The *Mir* Space Station as seen by the Shuttle *Atlantis* during STS-86

The launch of Shuttle *Atlantis* for STS-71

Section 1 - Introduction

Authors:

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1.   The largest benefit of the Phase 1 Program was the growth of trust and understanding between National Aeronautics and Space Administration (NASA) and the Russian Space Agency (RSA). The Phase 1 Program underwent many changes from the original program plan, including many significant contingencies and several emergencies. At the end of the program the ability of the management and Working Groups to work together and support each other through all of the challenges improved to a level that was inconceivable during the "Cold War" or even just 6 years earlier at the start of the Phase 1 program. This report contains a brief description of *Mir*-Shuttle and *Mir*-NASA program operations, the main achievements of the programs, and also lessons and recommendations for International Space Station (ISS) operations.

1.1.   How the Phase 1 Program Started

On June 17, 1992 in Washington D.C., George Bush, the President of the United States, and Boris Yeltsin, President of the Russian Federation, signed the "Agreement between the United States of America and the Russian Federation Concerning Cooperation in the Exploration and Use of Outer Space for Peaceful Purposes." This agreement states that one of the areas of cooperation will include a "Space Shuttle and *Mir* Space Station mission involving the participation of U.S. astronauts and Russian Cosmonauts." At this Washington meeting the leaders further agreed to flight(s) of Russian cosmonauts on the Shuttle in 1993, flight of a U.S. astronaut on a long-duration mission on *Mir* in 1994, and a docking mission between the Shuttle and the *Mir* in 1995. This was the beginning of the Phase 1 (*Mir*/Shuttle) Program.

On October 5, 1992, in Moscow, Daniel Goldin, Administrator of NASA, and Yuri Koptev, Director General of RSA, signed the "Implementing Agreement between the National Aeronautics and Space Administration of the United States of America and the Russian Space Agency of the Russian Federation on Human Space Flight Cooperation." This agreement further outlined details of cooperation that included: a Russian cosmonaut flying on the Shuttle mission STS-60 as a mission specialist; a U.S. astronaut launching on a Soyuz, flying more than 90 days on the *Mir*, and returning on a Shuttle; Russian cosmonauts on *Mir* being "changed out" via the Shuttle on the same flight that would return the U.S. astronaut; and evaluation of and possible contract for the Russian Androgynous Peripheral Docking Assembly developed by NPO Energia for use on the Shuttle. This program was called the *Mir*-Shuttle Program.

Later, the American side proposed expansion of the joint program: It would include up to 10 dockings of the Shuttle with *Mir* and would increase the presence of American astronauts on *Mir* to up to two years and deliver up to two tons of hardware on board the Russian Spektr and Priroda modules. Separate flights of up to six months were proposed for American astronauts on board *Mir*. In June 1994, a contract was concluded for work between RSA and NASA. This program was called *Mir*-NASA. The work performed for the *Mir*-Shuttle and *Mir*-NASA programs are considered as Phase 1 of the preparation for the creation of the International Space Station.

Initially Tommy Holloway at Johnson Space Center and Valeriy Ryumin at NPO-Energia were asked to be the technical program managers of the Phase 1 Programs on

their respective sides of the Ocean. Working groups, consisting of experts from RSC Energia, NASA, RSA, Institute for Biomedical Problems (IBMP), Gagarin Cosmonaut Training Center (GCTC), and other organizations and companies, were created to prepare the organizational and technical documentation and to carry out the flight plans.

The Phase 1 Program became a formal stand-alone program on the NASA side on October 6, 1994 when Associate Administer for Spaceflight, Jeremiah Pearson III, signed a letter establishing the Program Plan and officially appointing Tommy Holloway as Manager. The Program Plan stated that:

"Phase 1 represents the building block to create the experience and technical expertise for an International Space Station. The program will bring together the United States and Russia in a major cooperative and contractual program that takes advantage of both countries' capabilities."

In August of 1995, Frank Culbertson was named as the Phase 1 Program Manager, and he remained at this position for the duration of the Program.

1.2.   Objectives and Working Group Structure

Phase 1 was a stepping stone to the ISS. It was a chance for NASA to learn from the Russians' experience of building and maintaining a Space Station, and for both counties' space programs to fit these experiences into the plans and implementation of the ISS.

The four main objectives of the Phase 1 Program were:

1. Learn how to work with international partners,
2. Reduce risks associated with developing and assembling a space station,
3. Gain operational experience for NASA on long-duration missions,
4. Conduct life science, microgravity, and environmental research programs.

To accomplish these objectives, a Joint Working Group Structure was developed. This structure divided the mission planning and execution tasks into 9 different functions. Each country designated a Co-Chair for each group who was responsible for that function. These Co-Chairs chaired joint meetings (usually weekly via telecon, and occasionally face to face) and were empowered to sign protocols that documented agreements that were made within their discipline. See Table 1.1 for a list of working groups, their area of responsibility, and the names of the Co-Chairs.

Phase 1 Joint Working Group (WG) Structure

Table 1.1

Working Group (WG) Number and Name	Area of Responsibility	Russian Chair (through most of the program)	NASA Chair (through most of the program)
WG-0 Management Working Group	Technical direction of all Phase 1 activities; coordination of activities of working groups Technical coordination of RSA and NASA Activities Established Configuration Management Control and standards for documents and communications	Technical Director (RSC-E) Valeriy Viktorovich Ryumin Technical Director (RSA) Boris Dmitryevich Ostroumov Deputy Technical Director (RSA) Aleksandr Grigoriyevich Botvinko Chairman of Crew Training (Gagarin Crew Training Center) Yuri Nikolayevich Glaskov	Program Manager Frank L. Culbertson Deputy Program Manager James E. Van Laak Contract Director James R. Nise
	Coordination of Phase 1 Joint Milestone Template	Requirements Coordination (RSC-E) Anatoliy Vasilyevich Lomanov	Requirements Coordination Kathy Leary
WG-0 Cargo and Scheduling Subgroup	Joint manifesting, cargo traffic scheduling for *Mir*-NASA program, and cargo delivery to *Mir* by Shuttle	Co-Chair (RSC-E) Pavel Mikhailovich Vorobiev	Co-Chair Sharon Castle

Table 1.1 Cont.

Working Group (WG) Number and Name	Area of Responsibility	Russian Chair (through most of the program)	NASA Chair (through most of the program)
WG-1 Public Affairs Working Group	Plans, coordinates and implements all public affairs activities.	<u>Co-Chair</u> (MCC-M) Valeriy A. Udaloy	<u>Co-Chair</u> (Headquarters) Debra Rahn
WG-2 Joint Safety Assurance Working Group (JSAWG)	Evaluates safety requirements of the *Mir*/Shuttle Program, analyze off nominal situations, and review cargo safety	<u>Co-Chair</u> (RSC-E) Boris Ivanovich Sotnikov	<u>Co-Chair</u> Gary W. Johnson
WG-3 Flight Operations and Systems Integration Working Group	Develops flight programs, crew work schedules, and control, communications, and systems integration requirements. Performs analytical integration and operation analyses.	<u>Co-Chair</u> (RSC-E) <u>Lead Mir Flight Director</u> Vladimir Alekseyevich Solovyev <u>Deputy Lead Mir Flight Director</u> (RSC-E) Victor Dmitriyevich Blagov <u>Deputy for *Mir* Integration</u> (RSC-E) Yuri Pavlovich Antoshechkin	<u>Shuttle Operations Co-Chair</u> Philip L. Engelauf <u>Shuttle Integration Co-Chair</u> George Sandars
WG-4 Mission Science Working Group	Develops scientific programs and experiments, and requirements for scientific equipment.	<u>Co-Chair</u> (RSC-E) Oleg Nikolayevich Lebedev	<u>Co-Chair</u> John Uri
WG-5 Crew Training and Exchange Working Group	Develops requirements for crew functions, programs, schedules and crew training.	<u>Co-Chair</u> (RSC-E) Aleksandr Pavlovich Aleksandrov <u>Co-Chair</u> (GCTC) Yuri Petrovich Kargopolov	<u>Co-Chair</u> William C. Brown <u>Crew Representative</u> Shannon Lucid

Table 1.1 Cont.

Working Group (WG) Number and Name	Area of Responsibility	Russian Chair (through most of the program)	NASA Chair (through most of the program)
WG-6 Mir Operations and Integration Working Group	Coordinates the hardware integration, training, and operations activities of NASA hardware on Russian vehicles, for the *Mir* stand-alone operations (no Shuttle involved)	Co-Chair (RSC-E) Oleg Nikolayevich Lebedev	Co-Chair Rick Nygren
WG-7 Extravehicular Activity (EVA) Working Group	Defines the EVA requirements and the hardware required to support the EVAs.	Co-Chair Aleksandr Pavlovich Aleksandrov	Co-Chair Richard Fullerton
WG-8 Medical Operations Working Group	Defines requirements for health care systems in support of astronauts and cosmonauts involved in cooperative missions.	Co-Chair Valeri Vasilyevich Bogomolov (IBMP) Co-Chair (GCTC) Valeri Vasilyevich Morgun (GCTC)	Co-Chair Roger Billica Co-Chair Tom Marshburn

Astronaut Robert Gibson and cosmonaut Vladimir Dezhurov shake hands during STS-71

STS-60 cosmonaut, Sergei Krikalev