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Memorandum of Understanding Between the  
United States National Aeronautics and Space  
Administration and the European Space Agency  
on Cooperation in the Detailed Design,  
Development, Operation and Utilization of the  
Permanently Manned Civil Space Station

[1] The National Aeronautics and Space Administration (hereinafter "NASA") and the European Space Agency (hereinafter "ESA"),

Recalling that in his State of the Union Address of January 25, 1984, the President of the United States directed NASA to develop and place into orbit within a decade a permanently manned Space Station and invited friends and allies of the United States to participate in its development and use and to share in the benefits thereof, in order to promote peace, prosperity and freedom,



Recalling the terms of Resolution Number 2 adopted on 31 January 1985 by the ESA Council meeting at ministerial level on participation in the Space Station program,

Recalling the terms of Resolution Number 2 adopted on 10 November 1987 by the ESA Council meeting at ministerial level on participation in the Space Station program,

Recalling the NASA Administrator's letter of April 6, 1984, to the ESA Director General,

Having successfully implemented the Memorandum of Understanding between NASA and ESA for the Conduct of Parallel Detailed Definition and Preliminary Design Studies (Phase B) Leading toward Further Cooperation in the Development, Operation and Utilization of a Permanently Manned Space Station, which entered into force on June 3, 1985,

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 (hereinafter "the Intergovernmental Agreement") and particularly Article 4 thereof,

[2] Considering the Memorandum of Understanding between NASA and the Science and Technology Agency of Japan (STA) for the Cooperative Program Concerning Detailed Definition and Preliminary Design Activities of a Permanently Manned Space Station, which entered into force on May 9, 1985, and the Memorandum of Understanding between NASA and the Ministry of State for Science and Technology of Canada (MOSST), for a Cooperative Program Concerning Detailed Definition and Preliminary Design (Phase B) of a Permanently Manned Space Station, which entered into force on April 16, 1985,

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 and recognizing that the GOJ has designated STA in that Memorandum of Understanding as its Cooperating Agency, as provided for in Article 4 of the Intergovernmental Agreement,

Considering also the Memorandum of Understanding between NASA and MOSST on Cooperation in the Detailed Design, Development, Operation and Utilization of the Permanently Manned Civil Space Station,

Convinced that this cooperation among NASA, ESA, STA and MOSST 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 concerning the detailed design, development, operation and utilization of the permanently manned civil Space Station 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 [3] the nature of the genuine partnership, including the respective rights and obligations of the Parties to this MOU.

1.2. The specific objectives of this MOU are:

- to detail the roles and responsibilities of NASA, ESA, STA and MOSST (hereinafter the "partners") 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 STA and MOSST;
- 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 framework 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.

1.3. Relevant definitions and explanations are to be found in Article 22.

#### *Article 2 - General Description of the Space Station*

2.1. NASA has a Space Station program which will produce a core U.S. Space Station. ESA has a Columbus program, and STA and MOSST also have space programs to produce significant elements which, together with the core U.S. Space Station, will create an international Space Station complex with greater capabilities that will enhance the use of space for the benefit of all participating nations and humanity. MOSST's contribution will be an essential part of the infrastructure of the permanently manned civil international Space Station complex (hereinafter "the Space Station").

2.2. The Space Station will be a unique, multi-use facility in low-Earth orbit, comprising both manned and unmanned elements: a permanently manned base comprising elements provided by all the partners; unmanned platforms in near-polar orbit; a manned free-flying laboratory to be serviced at the manned base, and Space Station-unique ground elements to support the operation and utilization of the elements on orbit.

[4] 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, with elements in low inclination and near-polar orbits, 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 manufacturing capability in space, where the unique space environment enhances commercial opportunities;
- an infrastructure to encourage 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 manned mission to Mars, unmanned planetary probes, a manned survey of the asteroids, and a manned scientific and communications facility in geosynchronous orbit.

#### *Article 3 - Space Station Elements*

3.1. The Space Station will consist of elements 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.

[5] 3.2. NASA Space Station Flight Elements: NASA will design, develop and provide the following flight elements including subsystems, the Extra Vehicular Activity (EVA) system, the Space Station Information System, flight software and spares as required:

- one permanently attached Habitation Module with complete basic functional outfitting to support habitation for a crew of up to eight, including primary storage of crew provisions
- one permanently attached multipurpose Laboratory Module, located so as to contain the center of gravity of the manned base, with complete basic functional outfitting and including provisions for storage of NASA spares, secondary storage of crew provisions, and storage for safe haven capability
- two sets of Attached Payload Accommodation Equipment for accommodation of payloads externally attached to the Space Station Truss Assembly
- four Resource Nodes which provide pressurized volume for crew and equipment, connections between manned base pressurized elements and support of pressurized attached payloads
- Truss Assembly which is the manned base structural framework
- Solar Photovoltaic Power Modules which serve as the manned base electrical power source, providing 75kw of total power
- Propulsion Assembly
- at least three sets of Logistics Elements (pressurized and unpressurized Integrated Logistics System carriers) which provide systems operation support and user ground-to-orbit and return logistics and on-orbit supply for extended periods
- Airlock/Hyperbaric Airlock for purposes of crew and equipment transfer
- one Flight Telerobotic System (FTS)
- one Mobile Transporter which will serve to provide translation capability for the Mobile Servicing Center
- one Polar Platform to work together with the ESA-provided Polar Platform

[6] 3.3 ESA Space Station Flight Elements: ESA will design, develop and provide the following flight elements including subsystems, flight software and spares as required:

- one Attached Pressurized Module (APM), with volume equivalent to that of four Spacelab segments, permanently attached to the manned base, with complete basic functional outfitting and including provisions for storage of ESA spares, secondary storage of crew provisions, and storage for safe haven capability
- one Polar Platform to work together with the NASA-provided Polar Platform
- one Man-Tended Free Flyer (MTFF), including a pressurized module, with volume equivalent to that of two Spacelab segments, capable of autonomous operational periods of six months or longer

3.4 STA and MOSST Space Station Flight Elements: As reflected in the MOU between NASA and the GOJ and in the MOU between NASA and MOSST:

3.4.a. STA Space Station Flight Elements. STA will design, develop and provide 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 and an Exposed Facility, at least two Experiment Logistics 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 provisions for storage of STA spares, secondary storage of crew provisions, and storage for safe haven capability

3.4.b. MOSST Space Station Flight Elements: 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 and retrieval functions
- EVA support

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

[7] - one Mobile Servicing Center (MSC) which comprises a Mobile Remote Servicer (MRS) and the NASA-provided Mobile Transporter

- one MSC Maintenance Depot (MMD), primarily for maintenance of the MSC, including external storage of MOSST element spares. (Necessary internal storage of MOSST element spares will be provided in the NASA-provided elements)

- one Special Purpose Dexterous Manipulator (SPDM)

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 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 to support the flight elements listed in Article 3.2: equipment required for specialized or unique integration or launch; ground support equipment (GSE) and flight support equipment (FSE) including necessary logistics; engineering support centers and user support centers, a polar platform control center; and test equipment, mock-ups, simulators, crew training equipment, software and any facilities necessary to house these items. To support the Space Station as a whole, NASA will provide Space Station-unique ground elements including the Space Station Control Center (SSCC), the Payload Operations Integration Center (POIC), subsystem testbeds and elements related to logistics support and to software development including the Software Support Environment.

3.5.b. As will be agreed and documented in the program documentation as provided for in Article 7, ESA will provide, at defined locations, a defined capacity of the following Space Station-unique ground elements to support the ESA flight elements listed in Article 3.3: 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 centers 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 and in the MOU between NASA and MOSST, STA and MOSST will provide, at defined locations, a defined capacity of the following Space [8] Station-unique ground elements to support their flight elements listed in Article 3.4. 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, 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, in accordance with allocation commitments detailed in Articles 8.3 a, 8.3.b, and 8.3 c. Beyond these allocation commitments, the capabilities of the Space Station will be made available to the partners subject to specific arrangement between the relevant partners.

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's between NASA and the GOJ and between NASA and MOSST.

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 ESA for its design and development activities, access to and use of the Space Station-unique ground elements provided by NASA to support the Space Station as a whole will be provided for in appropriate program documentation as provided for in Article 7. Access by ESA and NASA to each other's remaining Space Station-unique ground elements for design and development activities will be subject to specific arrangements on a space-available basis.

[9]

#### *Article 5 - Major Program Milestones*

5.1. The Space Station program of NASA and the Columbus program of 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 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 (Phase C/D), mature operations and utilization (Phase E) will begin.

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

- Initiation of NASA's Phase C/D	Dec 1987
- Initiation of ESA's Phase C/D	Feb 1988
- NASA-provided Polar Platform Preliminary Design Review	Jan 1989
- First Space Station Element Launch	Jan 1994
- NASA-provided Laboratory Module Launch	Jan 1995

- Permanently Manned Capability	Oct 1995
- NASA-provided Polar Platform Launch	Oct 1995
- ESA-provided APM Launch	Oct 1996
- Completion of Manned Base Assembly	Nov 1996
- ESA-provided Polar Platform Launch	Mar 1997
- Completion of NASA's Phase C/D; Initiation of Phase E	Nov 1997
- First Station Servicing of MTFF	Jun 1998

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 assembly sequence for all elements of the Space Station, will be updated as necessary and formally controlled in appropriate program documentation as provided for 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.

- [10] 1. provide overall program coordination and direction;
2. perform overall system engineering and integration and perform system engineering and integration for NASA-provided elements consistent with these responsibilities;
3. establish, in consultation with the other partners, overall verification, safety, reliability, quality assurance and maintainability requirements and plans and develop verification, safety, reliability, quality assurance and maintainability 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 3.5.5;
4. confirm that the ESA verification, safety, reliability, quality assurance and maintainability requirements and plans for the APM, for the MTFF insofar as it has effects on the manned base associated with its servicing at the manned base, and for the ESA-provided Polar Platform insofar as it has effects on the NASA Space Transportation System (STS) associated with its servicing by the STS, developed by ESA in accordance with Article 6.2.a.5, meet or exceed the overall Space Station verification, safety, reliability, quality assurance and maintainability requirements and plans;
5. provide regular progress and status information on NASA Space Station program activities and plans;
6. 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 into the Space Station and/or the coordinated operation and utilization of ESA-provided elements;
7. develop, with ESA, the agreed joint documentation described in Article 7.1;
8. 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;
9. conduct overall Space Station preliminary design reviews, critical design reviews, design certification [11] reviews, safety, reliability and quality 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 STS, including the ESA-provided APM, are acceptable for launch, on-orbit assembly and orbital operations; that the ESA-provided Polar Platform, to be launched on Ariane-5, is acceptable for servicing by STS, and that the ESA-provided MTFF, to be launched by Ariane-5, is acceptable for servicing at the manned base; and accommodate ESA representation as necessary for NASA and ESA to fulfill their respective responsibilities under this MOU;

10. conduct for the elements it provides preliminary design reviews, critical design reviews, design certification reviews, and safety, reliability and quality assurance reviews; and accommodate ESA representatives as necessary for NASA and ESA to fulfill their respective responsibilities under this MOU;

11. support, as appropriate, and provide information necessary for ESA to conduct the reviews identified in Article 6.2.a.11;

12. deliver on-orbit the ESA-provided APM and its initial outfitting in accordance with Article 12 and the assembly sequence controlled in appropriate program documentation as provided for in Article 7; [and] assemble on-orbit and verify interfaces of Space Station flight elements, including the flight elements that ESA will provide, with assistance from ESA, in accordance with agreed assembly, activation and verification plans;

13. assist in the on-orbit activation and performance verification of the APM provided by ESA in accordance with agreed assembly, activation and verification plans;

14. 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 7.1;

15. establish in Europe and accommodate in the U.S. agreed liaison personnel as provided in Article 7.2;

[12] 16. 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;

17. work with ESA and the other partners to ensure that the Space Station Composite Utilization Plan described in Article 8.3.f can be accommodated by the elements provided by NASA, ESA and the other partners—in particular, work with ESA and the other partners to establish standard interfaces between the elements and user-provided hardware and software; provide standard and special user integration and user operations support as described in Articles 8.3.e, 8.3.h, and 8.3.i to users of the other partners or the other partners as users who are to use the NASA-provided flight elements; perform rack-level physical integration on the ground of NASA users of the APM, plan and conduct user operations; and make available Space Station-unique ground elements to support the Space Station Composite Utilization Plan. In addition, NASA will work with ESA in order that NASA and MOSST, respectively, may establish the capabilities to distribute data to NASA and MOSST users of the APM directly from the NASA Tracking and Data Relay Satellite System (TDRSS) space network and to process NASA and MOSST user commands to the APM through the TDRSS space network;

18. 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 documents described in Article 7.1;

19. develop a Space Station Information System (SSIS) architecture for the end-to-end data transmission between the Space Station data source and the data user; [and]



establish and maintain a Software Support Environment (SSE), including necessary hardware and Space Station software standards to be established by NASA in consultation with ESA and the other partners, to work in conjunction with an ESA software development facility, in accordance with the documents described in Article 7.1;

20. 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.19;

[13] 21. develop an Integrated Logistics System for the manned base in accordance with the documents described in Article 7.1;

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

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

24. 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 costs as provided in Article 9;

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

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

4. provide resupply and logistics management/integration support for Space Station operations;

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 8.1.c. In order to accomplish this, provide standard and special user integration and user operations support as described in Articles 8.3.e, 8.3.h, and 8.3.i, perform rack-level physical integration on the ground of NASA users of the APM; make available its Space Station-unique ground elements to support this Consolidated Plan; support planning for future utilization activities, and, using the capabilities provided for in Article 6.1.a.17, NASA and MOSST, respectively, may distribute data to NASA and MOSST [14] users of the APM directly from the TDRSS space network and process NASA and MOSST user commands to the APM through the TDRSS space network;

6. provide logistics flights for the NASA-provided elements in accordance with Articles 9 and 12, and provide logistics flights for the ESA-provided elements in accordance with Articles 9 and 12;

7. provide the Space Station Control Center and the Payload Operations Integration Center for manned base operations control, a polar platform control-center for the NASA-provided Polar Platform; and engineering support centers for the NASA-provided elements as provided in Article 8;

8. maintain the Software Support Environment including hardware and software standards for the support of Space Station operations,

- 9 maintain its flight and ground software in accordance with the Space Station software standards described in Article 6.1.a.19;
10. upon completion of manned base assembly plus a one-year operational verification period, provide docking, access and servicing for the MTFF at the manned base as required by ESA, however, no more frequently than once every six months; and
11. if appropriate STS capability exists, provide for STS servicing of the NASA-provided Polar Platform and, if ESA selects to use this STS capability and with details to be agreed by NASA and ESA, provide STS servicing of the ESA-provided Polar Platform in accordance with Articles 9 and 12.

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 APM consistent with NASA's overall system engineering and integration responsibilities;
2. design the APM to be compatible with the STS and with the Space Station Information System which includes use of TDRSS;
- 3 design and develop the ESA-provided MTFF, insofar as the MTFF has effects on the manned base associated with its [15] servicing at the manned base, the design and development of the MTFF will comply with otherwise established manned base requirements, capabilities and interfaces, including safety; the MTFF will be capable of autonomous operational periods of six months or longer;
4. design and develop the ESA-provided Polar Platform; insofar as the ESA-provided Polar Platform has effects on the STS associated with its servicing by the STS, its design and development will comply with the operational and safety requirements of the STS;
5. develop, in consultation with NASA, verification, safety, reliability, quality assurance and maintainability requirements and plans for the APM, for the MTFF insofar as it has effects on the manned base associated with its servicing at the manned base, and for the ESA-provided Polar Platform insofar as it has effects on the STS associated with its servicing by the STS that meet or exceed the overall Space Station verification, safety, reliability, quality assurance and maintainability requirements and plans established in Article 6.1.a.3, which address the elements in Articles 3.3 and 3.5.b;
- 6 provide regular progress and status information on Columbus Program activities and plans;
7. provide, as applicable, program information, systems requirements information and technical interface information necessary to understand the impact of the ESA-provided flight elements on the Space Station configuration and/or on the coordinated operation and utilization of the Space Station, and necessary to integrate those flight elements into the Space Station;
- 8 develop, with NASA, the agreed joint documentation described in Article 7.1;
- 9 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;
- 10 maintain, and provide to NASA on request, ground and on-orbit verification test procedures and results as necessary to assess that the ESA-provided APM complies with overall Space Station program requirements and interface requirements, and, insofar as they have effects on the STS and the manned base, that the [16] ESA-provided Polar Platform and MTFF comply with the operational and safety requirements associated with servicing

of these ESA-provided elements by the STS and at the manned base, respectively, as set forth in the documents described in Article 7.1;

11. conduct for the elements it provides preliminary design reviews, critical design reviews and other reviews as set forth in the documents described in Article 7.1 which will include review of safety, reliability and quality assurance, and accommodate NASA representation as necessary for NASA and ESA to fulfill their respective responsibilities under this MOU,

12. support as appropriate, and provide information necessary for NASA to conduct, the reviews identified in Article 6.1.a.9;

13. support, as appropriate, and provide information necessary for NASA to conduct the reviews identified in Article 6.1.a.10;

14. following design and development of the APM, arrange for the on-orbit delivery of the APM and its initial outfitting in accordance with Article 12 and in accordance with the assembly sequence controlled by appropriate program documentation as described in Article 7;

15. launch and operate the MTFF so that its first servicing at the manned base will be no earlier than the completion of the one-year manned base operational verification period, and launch and operate the ESA-provided Polar Platform;

16. assist in the on-orbit assembly and interface verification of the ESA-provided APM in accordance with agreed assembly, activation and verification plans,

17. activate on-orbit and verify performance of the ESA-provided APM, with assistance from NASA, in accordance with agreed assembly, activation and verification plans; activate on-orbit and verify performance of the ESA-provided MTFF, in accordance with the appropriate program documentation as described in Article 7 which addresses the MTFF insofar as it has effects on the manned base associated with its servicing at the manned base; and activate on-orbit and verify performance of the ESA-provided Polar Platform;

18. for each ESA-provided flight element, provide necessary ground and flight support equipment and initial spares; [17] 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 7.1;

19. establish in the United States and accommodate in Europe agreed liaison personnel as provided in Article 7.2,

20. 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;

21. work with NASA and the other partners to ensure that the Space Station Composite Utilization Plan described in Article 8.3.f can be accommodated by the elements provided by NASA, ESA and the other partners—in particular, work with NASA and the other partners to establish standard interfaces between the elements and user-provided hardware and software, provide standard and special user integration and user operations support as described in Articles 8.3.e, 8.3.h, and 8.3.i to users of the other partners or the other partners as users who are to use the ESA-provided flight elements; support and provide information necessary for NASA and MOSST to perform rack-level physical integration on the ground of NASA and MOSST users of the APM; plan and conduct user operations; make available Space Station-unique ground elements to support the Space Station Composite Utilization Plan; and support and provide information necessary for NASA and MOSST, respectively, to establish the capabilities to distribute data to NASA and MOSST users of the APM directly from the TDRSS space network and to process NASA and MOSST user commands to the APM through the TDRSS space network;

22. establish and maintain, in accordance with the documents described in Article 7.1, a comparable computerized technical and management information system to work in conjunction with the NASA computerized information system referred to in Article 6.1.a.18. ESA will be responsible for the provision of necessary hardware and software based on information format and communication standards established by NASA, in consultation with ESA and the other partners;

23. establish and maintain the necessary hardware and software for software production to work in conjunction with the Software Support Environment;

[18] 24. develop and maintain flight and ground software related to elements it provides; for the ESA-provided APM, the development and maintenance of this software will be in accordance with Space Station software standards described in Article 6.1.a.19;

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

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 APM, for the MTFF insofar as it has effects on the manned base associated with its servicing at the manned base and for the ESA-provided Polar Platform insofar as it has effects on the STS associated with its servicing by the STS.

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 costs as provided in Article 9;

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

3. 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 8.1.c. In order to accomplish this, provide standard and special user integration and user operations support as described in Articles 8.3.e, 8.3.h, and 8.3.i, support and provide information necessary for NASA and MOSST to perform rack-level physical integration on the ground of NASA and MOSST users of the APM, make available its Space Station-unique ground elements to support this Consolidated Plan; support planning for future utilization activities; and support and provide information necessary for NASA and MOSST, respectively, to distribute data to NASA and MOSST users of the APM [19] directly from the TDRSS space network and to process NASA and MOSST user commands to the APM through the TDRSS space network;

4. arrange for logistics flights related to the ESA-provided elements in accordance with Articles 9 and 12;

5. provide operations control centers and engineering support centers for the ESA-provided APM, Polar Platform and MTFF, as provided in Article 8; and

6. maintain its flight and ground software for the elements it provides; for the ESA-provided APM, the maintenance of this software will be in accordance with Space Station software standards described in Article 6.1.a.19

*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 Phase C/D activities consistent with the provisions of this MOU. This Article establishes the management mechanisms to coordinate the respective Space Station design and development (including assembly and verification) 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 the NASA Associate Administrator for Space Station and the ESA Director of Space Station and Platforms, will meet periodically throughout the lifetime of the program or promptly at the request of either Party to review the Parties' respective design and development activities. The Co-Chairmen will together take those decisions necessary to assure implementation of the cooperative design and development activities related to Space Station flight elements and to Space Station-unique ground elements provided by the Parties, including, as appropriate, to design changes of the Parties' flight elements during Phase E. In taking decisions regarding design and development, the PCC will consider operation and utilization impacts, and will [20] also consider 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 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/STA PCC and/or the NASA/MOSST PCC.

7.1.c. Multilateral Program Reviews will be organized by NASA and will meet as necessary at the request of any partner so that the Parties to this MOU and the other partners can report progress and discuss the status of their Phase C/D program activities.

7.1.d. The manned base and NASA-provided Polar Platform requirements, configuration, housekeeping resource allocations for design purposes, and element interfaces will be controlled by the Space Station Control Board (SSCB) chaired by NASA. The SSCB will also control Space Station activities through the completion of assembly and initial operational verification, and other Space Station configuration control activities related to the manned base, related to the MTFF insofar as it has effects on the manned base associated with its servicing at the manned base, and related to the ESA-provided Polar Platform insofar as it has effects on the STS associated with its servicing by the STS. ESA will be a member of the SSCB, and of such subordinate boards thereof as may be agreed, attending and participating when these boards consider items which affect the APM, interfaces between the NASA-provided and the ESA-provided elements, interfaces between the ESA-provided elements and the STS, interfaces between the ESA-provided elements and other partner-provided elements, or the accommodation on the manned base of the Composite Utilization Plan and the Composite Operations Plan described in Article 8. Decisions by the SSCB Chairman may be appealed to the PCC, although it is the duty of the SSCB Chairman to make every effort to reach consensus with ESA rather than have issues referred to the PCC. 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. NASA will be a member of the Columbus Control Board chaired by ESA, and of such subordinate boards thereof as may be agreed, attending and participating as appropriate. As far as the elements separated from the manned base are concerned, NASA will assume management responsibility for the design and development of the NASA-provided Polar Platform, including meeting requirements related to polar [21] platform user interfaces and polar platform STS servicing; ESA will assume management responsibility for the design and development of the ESA-provided Polar Platform, including meeting requirements related to polar platform user interfaces and polar platform STS servicing; [and] ESA will also assume management responsibility for the design and development of the MTFF and for meeting requirements related to its effects on the manned base associated with its servicing at the manned base.

7.1.e. NASA will develop an overall Program Plan for Space Station design and development based on information provided by all the partners detailing overall program content, implementation approach and schedules. ESA will develop a Columbus Program Plan for design and development detailing ESA program content, implementation approach and schedules. A Joint Program Plan (JPP) for design and development, signed by the NASA Associate Administrator for Space Station and the ESA Director of Space Station and Platforms, will cover the interrelationship between the ESA program and the overall program. Any modification or any addition to the JPP will be approved by the PCC.

7.1.f. NASA will develop a Program Requirements Document (PRD) based on information provided by all the partners providing the programmatic basis for the overall conduct of Phase C/D. A Joint PRD (JPRD), signed by the NASA Associate Administrator for Space Station and the ESA Director of Space Station and Platforms, will represent the top-level requirements related to the APM, the MTFF insofar as it has effects on the manned base associated with its servicing at the manned base and the ESA-provided Polar Platform insofar as it has effects on the STS associated with its servicing by the STS. The JPRD will identify the applicability to the ESA program of all paragraphs in the PRD, including any which are added or modified. Any modification or any addition to the JPRD will be approved by the PCC.

7.1.g. NASA has developed an overall Program Definition and Requirements Document (PDRD) based on information provided by all the partners which contains requirements for Space Station flight element hardware and software and provides the technical basis for the overall conduct of Phase C/D. A Joint PDRD (JPDRD), signed by the NASA Program Director and the ESA Program Manager, contains the detailed requirements related to the APM, the MTFF insofar as it has effects on the manned base associated with its servicing at the manned base and the ESA-provided Polar Platform insofar as it has effects on the STS associated with its servicing by the STS. The JPDRD identifies the applicability to the ESA program of all paragraphs in the PDRD including any which are added or modified. Any modification to the PDRD will be approved by the SSCB. Any modification or any addition to the co-signed JPDRD will be mutually agreed and [22] jointly signed by the NASA Program Director and the ESA Program Manager.

7.1.h. NASA will develop Architectural Control Documents (ACD's) which define and control the end-to-end architecture of the manned base distributed systems and control the interfaces of these systems with each other and with the flight elements. In addition, NASA will develop, in consultation with the appropriate partners, 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

or among ground elements. NASA will also develop a Baseline Configuration Document (BCD) based on information provided by all the partners which controls the configuration of the manned base and of the NASA-provided Polar Platform. The ACD's and the BCD will be developed by the start of NASA's Phase C/D; the ICD's will be developed early in Phase C/D. Any modification or any addition to the ACD's, the BCD and the ICD's will be approved by the SSCB. Joint interface documentation, which identifies the applicability to the ESA-provided APM of all interfaces in the ACD's, BCD and ICD's, including any which are modified, will be developed by NASA and ESA. This joint interface documentation will be mutually agreed and jointly signed by the NASA Program Director and the ESA Program Manager. Any modification or any addition to this joint interface documentation will be mutually agreed and jointly signed by the NASA Program Director and the ESA Program Manager. NASA and ESA will jointly develop an ICD which will govern the interfaces between the ESA-provided MTFF and the manned base in connection with the docking, access and servicing of the MTFF at the manned base, in accordance with Article 6.2.a.3. NASA and ESA will also jointly develop an ICD in which they will agree on standard user interfaces for the polar platforms they provide; this ICD will also govern the interfaces between the ESA-provided Polar Platform and the STS. The MTFF ICD will be developed early in Phase C/D; the Polar Platform ICD will be established no later than the Preliminary Design Review for the NASA-provided Polar Platform. The MTFF and Polar Platform ICD's will be mutually agreed and jointly signed by the NASA Program Director and the ESA Program Manager. Any modification or addition to these documents will be mutually agreed and jointly signed by the NASA Program Director and the ESA Program Manager.

7.1.i. Program Management Reviews will be held as necessary at which the NASA Program Director and the Program Managers representing ESA and the other partners will report on the status of their respective design and development activities, including schedule, element performance parameters and element [28] interface requirements. These formal Program Management Reviews will be held at least quarterly and will be chaired by NASA. Less formal status reviews will be held monthly; representatives of the partners' Program Managers will attend these reviews.

7.1.j. ESA will participate in selected NASA reviews on Space Station requirements, architecture and interfaces as defined in the JPP. Similarly, NASA will participate in selected ESA reviews as defined in the JPP, the other partners will participate as appropriate.

7.1.k. Through participation in the above management mechanisms, NASA and ESA agree to achieve commonality on the manned base as required by the overall Space Station safety requirements as defined pursuant to Article 10. NASA and ESA also agree to provide standard interfaces for Space Station users both in the permanently attached pressurized laboratories and on the polar platforms. 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. Liaison. The NASA Office of Space Station and ESA Space Station and Platforms 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 the NASA Program Director and the ESA Program Manager, 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 Space

Station Program Office. 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 co-signed by the Co-Chairmen of the 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 [24] 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 planning for and direction of the operation of the manned base (including all elements within the operational Command and Control Zone (CCZ) of the manned base as defined in the program documentation provided for in Article 7) and the NASA-provided Polar Platform. ESA will have the responsibility for the planning for and direction of the operation of the elements it provides which are separated from the manned base (specifically, the MTFE when outside the operational CCZ of the manned base and the ESA-provided Polar Platform when outside the operational CCZ of the STS, as defined in the program documentation provided for in Article 7). Operations and utilization activities will comprise long-range planning and top-level direction 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. A Multilateral Coordination Board (MCB) will be established as soon as possible after the start of NASA's Phase C/D and 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 will comprise the NASA Associate Administrator for Space Station; the ESA Director of Space Station and Platforms; the MOSST Deputy Secretary, Space Policy Sector, and the STA Director-General of the Research and Development Bureau. The NASA Associate Administrator for Space Station will chair the MCB. The Parties agree that all MCB decisions should be made by consensus. However, 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. 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. Decisions regarding the operation and utilization of the ESA-provided elements which are separated from the manned base and which do not have effects on the manned base associated with servicing at the manned base or have effects on the STS associated with servicing by the STS will be taken by ESA, except as otherwise specifically provided in Article 8.3.

[25] 8.1.c. The MCB will establish Panels which will be responsible for the long-range strategic coordination of the operation and utilization of the Space Station, to be called



the System Operations Panel and the User Operations Panel respectively, described in detail below. The MCB will develop a charter that will define 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 charter 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 and the annual Composite Utilization Plan developed by the Panels and described below. In doing so, the MCB will be responsible for resolving any conflicts between the Composite Operations Plan and the Composite Utilization Plan which cannot be resolved by the Panels. The COUP will be prepared by the User Operations Panel and agreed to by the System Operations Panel. The charter for these Panels will also delineate the Panels' delegated responsibilities with respect to adjustment of the COUP. The COUP will be implemented by the appropriate tactical- and execution-level organizations.

8.1.d. Manned Base Hardware. The following is provided to explain the relationships between the different types of elements on the manned base which are allocated for use by the partners. The Space Station manned base includes:

- accommodations elements; and
- infrastructural elements.

The accommodations elements are the NASA-provided Laboratory Module, the ESA-provided APM, the STA-provided JEM including the Exposed Facility and the Experiment Logistics Modules, and the NASA-provided Attached Payload Accommodation Equipment. The infrastructural elements comprise all other manned base elements, including servicing elements and other elements that produce resources which permit all manned base elements to be operated and used.

8.1.d.1. Housekeeping. Both accommodations elements and infrastructural elements will be used for assembly, for verification and for maintenance of the manned base in an operational status, and also for the storage of element spares, crew provisions and safe haven capability, with secondary storage of crew provisions to be distributed equally among the three laboratories. In such use, they are referred to, respectively, as providing:

- [26] - housekeeping accommodations; and
- housekeeping resources

During Phase C/D, these housekeeping accommodations and housekeeping resources will be controlled in appropriate program documentation as provided for in Article 7. During Phase E, 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 manned base in an operational status will be used 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 and ESA agree to seek to minimize the demands for housekeeping accommodations and housekeeping resources in order to maximize those available for utilization.

8.1 e Platforms and MTFF. Because of the different character of the platforms and the MTFF, differentiation between accommodations and resources is not required. Mechanisms governing the operation of these elements are to be found in Article 8.2 and mechanisms governing the utilization of these elements are to be found in Article 8.3.

## 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 will establish, within three months of its establishment, a System Operations Panel (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.

[27] 8.2.c. The SOP will develop, approve and maintain an Operations Management Plan for the operation, maintenance and refurbishment of and logistics for the manned base, the NASA-provided Polar Platform and the ESA-provided Polar Platform insofar as these platforms have effects on the STS associated with their servicing by the STS, and the MTFF insofar as it has effects on the manned base associated with its servicing at the manned base during Phase E. 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 Operations Management Plan will also address operational requirements for the manned base, the NASA-provided Polar Platform and the ESA-provided Polar Platform insofar as these platforms have effects on the STS associated with their servicing by the STS, [and] the MTFF insofar as it has effects on the manned base associated with its servicing at the manned base and Space Station-unique ground elements. The Operations Management Plan will provide the procedures for preparation of the baseline operations plans and maintenance plans provided for in Articles 6.1.a.24 and 6.2.a.27, annual refinements to these baseline plans, and the Composite Operations Plan 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 Space Station Composite Operations Plan (COP) consistent with the annual Space Station Composite Utilization Plan described in Article 8.3.f. The COP will also identify the housekeeping accommodations and housekeeping resources required for maintenance of the manned base in an operational status. Compatibility of the COP and the Composite Utilization Plan must be assured through coordination between the SOP and the User Operations Panel, described in Article 8.3.d, during the preparation and approval process.

8.2.e. NASA, with the participation of all the partners, will be responsible for integrated tactical-level activities for Space Station manned base 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. ESA and the other partners will provide personnel to the integrated tactical operations organization who will bring expertise on the elements [28] each provides and will participate in overall integrated tactical operations 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. In conjunction with the integrated activities, NASA, ESA and the other partners will each perform distributed tactical-level activities related to the elements each provides, such as decentralized system operations support planning, user support planning, logistics planning, and the accommodations assessments described in Article 8.3.h. Tactical-level activities will include planning for system operations and for user support activities across all manned base elements. Tactical-level activities for elements separated from the manned base when outside the operational CCZ of the STS or the manned base, as defined in the program documentation provided for in Article 7, will be performed by the element provider. However, where the same services, such as transportation, logistics and communications, are required by both the manned base and elements which are operating separated from the manned base, planning for these services will be performed by the integrated tactical operations organization.

8.2.f. Tactical Operations Plans (TOP's) for the manned base and for the MTFF insofar as it has effects on the manned base associated with its servicing at the manned base will be developed by the tactical operations organization described in Article 8.2.e to implement the COUP. Each TOP will include Increment Plans (IP's) for a period of two years prior to launch of the STS to the manned base for a specific increment. (An increment is normally the interval between visits of the STS for the purpose of resupply in support of manned base operations and utilization as approved in the COUP.) Each IP will describe the detailed manifest of user payloads, systems support equipment and supplies needed to support the increment. Each IP 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 for that increment. The IP will identify the crew complement and define logistics requirements including STS interface requirements, changes to housekeeping resource requirements, changes to housekeeping accommodation requirements and communication requirements, including TDRSS use and requirements for distribution of data, to support the subject increment.

8.2.g. NASA, with the participation of all the partners, will be responsible for integrated execution-level planning for and execution of the day-to-day operation of the manned base. ESA and the other partners will participate in discharging the responsibilities of the Space Station Control Center (SSCC), [29] established and managed by NASA, which will conduct execution-level activities and support tactical planning. ESA and the other partners will provide personnel to the SSCC. These personnel will bring expertise on the elements that partner provides, will participate in overall SSCC-based activities, and will support real-time on-orbit activities with emphasis on the elements 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. In conjunction with the integrated activities, NASA, ESA and the other partners will each perform distributed execution-level activities related to the elements each provides, such as monitoring and support of real-time systems operations. NASA, ESA and the other partners will provide engineering support centers to perform detailed engineering assessments and real-time operations support to the SSCC required for the operational control of the manned base elements they provide. Execution-level activities for elements separated from the manned base when outside the operational CCZ of the STS or the manned base, as defined in the program documentation provided for in Article 7, will be the responsibility of the element provider. The partners may also participate in and provide personnel to other execution-

level activities at other sites as agreed

8.2 h The International Operational Concepts Working Group (IOCWG), established by the Space Station Phase B MOU's, will continue to advise the Parties to this MOU in planning for the establishment of the SOP. Once the SOP is established, the activities of the IOCWG will end.

### 8.3. Utilization.

#### 8.3.a. Manned Base

8.3.a.1. NASA and MOSST will provide Space Station manned base infrastructural elements to assemble, maintain, operate and service the manned base; NASA and MOSST will also provide resources derived from these infrastructural elements to the other partners as provided in Article 8.3.a.2. ESA will retain the use of 41% of the user accommodations on its APM; NASA will retain the use of 97% of the user accommodations on its accommodations elements; NASA and ESA will each provide MOSST 3% of the user accommodations on their accommodations elements; and ESA will provide NASA the remaining user accommodations on its APM. NASA, ESA and MOSST will each control the selection of users for their allocations of user accommodations; such NASA, ESA and MOSST control of the selection of users for their allocation of user accommodations will be exercised in accordance with the procedures in this MOU and in the NASA-MOSST MOU for developing the Composite Utilization Plan.

[30] 8.3.a.2. Allocation of manned base resources among the partners will be in accordance with the following approach. Housekeeping resources required by all elements, and provided as noted in Article 8.1.d.1, will be set aside. The utilization resources will be allocated as follows: 20% of utilization resources will be allocated to NASA because of its Attached Payload Accommodation Equipment; 3% of utilization resources will be allocated to MOSST; [and] the remaining utilization resources will be apportioned equally among the three laboratory modules. ESA will be allocated 50% of the utilization resources apportioned to the ESA-provided APM and STA will be allocated 50% of the utilization resources apportioned to the ESA-provided JEM. NASA will be allocated 100% of the utilization resources apportioned to the NASA-provided Laboratory Module, the remaining 50% of the utilization resources apportioned to the ESA-provided APM and the remaining 50% of the utilization resources apportioned to the ESA-provided JEM. 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 COP and the Composite Utilization Plan. More than this allocation of any utilization resource may be gained by each partner through barter or purchase from other partners.

8.3.a.3. ESA's allocation of user accommodations and utilization resources will begin once the APM is verified following assembly to the manned base.

8.3.a.4. Manned base utilization resources are power, user servicing capacity, heat rejection capacity, data handling capacity, total crew time and EVA capacity. The initial list of manned base utilization resources to be allocated is power, user servicing capacity and total crew time. All other manned base utilization resources may be used without allocation. To support the operation and full international utilization of the Space Station manned base as defined in Article 3, NASA plans to provide the number of STS flights per year baselined by the SSCB during Phase C/D. From the total Space Station user payload capacity available on STS flights actually flown to and from the manned base each year, each partner will have the right to purchase STS launch and return services for its Space Station utilization activities, up to its allocated percentage of utilization resources. (The foregoing does not apply to STS launch and return capacity provided to and from the

manned base in connection with Space Station evolutionary additions.) Similarly, the partners will have the right to purchase, up to their allocated percentage of utilization resources, TDRSS data transmission capacity available to the manned base. The User Operations Panel, defined in Article 8.3.d, will update the lists of utilization resources and allocated utilization resources as necessary as NASA and the other partners gain experience.

[31] 8.3.b. Platforms

8.3.b.1. In recognition of the fact that platforms are separate elements that do not require extensive support from the infrastructural elements of the manned base, platforms are treated separately from the manned base.

8.3.b.2. NASA and ESA will share the use of each other's polar platforms on a balanced reciprocal basis, recognizing that the two platforms may have different capabilities and that the user community may propose specific splits based on actual payloads; such proposals must be agreed to by NASA and ESA, and by MOSST with respect to its 3% utilization of the polar platforms provided for in Article 8.3.b.3, and processed by the User Operations Panel as part of the development of the Composite Utilization Plan provided in Article 8.3.f.2. NASA and ESA will also provide associated user integration and user operations support to each other and each other's users.

8.3.b.3. MOSST will be provided 3% utilization of both the NASA and ESA polar platforms together with the associated user integration and user operations support. STA may purchase, barter or enter into other arrangements for platform utilization.

8.3.c. Man-Tended Free Flyer

8.3.c.1. ESA will retain the total use of the MTFF it provides.

8.3.c.2. Notwithstanding Article 8.3.c.1, each year, NASA will have an option to use up to 25% of MTFF utilization capacity by purchase at prices ESA routinely charges comparable customers or by barter such as for an amount of utilization resources and/or user accommodations. The conditions of such purchase or barter will be agreed between NASA and ESA.

8.3.c.3. In case of total use of the MTFF by ESA, all accommodations and resources required to service the MTFF at the manned base will come out of the user accommodations and utilization resources available to ESA as provided in Article 8.3.a.

8.3.d. It is the goal of the Parties to use the Space Station in a safe, efficient and effective manner. To accomplish this, the MCB will establish, within three months of its establishment, a User Operations Panel (UOP), to assure the compatibility of utilization activities of the manned base, the polar platforms, and use by the MTFF of manned base utilization resources and user accommodations. 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 [32] UOP activities. The UOP will take decisions by consensus, except as noted in Article 8.3.f.2, 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.e. The UOP will develop, approve and maintain a Utilization Management Plan 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 Plan 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.d; define standard user integration and user operations support; and describe the approach to distributed user integration and operations. The Plan will provide procedures for preparation of the partners' Utilization Plans and Composite Utilization Plan described in Article 8.3.f, including procedures for adjustment of these Plans as further information becomes available.

**8.3.f. Utilization Plan for the Manned Base and the Polar Platforms**

**8.3.f.1.** On an annual basis, five years in advance, NASA and ESA each will develop a Utilization Plan for all proposed uses of its allocation of manned base user accommodations and utilization resources, for all proposed uses of unallocated manned base utilization resources and Space Station-unique ground elements, and for all uses of the polar platforms. 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 Integrated Logistics System carriers in which user equipment, including MTFF equipment, is launched or returned to Earth as specified in the applicable Increment Plan. As regards the MTFF, the ESA Utilization Plan will include all uses of manned base user accommodations and utilization resources required to service the MTFF at the manned base, information necessary to determine whether any planned utilization of the MTFF would have effects on the manned base associated with its servicing at the manned base, and information related to Article 9.8(e) of the Intergovernmental Agreement. NASA and ESA 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 [33] 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.f.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 Composite Utilization Plan (CUP), covering the use of both flight and Space Station-unique ground elements, 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 manned base and/or related Space Station-unique ground elements, the issue will be forwarded to the MCB for resolution. In the event of failure of the UOP to reach consensus on the utilization of the ESA-provided Polar Platform, ESA will take the decision, and in the event of failure of the UOP to reach consensus on the utilization of the NASA-provided Polar Platform, NASA will take the decision; however, in either event, NASA and ESA will respect the utilization rights of Canada and of each other in any such decisions.

**8.3.f.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 9.8(a), 9.8(b) and 9.11 of the Intergovernmental Agreement will apply.

**8.3.g. Utilization Plan for the MTFF**

**8.3.g.1.** The MTFF Utilization Plan will be developed and approved by ESA. As appropriate, MTFF utilization will be consistent with Articles 8.3.c.2 and 8.3.f.1.

**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. In addition, partners providing user accommodations [34] will be responsible for providing standard user integration and user operations support to users of other partners or other partners as users, including conducting assessments of the flow of payload integration activities for all payloads manifested in the user accommodations they provide. Accommodation assessments for individual payloads manifested in a laboratory module covering engineering, operations and software compatibility will also be performed by the partner providing that laboratory module in support of the preparation and execution of Tactical Operations Plans and Increment Plans. Similarly, MOSST will be responsible for providing standard user integration and user operations support for users of the other partners or other partners as users of the flight elements provided by MOSST; and NASA will be responsible for providing standard user integration and user operations support for users of the other partners or other partners as users of the manned base systems/subsystems provided by NASA.

8.3.i. Each partner will participate in discharging the responsibilities of the Payload Operations Integration Center (POIC) established and managed by NASA which will be responsible for assistance to manned base users in planning and executing user activities on the manned base, for overall direction of the execution of user activities on the manned base, and for interaction with the SSCC in order to coordinate user activities with systems operations activities. Each partner will provide personnel to the POIC. 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 interaction between the POIC and SSCC will be described in the Operations Management Plan. Both NASA and ESA will provide user support centers which will function within the framework of NASA's responsibilities for the POIC. The interactions between the user support centers and the POIC will be described in the Utilization Management Plan. NASA and ESA will each be responsible, relative to the elements they provide which are separated from the manned base, for assistance to users in planning and executing user activities, for direction of the execution of user activities and for interaction with the MTFF and polar platform control centers to coordinate user and element operations activities.

8.3.j. 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 manned base element and only impacts users of the [35] provider of that element, the partner providing that manned base element will be responsible for resolving such conflicts in accordance with the content of the COUP, conflicts related to proposed polar platform utilization will be resolved as provided in Article 8.3.f.2.

8.3.k. 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 Utilization Management Plan. 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.

8.3.1 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 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.

8.3.m. The International Utilization Coordination Working Group (IUCWG), established by the Space Station Phase B MOU's, will continue to advise the Parties to this MOU in planning for the establishment of the UOP. Once the UOP is established, the activities of the IUCWG will end.

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 will be developed by the MCB.

8.5 The partners will seek to outfit the NASA-provided Laboratory Module, the ESA-provided APM and the STA-provided JEM to equivalent levels by the end of Space Station assembly in Phase C/D.

#### *Article 9 - Operations Costs Responsibilities*

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

[36] 9.1.a. The costs associated with ESA's providing personnel to undertake integrated tactical- and execution-level activities as provided for in Articles 8.2.c, 8.2.g, 8.3.h, and 8.3.i will be agreed between NASA and ESA and will be a contribution towards the satisfaction of ESA's common system operations costs responsibilities established below.

#### **9.2 Element operations costs**

9.2.a. NASA and ESA will each have operational responsibilities for the elements it provides as detailed in Article 8. Such operational responsibilities mean that NASA and ESA will each be financially responsible for element operations costs, that is, costs 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 costs for spares, launch and return costs of the fraction of the Integrated Logistics System carriers provided for in Article 3.2 that is attributable to spares, and also costs attributed to the maintenance and operation of element-unique ground centers.

#### **9.3. Common system operations costs**

9.3.a Manned Base. Other than the element operations costs covered in Article 9.2.a, NASA, ESA and the other partners will equitably share the common system operations costs, that is, the costs attributed to the operation of the manned base as a whole. The categories comprising common system operations costs 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 (SSCC-based operations, SSCC maintenance and common elements of the Software Support Environment), POIC-based operations and POIC maintenance; Integrated Logistics System operations, including consumables and common inventory management activities; prelaunch/post landing processing of logistics carriers, launch to orbit and return of consumables, crew and crew logistics, and launch and return of the fraction of the Integrated Logistics System carriers provided for in



Article 3.2 that is attributable to consumables and crew logistics; and transmission of housekeeping data between the manned base and the ground (SSCC, POIC and launch and landing sites). Each partner will be responsible for a percentage of common system operations costs equal to the percentage of Space Station utilization resources allocated to it in Article 8.3.a.2. ESA's responsibility for sharing common system operations costs will begin following the assembly and verification of the APM.

[37] 9.3.b. Platforms. NASA and ESA will each be responsible for the common system operations costs for the platforms which they provide.

9.3.c. Man-Tended Free Flyer. ESA will be responsible for the common system operations costs for the MTF if it provides.

9.3.d. Any changes to the list of common system operations costs in this Article will be made by agreement among the partners.

9.4. The Parties to this MOU and the other partners will work through the SOP to identify the detailed contents to be included in each common system operations cost category. The partners will also, each year, report to the SOP on their forecasts for future years for all costs included in the common system operations costs of the manned base and on their identified actual annual common system operations costs. The SOP will develop detailed procedures for implementing this Article. If possible, after the partners have gained experience in the operation of the Space Station, the SOP will endeavor to establish a fixed value for the annual common system operations costs.

9.5. 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; launch and return of payloads/experiments, spares and associated equipment; launch and return of the fraction of the Integrated Logistics System carriers provided for in Article 3.2 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 of the partners or of individual partners as users. Such costs will not be shared among NASA, ESA and the other partners, nor will such costs contribute toward the satisfaction of common system operations costs responsibilities. In addition, the DDT&E and operations costs of the users' support centers will not be shared among NASA, ESA and the other partners.

9.6. 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.

9.7. In case of failure of any partner to perform its operations responsibilities or to provide for its share of common system operations costs, 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.

[38]

#### *Article 10 - Safety*

10.1. In order to assure safety, NASA has the responsibility, working with the other partners, to establish overall Space Station safety requirements and plans covering Phase C/D and Phase E. Such requirements and plans for Phase C/D have been established, and development of further safety requirements and plans for Phase C/D and Phase E and changes to safety requirements and plans will be processed, according to the procedures in Articles 7 and 8. As far as the elements separated from the manned base and their payloads are concerned, NASA has the responsibility to establish and implement overall safety requirements and plans governing the NASA-provided Polar Platform, and ESA has the responsibility to establish and implement overall safety requirements and plans governing

the ESA-provided Polar Platform and the MTFF. The overall Space Station safety requirements and plans will be applicable to the MTFF insofar as it has effects on the manned base associated with its servicing at the manned base. STS safety requirements will be applicable to the ESA-provided Polar Platform insofar as it has effects on the STS associated with its servicing by the STS.

10.2. Each partner will develop detailed safety requirements and plans, using its own standards where practicable, for its manned base hardware and software that 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 safety requirements and plans have been met with respect to the Space Station manned base elements and payloads it provides. ESA will have the responsibility to certify that the MTFF and ESA-provided Polar Platform and their payloads are safe. However, NASA will have the overall responsibility to certify that all Space Station manned base elements and payloads are safe, including the MTFF and its payloads insofar as they have effects on the manned base associated with their servicing at the manned base. NASA will also have the responsibility to certify that the ESA-provided Polar Platform and its payloads are safe insofar as they have effects on the STS associated with their servicing by the STS.

10.3. NASA will conduct system safety reviews 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. MOSST will also participate in and support safety reviews by the other partners as appropriate related to the MOSST-provided elements and MOSST payloads. NASA and MOSST [39] support to such safety reviews will include provision of necessary safety-related information to enable the other partners to conduct their reviews. Furthermore, status reports on safety requirements and plans will be a standard agenda item at the Program Management Reviews provided for in Article 7.1.i. The partners will participate as appropriate in any Space Station safety review boards established by NASA.

10.4. NASA will have the responsibility for taking any decision necessary to protect the safety of the manned base, including all elements operating in conjunction with the manned base, or its crew in an emergency.

#### *Article 11 - Space Station Crew*

11.1. ESA has the right to provide personnel to serve as Space Station crew from the time that ESA begins to share common system operations costs as provided in Article 9.3.5. NASA will provide flight opportunities for ESA Space Station crew satisfying the percentage of the total crew requirement equal to the percentage of manned base utilization resources allocated to ESA in Article 8.3.a.2. Flight of ESA Space Station crew will be satisfied over time, not necessarily on each specific crew rotation cycle. The SOP will review the implementation of this paragraph on a biennial basis.

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 APM 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. Further, during the first two servicings of the MTFF at the manned base, a fully trained ESA crew member will participate in the relevant activities.

11.3. Space Station crew will meet medical standards and security and suitability requirements developed by NASA in consultation with ESA and the other partners regarding Space Station crew qualifications for long-term manned space flight. NASA and ESA

will jointly certify that these standards and requirements have been met by the ESA Space Station crew. Furthermore, the MCB may establish additional criteria for Space Station crew. Following certification, all Space Station crew will enter into an appropriate training cycle in order to acquire the skills necessary to conduct Space Station operations and utilization. Such training will be conducted in groups, subject to the requirements of different functional specializations. The training will include integrated manned systems operations training conducted primarily at NASA centers [40] and element-specific operations training conducted primarily by the partner providing the element at appropriate centers of all of the partners. In full consultation with ESA regarding the flight assignments of ESA crew members, NASA will designate, from among the certified Space Station crew, specific crew complements, which include the Space Station Commander, for specific crew rotation cycles, consistent with Article 11.1. NASA will designate specific crew complements to support payload requirements identified in the COUP. A specific crew complement will be trained as a team in preparation for a specific crew rotation cycle, subject to requirements of different functional specializations.

11.4. NASA and ESA will be financially responsible for all compensation, medical expenses, subsistence costs on Earth, and training for Space Station crew which they provide. Full training for all assigned duties will be required.

11.5. The Code of Conduct for the Space Station will be developed by NASA, with the full involvement of ESA, MOSST and the GOJ, and approved for the Space Station program in accordance with the principles for reaching decisions established in Article 8.1.b. It will, inter alia: establish a clear chain of command; 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 in or on the Space Station.

11.6. ESA crew selected for operating the MTFF outside the operational CCZ of the manned base are not considered Space Station crew, pursuant to this Article, for the purposes of that activity.

*Article 12 - Transportation, Communications  
and Other Non-Space Station Facilities*

12.1. Transportation

12.1.a For purposes of design of Space Station elements and payloads, NASA's STS is the baseline launch and return transportation system for the Space Station manned base and for the NASA-provided Polar Platform. ESA's Space Transportation System is the baseline launch transportation system for the MTFF and the ESA-provided Polar Platform.

12.1.b NASA will provide reimbursable STS launch services to ESA in connection with the assembly of the ESA-provided APM to the manned base and its initial outfitting in accordance with the program documentation described in Article 7.1. NASA will [41] also provide reimbursable launch and return services in connection with the logistics requirements of manned base elements. NASA will also provide reimbursable launch and return services in connection with the MTFF when it is serviced at the manned base and in connection with manned base users; availability of STS services for such purposes is as provided in Articles 8.3.a 4 and 8.3.c. NASA will also provide reimbursable launch services in connection with servicing of the ESA-provided Polar Platform, with details to be agreed by NASA and ESA, if appropriate STS capability exists and if ESA selects to use this capability. Reimbursement for such launch services may be in cash or agreed kind. All reim-

reimbursable STS services will be provided under launch services agreements. NASA will also provide launch and return services in connection with manned base common system operations logistics, costs for such services will be shared among the partners as provided in Article 9.3. ESA will provide the initial launch of the MTFF and the ESA-provided Polar Platform. ESA will also provide launch and return services in connection with the logistics requirements of the MTFF when it is not serviced at the manned base.

12.1.c. Other government or private sector space transportation systems of partners may be used in connection with the Space Station if they are compatible with the Space Station. Specifically, ESA will have the right of access to the Space Station manned base using the ESA Space Transportation System, including Ariane and Hermes. Recognizing that the responsibility for developing these systems and for making them technically and operationally compatible with the manned base rests with ESA, NASA will provide to ESA that information necessary for ESA to make them compatible. Technical, operational and safety requirements for access to the manned base will be controlled in appropriate program documentation as provided for in Articles 7 and 8.

12.1.d. With respect to financial conditions, NASA and ESA will provide reimbursable launch and return services to each other, to the other partners and to each other's and the other partners' users at prices they routinely charge comparable users. Launch and return services related to manned base common system operations logistics will also be made available by NASA on the same basis.

12.1 e. Both NASA and ESA will use their best efforts to accommodate additional launch and return 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 f. Each partner will respect the proprietary rights in and confidentiality of appropriately marked data and goods to be transported on its space transportation system.

[42] 12.2. Communications

12.2.a. Space Station communications will involve space-to-ground, ground-to-space, ground-to-ground and space-to-space data transmission. The TDRSS space network is the baseline communication system for the manned base elements and payloads, as well as for the NASA-provided Polar Platform and its payloads. ESA's Data Relay Satellite system (EDRS) is the baseline communication system for the ESA-provided Polar Platform and the MTFF and their payloads. ESA will be responsible for ensuring communications compatibility of the MTFF with the manned base for proximity operations, docking and servicing and of the ESA-provided Polar Platform with the STS for servicing as applicable. On a reimbursable basis, NASA and ESA will use their best efforts to accommodate, with their respective communication systems, specific Space Station-related requirements of each other and the other partners. With respect to financial conditions, NASA and ESA will provide such communication services at prices no higher than those they routinely charge comparable customers. Other communication systems may be used on the manned base by ESA, the other partners or Space Station users if such communication systems are compatible with the manned base and manned base use of TDRSS. Technical and operational requirements related to Space Station communications will be controlled in appropriate program documentation as provided for in Articles 7 and 8.

12.2.b. NASA and ESA will consult regarding the possible future addition of manned base capability to accommodate ESA-provided facilities permitting manned base use of EDRS, if compatible with the manned base and with manned base use of TDRSS.

12.2 c. Unless otherwise agreed by NASA and ESA, ground-to-ground transmission of polar platform data from one partner to the other partners or the other partners' users will conform to the communications transportation formats, protocols and standards agreed to by the Consultative Committee for Space Data Systems (CCSDS).

12.2.d Partners and users of the partners may implement measures to ensure confidentiality of their utilization data passing through the Space Station Information System and other communication 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 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 data passing through its communication systems, including its ground network and the communication systems of its contractors, when providing communication services to another partner.

[43] 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, Hermes 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.

[44]

*Article 14 - Space Station Evolution*

14.1. The 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 Phase C/D and Phase E. NASA will be responsible for development of overall manned base evolution concepts, in consultation with ESA and the other partners, and for integrating ESA's and the other partners' evolution concepts into an overall manned base evolution plan. ESA will be responsible for development and decision on subsequent implementation of evolution concepts for the ESA-provided Polar Platform and for the MTFF insofar as they have no technical or operational impacts on the STS or the manned base, in accordance with Articles 14.6 and 14.7.

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 manned base, and review recommendation 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 amendment of the relevant NASA-ESA, NASA-GOJ and NASA-MOSST MOU's or a separate agreement to which, to the extent that such addition is on the manned base or has a technical or operational impact on the STS or the manned base, NASA is a party to ensure that such addition is [45] consistent with NASA's overall programmatic responsibilities as detailed in this MOU.

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, to the extent that such addition is on the manned base or has a technical or operational impact on the STS or the manned base, an agreement with NASA to ensure that such addition is consistent with NASA's overall programmatic responsibilities as detailed in this MOU.

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 costs.

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.

[46]

16.4. The Parties will seek to minimize the exchange of funds while carrying out their respective responsibilities in this cooperative program, including, 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 to the NASA Associate Administrator for Space Station and the ESA Director of Space Station and Platforms for settlement. The Parties recognize that in the case of a question concerning the commitments made in this MOU to STA and/or MOSST, the consultations will be broadened so as to include the STA Director General of the Research and Development Bureau and/or the MOSST Deputy Secretary, Space Policy Sector

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 to the NASA Administrator and the ESA Director General for settlement. The Parties recognize that in case of a question concerning the commitments made in this MOU to STA and/or MOSST, the matter will also be referred to the Minister of State for Science and Technology of Japan and/or the Secretary of MOSST.

18.4. Any issues arising out of this MOU not satisfactorily settled through consultation, pursuant to this Article may be [47] 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.

*Article 19 - Entry into Force*

19 1 Pursuant to the Arrangement Concerning Application of the Space Station Intergovernmental Agreement Pending its Entry into Force, which became effective on September 29, 1988, 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.

19 2 Pending the entry into force of the Intergovernmental Agreement between 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.

19 3 If the United States or the European Partner withdraws from the Arrangement Concerning Application of the Space Station Intergovernmental Agreement Pending its Entry into Force, the corresponding Cooperating Agency will be deemed to have withdrawn from this MOU effective from the same date.

19 4 If, by December 31, 1992, the Intergovernmental Agreement has not yet entered into force between the United States and the European Partner in accordance with Article 25 of that Agreement, 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 21 of that Agreement, the corresponding Cooperating Agency will be deemed to have withdrawn from this MOU effective from the same date.

*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 creates specific rights or obligations accepted by another partner, that provision may be amended only with the written consent of that partner.

[48]

*Article 21 - 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.

*Article 22 - Definitions and Explanations*

22 1 In addition to the definitions specified in the Intergovernmental Agreement, the following definitions will apply to this MOU:

"international Space Station complex," also "Space Station," means the collection of elements listed in Article 3,

"manned base" means Space Station flight elements excluding the polar platforms and the MTFF;

"Parties" means NASA and ESA;

"partners" means NASA, ESA, STA and MOSST.



22.2. Explanation of the following terms may be found in this MOU in the Articles noted:

- "Accommodations" - Article 8.1.d
- "Command and Control Zone (CCZ)" - Article 8.1.a
- "Common system operations costs" - Article 9.3
- "Composite Operations Plan (COP)" - Article 8.2 d
- "Composite Utilization Plan (CUP)" - Article 8.3.f
- "Consolidated Operations and Utilization Plan (COUP)" - Article 8.1.c
- "Flight elements" - Article 3
- "Increment Plan (IP)" - Article 8.2.f
- "Infrastructure" - Article 8.1.b
- "Multilateral Coordination Board (MCB)" - Article 8.1.b
- "Payload Operations Integration Center (POIC)" - Article 8.3.i
- "Program Coordination Committee (PCC)" - Article 7.1.b
- "Resources" - Article 8.1.d and Article 8.3.a.4
- "Space Station Control Board (SSCB)" - Article 7.1.d
- "Space Station Control Center (SSCC)" - Article 8.2 g
- "Space Station-unique ground elements" - Article 3
- "System Operations Panel (SOP)" - Article 8.2.a and Article 8.2.b
- "Tactical Operations Plan (TOP)" - Article 8.2.f
- "User Operations Panel (UOP)" - Article 8.3.d

[49] DONE at Washington, this 29th day of September, 1988, in two originals in the English, French, German and Italian languages, each version being equally authentic.

[50] FOR THE UNITED STATES  
NATIONAL AERONAUTICS AND  
SPACE ADMINISTRATION

FOR THE EUROPEAN SPACE  
AGENCY

POUR L'ADMINISTRATION NATIONALE  
DE L'AERONAUTIQUE ET DE  
L'ESPACE DES ETATS UNIS

POUR L'AGENCE SPATIALE  
EUROPEENNE:

FÜR DEI NATIONALE LUFT UND  
RAUMFAHRTORGANISATION DER  
VEREINIGTEN STAATEN

FÜR DEI EUROPAISE  
WELTRAUMORGANISATION

PER L'AMMINISTRAZIONE  
NAZIONALE PER L'AERONAUTICA  
STATI UNITI

PER L'AGENZIA SPAZIALE  
EUROPEA:

signed by Dale D. Myers

signed by Reimar Leust