CONTENTS

PAGE

Preface ............................................................................................................................. II
List of Tables and Figures ................................................................................................. V - VI

1. Introduction .................................................................................................................. 1
   1.1. How the Phase 1 Program Started
   1.2. Objectives and Working Group Structure

2. Program Description ..................................................................................................... 9
   2.1. Description of the Mir-Shuttle and Mir-NASA Programs
   2.2. The Mir Space Station’s Flight Program in 1994 - 98
   2.3. Phase 1 Joint Mission Information
   2.4. Shuttle Mission Preparation Joint Milestones

3. Shuttle Integration With Mir ....................................................................................... 33
   3.1. Introduction
   3.2. Structure/Process/Organization Relationships
   3.3. Joint Accomplishments
   3.4. Docking System
   3.5. Lessons Learned/Applicability to ISS

4. Cargo Delivery and Return .......................................................................................... 57
   4.1. Summary Data on Cargo Delivered to/Returned From the Mir Under the Mir Shuttle/Mir-NASA Programs
   4.2. List of Russian Cargo on Shuttle Flights to the Mir Station
   4.3. Unique Features of Mir-Shuttle and Mir-NASA Orbiter Flights With Respect to Russian Cargo Accommodation
   4.4. Principal Stages of Orbiter Processing for Carrying Russian Logistics
   4.5. Parties’ Primary Accomplishments Under Mir-Shuttle/Mir-NASA Programs

5. Joint Shuttle-Mir Operations ....................................................................................... 105
   5.1. Mission Control and Real-Time Operations During Shuttle Docking Flights
   5.2. Operations During the Long-Duration Missions

6. Safety Assurance Process ............................................................................................ 129
   6.1. Introduction
   6.2. Documentation Structure
   6.3. Policies and Ground Rules
   6.4. Top Safety Joint Accomplishments
   6.5. Top Safety Lessons Learned
   6.6. Conclusions

7. Crew Training .............................................................................................................. 143
   7.1. Overview of Crew Training
   7.2. Training of Astronauts in Russia
   7.3. Mir Station Systems and Soyuz TM Training
   7.4. Training in the Soyuz TM Integrated Simulator
   7.5. Training of Astronauts on Mir Orbital Complex Simulators and System Mockups
   7.6. Conclusions and Proposals for the Overall Astronaut Training Program
   7.7. Training for Cosmonauts in the U.S.
   7.8. Crew Training for Execution of the Science Program
   7.9. NASA Astronaut Training for the Mir EVA Program
   7.10. Summary of Mir-NASA Crew Training

8. Joint EVA Working Group ......................................................................................... 179
   8.1. Executive Summary
   8.2. Structures/Processes/Relationships
   8.3. Certificate of Flight Readiness (COFR) Process
   8.4. Training
   8.5. Accomplishments
   8.6. Lessons Learned
   8.7. Summary of Joint Cosmonaut-Astronaut EVA
9. Medical Support
   9.1. Introduction
   9.2. Goals
   9.3. Principles and Structure
   9.4. Evaluating Crew Health and Medical Monitoring
   9.5. General Crew Training Overview
   9.6. Astronaut Training
   9.7. Biomedical Crew Training
   9.8. Role of Russian Flight Surgeons
   9.9. Conclusions and Recommendations for the Overall Medical Support Program
   9.10. Accomplishments and Lessons Learned
   9.11. Summary of the Medical Support Group’s Accomplishments

10. Crew Operations on Mir
    10.1. Introduction
    10.2. Joint Activities of Mir and Shuttle Crews
    10.3. NASA Astronaut Crew Transfers
    10.4. Accomplishments
    10.5. Objectives
    10.6. Crew Responsibilities
    10.7. EVA Operations
    10.8. Interactions of the Russian-American Crews With the Main Real-Time Operations
         Management Group and the NASA Consultant Group at MCC-M
    10.9. Conclusions and Recommendations

11. Science Program
    11.1. Introduction
    11.2. Mission Science Working Group (WG-4)

12. NASA Russian Public Affairs Working Group (WG-1) Report
    12.1. Responsibilities
    12.2. Structure
    12.3. Accomplishments
    12.4. Lessons Learned and Applications to ISS

13. Applications to the International Space Station (ISS)
    13.1. Unique Issues
    13.2. Use of Shuttle for the Space Station Logistics Support
    13.3. Interaction Between International Crews
    13.4. Space Station System Serviceability Over a Long-Term Mission
    13.5. Experience in Off-Nominal Situations Recovery
    13.6. Joint Ground Operations With Logistics Items
    13.7. Research of Station Environment
    13.8. Russian/U.S. Cargo Integration
    13.9. Development of Joint Documents
    13.10. Experience Gained in Joint Shuttle/Mir Complex Control From MCC-H/MCC-M
    13.11. Science Research Accomplishments
    13.12. Combining Experience of Two Space Engineering Schools

14. Conclusions

15. Acronym List
# TABLES AND FIGURES

<table>
<thead>
<tr>
<th>Section</th>
<th>Table/Figure Name</th>
<th>Table/ Figure No.</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>Phase 1 Joint Working Group Structure</td>
<td>1.1</td>
<td>4 - 6</td>
</tr>
<tr>
<td>2.0</td>
<td>Mir/NASA Integrated Flight Schedule</td>
<td>2.1</td>
<td>15 - 19</td>
</tr>
<tr>
<td></td>
<td>Dates and complement of U.S. long-duration missions on board <em>Mir</em></td>
<td>2.2</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Dates and complement of Phase 1 Missions</td>
<td>2.3</td>
<td>21 - 24</td>
</tr>
<tr>
<td></td>
<td>0002 Joint Milestones Template, Long-Duration Missions</td>
<td>2.4</td>
<td>29-30</td>
</tr>
<tr>
<td>3.0</td>
<td>Summary of Supply Water Transferred to <em>Mir</em></td>
<td>3.1</td>
<td>48</td>
</tr>
<tr>
<td></td>
<td><em>Mir</em> Pressurization Data</td>
<td>3.2</td>
<td>50</td>
</tr>
<tr>
<td>4.0</td>
<td>Data on cargo traffic to the <em>Mir</em> on Shuttle vehicles</td>
<td>4.1</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>Russian cargo delivered on STS-71</td>
<td>4.2</td>
<td>61</td>
</tr>
<tr>
<td></td>
<td>Russian cargo returned on STS-71</td>
<td>4.3</td>
<td>62</td>
</tr>
<tr>
<td></td>
<td>Russian cargo delivered on STS-74</td>
<td>4.4</td>
<td>63</td>
</tr>
<tr>
<td></td>
<td>Russian cargo returned on STS-74</td>
<td>4.5</td>
<td>64</td>
</tr>
<tr>
<td></td>
<td>Russian cargo delivered on STS-76</td>
<td>4.6</td>
<td>65</td>
</tr>
<tr>
<td></td>
<td>Russian cargo returned on STS-76</td>
<td>4.7</td>
<td>66</td>
</tr>
<tr>
<td></td>
<td>Russian cargo delivered on STS-79</td>
<td>4.8</td>
<td>67</td>
</tr>
<tr>
<td></td>
<td>Russian cargo returned on STS-79</td>
<td>4.9</td>
<td>68</td>
</tr>
<tr>
<td></td>
<td>NASA 2 (Shannon Lucid) returned individual equipment</td>
<td>4.10</td>
<td>69</td>
</tr>
<tr>
<td></td>
<td>Russian cargo delivered on STS-81</td>
<td>4.11</td>
<td>70</td>
</tr>
<tr>
<td></td>
<td>Russian cargo returned on STS-81</td>
<td>4.12</td>
<td>71</td>
</tr>
<tr>
<td></td>
<td>NASA 3 (John Blaha) returned individual equipment</td>
<td>4.13</td>
<td>72</td>
</tr>
<tr>
<td></td>
<td>Russian cargo delivered on STS-84</td>
<td>4.14</td>
<td>73</td>
</tr>
<tr>
<td></td>
<td>Russian cargo returned on STS-84</td>
<td>4.15</td>
<td>74</td>
</tr>
<tr>
<td></td>
<td>NASA 3 and NASA 4 (Jerry Linenger) returned individual equipment</td>
<td>4.16</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>Russian cargo delivered on STS-86</td>
<td>4.17</td>
<td>76 - 77</td>
</tr>
<tr>
<td></td>
<td>Russian cargo returned on STS-86</td>
<td>4.18</td>
<td>78</td>
</tr>
<tr>
<td></td>
<td>NASA 5 (Michael Foale) returned individual equipment</td>
<td>4.19</td>
<td>79</td>
</tr>
<tr>
<td></td>
<td>Russian cargo delivered on STS-89</td>
<td>4.20</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>Russian cargo returned on STS-89</td>
<td>4.21</td>
<td>81</td>
</tr>
<tr>
<td></td>
<td>NASA 5 (David Wolf) returned individual equipment</td>
<td>4.22</td>
<td>82</td>
</tr>
<tr>
<td></td>
<td>Russian cargo delivered on STS-91</td>
<td>4.23</td>
<td>83</td>
</tr>
<tr>
<td></td>
<td>Russian cargo returned on STS-91</td>
<td>4.24</td>
<td>84</td>
</tr>
<tr>
<td></td>
<td>NASA 7 (Andrew Thomas) returned individual equipment</td>
<td>4.25</td>
<td>85</td>
</tr>
<tr>
<td></td>
<td>Summary of the mass of Russian logistics material components transported to <em>Mir</em> on the Shuttle</td>
<td>4.26</td>
<td>86</td>
</tr>
<tr>
<td>6.0</td>
<td>Joint Safety Assurance Working Group Documentation Structure</td>
<td>6.1</td>
<td>137</td>
</tr>
</tbody>
</table>