather than have issues referred to the PCC level. Such appeals will be made and processed expeditiously. Pending resolution of appeals, ESA need not proceed with the implementation of an SSCB decision as far as its provided elements are concerned. NASA may, however, proceed with an SSCB decision as far as its provided elements are concerned. Additional details regarding appeals to the NASA/ESA PCC are contained in the Joint Program Plan described in Article 7.2.a. NASA will be a member of the ESA Space Station control board (or its equivalent) chaired by ESA, and of such subordinate boards thereof as may be agreed, attending and participating as appropriate.

7.1.e. ESA will participate in selected NASA reviews on Space Station requirements, architecture and interfaces as defined in the Joint Management Plan (JMP) described in

Article 7.2.b. These reviews are program-level reviews which assure that the Space Station Program is progressing in accordance with relevant program documentation. Similarly, NASA will participate in selected ESA reviews as defined in the JMP; the other partners will participate as appropriate.

7.1.f. Through participation in the management mechanisms, NASA and ESA agree to achieve commonality on the Space Station as required by the overall Space Station safety requirements as defined pursuant to Article 10. NASA and ESA also agree to work through the management mechanisms in order to establish standard interfaces if necessary for Space Station users in the permanently attached pressurized laboratories. Exceptions to these requirements for commonality may be agreed on a case-by-case basis between NASA and ESA. In addition, NASA and ESA will work through the above management mechanisms to seek agreement on a case-by-case basis regarding the use of interchangeable hardware and software in order to promote efficient and effective Space Station operations, including reducing the burden on the Space Station logistics system.

7.2. Program Documentation

7.2.a. A Joint Program Plan (JPP) for detailed design and development, signed by the designated representatives of NASA and ESA, will cover the interrelationship between the ESA program and the overall program, the NASA/ESA top-level requirements including schedule, management relationships, NASA/ESA Space Station organizational structures and additional details regarding appeals to the NASA/ESA PCC. Any modification to the JPP will be approved by the PCC.

7.2.b. The Joint Management Plan (JMP) defines the programmatic and technical coordination processes and jointly developed documentation used by NASA and ESA for all Space Station design, development and implementation activities. The JMP and all changes to it will be jointly signed by the designated representatives of NASA and ESA.

7.2.c. The Concept of Operations and Utilization (COU) document is the source of information which describes how the Space Station operates and is operated. The content of the document will be consistent with the tasks and products produced or prepared by the partners. This document, during the detailed design and development phase of the program, is under the control

of the SSCB. However, decisions regarding operation and utilization activities will be taken in accordance with Article 8.

7.2.d. NASA, in conjunction with the other partners, develops an overall Space Station Systems Specification based on information provided by all partners which contains the performance and design requirements for the Space Station flight element and ground facilities hardware and software and provides the technical basis for overall conduct of Space Station detailed design and development activities. The Systems Specification, approved by the SSCB, contains the requirements related to all partners' elements. Any modification to the Systems Specification will be approved by the SSCB. The Systems Specification also includes NASA/ESA joint requirements. This section will be jointly signed by the designated representatives of NASA and ESA.

7.2.e. NASA and ESA will develop a jointly signed ESA Segment Specification that meets the requirements of the Systems Specification. NASA and ESA will also develop jointly signed Interface Requirements Documents (IRDs) defining the requirements on the interfaces between the Space Station and the ESA Segment. The ESA Segment Specification and the IRDs will be controlled by the SSCB. ESA will develop element specifications for ESA hardware/software and these specifications will meet the requirements in the jointly signed Segment Specification and the Systems Specification.

7.2.f. NASA and ESA will develop and sign Interface Control Documents (ICD's) which control interfaces: between the flight elements comprising infrastructural elements and the flight elements comprising accommodations elements as defined in Article 8.1.d; between the flight elements comprising infrastructural elements; and, as appropriate, between any other flight elements; between flight and ground elements; or among ground elements. Any modifications or any additions to the ICDs will occur through the SSCB-approved process. NASA will also develop a Baseline Configuration Document (BCD), based on information provided by all the partners, which will be the reference document reflecting the configuration of the Space Station.

7.3. Liaison The NASA Office of Space Station and ESA Manned Spaceflight and Microgravity Directorate are responsible for NASA/ESA liaison activities. ESA may provide representative(s) to NASA Headquarters in Washington, D.C., and NASA may provide representative(s) to ESA Headquarters in Paris. In order to facilitate the working relationships between NASA and ESA, ESA will provide and NASA will accommodate ESA liaison to the NASA Space Station Program Office. Similarly, NASA will provide and ESA will accommodate NASA liaison to the ESA Manned Spaceflight Programme Department. In addition, by mutual agreement, ESA may provide and NASA will accommodate ESA liaison to NASA Centers involved in the Space Station program, and NASA may provide and ESA will accommodate liaison to ESA Centers involved in the ESA Space Station program. Arrangements specifying all conditions relating to the liaison relationships will be agreed and jointly signed by the Co-Chairmen of the NASA/ESA PCC

Article 8

Management Aspects of the Space Station Program Primarily Related to Operations and Utilization

8.1. General

8.1 a. NASA and ESA each have responsibilities regarding the management of their respective operations and utilization activities and the overall Space Station operations and utilization activities, in accordance with the provisions of this MOU. NASA will have the responsibility for the overall management and coordination, through the management mechanisms established in this Article, of the operation of the Space Station, including Earth-to-orbit vehicle access in accordance with Articles 4.1 and 12. Operations and utilization activities will comprise long-range planning and top-level management and coordination, which will be performed by the strategic-level organizations; detailed planning and support to the strategic-level organizations which will be performed by the tactical-level organizations; and implementation of these plans which will be performed by the execution-level organizations

8.1.b. The Multilateral Coordination Board (MCB) will meet periodically over the lifetime of the program or promptly at the request of any partner with the task to ensure coordination of the activities of the partners related to the operation and utilization of the Space Station. The Parties to this MOU and the other partners will plan and coordinate activities affecting the safe, efficient and effective operation and utilization of the Space Station through the MCB, except as otherwise specifically provided in this MOU. The MCB comprises representatives of NASA, ESA, CSA, STA, and RSA. The NASA representative will chair the MCB. The Parties agree that all MCB decisions should be made by consensus. Where consensus cannot be achieved on any specific issue within the purview of the MCB within the time required, the Chairman is authorized to take decisions. Nothing in this paragraph shall, however affect the rights of any partner to use the consultation and settlement of disputes provisions of Article 18. Pending resolution of these issues through consultations, in accordance with the mechanism established in Article 18, a partner has the right not to proceed with implementation of a decision with respect to its elements. If consensus cannot be achieved on issues not primarily technical or programmatic in nature, including such issues with a political aspect, the consultations and settlement of disputes provisions of Article 18 only will apply. The Parties agree that, in order to protect the interests of all partners in the program, the operation and utilization of the Space Station will be most successful when consensus is reached and when the affected partners' interests are taken into account. MCB decisions will not modify rights of the partners specifically provided in this MOU.

8.1.c The MCB has established Panels responsible for the long-range strategic coordination of the operation and utilization of the Space Station, including supporting services such as transportation and communications, called the System Operations Panel (SOP) and the User Operations Panel (UOP) respectively, described in detail below. The MCB has developed a SOP-UOP Charter that defines the organizational relationships and responsibilities of these Panels, and the organizational relationships of these Panels with the tactical- and execution-level organizations described below. Any modifications to the SOP-UOP Charter, including

consolidation of the panels, will be approved by the MCB. The MCB will approve, on an annual basis, a Consolidated Operations and Utilization Plan (COUP) for the Space Station based on the annual Composite Operations Plan (COP) and the annual Composite Utilization Plan (CUP) developed by the Panels and described below. In doing so, the MCB will be responsible for resolving any conflicts between the COP and the CUP which cannot be resolved by the Panels. The SOP and UOP will work together to prepare the COUP as described in the SOP-UOP Charter. The SOP-UOP Charter also delineates the Panels' delegated responsibilities with respect to adjustment of the COUP. The COUP will be implemented by the appropriate tactical- and execution-level organizations. The MCB has also established a Panel for the coordination of crew-related issues, called the Multilateral Crew Operations Panel (MCOP), described in detail in Article 11.

8.1.d. Space Station Flight Elements. There are three categories of Space Station flight elements:

- accommodations elements;
- infrastructural elements; and
- other flight elements.

The accommodations elements are the NASA-provided Laboratory Module, the NASA-provided Centrifuge Accommodation Module, the ESA-provided European

pressurized laboratory including the accommodations for external payloads, the GOJ -provided JEM including the Exposed Facility and the Experiment Logistics Modules, the RSA-provided Universal Docking Module payload accommodations and the RSA-provided Research Modules (hereinafter the "laboratory modules"); and the RSA-provided accommodation sites for external payloads and the NASA-provided accommodation sites for external payloads. The infrastructural elements comprise Space Station flight elements, including servicing elements, such as the Mobile Servicing Center and other elements that produce resources which permit all Space Station flight elements to be operated and used. Other flight elements include the CSA-provided SPDM and elements used to resupply the Space Station such as orbital transfer vehicles and logistics carriers.

8.1.d.1. Housekeeping. Accommodations elements, infrastructural elements, the CSA-provided SPDM and Space Station resources will be used for assembly, for verification and for maintenance of the Space Station in an operational status, and also for the storage of element spares and crew provisions, with secondary storage of crew provisions to be distributed among the laboratory modules. In such use, they are referred to, respectively, as:

- housekeeping accommodations; and
- housekeeping resources.

During Space Station detailed design and development, these housekeeping accommodations and housekeeping resources will be controlled in appropriate program documentation as provided for

in Article 7. During Space Station mature operations and utilization, these housekeeping accommodations and housekeeping resources will be controlled according to the mechanisms in Article 8.2.d

8.1.d.2. Utilization. The accommodations and resources not required to maintain the Space Station in an operational status will be available in connection with Space Station utilization, and are referred to, respectively, as:

- user accommodations; and
- utilization resources.

Details regarding the allocation of the Space Station user accommodations and utilization resources are provided in Article 8.3. NASA, ESA, and the other partners agree to minimize the demands for housekeeping accommodations and housekeeping resources in order to maximize those available for utilization. NASA, ESA and the other partners will work to establish standard interfaces between the elements and the user-provided hardware and software.

8.2. Operations

8.2.a. It is the goal of the Parties to this MOU to operate the Space Station in a manner that is safe, efficient and effective for both Space Station users and Space Station operators. To accomplish this, the MCB has established the SOP to coordinate strategic-level operations activities and operations planning activities as provided for in Article 8.1.c.

8.2.b. The SOP will comprise one member each from NASA, ESA and the other partners. Members may send designated alternates to SOP meetings. In addition, each partner may call upon relevant expertise as necessary to support SOP activities. The SOP will take decisions by consensus; in the event of failure to reach consensus on any issue, the issue will be forwarded to the MCB for resolution. In the interest of efficient management, NASA and ESA recognize that the SOP should take the responsibility routinely to resolve all operations issues as expeditiously as possible rather than refer such issues to the MCB.

8.2.c. The SOP will develop, approve and maintain an Operations Management Plan (OMP) for the operation, maintenance and refurbishment of and logistics for the Space Station. This Plan will describe relationships among the strategic, tactical and execution levels of operations management, where the strategic level is coordinated by the SOP; the tactical level, by the tactical operations organization referred to in Article 8.2.e; and the execution level, by implementing organizations and field centers. Consistent with the other provisions of this Article, the OMP will also address operational requirements for the Space Station flight elements and Space Station-unique ground elements. The OMP will provide the procedures for preparation of the baseline operations plans and maintenance plans provided for in Articles 6.1.a.28 and 6.2.a.27, annual refinements to these baseline plans, and the COP, described in Article 8.2.d, including procedures for adjustment of these plans as further information becomes available.

8.2.d. On an annual basis, NASA and ESA will each provide to the SOP any significant refinements to their baseline operations plans and maintenance plans five years in advance. Using the operations and maintenance plans and these refinements provided by all of the partners, including requirements for use of Space Station-unique ground elements, the SOP will develop and approve an annual COP consistent with the annual CUP, described in Article 8.3.g. The COP will also identify the housekeeping accommodations, housekeeping resources, launch and return transportation services and data transmission capacity required for maintenance of the Space Station in an operational status. Compatibility of the COP and the CUP must be assured through coordination between the SOP and the UOP described in Article 8.3.e, during the preparation and approval process.

8.2.e. NASA, with the participation of ESA and the other partners, will be responsible for integrated tactical-level activities for Space Station operations. To this end, NASA will establish an integrated tactical operations organization and the other partners will participate in discharging the responsibilities of this organization. The integrated tactical-level activities for the detailed design and development are controlled by the SSCB. NASA, ESA and the other partners will assign experts on the elements each provides to perform integrated tactical operations functions and to participate in overall integrated tactical operations activities. NASA and ESA will consult and agree regarding the procedures for support of integrated tactical activities, the personnel, their location and all administrative conditions related to ESA personnel located in the United States and those related to NASA personnel located in Europe. In conjunction with the integrated activities, NASA, ESA and the other partners will each perform distributed tactical-level activities related to the elements and services each provides, such as decentralized system operations support planning, user support planning, logistics planning, and the accommodations assessments described in Article 8.3.i. Integrated tactical-level activities will include planning for: system operations, user support activities across all Space Station elements, Earth-to-orbit vehicle capabilities, data transmission and Earth-to-orbit vehicle operations within the operational control zone. Tactical-level activities for Earth-to-orbit vehicles separated from the Space Station when outside the operational control zone of the Space Station, as defined in the program documentation provided for in Article 7, will be performed by the Earth-to-orbit vehicle provider.

8.2.f. Multi-Increment Manifests for the Space Station will be developed by the integrated tactical operations organization described in Article 8.2.e to implement the COUP. These manifests will implement launch and return transportation agreements documented in the COUP and include vehicle access, assembly activities, logistics and crew exchange. In addition to the COUP, the Multi-Increment Manifests, Space Station assembly and operational requirements, and payload integration documentation will be used to develop the Increment Definition Requirements Document (IDRD). The IDRD documents increment-specific plans and requirements, is controlled by the integrated tactical operations organization and is baselined two years prior to increment start. For periods up to the completion of assembly and initial operational verification, the IDRD will be controlled by the SSCB, as described in Article 7.1.d. Each IDRD will describe the detailed manifest of user payloads, systems support equipment and supplies needed to support the increment. Each IDRD will also describe changes to the complement of hardware and software to be flown during that increment and the payload and system support activities needed to carry out the activities approved in the COUP. The IDRD

will identify the crew complement and define logistics requirements, including Earth-to-orbit vehicle interface requirements, changes to housekeeping resource requirements, changes to housekeeping accommodation requirements, and communication requirements, including communications systems use and requirements for distribution of data, to support the subject increment. Earth-to-orbit vehicle integration details regarding crew transportation, interface requirements for station cargo planning, including pressurized and unpressurized carriers, are contained in standard integration documentation as set forth in the documents described in Article 7.2 and defined by the integrated tactical operations organization.

8.2.g.1. NASA, with the participation of ESA and the other partners, will be responsible for integrated execution-level planning for and management of integrated command and control. NASA will coordinate the execution of the overall integrated operation of the Space Station. Performance of integrated execution-level activities for the Space Station as a whole will be implemented by the Space Station Control Center (SSCC) and the Mission Control Center - Moscow (MCC-M) within the integrated command and control concept: integrated command and control of the Space Station during unmanned and manned periods of operation, including crew rescue operations and management of trajectory (ballistics), momentum, altitude and attitude of the Space Station. Each partner will assign experts on the elements it provides to participate in integrated execution-level activities, and to support real-time on-orbit activities with emphasis on the elements it provides. NASA and ESA will also consult and agree regarding the procedures for support of integrated execution-level activities, the personnel, their location, and administrative conditions related to these personnel. NASA, ESA and the other partners will be responsible for execution of the day-to-day operations in accordance with the integrated planning. The SSCC, established and managed by NASA, will provide integrated command and control of the Space Station and will work in conjunction with the MCC-M, established and managed by RSA, which will also provide command and control functions, including command and control functions for the Space Station as a whole as agreed between NASA and RSA.

8.2.g.2. In addition to supporting the integrated operations as described above for system operations of the elements they provide: NASA will also establish, within the SSCC, its element-unique execution-level operations functions; RSA will also establish, within the MCC-M, its element-unique execution-level operations functions; and the other partners will establish element-unique execution-level operations functions. NASA, ESA and the other partners will consult and agree regarding the element-unique execution-level operations functions to be performed by each partner to work in conjunction with the integrated execution-level functions.

8.2.g.3. The interaction between element-unique execution-level operations functions and the integrated SSCC and MCC-M functions will be described in the OMP. NASA, ESA and the other partners will provide engineering support to perform detailed engineering assessments and real-time operations support required for the operational control of the Space Station elements they provide. Execution-level activities for Earth-to-orbit vehicles separated from the Space Station flight elements when outside the operational control zone of the Space Station flight elements, as defined in the program documentation provided for in Article 7, will be the responsibility of the respective Earth-to-orbit vehicle provider. Execution-level activities for vehicles within the operational control zone will be addressed through the integrated execution-level planning described above.

8.3. Utilization

8.3.a. NASA, CSA and RSA will provide Space Station infrastructural elements to assemble, maintain, operate and service the Space Station; NASA, CSA and RSA will also provide resources derived from these infrastructural elements to the other partners as provided in

Article 8.3.b. Any partner providing user accommodations will retain the use of those accommodations, except for any allocations to other partners, in compensation for their provision of resources, based on those partners' contributions of infrastructural elements and taking into account NASA's role in the overall program management, systems engineering and integration. As applicable, accrued equivalent user accommodation rights are accumulated by each partner first in its own user accommodations. Consequently.

- NASA will retain the use of 97.7% of the user accommodations on its laboratory modules, 97.7% of the use of its accommodation sites for external payloads and will have the use of 46.7% of the user accommodations on the European pressurized laboratory and 46.7% of the user accommodations on the JEM;
- RSA will retain the use of 100% of the user accommodations on its laboratory modules and the use of 100% on its accommodation sites for external payloads,
- ESA will retain the use of 51% of the user accommodations on its laboratory module;
- the GOJ will retain the use of 51% of the user accommodations on its laboratory module; and
- CSA will have the use of the equivalent of 2.3% of the Space Station user accommodations provided by NASA, ESA and the GOJ.

Each partner will control the selection of users for its allocation of user accommodations; such control will be exercised in accordance with the procedures in this MOU, in the MOU between NASA and the GOJ, in the MOU between NASA and CSA, and in the MOU between NASA and RSA for developing the CUP.

8.3 b Allocation of Resources

With the exception of crew time, which is allocated as provided in Article 8.3.c, allocation of Space Station resources among the partners will be in accordance with the following approach. RSA will retain 100% of the housekeeping and utilization resources which RSA provides, except as otherwise provided in Article 6. Other than those resources provided to RSA in accordance with Article 6, resources provided by NASA and CSA infrastructural elements will be made available to NASA, ESA, the GOJ and CSA. These resources, excluding those which may be used without allocation as provided in Article 8.3.d, will be allocated as follows: housekeeping resources as noted in Article 8.1.d.1, and required by the elements provided by NASA, ESA, the GOJ and CSA, will be set aside. The remaining resources, which are utilization resources, will be allocated as follows: 76.6% of utilization resources will be allocated to NASA; 12.8% of

utilization resources will be allocated to the GOJ, 8.3% of utilization resources will be allocated to ESA; and 2.3% of utilization resources will be allocated to CSA; the above allocation of utilization resources is to the partner, not to the elements, and may be used by the partner on any Space Station element consistent with the COUP. Plans for use of partner allocations of Space Station resources will be developed through integrated planning mechanisms as provided elsewhere in this Article. More than this allocation of any utilization resource may be gained by each partner through barter or purchase from other partners

8.3.c. Allocation of Crew Time

8.3.c.1. During the period of a three-person crew, crew time required for assembly, verification and maintenance of the Space Station in an operational status will be set aside. Any remaining crew time will be allocated for utilization: 50% of the utilization crew time will be allocated to NASA and 50% to RSA. The above allocations will be adjusted through implementing arrangements as allocations to the other partners for utilization crew time begin. As applicable, specific allocations of utilization crew time to ESA, the GOJ and CSA will be commensurate with utilization resource allocations specified in Article 8.3.b.

8.3.c.2. Following outfitting of the NASA-provided Habitation Module and initial operational verification of the NASA-provided crew rescue vehicle that allows expansion of the crew complement to seven, RSA will have the rights to on-orbit crew time of the equivalent of three crew to perform systems operations for, and utilization activities in or on, its elements. NASA, ESA, the GOJ and CSA will share the rights to on-orbit crew time of the equivalent of four crew to perform systems operations for, and utilization activities in or on, their elements as follows: crew time required for maintenance of the Space Station in an operational status will be set aside, and any remaining crew time will be allocated for utilization. Of this crew time remaining for utilization, 76.6 % will be allocated to NASA; 12.8% to the GOJ, 8.3% to ESA; and 2.3 % to CSA.

8.3.c.3. Allocation of crew time to the partners is for the purpose of ensuring equitable distribution of crew time for partner activities. Planning and execution of crew activities will be integrated in accordance with Article 11.6.

8.3.d Space Station Resources, and Transportation and Communication Services

8.3.d.1. Space Station utilization resources are power; user servicing capacity, including services of the CSA-provided SPDM; heat rejection capacity; data handling capacity; crew time; and EVA capacity. The initial list of Space Station utilization resources to be allocated is power and crew time. All other Space Station utilization resources may be used without allocation. To support the operation and full international utilization of the Space Station as defined in Article 3, NASA, ESA, the GOJ and RSA will provide launch and return transportation services as provided in Article 12.1 and consistent with the integrated traffic planning process. From the total Space Station user payload capacity available on Space Station launch and return transportation flights actually flown each year, each partner will have the right to obtain launch and return transportation services, to support its Space Station utilization plan, commensurate with its allocation of utilization resources either through its own provision of this capacity or

through purchase from any other partner providing such services. NASA, ESA, the GOJ and RSA will correspondingly ensure, through the planning mechanisms established in this Article and in Article 12, that all partners can exercise their right to obtain launch and return transportation services to support their Space Station utilization plans. It is anticipated that NASA, ESA, the GOJ and RSA will exercise this right first through provision of their own payload launch and return transportation capacity (The foregoing does not apply to launch and return transportation capacity provided for the Space Station in connection with Space Station evolutionary additions.) Similarly, the partners will have the right to obtain, commensurate with their allocation of utilization resources, TDRSS data transmission capacity provided by NASA, RSA Data Relay Satellite data transmission capacity, and data transmission capacity provided by other partners as applicable, and available for the Space Station as provided in Article 12.2 and consistent with the COUP. The UOP, defined in Article 8.3.e, will update the lists of utilization resources and allocated utilization resources as necessary as NASA and the other partners gain experience.

8.3.d.2. The use of ESA's allocated share of utilization resources and the use of user accommodations on the European pressurized laboratory will begin once this laboratory is verified following assembly to the Space Station.

8.3.e. It is the goal of the Parties to use the Space Station in a safe, efficient and effective manner. To accomplish this, the MCB has established a UOP, to assure the compatibility of utilization activities of the Space Station. The UOP will comprise one member each from NASA, ESA and the other partners. Members may send designated alternates to UOP meetings. In addition, each partner may call upon relevant expertise as necessary to support UOP activities. The UOP will take decisions by consensus; in the event of failure to reach consensus on any issue, the issue will be forwarded to the MCB for resolution. In the interest of efficient management, NASA and ESA recognize that the UOP should take the responsibility to routinely resolve all utilization issues as expeditiously as possible rather than refer such issues to the MCB.

8.3.f. The UOP will develop, approve and maintain a Utilization Management Plan (UMP) which will describe relationships among the strategic, tactical and execution levels of utilization management, where the strategic level is coordinated by the UOP; the tactical level, by the integrated tactical operations organization described in Article 8.2.e; and the execution level, by implementing organizations and field centers. The UMP will also establish processes for utilization of the Space Station elements, including the user support centers and other Space Station-unique ground elements provided by all the partners, consistent with Article 8.3.e; define standard user integration support and standard user operations support; and describe the approach to distributed user integration and operations. The UMP will provide procedures for preparation of the partners' Utilization Plans and CUP described in Article 8.3.g, including procedures for adjustment of these Plans as further information becomes available.

8.3.g. Utilization Plan for the Space Station

8.3.g.1. On an annual basis, five years in advance, NASA, ESA, and the other partners each will develop a Utilization Plan for all proposed uses of its allocation of Space Station user

accommodations and utilization resources, for the use of their right to obtain launch and return transportation services and data transmission capacity, and for all proposed uses of unallocated Space Station utilization resources and Space Station-unique ground elements. Each partner will satisfy the requirements of its users for storage within the user accommodations available to that partner, with the exception of temporary on-orbit storage in the logistics carriers in which user equipment is launched or returned to Earth as specified in the applicable IDRD. NASA, ESA, and the other partners each will prioritize and propose appropriate schedules for the user activities in its Utilization Plan, including the use of user support centers and other Space Station-unique ground elements to support the utilization of the flight elements. These individual Utilization Plans will take into consideration all factors necessary to assure successful implementation of the user activities, including any relevant information regarding crew skills and special requirements associated with the proposed payloads.

8.3.g.2. NASA and ESA each will forward its Utilization Plan to the UOP. Using the Utilization Plans of NASA, ESA and the other partners, the UOP will develop the CUP, covering the use of both flight and Space Station-unique ground elements, launch and return transportation services and data transmission capacity, based on all relevant factors, including each element-provider's recommendations regarding resolution of technical and operational incompatibilities among the users proposed for its elements. In its use of the Space Station, each partner will seek, through the mechanisms established in this MOU, to avoid causing serious adverse effects on the use of the Space Station by the other partners. In the event of failure of the UOP to reach consensus on the utilization of the Space Station flight elements and/or related Space Station-unique ground elements, the issue will be forwarded to the MCB for resolution.

8.3.g.3. Utilization Plans proposed by NASA, ESA and the other partners which fall completely within their respective allocations and do not conflict operationally or technically with one another's Utilization Plans will be automatically approved. However, Articles 9.3(a), 9.3(b) and 9.6 of the Intergovernmental Agreement will apply.

8.3.h. Each partner will participate in integrated tactical-level planning of user activities. To this end, each partner will provide personnel to the operations organization described in

Article 8.2.e. These personnel will participate in integrated tactical-level planning of user activities; they will also support the strategic-level planning of user activities. NASA and ESA will consult and agree regarding the responsibilities to be discharged by the ESA personnel. NASA and ESA will also consult and agree regarding the number of ESA personnel and all administrative conditions related to these personnel.

8.3.i. A partner providing accommodations elements will be responsible for providing standard user integration support and standard user operations support for use of its accommodations elements by users of the other partners or the other partners as users. In the case of such use, the partner sponsoring the user will be responsible for performing integration of its payload on the ground. Such integration will be to appropriate standard interface levels as agreed among the affected partners. Accommodation assessments for the integrated payload complements manifested in an accommodation element covering engineering, operations and software compatibility will also be performed by the partner providing that accommodation element in

support of the preparation and execution of the IDRDs. Similarly, CSA will be responsible for providing standard user integration support and standard user operations support for users of the other partners or the other partners as users of the flight elements provided by CSA. As required, NASA or RSA will be responsible for providing standard user integration support and standard user operations support for users of the other partners or the other partners as users of the Space Station systems or subsystems each provides.

8.3.j. NASA, ESA, the GOJ and CSA will participate in discharging the responsibilities of the Payload Operations Integration Center (POIC) established and managed by NASA which will be responsible for the following integrated functions for the Space Station as a whole: overall integration of the planning of user activities on the Space Station, overall management and coordination of the execution of user activities on the Space Station, and interaction with the SSCC in order to coordinate user activities with systems operations activities. NASA will also establish, within the POIC, its element-unique payload operations integration functions. Each of these partners will provide personnel to the POIC. These personnel will bring expertise on the accommodations elements and payloads that partner provides, will participate in integrated POIC-based activities and will support real-time on-orbit activities with emphasis on the accommodations elements and payloads each provides. NASA and ESA will consult and agree regarding the responsibilities to be discharged by the ESA personnel. NASA and ESA will also consult and agree regarding the number of ESA personnel and all administrative conditions related to these personnel. The partners may also participate in and provide personnel to other execution-level utilization activities at other sites as agreed. RSA will participate in the above activities as agreed in implementing arrangements. For operations integration of all payloads in each of the accommodation elements they provide, NASA, ESA, the GOJ and RSA will establish element-unique payload operations integration functions to work in accordance with the IDRD and in coordination with the POIC, as provided above. The interaction between the integrated functions of the POIC and the SSCC will be documented in the OMP. NASA, ESA, the GOJ and RSA will also provide user support centers to assist Space Station users in planning and executing user activities on the Space Station. The interaction between the element-unique payload operations integration functions, the user support functions, and the integrated functions of the POIC will be described in the UMP.

8.3.k. In working out problems which may arise after the development of the COUP, in the case of a technical or operational incompatibility between users, the partner(s) providing the element(s) in which the users have accommodations, as well as other impacted partners, will provide appropriate analyses and recommendations to the appropriate strategic-, tactical- or execution- level organization for resolution of conflicts. However, if such conflict only has impacts within a single Space Station element and only impacts users of the provider of that element, the partner providing that element will be responsible for resolving such conflicts in accordance with the content of the COUP.

8.3.l. NASA, ESA and the other partners may at any time barter for, sell to one another or enter into other arrangements for any portion of their Space Station allocations, and are free to market the use of their allocations individually or collectively, according to the procedures established in the UMP. The terms and conditions of any barter or sale will be determined on a case-by-case basis by the parties to the transaction. The partner providing allocations will ensure that the

obligations it has undertaken under this MOU are met. NASA, ESA and the other partners each may retain the revenues they derive from such marketing.

8.3.m. NASA and ESA will make their Space Station-unique ground elements, including user support centers, available for use by each other and the other partners in order to support fully both the standard and special user integration and operations support approved in the CUP and the requirements in the COP. Any special user integration support or user operations support provided by a partner to users of the other partners or other partners as users will be provided on a reimbursable basis at prices routinely charged comparable users for similar services.

8.4 In order to protect the intellectual property of Space Station users, procedures covering all personnel, including Space Station crew, who have access to data are developed by the MCB

1.The partners will seek to outfit the laboratory modules to equivalent levels by the end of Space Station detailed design and development.

Article 9

Responsibilities for Operations Costs and Activities

9.1. The Parties, and the other partners under the relevant MOUs, will seek to minimize operations costs for the Space Station. The Parties, and the other partners under the relevant MOUs, will also seek to minimize the exchange of funds, for example, through the performance of specific operations activities.

9.2. Element Operations Costs and Activities

9.2.a. NASA and ESA will each have operational responsibilities for the elements it provides as detailed in Articles 6 and 8. Such operational responsibilities mean that NASA and ESA will each be responsible for element operations costs or activities, that is, costs or activities attributed to operating and to sustaining the functional performance of the flight elements that it provides, such as ground-based maintenance, sustaining engineering, provision of spares, launch and return of spares, launch and return of the fraction of the logistics carriers provided for in Article 3 that is attributable to spares, and also costs or activities attributed to the maintenance and operation of element-unique ground centers.

9.3. Common System Operations Costs and Activities

9.3.a. NASA, ESA and the other partners will equitably share responsibilities for the common system operations costs or activities: that is, the costs or activities attributed to the operation of the Space Station as a whole. Common system operations costs and activities will not include the element operations costs and activities described in Article 9.2 nor the user operations costs and activities described in Article 9.6. RSA will be responsible for the share of the common system operations costs or activities corresponding to the operation of the elements it provides; NASA, ESA, the GOJ and CSA collectively will be responsible for the share of common system operations costs or activities corresponding to the support of the operation of elements they

collectively provide using the following approach: each will be responsible for a percentage of common system operations costs or activities equal to the percentage of Space Station utilization resources allocated to it in Article 8.3.b. The categories comprising common system operations are: integrated tactical planning activities performed by the integrated tactical operations organization provided for in Article 8.2.e, including user integration planning and maintenance of common documentation; space systems operations (operations and maintenance of integrated SSCC and MCC-M functions, and common elements of software integration, test and verification capability); operations and maintenance of integrated POIC functions; integrated logistics management including resupply, on-board maintenance and inventory integration; prelaunch/postlanding processing of logistics carriers; and launch to orbit and return of consumables, crew and crew logistics, and launch and return of the fraction of the logistics carriers provided for in Article 3 that is attributable to consumables and crew logistics. Any changes to the list of categories comprising common system operations in this Article will be made by the SOP. ESA's sharing of common system operations responsibilities will begin once the European pressurized laboratory is verified following assembly to the Space Station.

9.3.b. ESA will perform common system operations activities for the benefit of NASA and the other partners, and NASA will perform, or arrange for other partners to perform common system operations activities for the benefit of ESA and the other partners in accordance with Articles 6 and 8. Compensation for performance of these activities is as agreed in implementing arrangements. NASA, the GOJ, CSA and RSA will perform common system operations activities as specified in the MOU between NASA and the GOJ, the MOU between NASA and CSA, and the MOU between NASA and RSA.

9.3.c. In accordance with the MOU between NASA and RSA, full satisfaction of the RSA share of common system operations responsibilities, through performance of common system operations and other activities, is as agreed in implementing arrangements. In addition to RSA's activities referred to above, RSA will perform common system operations, contributing to the support of the operation of elements NASA, ESA, the GOJ and CSA collectively provide. NASA, ESA, the GOJ and CSA will work together, in accordance with Article 9.4, to identify and quantify such activities and to account for them in the contents of the common system operations activities and costs.

9.4 The SOP will develop detailed procedures for the implementation of this Article, including to identify the detailed contents to be included in each category comprising common system operations and to estimate, based on agreed assumptions, a not-to-exceed figure for common system operations activities and costs to be approved by the MCB. The partners will also, each year, report to the SOP on their forecasts for future years for the common system operations activities and costs and on their identified actual annual common system operations activities and costs. The SOP, in consultation with the UOP, will work to contain the common system operations activities and costs within the estimated not-to-exceed figure approved by the MCB and to this end will recommend to the MCB corrective measures in the COUP whenever it appears that the annual forecasted costs may exceed this figure. In such cases, the MCB will either approve the SOP's recommendations or take other measures, including reevaluation and adjustment of the not-to-exceed figure. If possible, after the partners have gained experience in the operation of the Space Station, the SOP will endeavor to establish fixed values for the annual

common system operations activities and costs. RSA will participate in the process as appropriate.

9.5. Offsets

9.5.a. Any partner may, as agreed with NASA, in consultation with the other partners, perform common system operations or other activities to offset its responsibility for common system operations costs. NASA will establish with this partner, and any affected partners, implementing arrangements on the contents and scope of the common system operations activities and on any other activities to be performed by this partner to offset its responsibility for common system operations costs.

9.5.b. The provision by ESA of personnel as provided for in Articles 8.2.e, 8.2.g, 8.3.h, and 8.3.i, will be a contribution towards the offset of ESA's common system operations costs responsibility. ESA may also provide launch and return transportation as provided for in Article 12.1.i, and/or communication services as provided for in Article 12.2.h, as contributions towards the offset of ESA's common system operations costs responsibility. In accordance with Article 9.5.a, NASA and ESA will work together and with the other partners in such a way that provision by ESA of these services and performance of other activities lead to full offset of ESA's responsibility for common system operations costs, to the extent permitted by applicable laws and regulations. If ESA's responsibility for common system operations costs is not fully offset pursuant to this Article, any balance will remain ESA's responsibility and will not be transferred to NASA or another partner, nor reduced, unless otherwise agreed.

9.6 Costs of User Activities

9.6.a. Costs of user activities such as payload/experiment design, development, test and evaluation (DDT&E); payload ground processing; provision of payload/experiment spares and associated equipment; transmission and handling of user data; launch and return of payloads/experiments, spares and associated equipment; launch and return of the fraction of the logistics carriers provided for in Article 3 that is attributable to user payloads/experiments, spares and associated equipment; and any special user integration or user operations support, including specialized crew training, will be the responsibility of Space Station users or of individual partners as users. Such costs will not be shared among NASA, ESA and the other partners. In addition, the DDT&E and operations costs of the users' support centers will not be shared among NASA, ESA and the other partners.

9.7. NASA, ESA and the other partners will not recoup their DDT&E costs for their elements from one another in the operation and utilization of the Space Station.

9.8. In the case of failure of any partner to perform its operations responsibilities, as provided in Article 9.2, or to provide for its share of common system operations responsibilities, as provided in Article 9.5, the partners will meet to discuss what action should be taken. Such action could result in, for example, an appropriate reduction of the failing partner's rights to its allocations.

Article 10

Safety

10.1. In order to assure safety, NASA has the responsibility, working with ESA and the other partners, to establish overall Space Station safety requirements and plans covering Space Station detailed design and development and mature operations and utilization. Such requirements and plans for detailed design and development have been established, and development of further safety requirements and plans for detailed design and development and mature operations and changes to safety requirements and plans will be processed according to the procedures in Articles 7 and 8.

10.2. Each partner will develop detailed safety requirements and plans, using its own requirements for its Space Station hardware and software. Such requirements and plans must meet or exceed the overall Space Station safety requirements and plans. Each partner will have the responsibility to implement applicable overall and detailed Space Station safety requirements and plans throughout the lifetime of the program, and to certify that such requirements and plans have been met with respect to the Space Station elements and payloads it provides. NASA will have the overall responsibility to certify that the Space Station as a whole and its elements and payloads are safe.

10.3. NASA will conduct overall integrated system safety reviews for Space Station elements, launch package stage, and payloads, which ESA will support. NASA, ESA and the other partners will also conduct safety reviews of the elements and payloads they provide; NASA will participate in and support such reviews by the other partners. Each partner will also participate in and support safety reviews by the other partners as appropriate, related to the elements and payloads which that partner provides. Partner support to such safety reviews will include provision of necessary safety-related information to enable the other partners to conduct their reviews. The partners will participate as appropriate in any Space Station safety review boards managed by NASA.

10.4. NASA, ESA and the other partners will establish contingency procedures for on-orbit emergencies to protect the safety of the Space Station and its crew. NASA, ESA and the other partners will also establish a process for consultations in the event of on-orbit emergencies for which contingency procedures do not exist. If this consultation process cannot be followed within the time required, due to the nature of the emergency, or if consensus cannot be reached within the time required, NASA will have the responsibility for making decisions necessary to protect the safety of the Space Station and its crew, following procedures agreed in advance for implementation of such decisions.

Article 11

Space Station Crew

11.1. Each partner has the right to provide personnel to serve as Space Station crew from the time the partner begins to share common system operations responsibilities. During the period of

a three-person crew, NASA and RSA will be allocated 50% of the three crew flight opportunities. The above allocations will be adjusted as allocations to the other partners for crew flight opportunities begin, commensurate with utilization resource allocations specified in Article 8.3.b, while maintaining equal shares for NASA and RSA. Such adjustments will be as agreed in implementing arrangements between NASA and RSA. During Assembly, flight opportunities for NASA and RSA Space Station crew will be satisfied over time and not necessarily on each specific crew rotation cycle; however, in the event of adjustments, each crew complement will have at least one representative from NASA and one from RSA. Following outfitting of the NASA-provided Habitation Module and initial operational verification of the NASA-provided crew rescue vehicle, when the Space Station has a crew of seven, RSA will be allocated three crew flight opportunities. The remaining four crew flight opportunities will be allocated to NASA, ESA, the GOJ and CSA commensurate with utilization resource allocations specified in Article 8.3.b and will be satisfied over time, not necessarily on each specific crew rotation cycle. The SOP will annually or as required by any partner review the implementation of this paragraph and provide its conclusions to the MCB.

11.2. During assembly and verification, a fully trained ESA crew member will participate in the on-orbit assembly and system verification of the ESA-provided European pressurized laboratory and other assigned flight element assembly and system verification tasks planned during that on-orbit period as provided in the verification plan described in Articles 6.1.a.4 and 6.2.a.3. NASA takes note of ESA's request for assignment, subject to applicable crew assignment procedures, of an ESA crew member in connection with the demonstration flight of the European orbital transfer vehicle.

11.3. The MCB has established a Multilateral Crew Operations Panel (MCOP), which will be the primary forum for the top-level coordination and resolution of Space Station crew matters which affect all partners including the processes, standards and criteria for selection, certification, assignment and training of Space Station crew. The MCB will develop an MCOP Charter that defines the specific responsibilities of this Panel. Any modifications to this Charter will be approved by the MCB. The MCOP will have a rotating chairmanship and all decisions taken will be by consensus. The partners will propose to the MCOP their candidates for Space Station crew based on mission requirements and allocated flight opportunities. If the MCOP determines the candidates meet the Space Station crew standards and criteria, the candidates will be assigned to specific crew complements, subject to approval in accordance with the partners' internal agency procedures. Following assignment to a crew, the entire crew will begin increment-specific training in order to acquire skills necessary to conduct Space Station operations and utilization. One or more specific crew complements can be trained as a team in preparation for a specific crew rotation cycle according to the agreed curriculum and specific mission requirements. The MCOP will determine the readiness of the crew for flight based on the results of a review of the crew's medical condition and the crew's performance during training.

11.4. NASA, ESA and the other partners will establish a Multilateral Medical Policy Board (MMPB) to provide coordination and oversight of crew health issues. NASA and ESA will each provide a single point of contact for medical support who will have full responsibility on behalf of its respective agency to resolve issues related to the development of a common system for medical support. The MMPB will be supported by a Multilateral Space Medicine Board

(MSMB) and by a Multilateral Medical Operations Panel (MMOP), established by NASA and ESA with the other partners, which will be the primary working level groups for coordination of crew health matters including clinical care, medical standards, preventative medicine (including operational countermeasures) and environmental monitoring. The MMOP and the MSMB will operate on the principle of consensus. The MMOP will develop medical standards, certification criteria, pre-flight, in-flight, and post-flight medical care requirements, medical hardware responsibilities and operational procedures and recommend them to the MSMB for approval. The MSMB will present its decisions and findings to the MMPB and MCOP, as appropriate, for review and concurrence. NASA and ESA will be responsible for medical certification of their respective crew members in accordance with agreed standards, and will present the appropriate documentation to the MSMB for approval. The MSMB will have responsibility for final medical certification of crew and for oversight of the implementation of medical operations.

11.5. NASA, ESA and the other partners will establish a Human Research Multilateral Review Board (HRMRB). This Board will have the responsibility for assuring that human research protocols do not endanger the health, safety, and well-being of human research subjects on the Space Station, while ensuring ethical conduct of experiment operations. The HRMRB will review and approve, prior to their implementation, human research protocols for the Space Station proposed by the partners. The HRMRB will operate on the principle of consensus.

11.6. The Space Station crew will operate as one integrated team with one Commander. Consistent with the principle of integrated crew, the entire crew will operate under a single timeline for performance of all operations and utilization activities. The crew Commander will be responsible for the mission program implementation and crew safety assurance aboard the Space Station. Specific details concerning this integrated crew concept will be agreed by the MCOP.

11.7. NASA will be financially responsible for all compensation, medical expenses, subsistence costs on Earth, and training for Space Station crew which it provides. ESA will be financially responsible for all compensation, medical expenses, subsistence costs on Earth, and training for Space Station crew which it provides. NASA and ESA each agree to waive fees for Space Station-related training for the other's Space Station crew. Specifically, ESA will not be charged Space Station-related training costs for its Space Station crew training at NASA or NASA contractor facilities, and NASA will not be charged Space Station-related training costs for its Space Station crew training in ESA or ESA contractor facilities. This waiver of fees will also apply to any Space Station-related crew training at NASA or NASA contractor facilities or at ESA or ESA contractor facilities for all other partners' Space Station crew. Space Station-related crew training will be defined by the MCOP. Such training includes instruction training materials and equipment, access to all necessary facilities (including travel among NASA and NASA contractor facilities and travel among ESA and ESA contractor facilities) and all costs for activities in the agreed training plan and curriculum that will be used for training following certification of Space Station crew pursuant to Article 11.3. Agreed training for all assigned duties will be required.

11.8. The Space Station Code of Conduct will be developed by the partners and submitted to the MCB for approval. Each partner must have approved the Space Station Code of Conduct before

it provides Space Station Crew. The Space Station Code of Conduct will, inter alia: establish a clear chain of command on-orbit; clear relationship between ground and on-orbit management; and management hierarchy; set forth standards for work and activities in space, and, as appropriate, on the ground; establish responsibilities with respect to elements and equipment; set forth disciplinary regulations; establish physical and information security guidelines; and provide the Space Station Commander appropriate authority and responsibility, on behalf of all the partners, to enforce safety procedures and physical and information security procedures and crew rescue procedures for the Space Station.

Article 12

Transportation, Communications and Other Non-Space Station Facilities

12.1. Transportation

12.1.a Launch and return transportation services for the Space Station will be provided by the following government and private sector space transportation systems:

- the U.S. Space Shuttle;
- the European Ariane-5 launch vehicle and the associated orbital transfer vehicle;
- the Russian Proton, and Soyuz launch vehicles and the Progress M and Soyuz TM; and
- the Japanese H-II launch vehicle and the associated orbital transfer vehicle.

12.1.b The partners will also have the right of access to the Space Station for launch and return transportation services using other government or private sector space transportation systems of the partners. Potential future partner space transportation systems include:

- the European vehicle for crew and cargo delivery and return, and
- the Japanese Space Transportation System for Space Station launch and return transportation services

12.1 c Recognizing that the responsibility for developing space transportation systems and for making them technically and operationally compatible with the Space Station rests with the providing partner, the appropriate partners will exchange that information necessary to support such compatibility. Technical, operational and safety requirements for access to the Space Station will be controlled in appropriate program documentation as provided for in Articles 7 and 8.

12.1.d. Provision of launch and return transportation services to the Space Station will be in accordance with the integrated traffic planning, management mechanisms, and documentation provided for in Articles 7 and 8 and in accordance with Article 9. NASA, ESA and the other partners providing Space Station launch and return services will each develop a partner

transportation model, for their transportation systems. The partners' transportation models will be combined into a single integrated launch and return transportation model for the Space Station program. This integrated launch and return transportation capability to be provided by the partners providing launch and return transportation services will be the basis for the integrated traffic planning process supporting the development of the COUP, which will specify launch and return vehicles, their capabilities, allocation of launch and return transportation services to the partners, and the relevant schedules

12.1.e. Except as otherwise agreed, each partner provides or arranges with other partners on a reimbursable basis for the provision of launch and return transportation services for the flight elements it provides including assembly and logistics requirements. With regard to utilization activities, each partner provides or arranges with other partners on a reimbursable basis for the provision of launch and return transportation services in connection with its Space Station users. The right to obtain launch and return transportation services for Space Station utilization activities is as provided in Article 8.3.d. Reimbursement for such services may be in cash, or agreed kind. All reimbursable transportation services will be provided under launch services agreements.

12.1.f. NASA will provide reimbursable Space Shuttle launch and return transportation services to ESA in connection with the assembly of the ESA-provided European pressurized laboratory to the Space Station including its initial outfitting in accordance with the program documentation described in Article 7.2. Consistent with Article 16.4, ESA reimbursement for these services will be made through the provision of goods and services as described in Article 6.3 and set forth in implementing arrangements.

12.1.g. NASA will provide reimbursable Space Shuttle launch and return transportation services to the GOJ in connection with the assembly of the GOJ-provided JEM to the Space Station and its initial outfitting in accordance with the program documentation described in Article 7.2.

12.1.h. NASA will be responsible for standard Space Shuttle launch and return transportation services in connection with the assembly of the CSA-provided flight elements to the Space Station (CSA will be responsible for any optional Space Shuttle launch services required in connection with the assembly of the CSA-provided flight elements to the Space Station).

12.1.i. Partners which provide launch and return transportation services in connection with Space Station common systems operations will do so in accordance with Article 9.

12.1.j. Each partner will use its best efforts to accommodate additional launch and return transportation service requirements in relation to the Space Station, as well as proposed requirements and flight schedules related to the Space Station activities described above.

12.1.k. Each partner will respect the proprietary rights in, and confidentiality of, appropriately marked data and goods to be transported on its launch and return transportation system.

12.2. Communications

Space Station communications will involve space-to-ground, ground-to-space, ground-to-ground and space-to-space data transmission.

12.2.a. NASA will provide the TDRSS space and ground communications network for command, control and operations of Space Station elements and payloads, as provided for in Article 8.2.g, and other Space Station communications purposes.

12.2.b. RSA will provide the RSA Data Relay Satellite system space and ground network for command, control and operations of Space Station elements and payloads, as provided for in Article 8.2.g, and other Space Station communications purposes

12.2.c. ESA may provide the EDRS space and ground network for complementary communications support for command, control and operations of the European pressurized laboratory and payloads, and other Space Station communications purposes.

12.2.d. The GOJ may provide the GOJ data relay satellite system space and ground network for complementary communications support for command, control and operations of the JEM and payloads, and other Space Station communications purposes

12.2.e. Recognizing that the responsibility for developing the above systems and for making them technically and operationally compatible with the Space Station and with Space Station use of TDRSS and the RSA Data Relay Satellite system rests with the providing partner, NASA or RSA will provide information necessary to support such compatibility. Other communications systems may be used on the Space Station by the partners or Space Station users if such communications systems are compatible with the Space Station and with the Space Station use of TDRSS and the RSA Data Relay Satellite system. Technical, operational, regulatory and security requirements related to Space Station communications will be controlled in appropriate program management mechanisms and in documentation as provided for in Articles 7 and 8. Unless otherwise agreed with NASA or NASA and RSA, end-to-end transmission of data throughout the Space Station communications system will be compatible with the communications transportation formats, protocols and standards agreed to by the Consultative Committee for Space Data Systems (CCSDS).

12.2.f. Provision of Space Station communications will be in accordance with the management mechanisms and documentation provided for in Articles 7 and 8 and documented in the COUP.

12.2.g. With regard to utilization activities, each partner will provide, or arrange with other partners on a reimbursable basis for the provision of, communications services in connection with its Space Station users. Reimbursement for such services may be in cash, or agreed kind. All reimbursable communications services will be provided under communications services agreements. The right to obtain TDRSS or RSA Data Relay Satellite system data transmission capacity and data transmission capacity provided by other partners as applicable for Space Station utilization activities is as provided in Article 8.3.d. The partners will use their best efforts to accommodate, with their respective communications systems, each other's specific Space Station-related requirements.

12.2.h. Partners and users of the partners may implement measures to ensure confidentiality of their utilization and housekeeping data passing through the communications systems being used in connection with the Space Station. (Notwithstanding the foregoing, data which are necessary to assure safe operations will be made available according to procedures in the Operations Management Plan and the Utilization Management Plan and their use will be restricted to safety purposes only.) Each partner will respect the proprietary rights in, and the confidentiality of, the utilization and housekeeping data passing through its communications systems, including its ground network and the communications systems of its contractors, when providing communications services to another partner. Each partner will respect the confidentiality of personnel and medical data passing through its communications systems, including its ground network and the communications systems of its contractors, when providing communications services to another partner.

12.2.i. The partners will each assure that their Space Station information resources, such as computer systems and data transmission systems, are provided a level of security and integrity consistent with potential harm from their loss, inaccuracy, alteration, unavailability, or misuse. The level of security and integrity referred to above is defined through the management mechanisms and controlled in the documentation provided for in Articles 7 and 8.

12.3. Other Non-Space Station Facilities

12.3.a. Should ESA desire to use the Space Shuttle, Spacelab, or other NASA facilities on a cooperative or reimbursable basis to support the development of its Space Station Utilization Plan or to support its Space Station detailed design or development activities, NASA will use its best efforts to accommodate ESA's proposed requirements and schedules. Likewise, should NASA desire to use Ariane or other ESA facilities on a cooperative or reimbursable basis to support the development of its Space Station Utilization Plan or to support its Space Station detailed design or development activities, ESA will use its best efforts to accommodate NASA's proposed requirements and schedules.

12.3.b. If NASA and ESA agree that it is appropriate and necessary for the conduct of the cooperative program, NASA and ESA will use their good offices in connection with attempting to arrange for the use of U.S. and European Governments' or contractors' facilities by the Parties and/or their contractors. Such use will be subject to separate arrangements between the user and the owner of the facilities.

Article 13

Advanced Development Program

13.1. NASA and ESA each are conducting Space Station advanced development programs in support of their respective detailed design and development activities. Cooperation in such advanced development activities will be considered on a case-by-case basis and entered into where it is advantageous to both sides and where there are reciprocal opportunities.

13.2. ESA proposals to use NASA advanced development test beds or other NASA facilities in support of ESA's Space Station advanced development program will be considered on a case-by-case basis either on a cooperative or reimbursable basis. Likewise, NASA proposals to use ESA's facilities in support of NASA's Space Station advanced development program will be considered on a case-by-case basis either on a cooperative or reimbursable basis.

13.3 Should ESA desire to use the Space Shuttle or Spacelab on a cooperative or reimbursable basis to support ESA Space Station advanced development activities, NASA will use its best efforts to accommodate ESA's proposed requirements and flight schedules. Likewise, should NASA desire to use ESA launch vehicles on a cooperative or reimbursable basis to support NASA Space Station advanced development activities, ESA will use its best efforts to accommodate NASA's proposed requirements and flight schedules

Article 14

Space Station Evolution

14.1 NASA, ESA and the other partners intend that the Space Station will evolve through the addition of capability and will strive to maximize the likelihood that such evolution will be effected through contributions from all the partners. To this end, it will be the object of the Parties to provide, where appropriate, the opportunity to the other partners to cooperate in their respective proposals for additions of evolutionary capability. The Space Station together with its additions of evolutionary capability will remain a civil station, and its operation and utilization will be for peaceful purposes, in accordance with international law.

14.2. This MOU sets forth rights and obligations concerning only the elements listed in Article 3, except that this Article and Article 16 of the Intergovernmental Agreement will apply to any additions of evolutionary capability. As such, this MOU does not commit either Party to participate in, or grant either Party rights in, the addition of evolutionary capability.

14.3 NASA and ESA agree to study evolution concepts for the Space Station during detailed design and development and mature operations and utilization. NASA will be responsible for development of overall Space Station evolution concepts, in consultation with ESA and the other partners, and for integrating ESA's and the other partners' evolution concepts into an overall Space Station evolution plan.

14.4. NASA, ESA, and the other partners will participate in an International Evolution Working Group (IEWG) to coordinate their respective evolution studies and to consider overall Space Station evolution concepts and planning activities.

14.5. The MCB will review specific evolutionary capabilities proposed by any partner, assess the impacts of those plans on the other partners' elements and on the Space Station, and review recommendations for minimizing potential impacts on Space Station activity during the addition of evolutionary capabilities

14.6. Following the review and assessment provided for in Article 14.5, and consistent with the provisions of the Intergovernmental Agreement, cooperation between or among partners regarding the sharing of addition(s) of evolutionary capability will require either the amendment of this MOU, the MOU between NASA and the GOJ, the MOU between NASA and CSA and/or the MOU between NASA and RSA, or a separate agreement to which NASA, to ensure that any addition is consistent with the overall program, and any other partner providing a Space Station element or space transportation system on which there is an operational or technical impact, will be a party.

14.7. Following the review and assessment provided for in Article 14.5, and consistent with the provisions of the Intergovernmental Agreement, the addition of evolutionary capability by one partner will require prior notification of the other partners and an agreement with NASA, to ensure that any addition is consistent with the overall program, and with any other partner providing a Space Station element or space transportation system on which there is an operational or technical impact.

14.8. The addition of evolutionary capability will in no event alter the rights and obligations of either Party to this MOU concerning the elements listed in Article 3, unless otherwise agreed by the affected Party.

Article 15

Cross-Waiver of Liability; Exchange of Data and Goods; Treatment of Data and Goods in Transit; Customs and Immigration; Intellectual Property; Criminal Jurisdiction

The Parties note that, with respect to the cross-waiver of liability, exchange of data and goods, treatment of data and goods in transit, customs and immigration, intellectual property and criminal jurisdiction, the relevant provisions of the Intergovernmental Agreement apply.

Article 16

Financial Arrangements

16.1. Each Party will bear the costs of fulfilling its responsibilities, including but not limited to costs of compensation, travel and subsistence of its own personnel and transportation of all equipment and other items for which it is responsible under this MOU. However, as provided in Article 9.3, the partners will equitably share common system operations responsibilities.

16.2. The ability of each Party to carry out its obligations is subject to its funding procedures and the availability of appropriated funds.

16.3. In the event that funding problems are arising that may affect a partner's ability to fulfill its responsibilities under this MOU, that partner will promptly notify and consult with the other partners. Further, the Parties undertake to grant high priority to their Space Station programs in developing their budgetary plans.

16.4. The Parties will seek to minimize the exchange of funds while carrying out their respective responsibilities in this cooperative program, including through the performance of specific operations activities as provided for in Article 9 or, if they agree, through the use of barter, that is, the provision of goods or services.

Article 17

Public Information

17.1. NASA and ESA will be responsible for the development of an agreed Public Affairs Plan that will specify guidelines for NASA/ESA cooperative public affairs activities during the detailed design, development, operation and utilization of the Space Station.

17.2. Within the Public Affairs Plan guidelines, both NASA and ESA will retain the right to release public information on their respective portions of the program. NASA and ESA will undertake to coordinate with each other, and, as appropriate, with the other partners, in advance concerning public information activities which relate to each other's responsibilities or performance in the Space Station program.

Article 18

Consultation and Settlement of Disputes

18.1. The Parties agree to consult with each other and with the other partners promptly

when events occur or matters arise which may occasion a question of interpretation or implementation of the terms of this MOU.

18.2. In the case of a question of interpretation or implementation of the terms of this

MOU, such question will be first referred for settlement to the appropriate officials designated, respectively, by the NASA Administrator and the ESA Director General. The Parties recognize that in the case of a question which requires consideration by another partner, the consultations will be broadened so as to include appropriate officials designated, respectively, by the Minister of State for Science and Technology of Japan, the President of CSA or by the RSA General Director

18.3. Any question of interpretation or implementation of the terms of this MOU

which has not been settled in accordance with Article 18.2 will be referred for settlement to the NASA Administrator and the ESA Director General. The Parties recognize that in case of a question which requires consideration by another partner, the matter will also be referred to the Minister of State for Science and Technology of Japan, the President of CSA and/or the RSA General Director.

18.4. Any issues arising out of this MOU not satisfactorily settled through

consultation pursuant to this Article may be pursued in accordance with the relevant provisions of the Intergovernmental Agreement.

18.5. Unless otherwise agreed between NASA and ESA, implementation of decisions

made pursuant to mechanisms provided for in this MOU will not be held in abeyance pending settlement of issues under this Article, except as provided in Articles 7.1.d and 8.1.b.

Article 19

Entry into Force

19.1. Pursuant to the Arrangement Concerning Application of the Space Station

Intergovernmental Agreement Pending its Entry into Force (hereinafter the "Provisional Arrangement"), which became effective on January 29, 1998, this MOU will enter into force after signature of both the NASA Administrator or his designee and the ESA Director General or his designee, upon written notification by each Party to the other that all procedures necessary for its entry into force have been completed. Upon entry into force of this MOU, the 1988 MOU will cease to be in force.

19.2. Pending the entry into force of the Intergovernmental Agreement for the Government of the United States and the European Partner in accordance with Article 25 of that Agreement, the Parties agree to abide by the relevant terms of that Agreement, to the fullest extent possible consistent with applicable domestic laws and regulations.

19.3. If the United States or the European Partner withdraws from the Provisional Arrangement, the corresponding Cooperating Agency will be deemed to have withdrawn from this MOU effective from the same date.

19.4. If the Intergovernmental Agreement has not entered into force between the United States and the European Partner in accordance with Article 25 of that Agreement within a period of two years after its signature, the Parties will consider what steps are necessary and appropriate to take account of that circumstance

19.5. If the United States or the European Partner gives notice of withdrawal from the Intergovernmental Agreement in accordance with Article 28 of that Agreement, the corresponding Cooperating Agency will be deemed to have withdrawn from this MOU effective from the date of such withdrawal.

Article 20

MOU Amendments

This MOU may be amended at any time by written agreement of the Parties. Any amendment must be consistent with the Intergovernmental Agreement. To the extent that a provision of this MOU reflects specific rights or obligations accepted by another partner under other MOUs with NASA, that provision may be amended only with the written consent of that partner.

Article 21

Language

The working language for all activities under this MOU will be the English language and all data and information generated and provided under this MOU will be in the English language. The foregoing principle does not preclude the use of another language when such use is accepted, in specific instances, as agreed by the Parties.

Article 22

Review

Upon the request of either Party, the Parties will meet for the purpose of reviewing and promoting cooperation in the Space Station. In the process of this review, the Parties may consider amendments to this MOU.

DONE at Washington, D.C., this 29th day of January, 1998, in two originals in the English, French, German and Italian languages, each text being equally authentic.

FOR THE NATIONAL AERONAUTICS
AND SPACE ADMINISTRATION
OF THE UNITED STATES OF
AMERICA

FOR THE EUROPEAN SPACE
AGENCY:

signed by NASA Administrator

signed by ESA Director General

Daniel S. Goldin

Antonio Rodata