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U.S. HOUSE OF REPRESENTATIVES

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

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December 1, 1994

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225-6371 COMMITTEE
225-5101

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Hon. George E. Brown, Jr.
Chairman
Committee on Science, Space, and Technology
U.S. House of Representatives
Washington, D.C. 20515

Dear Mr. Chairman:

Enclosed herewith is my report, "Update Investigation of U.S. Russian Space Cooperation, October 17-21, 1994," which documents the findings and observations of CODEL SENSENBRENNER authorized by you on September 8, 1994.

This report also provides an update on the European Space Agency's intended contributions. Since the time of last ESA Council meeting in January, ESA has considerably refined a series of technical proposals it first shared with this CODEL in January. Yet, due to the recent organization of the Italian government, the German parliamentary election the day of our arrival in Paris, and the upcoming French presidential and parliamentary elections due in May, political and financial decisions have not been formally taken.

The principal findings of this investigation deal with U.S.-Russian cooperation, however, since Russia's contributions are more clearly defined and encompass significant Russian space technology.

1. *While significant progress must be made before consideration of the Fiscal Year 1996 NASA budget, I have much greater confidence in the overall space partnership today than I did in January. The high priority given by the Russian government to the space program and this collaboration was evident throughout the consultations, particularly with the First Deputy Prime Minister, Mr. Oleg Soskovets. Between the strong Russian support and the deployment of as many as 70 NASA personnel for the incremental design review underway during our visit, I have confidence that negotiations and technical discussions can be concluded prior to consideration of the next NASA budget request.*

2. *In terms of partnership arrangements, however, three areas continue to cause some concern. First, as was discovered during the consultations of the CODEL in France, the European Space Agency is yet to formally make political and financial commitments to the technical program ESA engineers tentatively agreed to in January. Second, Russia and the United States have not yet agreed on a Memorandum of Understanding that would clearly outline Russia's partnership role in the program, including mutual obligations and the valuation of its partner contributions. Third, the U.S.-Russian MOU must be agreed to before Russia will sign the multilateral Intergovernmental Agreement of all space station partners. The renegotiated Intergovernmental Agreement is expected to be considerably different than the 1988 agreement to which NASA had hoped Russia would simply join.*

3. *To the extent technical progress was evident, work on Phase-1 of the U.S.-Russian cooperative agreement appears on track. The March 3, 1995 launch date for U.S. astronaut/physician Dr. Norman Thagard has been kept, despite a potentially three month delay of the U.S.-sponsored Russian "Spektr" module. On this point, Russian engineers continue to work on integration tasks for "Spektr" in a business-like fashion.*

Finally, given the fluid status of U.S.-Russian negotiations on the Memorandum of Understanding and the technical design process, it was neither appropriate nor possible for the CODEL to determine the extent of U.S. dependence on Russian elements at the time of this visit. It was made clear that my Russian interlocutors were aware of these concerns, but no detailed launch sequence or subsystem work breakdown was provided. This is something Congress will continue to examine over the next year.

Sincerely,

F. JAMES SENSENBRENNER, JR.
Ranking Republican Member
Subcommittee on Space

cc: Hon. Robert S. Walker
Hon. Ralph M. Hall

Update Investigation of U.S.-Russian Space Cooperation October 17-21, 1994

REPORT

of

The Hon. F. James SENSENBRENNER, Jr.

Ranking Republican Member
Subcommittee on Space

Committee on Science, Space and Technology
U.S. House of Representatives
Washington, DC 20515

SUMMARY:

The cost and risk associated with the development of a sophisticated international space research facility has not escaped the governments responsible for undertaking development of the international space station. The manned space fortunes of the United States, Russia, Europe, Japan, and Canada rely upon meeting three challenges that will determine the successful execution of the largest international science program in history. These are continued political relations between the partner states, fair allocation of the project's significant costs and benefits, and the successful melding of disparate technological approaches. The significance of these challenges is captured in this report. Yet, despite the tall order the space station project presents to the National Aeronautics and Space Administration (NASA) and the American people, these challenges have been fully embraced by Russian and European space officials.

FINDINGS:

The key findings of the investigation are summarized here, with a detailed discussion of the issues following throughout.

1. ***While significant progress must be made before consideration of the Fiscal Year 1996 NASA budget, I have much greater confidence in the overall space partnership today than I did in January. The high priority given by the Russian government to the space program and this collaboration was evident throughout the consultations, particularly with the First Deputy Prime Minister, Mr. Oleg Soskovets. Between the strong Russian support and the deployment of as many as 70 NASA personnel for the incremental design review underway during our visit, I have confidence that negotiations and technical discussions can be concluded prior to consideration of the next NASA budget request.***

2. ***In terms of partnership arrangements, however, three areas continue to cause some concern. First, as was discovered during the consultations of the CODEL in France, the European Space Agency is yet to formally make political and financial commitments to the technical program ESA engineers tentatively agreed to in January. Second, Russia and the United States have not yet agreed on a Memorandum of Understanding that would clearly outline Russia's partnership role in the program, including mutual obligations and the valuation of its partner contributions. Third, the U.S.-Russian MOU must be agreed to before Russia will sign the multilateral Intergovernmental Agreement of all space station partners. The renegotiated Intergovernmental Agreement is expected to be considerably different than the 1988 agreement to which NASA had hoped Russia would simply join.***

3. ***To the extent technical progress was evident, work on Phase-1 of the U.S.-Russian cooperative agreement appears on track. The March 3, 1995 launch date for U.S. astronaut/physician Dr. Norman Thagard has been kept,***

despite a potentially three month delay of the U.S.-sponsored Russian "Spektr" module. On this point, Russian engineers continue to work on integration tasks for "Spektr" in a business-like fashion.

PURPOSE OF THE INVESTIGATION:

This report serves to update Appendix B of the Chairman's Report, "Oversight Visit; Baikonur Cosmodrome," March 23, 1994, (House Report 103-451), which enumerated a number of concerns with the proposed program plan and associated agreements between NASA and the Russian Space Agency (RSA) to develop and operate the international space station, in partnership with our longstanding space partners in Western Europe, Canada and Japan. This Congressional oversight visit to Moscow and Paris was to assess the international space partnership and program progress since passage of the Fiscal Year 1995 Appropriations bill for NASA, and the defeat of an amendment to that measure that sought to eliminate funding for the space station program.

Rep. F. James Sensenbrenner, Jr., Ranking Republican Member of the Subcommittee on Space, and two Subcommittee staff Members (Elaine David and Nick Fuhrman) conducted the update investigation. The Delegation was escorted in Moscow by the U.S. Embassy Science Counselor and Science Officer. In Paris, the delegation was escorted by the NASA European Representative. Occurring while the NASA-RSA incremental design review was underway in Moscow, "CODEL SENSENBRENNER" sought to:

1. Hear from a large cross-section of Russian views on the space station project, including opposition views.

2. Assess the Russian partnership from the standpoint of stability, sustainability, and fiscal accountability.

3. Observe work in progress on Phase-1 of the space cooperation

agreement, including hardware integration for the Shuttle-Mir program to commence in March, 1995.

4. Determine what obstacles remain for the European Space Agency to determine its proposed contributions to the space station.

5. Examine the progress made in concluding new agreements between the partners, specifically the status of the U.S.-Russian Memorandum of Understanding (MOU) and the multilateral Intergovernmental Agreement (IGA).

BACKGROUND:

Nearly three years ago, in January 1992, Rep. F. James Sensenbrenner, Jr., Ranking Republican Member of the Subcommittee on Space, completed an investigation of European space activities, after which he was able to conclude that in spite of major funding difficulties faced by European Space Agency (ESA) member states, ESA's primary contribution to the Space Station Freedom program, the Attached Pressurized Module (APM) would proceed on schedule. Moreover, Sensenbrenner discovered a major shift in ESA's long-term space strategy away from the goal of European space autonomy, forsaking it for a cooperative space strategy with other spacefaring nations, in particular the United States.

During the January, 1994 visits of Congressman Sensenbrenner to the major ESA member states, (immediately following the CODEL's visit to Moscow), it became apparent that by forging the partnership with Russia, European space interests had been subordinated by the U.S. to Russia's demonstrated interest in becoming a "senior partner" in the program. Evenwhile ESA participated with the U.S. in redesigning the space station to include Russia, the principal change to the partnership caused by Russia's participation was that Russia could expect its cost share to be offset entirely by providing critically important services to the facility for which the other partners, including the U.S., would have no substitute. As a result, ESA began

to reconsider its proposed contributions to the program, seeking a way for ESA to balance its partnership costs by contributing critical services as well. Given the uncertainty of its proposed contributions, and the certain NASA emphasis on accommodating Russia's needs first, the potential existed in January that European governments might take the uncertainty as an opportunity to cause ESA's withdrawal from the space station project.

In January, the CODEL was presented with a concept for introducing ESA as a provider of critically important hardware contributions. Specifically, a role for the Ariane-V launch system was proposed as a possible offset to ESA's utilization costs, and would include logistics transport, crew return, and possibly two-way crew transfer. This concept, which will be discussed further herein, has been considerably refined since January, and along with the Columbus laboratory facility, now forms ESA's "Mainstay" commitment to the space station.

The cost-sharing concepts introduced by Russia's ability to contribute critically needed hardware and services to the space station partnership remain a point of negotiation today. It will ultimately be resolved at the conclusion of the multilateral IGA, to be based on the U.S.-Russian MOU necessary to outline Russia's role in the project. The essence of these documents will be the economic policy of the space station program, and will provide a formula for valuation of partner contributions such as ESA's Ariane-V and Russia's Proton launcher, and utilization cost allocations. By the same token, these agreements will of necessity be based on the space station's design assumptions for various partners' roles in delivery of critical hardware and logistics support, and the extent of the partners' dependence on any one partner for critical path hardware, functions, and services.

As a result of the January visit, and after considering the cost-sharing concepts then apparent, Rep. Sensenbrenner observed that a situation of dependence on Russia for critical path hardware, functions and services had been accepted by NASA without regard to maintaining U.S. spacecraft redundancy and survivability. The "dependence issue," as it became known throughout 1994, is both a matter of reserving the right to

continue operation of the spacecraft in the event Russia became unable or unwilling to continue the partnership, and of economic relations among the station partners. The potential existed for one partner, Russia, to maintain a "monopoly" in the critical areas of spacecraft reboost, oxygen supply and replenishment, refueling of propulsion nodes, and the like.

During Congressional consideration of the President's Fiscal Year 1995 budget request for NASA and prior to House consideration of the NASA Appropriation's bill, Rep. Sensenbrenner sought and received the President's commitment to conduct the space station partnership in a manner that would preserve United States capabilities to fly and operate the space station were Russia to withdraw from the project at any time, and to reduce U.S. dependence on Russia for critical path hardware, functions and services. (See Attachment A).

As the joint space station program now enters a second year of full funding by Congress, it faces three challenges that will determine feasibility and success for this massive undertaking:

1. The general political relationship between the space station partner governments, as well as political support for space station funding within each of the partner states.

2. The economic responsibilities of the partners, the balance struck between partner costs of research utilization, and contributions of necessary resources to the partnership, to be determined by the multilateral IGA and the bilateral U.S.-Russian MOU.

3. The ability to successfully integrate technology across many cultures and engineering philosophies on schedule and on budget.

Accordingly, this report is organized around these three major themes with specific issues raised and the relevant discourse presented throughout, as appropriate.

The Ariane-V system improvements to support station would be primarily French, but these elements would go on-line much later in the program, or as some fear, after there is no program. In the meantime, a firm commitment to build the Columbus module now means expending French contributions to ESA now.

But, as Rep. Sensenbrenner pointed out after receiving several views on the political challenge facing ESA management, that without a serious commitment by ESA to go forward with contracts to build hardware for the space station, worse political problems would arise: Opponents of the space station in Congress could fairly conclude that Europe withdrew from the space station program and would use the fractured alliance as an argument against all station funding. Rep. Sensenbrenner said that throughout 1994, ESA had to come to terms with what America had done with Russia to redesign the space station, and whether Congress would support the program. He said he couldn't blame ESA or its members for taking a year to see whether there would even be a space station program, but now that there is one, ESA must act swiftly, and before Congress debates the space station next year, if possible.

Sensenbrenner's charge to ESA will require commitments by the member states to a funding profile even though the governments of Italy and Germany are in the process of forming after recent elections. In France, for instance, a funding commitment will need to be made on the eve of its April Presidential elections. Rep. Sensenbrenner cautioned that waiting until June, 1995 for ESA members to fund its "Mainstay" program proposal, consisting of the COF and the Ariane-V improvements, could be too late for consideration during the annual space station debate in Congress, and was relieved to learn from Director General Luton that a meeting of ESA ministers would possibly be scheduled in March, 1995, with a limited agenda for making the initial funding commitments for Europe's participation.

Rep. Sensenbrenner indicated his general confidence that ESA would be able to negotiate the difficult arrangements that must be reached between its principal member states. Almost no simpler alternative exists for Europe to maintain its human presence in space. The unspoken reality is that Europe's significant past investments

POLITICAL CONSIDERATIONS

Western European Space Policy

For ESA, which NASA had ignored for a good part of 1993 while it redesigned the space station in close consultation with Russia, 1994 witnessed NASA's efforts at repairing this traditional space alliance. The concept proposals for integrating Ariane-V capabilities into space station logistics and crew transfer, first shared with this CODEL in January, have been embraced by NASA, provided that such contributions do not become a substitute for the Columbus Orbital Facility (COF), the ESA laboratory module. (See Attachment B).

Among ESA's thirteen member states, France, Germany, and Italy provide 70% of the national contributions that make up ESA's budget. In turn, ESA is expected to allocate the work content of its space program back to the funding states according to their contribution. For this reason, ESA Director General Jean-Marie Luton has a delicate task designing a program that both raises sufficient program funds from each member state to cover the total projected costs, while returning contracts back to those states in a timely manner. The additional problem facing ESA now is a partial hang-over from the 1993 U.S.-Russian redesign exercise, meaning the prospect of yet another redesign has made member states noticeably cautious with their commitments to the space station effort. In particular, a French financial commitment to ESA is hard to make under the threat of further changes, since France's "piece of the pie," i.e., the Crew Transport Vehicle (CTV) element, would be under contract much later on in the execution of the program, and after significant funds were expended on the COF.

NASA's willingness to be flexible in accepting ESA's proposed contributions seems to have been appreciated by the ESA and French space officials with whom Rep. Sensenbrenner met. The issue of staging contract commitments to coincide with funding requirements is critical because the first ESA contribution is intended to be the Columbus laboratory, which will primarily be built by German aerospace firms.

to acquire autonomy and space infrastructure could simply go to waste if ESA chose not continue the manned space partnership begun with the U.S. and expanded to include Russia with the U.S. assuming much of the technical and political risk. The space station is, in short, the best possible deal for ESA so long as its member states wish to send humans into space. The prospect that ESA could simply collaborate with Russia in lieu of the U.S., which was once considered a viable alternative for ESA, today seems a distant hope as ESA observes the enormous amount of effort required by NASA to develop even plans for the Shuttle-Mir program. It could also be noted that ESA's experience flying astronaut passengers on the Russian Mir station has not been without constant negotiation and sporadic moments of acute uncertainty.

Russian Space Policy

Without question, the international space station enjoys the high level political support of both the Russian and American governments. This was made evident by the CODEL's warm reception by First Deputy Prime Minister Oleg Soskovets. After President Boris Yeltsin and Prime Minister Viktor Chernomyrdin, the Deputy Premier has unusually broad powers over the functioning of the Russian government and industry. RSA Director General Yuri Koptev reports directly to the Deputy Premier. The situation with regard to the space station program's high profile in the American government is only somewhat more diffuse, given the layers of White House policymakers residing between the NASA Administrator and the Vice President, who is Prime Minister Chernomyrdin's counterpart in the Bilateral Commission on Energy and Scientific Cooperation, better known as the "Gore-Chernomyrdin Commission." Nevertheless, the resulting close work relationship between the office of the U.S. Vice President and the highest levels of Russian officialdom is as unprecedented as it is striking.

In fact, Rep. Sensenbrenner was informed during one meeting in Moscow that the previous evening the Vice President and the Prime Minister personally resolved the matter relating to the import and customs duty on U.S. space hardware intended to fly on the Russian "Spektr" module as part of the Shuttle-Mir experiment suite.

(See Attachment C). The incident illustrates that despite predictable bureaucratic obstacles and outright intransigence, the top levels of the two governments are fully engaged and committed to forcing the program along on schedule. The rigors of doing business in Russia remain what they have been for some time, according to representatives of American aerospace companies Rep. Sensenbrenner met with in Moscow, but the space station program seems to enjoy sufficient high-level protection from the core Russian government.

Yet, the incident illustrates a political irony as well, which is the space station program would be hopelessly lost in red tape if Russia were by this time a full-blown democracy. (The prospect of endless legal bickering and restraining orders comes to mind.) The success of this project does appear to depend greatly on power shown by the top in the form of sufficient Russian government funding and control over distributing any U.S. funds expended as part of the $400 million contract covering Phase-1 and some Phase-2 activities. While it is certainly the hope of the American people that such a collaboration as this will foster decentralization of the Russian economic and political system, it is exactly that centralized authority that has assured the space station's progress so far.

A growing factor in the political analysis of space policy in Russia is the new Russian Duma, or lower house of parliament. Rep. Sensenbrenner met four members of the Duma, including the Chairman and Subcommittee Chairman of the analog Committee to the House Committee on Science, Space, and Technology. According to analysts Rep. Sensenbrenner met with at the U.S. Embassy, the new Duma is being given a solid chance to develop and enact laws and see their actions taken seriously by the executive branch, despite the apparent authority of the executive branch to ignore them or rule by decrees of its own. In all meetings with the executive branch and with Russian aerospace firms, appropriate consideration was shown to the Duma as a institution of budgetary power, and the need to build support for space funding among Duma members was cited several times. The Duma's recent vote that overwhelmingly approved the Russian government's lease agreement with the Kazakh government on the Baikonur Cosmodrome was cited by First Deputy Prime Minister

Soskovets and RSA Director Koptev as an overwhelming vote endorsing closer space ties with the U.S., including commercial space launch.

Russian Political Stability

Rep. Sensenbrenner was the first U.S. Member of Congress to visit the new Duma since its rebuilding in separate location in central Moscow, following the parliamentary coup attempt of 1993 that resulted in the incineration of several floors of the Russian White House. The parliamentary coup attempt continues to recall vivid memories of American expatriates working in Moscow offices across from the White House. Fears of future instability and insurrection are shared by most Americans working in Moscow, but these are routinely eclipsed by more immediate fears of bureaucratic harassment and street crime.

Balanced against the present day difficulties facing Russians is the positive long-term outlook shared by Russian government officials at all levels. Contrary to the conventional wisdom that says it is easy to predict two, three, or five years ahead, Russian officials said the only real instability lays in the near term, and that fundamentally the government and the Russian people would continue to support space cooperation with the U.S. These officials stress that space development is a vested political interest that may face ups and downs depending on political cross-currents, but that the decision to cooperate with the U.S. was a basic one that cannot be reversed by any subsequent leadership. In short, they argued, it would always be a national self-interest to market launch services, to develop and utilize space infrastructure, and it could not do so profitably without Russia's continued political and economic integration with other nations.

Missile Proliferation

Meanwhile, Rep. Sensenbrenner sought to remind the Russian Space Agency that during a Subcommittee hearing Russia's participation in the space station was explicitly linked by the U.S. Department of State to Russia's continued adherence to

the Missile Technology Control Regime. Sensenbrenner explained that it concerned him because Indian space officials could attribute advances in warhead delivery systems to its prior contract with Russia for acquiring space technology. Director Koptev responded that U.S. Ambassador Lynn Davis recently, during nonproliferation talks with the Russian MFA, officially declared to Russia the U.S. has no claims against Russia for anything it was doing with India, and that Russia's business with India had been fully reconsidered at the time of joining the space station partnership. Furthermore, Koptev pointed out that it was Russia, not the U.S., who insisted that Russia become a full partner in the MTCR, and not merely an adherent. Koptev stressed that he and the RSA had taken control of such matters personally.

U.S. Foreign Policy

The possibility that the U.S. may wish to expand space cooperation to include Ukraine and China was raised by Russian officials. In the case of China, both Director Koptev and Deputy Premier Soskovets cautioned against the U.S. making China a space station partner without consulting with them and, presumably, the other international partners beforehand. Rep. Sensenbrenner suggested that if the U.S. were to invite China to participate, China should first show the partners what it planned to contribute to the project, and the existing partners could then decide if they wanted to include China. Director Koptev later expanded upon the discussion of China begun with Deputy Premier Soskovets. He did not see how China could be at the level of sophistication necessary for participation in the space station for at least fifteen years, sometime around 2010. But, he added that if the U.S. was making plans for China, the discussion with Russia should begin now, not later.

Director Koptev also cautioned against the U.S. making bilateral space agreements with the Ukraine without consulting Russia. He said that of necessity and because their space enterprises were interdependent, any deal between the U.S. and Ukraine in space would be a three-way deal.

ECONOMIC CONSIDERATIONS

Apart from the heightened political importance Russia's participation has brought to the space station partner governments, a virtual balance sheet negotiation to determine partner utilization infrastructure in relation to partner-provided services has begun in earnest. Since the Russian contributions to the program implementation plan will provide necessary services and supplies to the general partnership, a distinction has been made between partner contributions such as research modules that consume oxygen and water as "consumers," and partnership contributions that "supply" resources such as logistics resupply flights to the station. Until Russia joined the program, the partners had planned to depend primarily on U.S. transportation and logistics, thereby dividing shares of operational costs according to the partners' percentage of allocated laboratory facilities.

Status of the Intergovernmental Agreement

Now that the cost-sharing arrangements are to be balanced by each partner's desire to use and ability to supply either resources in-kind or cash, according to NASA and representatives of the Russian Ministry of Foreign Affairs (MFA), the IGA is being renegotiated to account for inputs to the station by partners as well as the research output of the station to partners. It is obvious that such a negotiation may prove to be hopelessly complex, and could possibly collapse if partners sought to retailor their contributions to fit an emerging cost sharing formula that could arise from negotiations of the U.S.-Russian MOU.

During the CODEL's discussion with the MFA, which has the responsibility to negotiate the multilateral IGA on Russia's behalf, Rep. Sensenbrenner was told that it was simply not possible for Russia to add its signature to the existing IGA, signed in 1988 by the partners to the Space Station Freedom program. Citing Russia's more important role in the partnership, as compared to the European, Japanese and Canadian contributions, MFA representatives argued that the new cost-sharing formula would need to reflect the significant role Russian elements will play in the

development and operation of the space station.

In addition to sharing the MFA view on cost-sharing, Rep. Sensenbrenner was advised that key issues of Russian sovereignty would need to be negotiated in the IGA. Specifically, the question of which nation's laws shall be in effect aboard the space station was raised, not just in relation to the unlikely event of criminal activity, but where intellectual property law and other American laws that may simply be unfamiliar to Russian cosmonauts. The practical concern raised was causing Russian cosmonauts to learn American law before being qualified to serve on the station. Moreover, the MFA said it could not take an IGA with such provisions before the State Duma as it would quickly be voted down. Rep. Sensenbrenner remarked that the last thing he would want to see Russia import from America is the U.S. legal system.

The MFA said that it feels these sensitive issues could be resolved by adopting consultative procedures in lieu of strict agreements, and expressed its confidence that the IGA could be completed sometime in Spring, 1995.

Status of the Memorandum of Understanding

Strictly speaking, the bilateral MOU should provide a clear understanding of what Russia will provide to the partnership, what it will contribute from its national space program, what will be provided to NASA for payment under contract, and what contributions will receive compensation from the international partnership. The CODEL was not given many details on the status of the MOU since during the visit, NASA and RSA were conducting the space station program's incremental design review, which could ultimately change the terms and conditions necessary for reaching the MOU. As discussed above, the IGA negotiations that continue in parallel with the MOU talks, depend for conclusion on the MOU.

Potential Impact of MOU on ESA

Although any scenario seems plausible at this time, one can expect that ESA will want to know more about the U.S.-Russian MOU before its Ministers can commit to funding specific program elements. Knowing the extent to which the U.S. plans to depend on Russian elements for necessary functions, for instance the number of logistics flights to be flown by the Proton launcher, will determine to some extent ESA's desire to develop Ariane-V elements for logistics. Since little is known at this time, it may be longer than hoped before the partners agree and commit to a business scenario for the space station.

TECHNICAL CONSIDERATIONS

Program Management

Shortly after arriving in Moscow, Rep. Sensenbrenner was introduced by Kenny Mitchell, Manager of the Space Station Liaison Office to all NASA personnel tasked to the NASA Townhouse on the U.S. Embassy compound. Approximately 15 people were present, including three Russian nationals who work in support capacities. In addition, Rep. Sensenbrenner was told that approximately 70 NASA people were in-country to work with the Russian Space Agency team on the pending incremental design review. This mass of NASA personnel was impressive for two reasons. First, negotiating technical issues that will have a direct bearing on the MOU and cost-sharing effects in the IGA is a critical effort that deserves sufficient NASA attention. It seemed that NASA's large presence was adequate for the kind of work involved and the likelihood that technical approaches would require careful examination before issues could be closed out. The full scope of the incremental design review was not briefed to the CODEL, however. Second, although it would be preferable to have fewer engineers in-country and take more time with the reviews, having a sufficient task force present should enable the entire process to stay on schedule. Given the language barrier and anecdotal information about how long it can take to reach agreement, it seems impossible to conduct such a review in serial

fashion.

During the CODEL's consultation at RSA, Director Koptev stressed the importance of keeping the launch schedule and the need to eliminate bureaucracy on the U.S. side of the program. Although he was not specific about a particular problem, he expressed frustration with negotiations over costs rather than maintaining schedules. He expressed confidence in the design review then underway, saying that the U.S. and Russians agree on the basic program and continue working technical issues as progress continues. He said he recognized the importance of being responsible and for following rules, but emphasized the possibility for schedule delays resulting from U.S. red tape.

NPO Energia

The technical highlight of the visit to Moscow was the hands-on tour of NPO Energia conducted by First Deputy General Designer Viktor Legosatev. Dr. Legostaev showed Rep. Sensenbrenner some of the world's most precious space artifacts, including the test duplicate copy of the Sputnik satellite and the spacecraft that carried Yuri Gagarin, the first human in space. NPO Energia has an extremely valuable international space museum unique in the history of space achievements.

But NPO Energia is also the design bureau and integrator of all Russia's manned spacecraft systems. Dozens of technicians were working on various spacecraft components during the tour, including a contingent said to be testing electircal interfaces for the Spektr laboratory module, which will be launched and docked to the Russian Mir space station next year.

Dr. Legostaev expressed confidence that despite the delay in delivery of some U.S. experiment equipment, it could be integrated in a timely manner. He pointed out NPO Energia rules require foreign hardware of this type to be on the premises six months prior to integration, and that by this standard, Spektr is ahead of schedule. A new launch date would be determined sometime in December.

Khrunichev State Research and Production Space Center

During the visit to the Khrunichev works, the CODEL was shown significantly more space hardware relevant for the space station program than it was shown in January. Of particular interest, the Space Station Alpha Service Module, formerly the Mir-II core module was being fabricated. At this point only the large aluminum alloy structure has been fabricated, and technicians were apparently inspecting welds or checking for other manufacturing flaws as we passed by. This is the actual flight hardware that will connect with the Russian FGB space tug on the Russian side of the station.

While the delegation did not see the space station's FGB flight hardware, Rep. Sensenbrenner was briefed by the General Designer of the FGB at length on the prior flights of FGB-type spacecraft. During the plant tour, Sensenbrenner was guided by approximately five FGB configurations and related hardware. Clearly, this is a multi-purpose space bus having a number of specific mission customers over the years. (See Attachment D).

APPENDIX: CONDUCT OF THE INVESTIGATION

Monday, October 17

09:00 AM: Briefing by NASA European Representative Jim Zimmerman at Embassy Paris.

11:00 AM: Meeting with CNES President René Pellat; Director General Jean-Daniel Levi; Head of Astronauts Office Jean-Loup Chretien; Director of International Relations Dr. Issac Revah; International Relations Assistant to the Director for Bilateral Relations Gerard Blondeau; and International Relations Area Manager Gerard Petitalot.

12:00 PM: Lunch hosted by CNES

15:30 PM: Meeting at U.S. Embassy with Ambassador Pamela Harriman, accompanied by Science Counselor Sam Bosken.

18:00 PM: Meeting with European Space Agency Director General Jean-Marie Luton; Director of Manned Space Flight and Microgravity Jörg E. Feustel-Büechl; Associate Director for Strategy, Planning and International Policy Jean Jacques Dordain; and U.S. and Russian Cooperation Officer Karin Barbance.

19:30 PM: Dinner hosted by ESA

TUESDAY, OCTOBER 18

06:30 AM: Depart Hotel for CDG

09:35 AM: Depart Paris CDG to Moscow SVO via AF #1826

15:15 PM: Arrive Moscow; met by ES&T Counselor Vlad Sambaiew and ES&T Control Officer Steve Berk

15:45 PM: Proceed to Hotel

17:20 PM: Depart Hotel for Embassy

17:45 PM: Meet Members of NASA Liason Office, Townhouse 8, NASA Space Station Program Manager Kenny Mitchel and Deputy Program Manager Dave Kerbeck.

Country Team Briefing led by Chargé Richard Miles; Political Counselor William Burns, Air Force Liaison William Thurston; Economic Counselor Barbara Griffiths; USAID Officer James Norris.

19:30 PM: Dinner at Townhouse 1, hosted by U.S. Embassy Charge' Richard Miles. Guests included Defense Complex and Conversion Department Expert Vladimir Pivnyuk; Russian Ministry of Foreign Affairs Director of Science and Technical Cooperation Sergei Kislyak; State Duma Deputies Vitaly Sevastenov and Magomed Tolboyev; and Director of Parliament Center Aleksey Adrov.

WEDNESDAY, OCTOBER 19

09:45 AM: Met at Hotel by Embassy Moscow S&T Officer; Proceed to Khrunichev Enterprise.

10:00 AM: Meeting with Khrunichev First Deputy Director Alexander

Lebedev; Design Center Director Vladimir Karrask; FGB Project Director Sergei Shaevich; and Public Relations Officer Andrew Derbyshev.

12:00 PM: Lunch hosted Deputy Director Lebedev

13:30 PM: Depart RSA for Ministry of Foreign Affairs

14:00 PM: Meeting with Aleksander Yakovenko, MFA Deputy Director, Department of Science and Technology Cooperation and Head of Russian Delegation to Multilateral Talks on Space Station; MFA First Deputy Director of the Bureau of North America Alexei Kvasov; and MFA Department Counsellor Ivan Soltanovski.

14:45 PM: Depart MFA for White House

15:00 PM: Meeting at Council of Ministers with First Deputy Prime Minister Oleg Soskovets.

15:45 PM: Depart for Russian Space Agency

16:00 PM: Meeting with Russian Space Agency Director General Yuri Koptev.

18:00 PM: Dinner hosted by Director General Koptev

19:30 PM: Depart for Hotel

THURSDAY, OCTOBER 20

08:00 AM: Depart Hotel for consultation and tour at NPO Energia

09:00 AM: Meeting with Energia First Deputy General Designer Viktor Legostaev; First Deputy Director General and and Director of the Plant Alexey Borisenko; Director of Manned Spaceflight Valerei Rumin; Head of Business Development Department Alexander Derechin; Head of Foreign Relations Department Boris Artemov; and Head of Division for Spacecraft Docking Systems Vadim Kudrjavtsev; and First Deputy Director of RSA Boris Ostrumov.

12:00 PM: Lunch hosted by NPO Energia

13:00 PM: Depart for State Duma

14:00 PM: Meeting with Deputy Vladimir Gusev, Chairman, Committee for Industry, Construction, Transport and Power Engineering (CICTPE); Deputy Mogomed Tolboyev, Deputy Chairman, CICTPE; and Assistant to Chairman Gusev Vitaly Peshkov.

16:00 PM: Open

19:00 PM: Dinner with U.S. aerospace companies working in Moscow at hosted by Michael Friend, Director, Boeing Moscow Technical Center.

FRIDAY, OCTOBER 21

05:00 AM: Depart Hotel for Sheremetyevo II

07:35 AM: Depart Moscow SVO to Frankfurt FRA via DL #61

THE WHITE HOUSE

WASHINGTON

June 22, 1994

Dear Representative Sensenbrenner:

As the House of Representatives nears floor consideration of the VA, HUD and Independent Agencies Appropriations Bill for FY 1995, I am writing to inform you of the Administration's policy with respect to NASA's International Space Station program.

The Space Station is an important international partnership that includes the United States, Canada, the European Space Agency, Japan, and most recently, Russia. However, in keeping with the concerns raised by you and other members of the House and Senate, I want to assure you that the United States will maintain in-line autonomous U.S. flight and life support capability during all phases of station assembly.

You recently received a letter from my Science Advisor, Dr. John Gibbons, outlining the specific steps NASA is taking to address your concerns. These steps are being made a part of the program's baseline and will be reflected in all future cost estimates and launch schedules. As the program continues to develop and NASA reaches subsequent implementing agreements with the Russian Space Agency and U.S. contractors in order to achieve program element milestones, the U.S. will retain in-line autonomous capabilities.

I know you have supported our commitment to an active space partnership with Russia. Russia's hardware contributions to the International Space Station will be important and I am confident that Russia's immense space capabilities will prove them an economical and reliable partner. I hope that you will conclude, as I have, that we have achieved a balanced strategic partnership in space that will serve American interests. I look forward to working with you to assure that Congress recognizes the progress we have made and demonstrates its resolve to proceed.

Sincerely,

Bill Clinton

The Honorable James F. Sensenbrenner, Jr.
Ranking Republican Member
Subcommittee on Space
Committee on Science, Space and Technology
House of Representatives
Washington, D.C. 20515

esa

Meeting
between Mr. F.J. Sensenbrenner, JR.,
Member of Congress of the United States of America
and Mr. J.-M. Luton, ESA Director General

INTERNATIONAL SPACE STATION ALPHA
- EUROPEAN INVOLVEMENT -

ESA H.O. Paris, 17 October 1994

J. Feustel-Büechl
Director of Manned Spaceflight and Microgravity

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- The "mainstay" of the European Contribution to ISSA as defined by ESA Council is including:

  - Columbus Orbital Facility (COF)
  - Automatic Transfer Vehicle (ATV)
  - Crew Transfer Vehicle (CTV)
  - Utilisation concept.

- The "Mainstay" reflects the reaffirmed political commitment of Europe to play to the full its role as a partner in the ISSA programme.

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COF

- The COF (Columbus Orbital Facility), i.e. the European permanently attached laboratory, is baselined in the programme since the 1988 agreements (IGA/MOU).
- ESA is proposing a reviewed configuration of the COF resulting from a "design-to-cost" exercise and featuring:
  - a 4-rack module length
  - accommodation of 10 standard payload racks
  - subsystem commonality with the MPLM
- Its launch date is targeted to early 2001, consistent with the updated ISSA assembly sequence.

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ATV

- The ATV (Automated Transfer Vehicle) is a necessary complement for Ariane-5 to perform missions to the International Space Station ISSA.
- The ATV, with Ariane-5, will contribute to the ISSA logistics (upload of unpressurized cargo).
- Additionally, the role of ATV is under discussion for the ISSA in-orbit refuel/reboost function which would increase the robustness of the Station (complement to Russian Progress).
- Concerning the refuel/reboost function of ATV, the capability for it to ensure Station robustness was acknowledged in recent trilateral (ESA/NASA/RSA) discussions.
- Use of ATV for logistics has been included in ISSA operation planning and it is fundamental to support ESA's share of operation common costs.
- ESA and NASA have jointly established the next steps towards a formal agreement on the ATV role, which should be finally clarified before end 94.
- A mixed fleet scenario (Russian Progress and European ATV) is being studied by NASA with active ESA and RSA support.

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CTV

- The interest expressed by NASA in ESA contributing to the ISSA crew rescue in the 2002 time-frame is being followed up by ESA in the definition of CTV (Crew Transport Vehicle) design requirements.
- NASA agreed on the potential of using the ESA vehicle at a later stage also for crew transfer missions if its technical capabilities are upgraded accordingly.
- During the next months, ESA, NASA and RSA will explore options for cooperation in the crew rescue vehicle.

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- For both ATV and CTV, ESA expressed the key requirements associated with the European decision process.

  a) To have a nominal role of ATV and CTV firmly established in the ISSA operations scenario.

  b) To reach an agreement in principle on the above roles in the next few months, to support ESA programme proposal, which has to be tabled before end 94.

- ESA is very pleased of the progress achieved so far and of the positive NASA attitude in discussing these matters.

ESA PLAN FOR ISSA UTILISATION

- Overall ESA Utilisation Concept is in elaboration.
  European Member States favour balanced multidisciplinary use of Space Station
  Presently planned sharing between disciplines:

Microgravity Research	40-50%	Earth Observation	10-20%
Space Sciences (incl. Fundamental Physics)	10-20%	Technology & Applications	20-30%

- ESA is preparing a programme for development of facilities and instruments from all four disciplines, which can make use of the unique opportunity offered by Space Station.

STEPWISE REALISATION OF ESA's PLANS FOR UTILISATION

- ESA is preparing its utilisation plan according to the following phases:
  - Precursor Missions (SPACELAB, EUROMIR) (94-98)
  - Phase I: Participation in NASA missions to Mir with microgravity facilities (95-97)
  - Phase II: Early Opportunities prior to launch of ESA Element (98-2001)
  - Phase III: ESA Element Utilisation (> 2001)
- ESA has excellent cooperation with NASA in the field of material & life science missions (e.g. IML-2, LMS, Neurolab) and is interested to continue this fruitful preparation of ISSA utilisation
- ESA is interested to broaden the dialogue with NASA to other disciplines (Earth observation, technology, science) related to ISSA utilisation

SUMMARY CONCLUSIONS

- ESA considers the current cooperation with NASA on ISSA very good, both on the definition of flight elements and in the utilisation area.

- ESA is in the process of clarifying the final configuration of the COF and the roles for ATV and CTV with NASA participation.

- ESA is pursuing a joint action with NASA to expand to other utilisation disciplines the strict links already existing in microgravity (material & life science).

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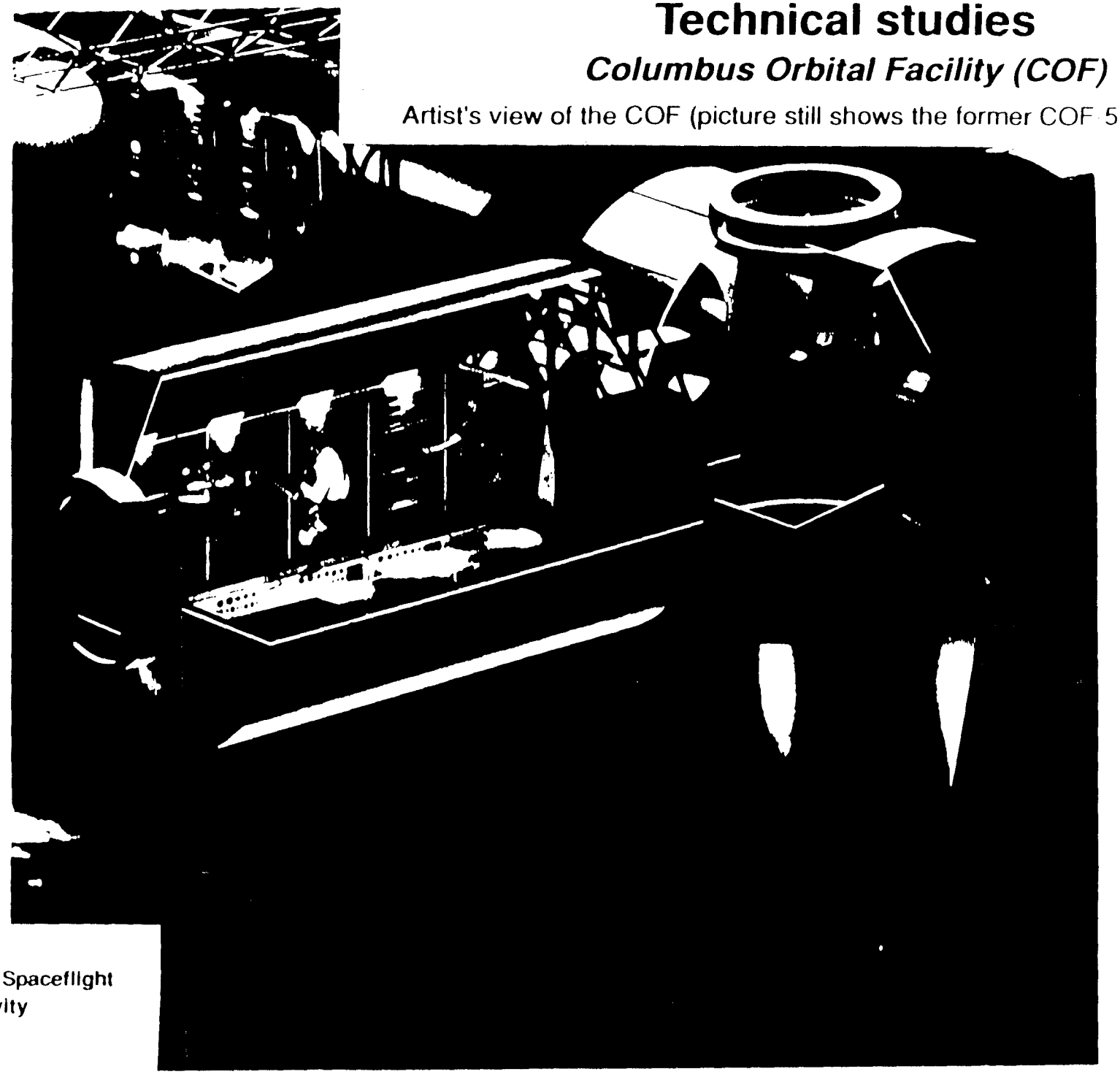
Technical studies

Columbus Orbital Facility (COF)

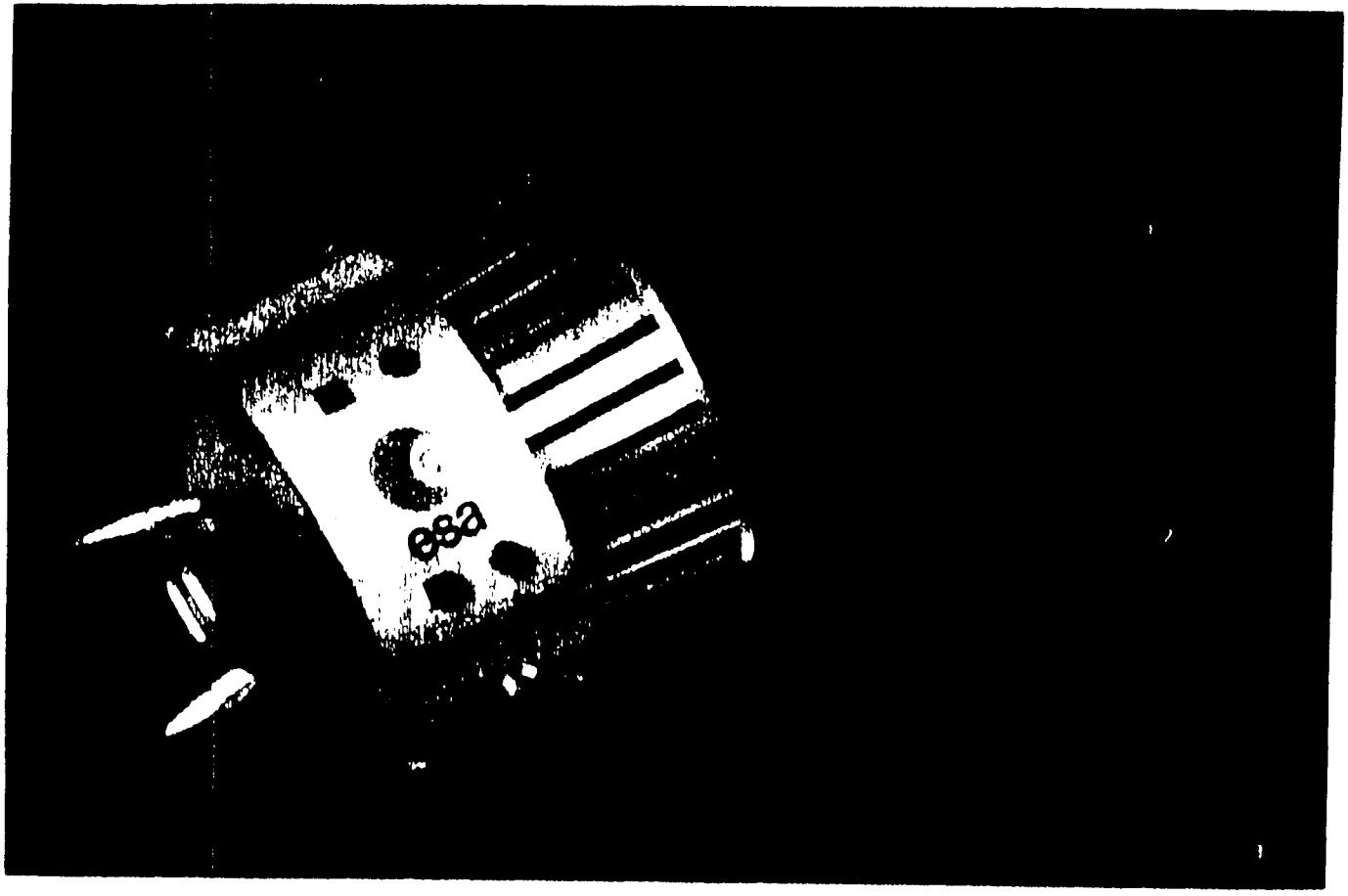
Artist's view of the COF (picture still shows the former COF-5 configuration)



rectorate of Manned Spaceflight
and Microgravity

MSM PI DI 54

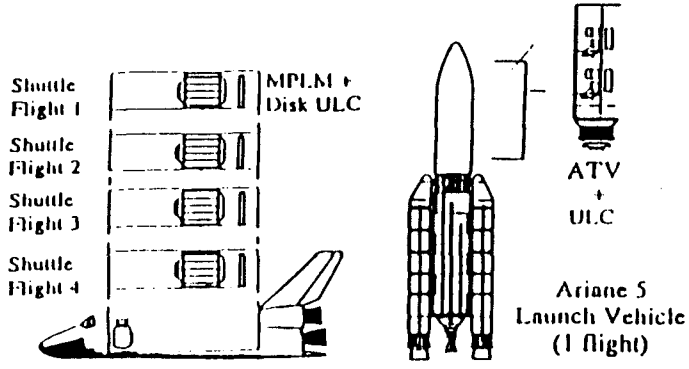
ATV General Architecture



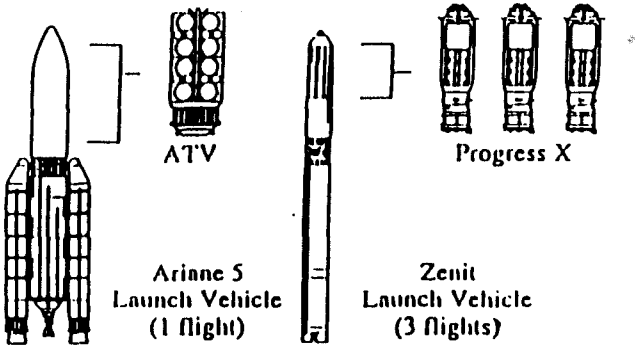
Technical studies

Automated Transfer Vehicle (ATV)

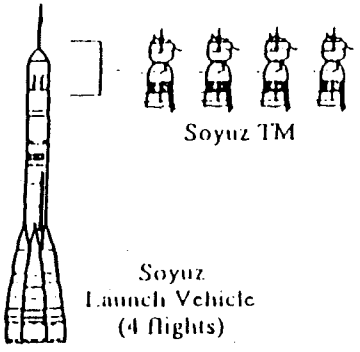
Annual flight scenario using European vehicles for the logistical support of the International Space Station



Shuttle
Logistics Cargo



Propellant, High Pressure Gas, and Russian
Logistics Cargo

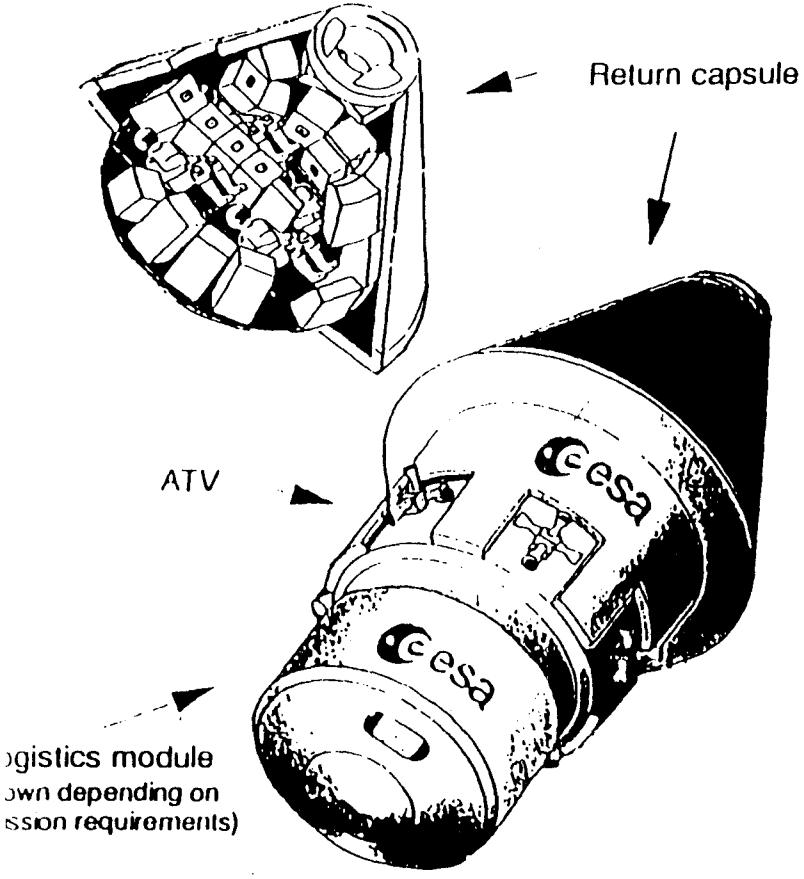


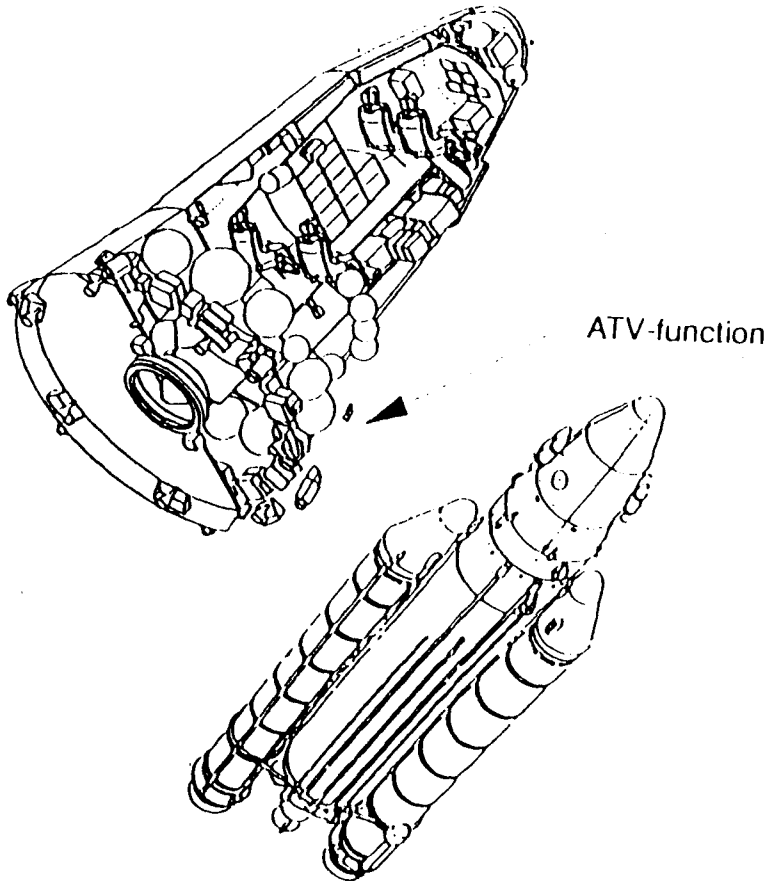
Russian Crew Rotation
and ACRV Replacement

esa

Technical studies

Crew Transport Vehicle (CTV)





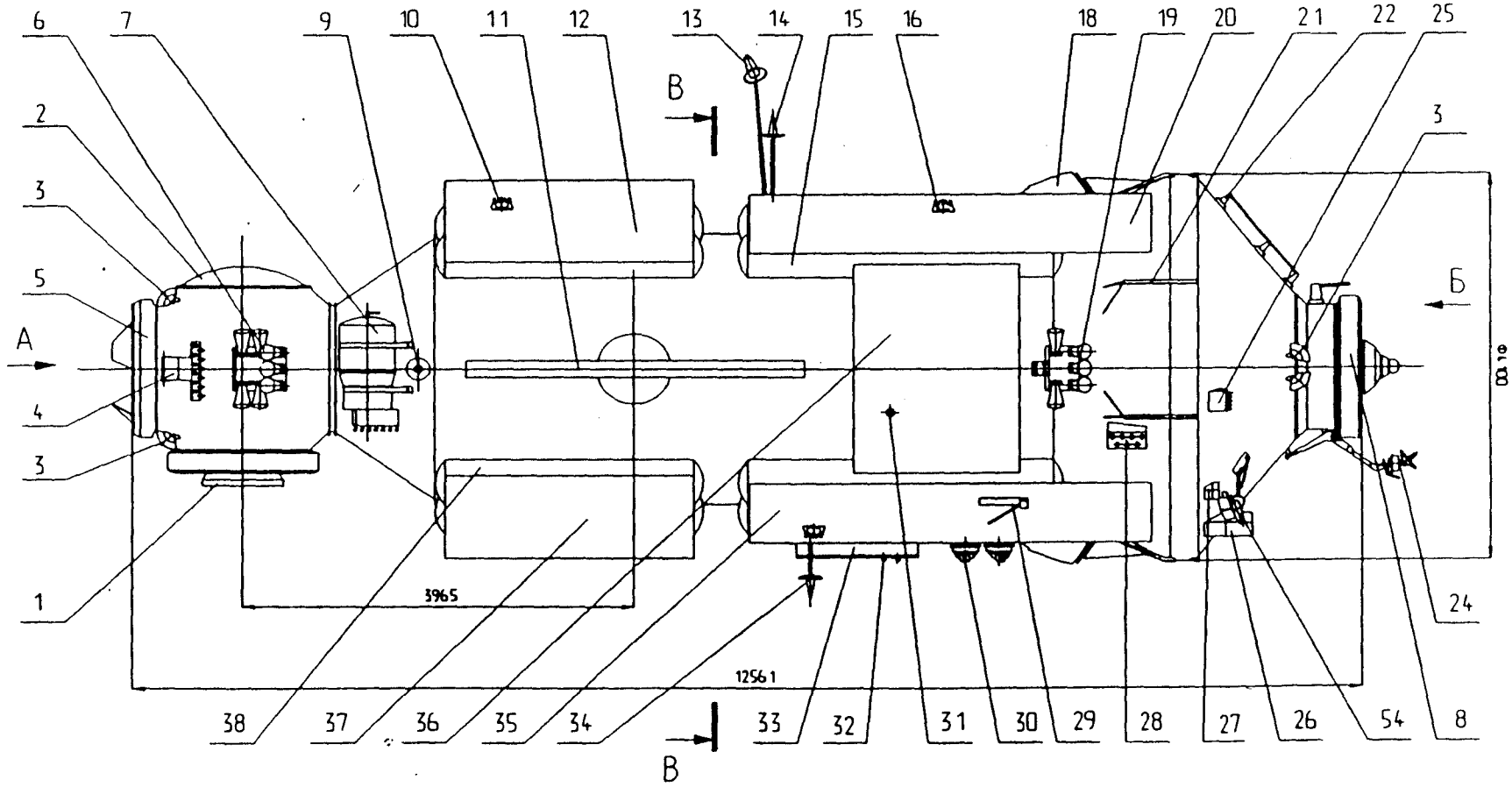
CTV - Conventional concept in which, like the Apollo capsule, the CTV capsule enters the atmosphere and lands with its heatshield in front

Right: CTV - a more advanced concept in which the vehicle enters the atmosphere and lands with the nosecone in front, like an aeroplane

ФГБ - ЭНЕРГЕТИЧЕСКИЙ БЛОК
FGB - ENERGY BLOCK

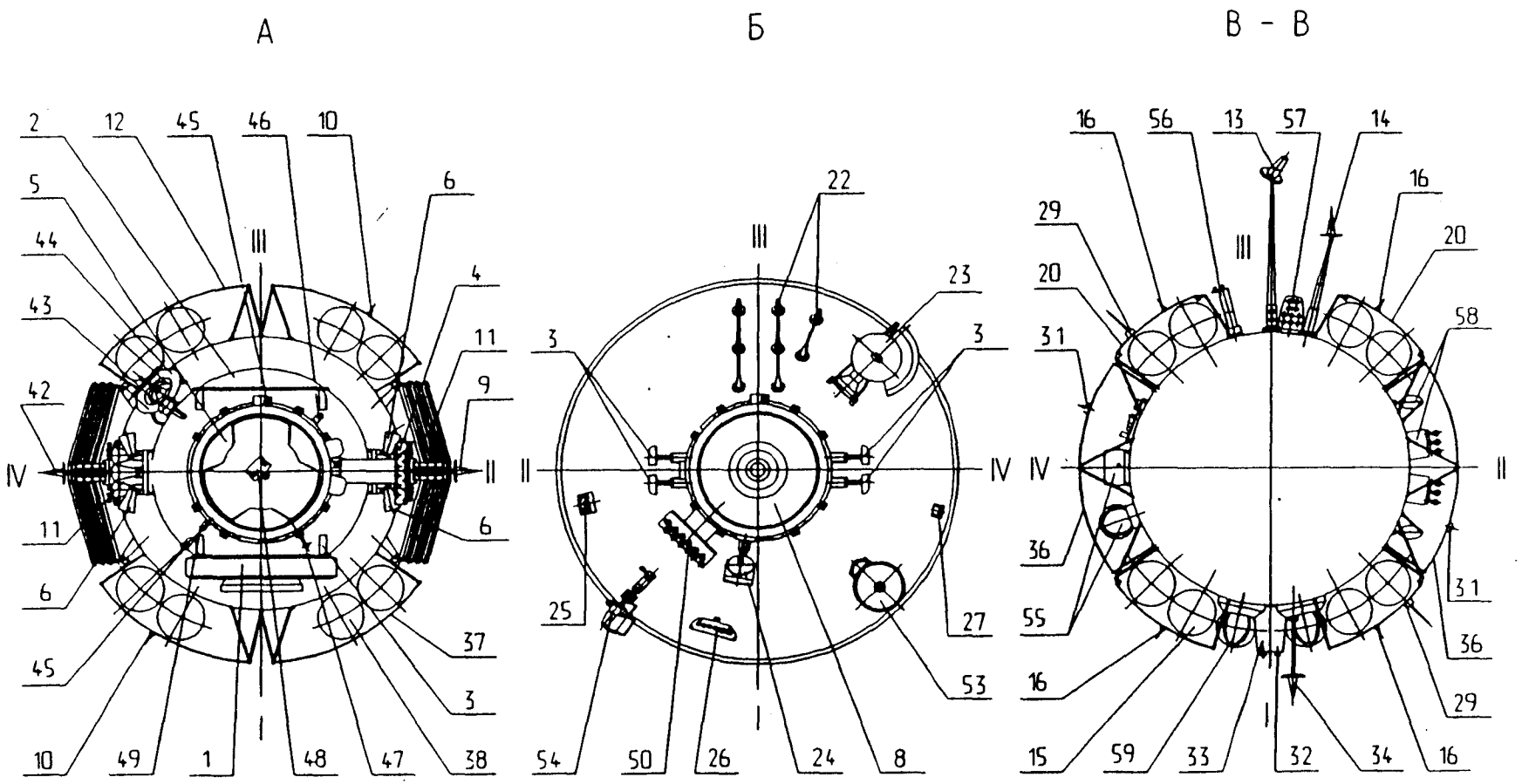
Поэтапное рассмотрение проекта
Incremental design review

Общий вид ФГБ
FGB general view



Общий вид ФГБ

FGB general view



Общий вид ФГБ

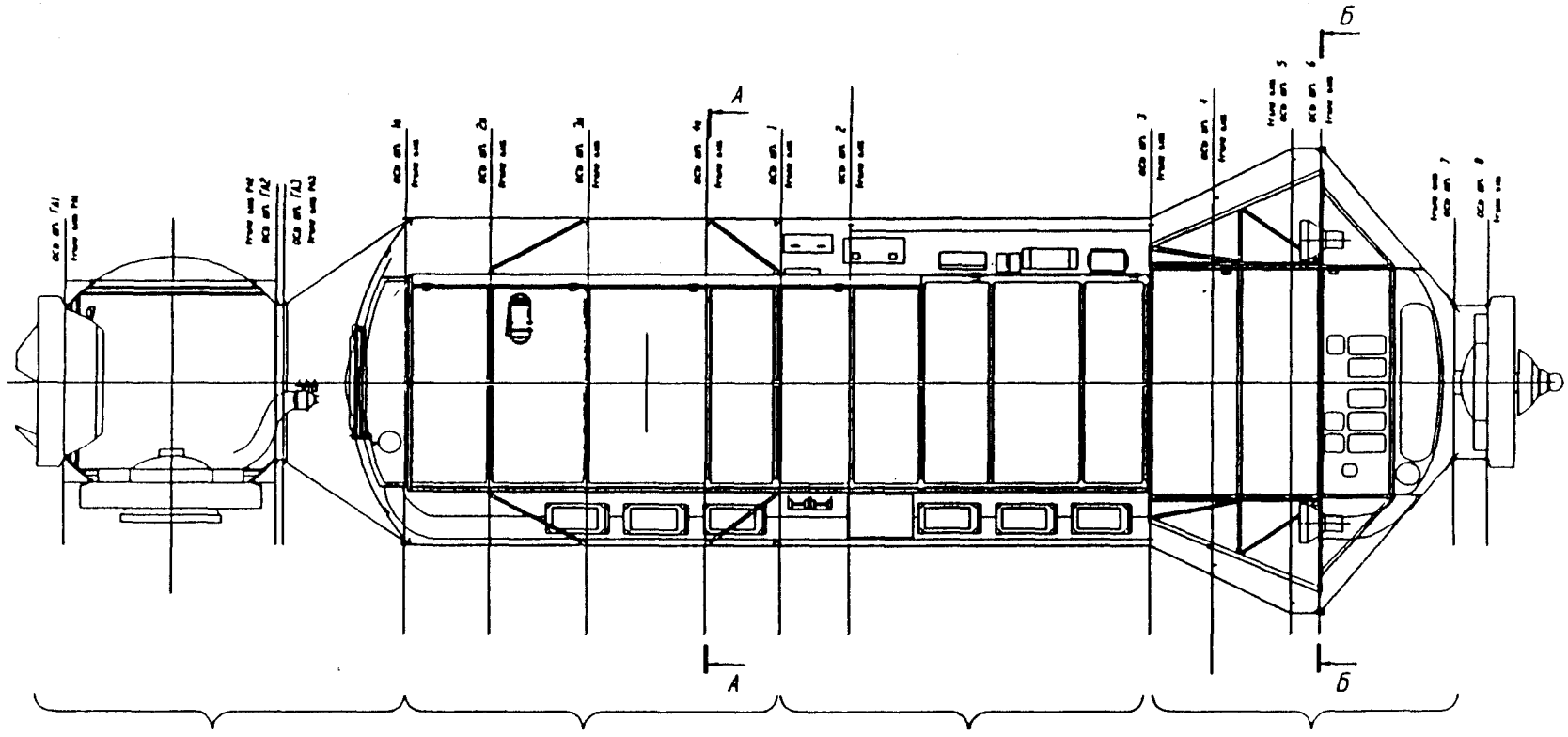
1. Агрегат стыковочный гибридный (конус):
2. Герметичная крышка:
3. Блок Б 12:
4. Блок электроразъемов связи с NODE:
5. АПАС:
6. Блок двигателей 11Д458 (ДПС):
7. Блок компрессоров:
8. Агрегат стыковочный гибридный (штырь):
9. Антенна АКР-ВКА N 3:
10. Антенна АТ:
11. Солнечная батарея:
12. Панель НХР:
13. Антенна АКР-ВКА N 2:
14. Антенна А1-798А N2:
15. Топливный бак:
16. Антенна АД-10:
18. Агрегат 11Д442:
19. Блок двигателей 11Д458 и 17Д58Э (ДПС и ДТС):
20. Панель НХР:
21. Направляющая:
22. Поручни:
23. Антенна АС-ВКА:
24. Антенна АО-ВКА:
25. Плата ВЧ-разъемов:
26. Плата отрывных разъемов связи с РН:
27. Блок концевых выключателей:
28. Панель заправки "О":
29. Антенна АМ-66:
30. Прибор ориентации на Землю 256К:
31. Антенна АС-11:
32. Панель заправки шаробаллонов:
33. Панель агрегатов высокого давления:
34. Антенна А1-798А N 1:
35. Панель НХР:
36. Панель НХР:
37. Панель НХР:
38. Топливный бак:
42. Антенна АКР-ВКА N4:
43. Телекамера:
44. Гнездо манипулятора:
45. Призменный отражатель АПО-ВКА:
46. Блок огня зеленый БОЗ:
47. Блок огня проблесковый ПО-1:
48. Прибор оптического канала БГО2-ВКА:
49. Блок огня белый БОБ:
50. Плата электроразъемов связи с СМ:
53. Антенна 2АСФ1-М-ВКА:
54. Антенна АКР-ВКА N 1:
55. Агрегаты ПГС:
56. Панель заправки СОГС:
57. Плата электроразъемов:
58. Агрегаты СОТР:
59. Шаробаллоны ВД.

Fgb general view.

1. Hybrid docking unit (drogue):
2. Hermetically sealed cover:
3. Block Б 12:
4. Block of electrical connectors with NODE:
5. APDU:
6. Block of engines 11Д458 (engine of berthing and stabilization):
7. Compressor block:
8. Hibrid docking unit (probe):
9. Antenna АКР-ВКА N3:
10. Antenna АТ:
11. Solar array:
12. Panel of external refrigerator-radiator:
13. Antenna АКР-ВКА N2:
14. Antenna А1-798А N2:
15. Propellant tank:
16. Antenna АД-10:
18. Unit 11Д442:
19. Block of engines 11Д458 and 17Д583 (engines of berthing and engines of accurate stabilization):
20. Panel of external refrigerator-radiator:
21. Guide:
22. Handrails:
23. Antenna АС-ВКА:
24. Antenna АО-ВКА:
25. Plate of highfreguency connectors:
26. Plate of umbilical connectors with LV:
27. Block of limit switchs:
28. Panel of oxidizer filling:
29. Antenna АМ-66:
30. Device 256К of orientation to ground:
31. Antenna АС-11:
32. Panel of spherebaltons filling:
33. Panel of high pressure units:
34. Antenna А1-798А N1:
35. Panel of external refrigerator-radiator:
36. Panel of external refrigerator-radiator:
37. Panel of external refrigerator-radiator:
38. Propellant tank:
42. Antenna АКР-ВКА N4:
43. TV camera:
44. Manipulator aperture:
45. Prism reflector АПО-ВКА:
46. Block of green light БОЗ:
47. Block of flash light ПО-1:
48. Optical channel device БГО2-ВКА:
49. Block of white light БОБ:
50. Plate of electrical connectors with SM:
53. Antenna 2АСФ1-М-ВКА:
54. Antenna АКР-ВКА N1:
55. Pneumatic hydraulic system units:
56. Panel of filling of gas composition supply system:
57. Plate of electrical connectors:
58. Thermocontrol system units:
59. High pressure spereballons.

Компоновка оборудования внутри ФГБ

Equipment arrangement inside FGB



Герметичный адаптер

Pressurized adapter

Приборно-герметичный отсек - 3 (ПГО-3)

Pressurized equipment compartment - 1 (ПГО-1)

Приборно-герметичный отсек - 1 (ПГО-1)

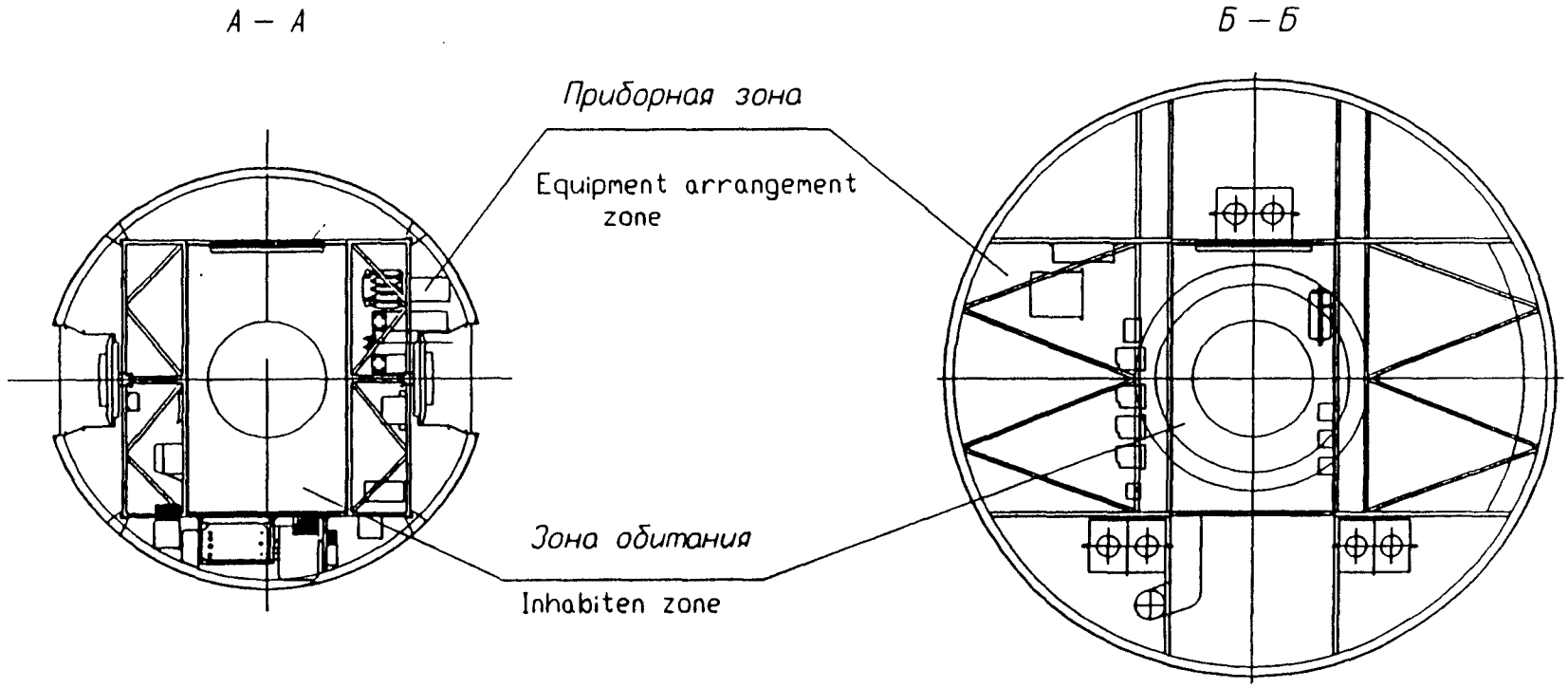
Pressurized equipment compartment - 3 (ПГО-3)

Приборно-герметичный отсек - 2 (ПГО-2)

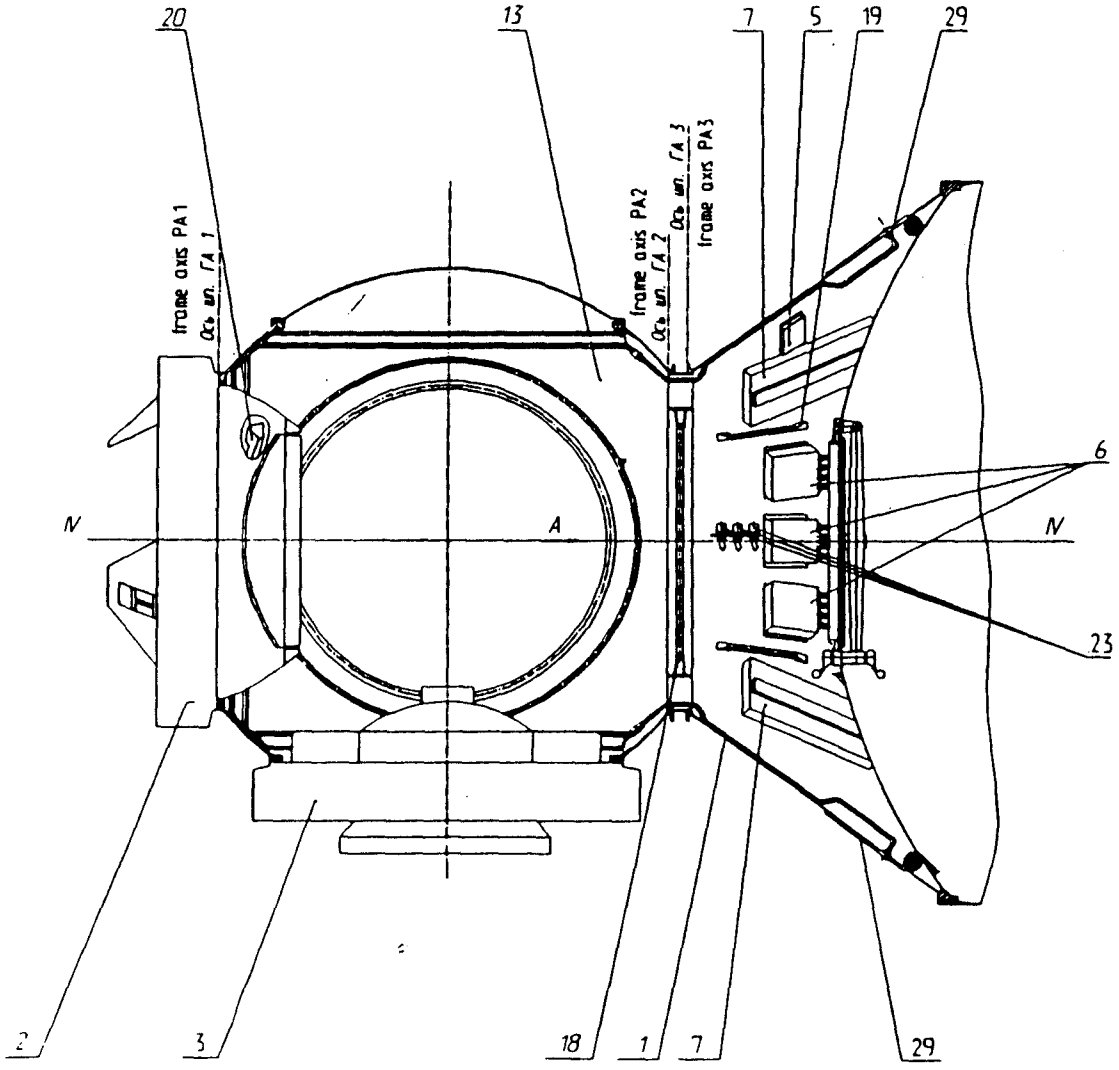
Pressurized equipment compartment - 2 (ПГО-2)

Компоновка оборудования внутри ФГБ

Equipment arrangement inside FGB



Компоновка оборудования внутри ГА
Equipment arrangement inside pressurized adapter



29 Плата гермопроходников
Plate of sealed adapter connector

23 Датчик давления МДД-ТЕ
Pressure sensor МДД-ТЕ

19 Поручень
Handrail

18 Поручень
Handrail

13 Клапан выравнивания давления
Valve for pressure equalization

10 Щиток освещения ЩО ПО
Illumination board ЩО ЛО

7 БКПТ
Power commutation block

6 БУП-2
Actuator control block-2

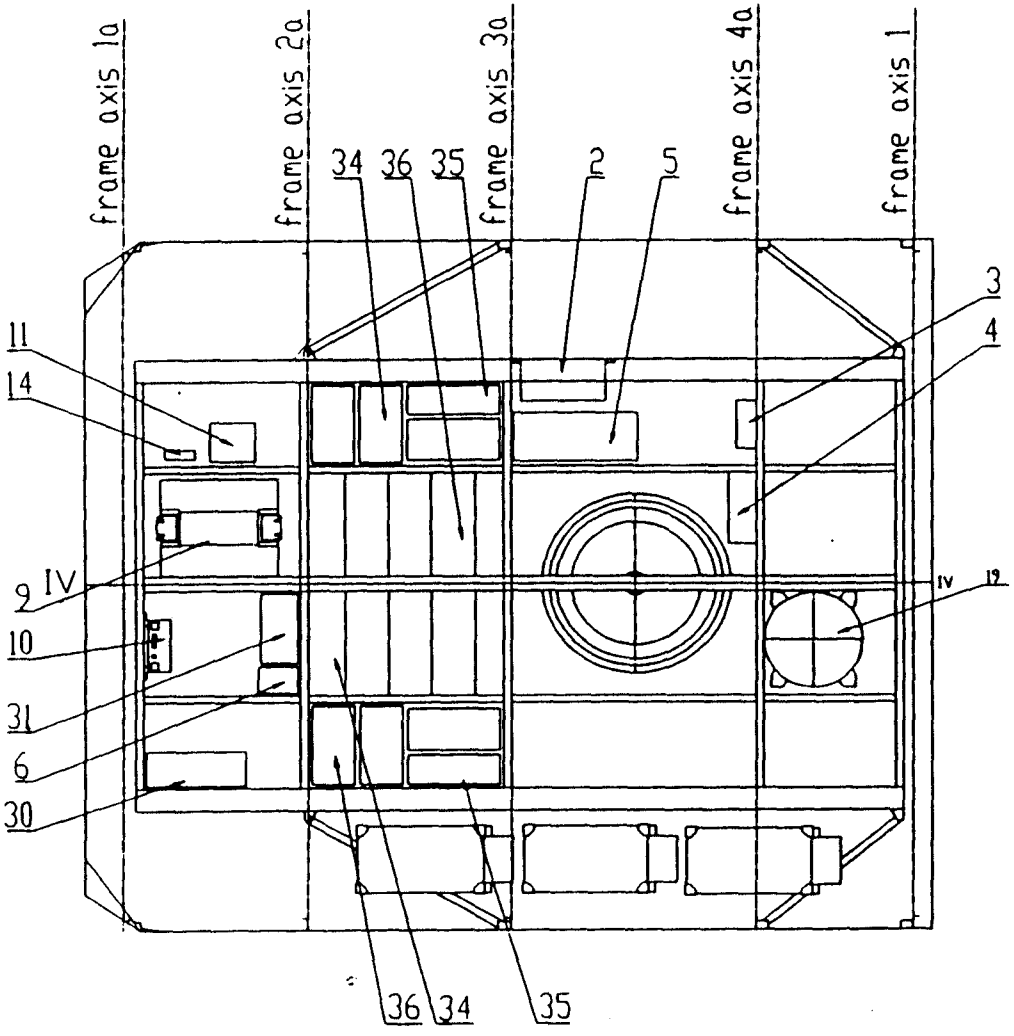
5 БУП-1
Actuator control block-1

3 АСГК
Hybrid docking unit

2 АПАС
APDU

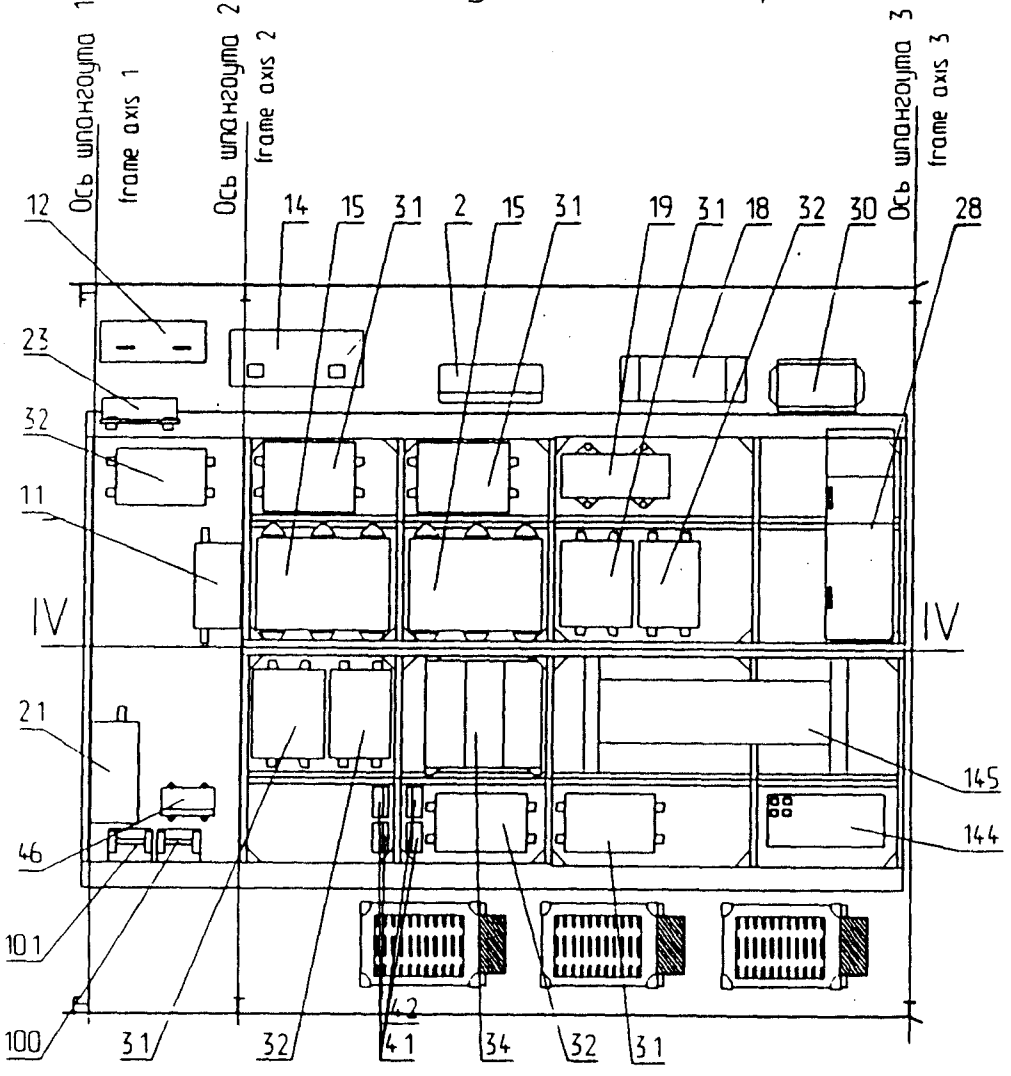
1 Корпус ГА
Pressurized adapter body

Компоновка оборудования внутри ПГО-3
Equipment arrangement inside pressurized equipment compartment - 3



36	Контейнер Container
35	Контейнер Container
34	Контейнер Container
31	Блок радиопередатчика Radio transmitter block
20	Поглатитель Absorber
19	Фильтр вредных примесей Detrimental impurities filter
11	Электронный блок Electronic block
10	Преобразователь Converter
9	Контейнер Container
6	Блок Б13 Block
5	Блок Б14 Block
4	Блок Б15 Block
3	Блок Б01 Block
2	Блок Б03 Block

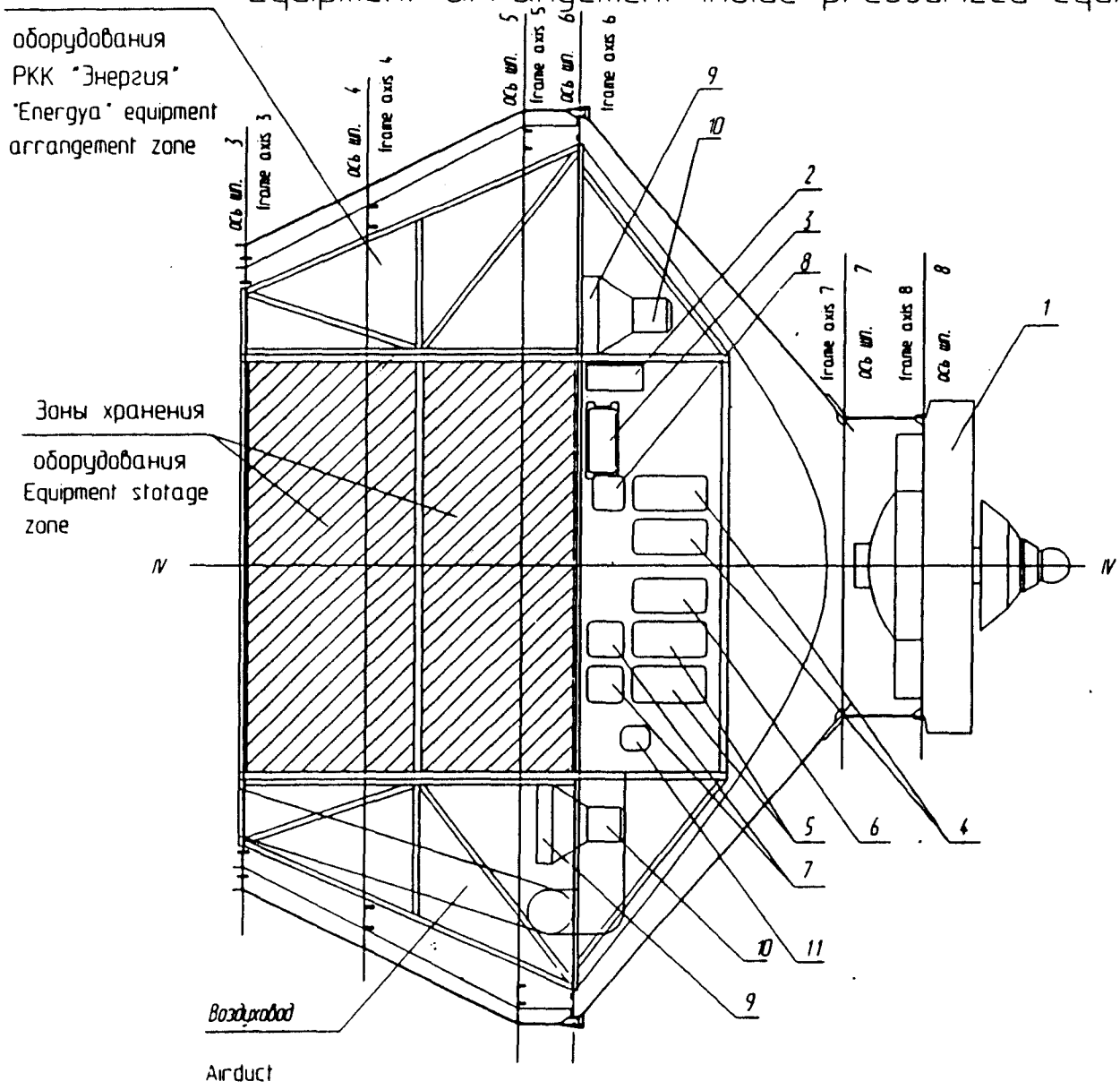
Компоновка оборудования внутри ПГО-1
Equipment arrangement inside pressurized equipment compartment - 1



101	ША 262С Block ША 262С
100	ША 262С Block ША 262С
46	Прибор 38Г6 Device 38Г6
41	СС-ЭВМ Block СС-ЭВМ
32	Унифицированный прибор силовой коммутации (УПСК) Unified device of power commutator
31	Унифицированный коммутационный прибор (УПК) Unified commutation device
30	Долговременное запоминающее устройство 17Л34-А03 Long-term memory 17Л34-А03
23	Блок приборов (ПЗУ-В) Block of devices (ПЗУ-В)
21	Автоматика двигательной установки (АДУ) Automatics of engine unit
19	Бортовой коммутатор (БК) Onboard commutator
18	Специальное запоминающее устройство (СЗУ) Special memory
15	Прибор кодового обмена (ПКО) Code exchange device
14	Устройство вывода-ввода информации (УВВ-3) Input-output information device
12	Блок распределения питания (БРП-3) М34-07 Distribution power device
11	Автоматика пиросредств (АПС) М34-11 Pirmeans automatics
2	Блок питания ГИВУСа 23А6 (2) БП 163 Power block of gyroscopic meter of angular velocity vector

Компоновка оборудования внутри ПГО-2

Зона размещения Equipment arrangement inside pressurized equipment compartment - 2



11 - Бортовая розетка РБС-У
Onboard socket РБС-У

10 - Вентилятор МО-2
Fan МО-2

9 - Газожидкостный теплообменник ГЖТ
Gas-liquid heat exchanger

8 - Щиток освещения ЩО-ЛО
Illumination board ЩО-ЛО

7 - Пульт контроля параметров ПКПМ-1
Parameters control panel

6 - Пульт сигнализации ПСМ-1
Signalling panel

5 - Пульт контроля систем ПКСМ
Systems control panel

4 - Пульт выдачи команд ПВКМ
Commands sending panel

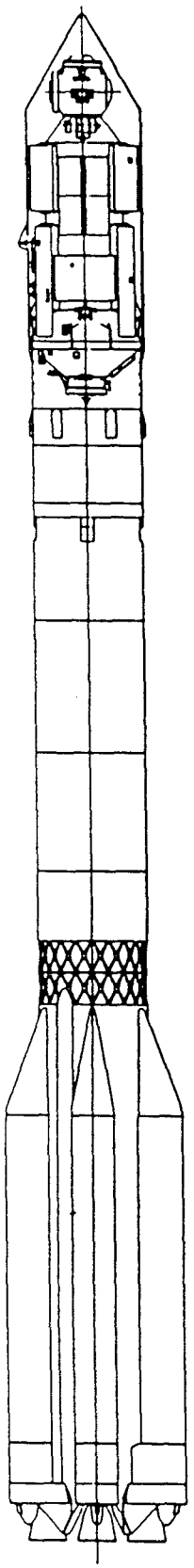
3 - Блок управления СПТ
Control block of PTS

2 - Блок Б13
Block Б13

1 - Агрегат стыковочный
гибридный (штырь)

Рнкшв бшслштп гтше (Экшшу)

РН "Протон" с ФГБ
Proton LV with FGB



Характеристики трехступенчатой РН:

Стартовая масса РН с ФГБ 700 т

Ракета-носитель 'Протон' обеспечивает выведение ФГБ на опорную орбиту с параметрами :

наклонение	51.6 град,
максимальная высота	342.1 км,
минимальная высота	220.4 км,
период обращения	89.84 мин.

Компоненты топлива:

окислитель	Азотный тетраксид
горючее	Несимметричный диметилгидразин

Сухая масса РН 47,1 т

Комплектация ДУ

I ступени	Шесть ЖРД
II ступени	Четыре ЖРД
III ступени	Один основной ЖРД Один 4-камерный рулевой ЖРД

Суммарная тяга ДУ

I ступени (у Земли)	161,9 тс x 6 = = 971,4 тс
II ступени	59,36 тс x 4 = = 237,44 тс
III ступени	59,36 тс + 3,15 тс = = 62,51 тс

Three-stage LV characteristics:

Launching mass of LV with FGB: 700 t

Proton LV ensures FGB injection into support orbit with parameters:

inclination:	51,6 deg
max altitude:	342,1 km
min altitude:	220,4 km
orbital period:	89,84 min

Propellant components:

Oxidizer	Nitrictetroxide
Fuel	Unsymmetrical dimetil hydrazine

LV dry mass: 47,1 t

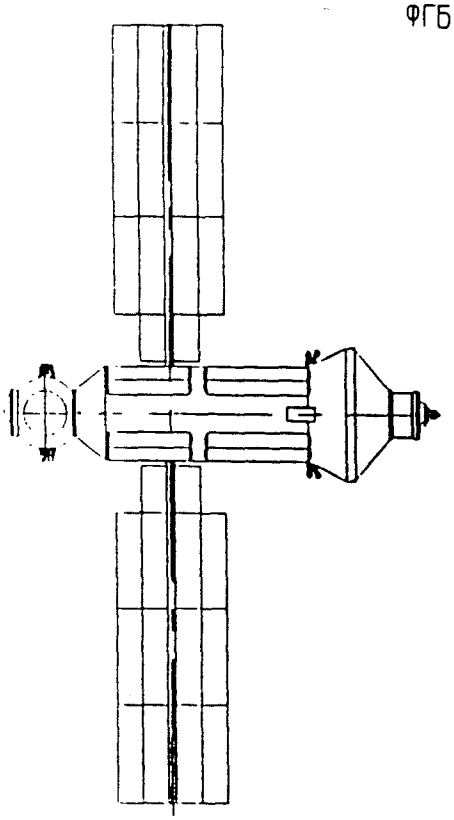
Propulsion unit complete set:

I stage	6 liquid engines
II stage	4 liquid engines
III stage	1 main liquid engine 1 gimbal liquid engine with 4 chambers

Propulsion unit total thrust

I stage (on ground)	161,9 t sec x 6 = = 971,4 t sec
II stage	59,96 t sec x 4 = = 237,44 t sec
III stage	59,39 t sec +3,15 t sec = = 62,51 t sec

ФГБ - энергетический блок



ОСНОВНЫЕ ТЕХНИЧЕСКИЕ ХАРАКТЕРИСТИКИ ФГБ

Ракета-носитель:	"Протон"
Стартовая масса:	23500 кг
Масса на орбите:	19340 кг
Длительность функционирования на орбите:	13 и более лет
Гарантированная среднесуточная мощность электроснабжения напряжением 28 В:	3 кВт
Высота опорной орбиты	
максимальная:	342,1 км
минимальная:	220,4 км
Высота монтажной орбиты:	350 км
Высота рабочей орбиты:	410-450 км
Наклонение рабочей орбиты:	51,6 град.
Мощность электроснабжения NODE1:	
среднесуточная:	1,5 кВт
максимальная:	3 кВт

НАЗНАЧЕНИЕ ФГБ

1. ФГБ - первый элемент МКС, он обеспечивает последующее объединение (сборку) американских и российских элементов и функционирует в составе станции в течение длительного срока, являясь частью обитаемого пространства станции, ее двигательной и энергетической систем.

2. ФГБ обеспечивает электроснабжение МКС на начальном этапе сборки.

3. ФГБ осуществляет прием, хранение и выдачу топлива в составе объединенной пневмогидравлической системы, включающей рабочий модуль и транспортные корабли.

4. ФГБ может являться местом установки научно-исследовательского, экспериментального и иного целевого оборудования, а также местом хранения расходуемых запасов и ресурсного оборудования.

5. ФГБ обеспечивает управление движением и поддержание орбиты станции до полета IR.

ОСНОВНЫЕ ТРЕБОВАНИЯ К ФГБ
ОСНОВНЫЕ ТЕХНИЧЕСКИЕ ХАРАКТЕРИСТИКИ ФГБ

На всех этапах эксплуатации необходимо:

сохранение прочностных характеристик конструкции, позволяющих воспринимать статические и динамические нагружения, воздействие среды окружающего космического пространства;

обеспечение заданных температурных и динамических условий работы бортового оборудования, а также соответствующих параметров атмосферы внутри гермообъема;

управление бортовыми системами по командам с Земли или с борта служебного модуля;

контроль состояния и функционирования элементов конструкции и бортовых систем в автоматическом режиме;

обмен информацией в направлениях "Борт-Земля", "Земля-Борт" по радио и телевизионным каналам связи;

информационное обеспечение экипажа;

проведение измерений текущих навигационных параметров.

На автономном участке полета, а также в составе сборки космических аппаратов ФГБ выполняет следующие функции:

изменение параметров орбиты с целью перевода ФГБ с опорной орбиты на орбиту монтажа или рабочую орбиту;

построение и поддержание заданной ориентации в пространстве для обеспечения максимального энергосъема с БС или в процессе стыковки;

ориентация и стабилизация при проведении сближения и стыковки (в качестве пассивного аппарата) с МКП и МТКК "Спейс Шаттл" с созданием необходимых интерфейсов на стыках ФГБ-МКП, ФГБ-NODE;

электроснабжение NODE1;

сближение и стыковка в составе связки в качестве активного аппарата с служебным модулем;

выполнение динамических операций в автоматическом режиме по командам, вырабатываемым бортовым вычислительным комплексом.

В режиме совместного полета в составе МКС требуется:

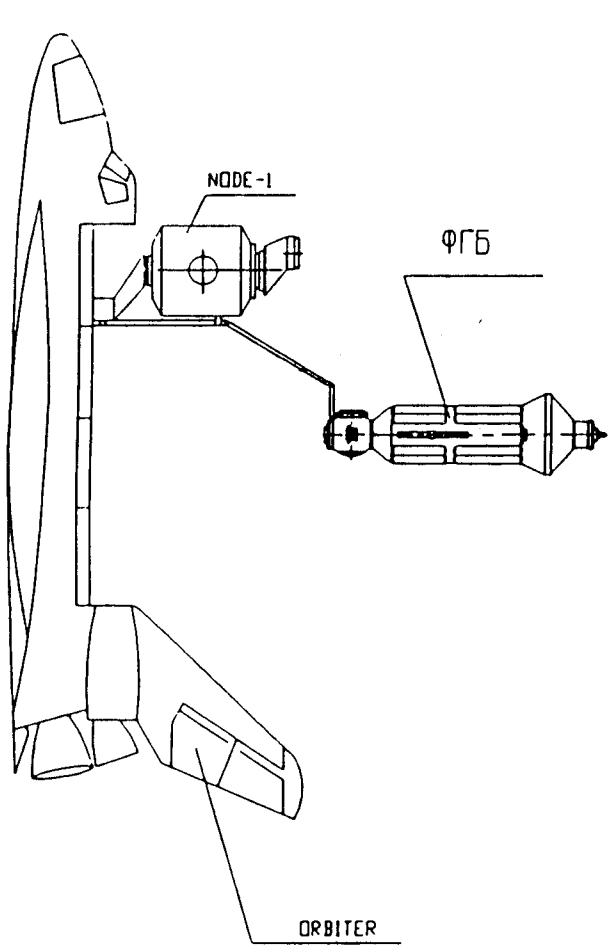
обеспечение перехода экипажа в смежные элементы МКС, организация коммуникаций, в т.ч. транзитных, со смежными элементами МКС;

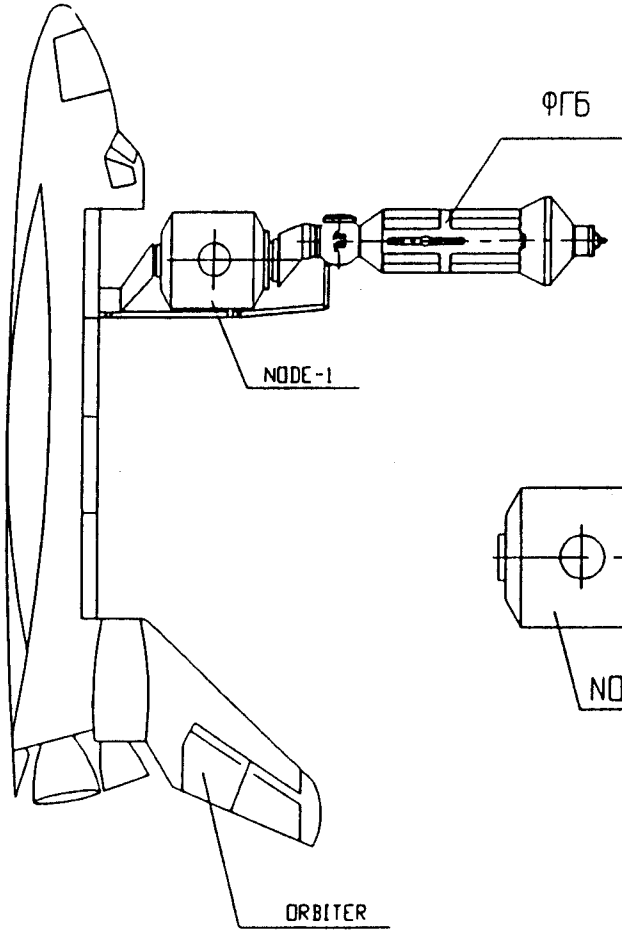
объединение бортовых систем ФГБ в единые информационную и энергетическую системы в рамках российской части станции или МКС;

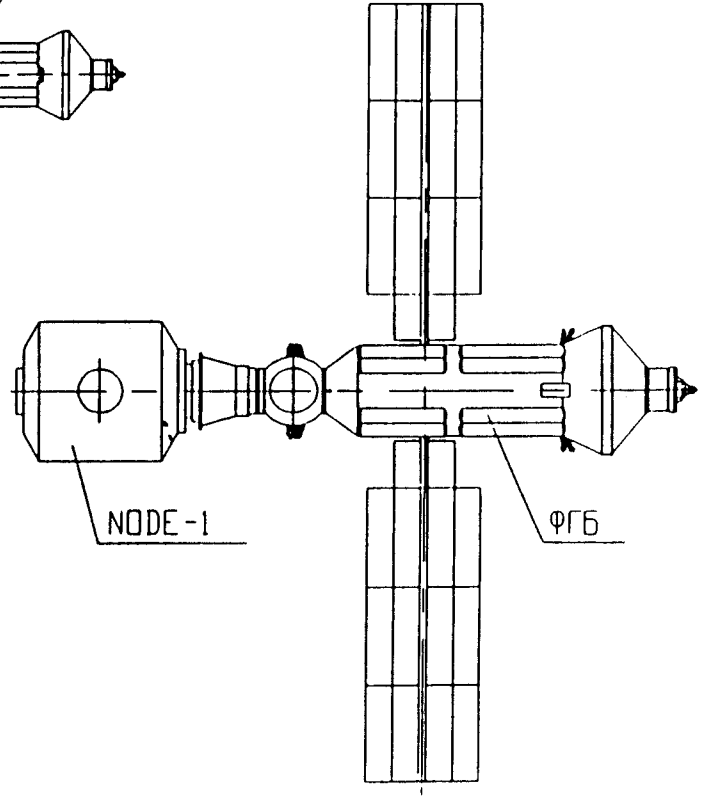
обеспечение безопасности и комфортных условий пребывания экипажа на борту МКС при объединении обитаемых отсеков ФГБ со смежными элементами МКС в части, предусматривающей разделение функций между ФГБ и другими элементами МКС;

взаимодействие с пневмогидросистемами двигательных установок служебного модуля, ГТК "Прогресс М" с целью приема, хранения и выдачи топлива.

ПОЛЕТ 2А







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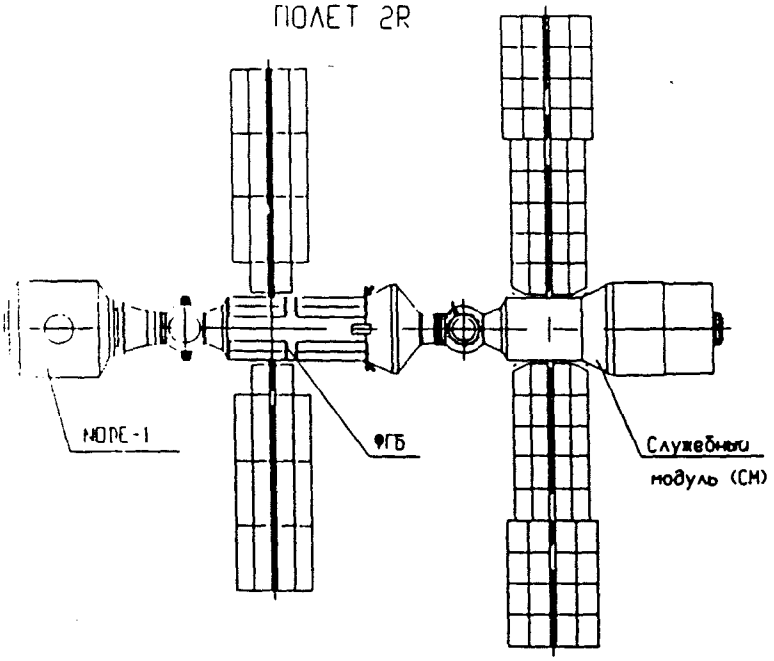
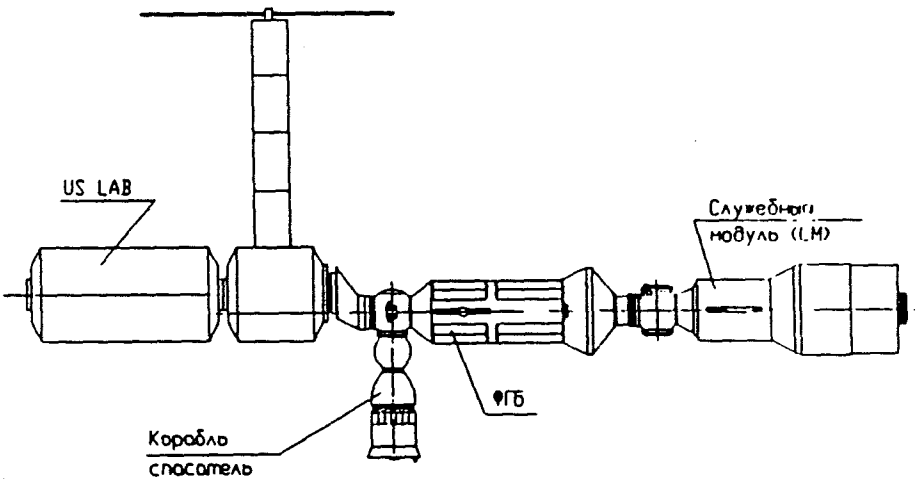


ПОЛЕТ 4A



ПОЛЕТ 11R