

Executive Summary

The end of the Cold War, the collapse of the Soviet Union, and the changing world order have provided new opportunities and new incentives for the United States and other countries to cooperate with Russia in space science, space applications, and human spaceflight. Although U.S. attempts to cooperate on space activities with the Soviet Union began more than 30 years ago, intense political and military competition between the two countries severely limited the scope and duration of such activities. Today, the United States government is actively pursuing cooperation with Russia on a wide range of space activities, including the International Space Station. In addition, U.S. aerospace firms have entered into joint ventures, licensing agreements, and cooperative technical agreements with a variety of newly organized Russian counterparts.

The emergence of Russia as a major cooperative partner for the United States and other spacefaring nations offers the potential for a significant increase in the world's collective space capabilities. Expanding U.S.-Russian cooperation in space since 1991 has begun to return scientific, technological, political, and economic benefits to the United States. Yet, Russia is experiencing severe economic hardship and its space program has undergone major structural changes. The future success of U.S.-Russian cooperative projects in space will depend on:

- successful management of complex, large-scale bilateral and multilateral cooperative projects;
- progress in stabilizing Russia's political and economic institutions;
- preservation of the viability of Russian space enterprises;
- flexibility in managing cultural and institutional differences;



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- continued Russian adherence to missile-technology-proliferation controls; and
- additional progress in liberalizing U.S. and Russian laws and regulations in export control, customs, and finance.

FOREIGN POLICY BENEFITS AND RISKS

Russia's technical contributions to the International Space Station offer a substantial increase in planned space station capabilities. Just as important to the United States are the foreign policy gains from this and other human spaceflight projects, such as the Shuttle-Mir dockings. U.S. officials expect cooperative activities to help promote economic and political stability in Russia. For example, the National Aeronautics and Space Administration's (NASA's) purchase of nearly \$650 million in goods and services from Russia during fiscal years 1994-97, by far the largest transfer of U.S. public funds to the Russian government and private organizations, is an important signal of U.S. support for Russia's transition to a market economy. These purchases should help preserve employment for Russian engineers and technicians in at least some of Russia's major space-industrial centers, thereby inhibiting proliferation through "brain drain" and helping to sustain Russian adherence to the Missile Technology Control Regime. Moreover, NASA's purchases improve the chances that Russia will be able to meet its obligations to the space station project, thereby enhancing prospects for success.

Nevertheless, such purchases entail some political risk in the United States, as well as the risk to the space station if the Russian government and enterprises are not able to perform. Some U.S. observers question the wisdom of supporting any part of the Russian aerospace industry, which provided much of the technological substance for the Soviet threat to the United States; others believe that U.S. officials have made adequate provision to ensure that U.S. funds remain in the civil space sector.

OTHER BENEFITS AND RISKS

NASA is exploring cooperative space research and development with Russia in virtually every programmatic area. Aside from the space station, activities include flights of instruments on each other's spacecraft and joint missions using Russian launch capabilities with U.S.-built spacecraft. Public sector cooperation in space science and Earth observations is developing well for the most part. The political, technical, and administrative risks involved are somewhat higher than they are in NASA's traditional cooperative relationships, but—except for the space station—Russian contributions are not in the "critical path" to completion of key projects; program managers understand the risks involved and have made contingency plans to minimize long-term risks.

Cooperation on projects involving human spaceflight involves both potentially greater programmatic benefits and higher risks than it does in space science and applications. The United States stands to gain new experience in long-duration spaceflight and a better understanding of Russia's technology and methods. On the other hand, the United States risks possible project failure if Russia proves unable to perform as promised.

Placing the Russian contribution in the critical path to completion of the space station poses unprecedented programmatic and political risks. The Russian elements must be delivered on time and within budget; failure to do so could cause serious difficulties, both programmatically and in NASA's relations with its other partners and with Congress. Knowledgeable observers express concern about the stability and staying power of the Russian aerospace sector, about the Russian track record in delivering new spacecraft, and about the condition of the Baikonur launch complex (used to launch Proton and Soyuz vehicles). On another level, observers worry that political and/or military events within Russia or between Russia and other countries could cause either party to seek to amend the space station program or withdraw from it.

Given the significance of the Russian contribution to the space station, the U.S. ability to make up for delays or failure to deliver is severely limited by available U.S. resources. However, participants in current cooperative ventures suggest some other precautions that could be taken, both in the space station project and in space robotic cooperation:

- Seek better understanding of the larger political and economic forces that could affect Russian ability to deliver on commitments, perhaps through further systematic analysis of Russian aerospace industry developments.
- Maximize open and frank communication. To avoid as many technical and managerial surprises as possible, seek (and be willing to allow) a high degree of communication and interpenetration between the U.S. and Russian programs.
- Be prepared for delays and reverses.
- Be aware of and manage cultural differences effectively.

COMMERCIAL COOPERATION

Because of the potential for diverting civilian space technologies to enhance Soviet military capabilities, during the Cold War, the federal government effectively precluded U.S. aerospace firms from entering into cooperative business agreements with Russian entities. Now, most large U.S. aerospace companies are pursuing some form of joint venture or partnership with Russian concerns, especially in launch services and propulsion technologies. Although several of these emerging commercial partnerships show promise, and some could result in large revenues, none of them yet appear to be profitable, and it is too early to tell how successful they will be. Here, too, the risks are larger than they are in cooperative ventures with Japanese and Western aerospace firms because of unstable Russian political, economic, and legal conditions and potential linkage to U.S.-Russian political relations. The U.S. government could assist U.S. industry by further liberalizing U.S. export-control laws and regulations.

RUSSIA, THIRD PARTIES, AND THE UNITED STATES

The French experience in cooperating with the Soviet Union and Russia since 1966 largely parallels and confirms that of the United States. The European Space Agency has budgeted over \$320 million for space cooperation with Russia, largely for European-built hardware that will be installed in the Russian portion of the International Space Station.

The U.S. decision to bring Russia into the space station partnership initially caused considerable strain in relations with the existing partners, already frayed by years of U.S. design changes and cost increases and aggravated by a general cooling of public enthusiasm for human spaceflight. Challenging negotiations remain to complete the realignment of the agreements covering the station's construction and utilization, but the working relationships now appear to be developing more smoothly.

DOMESTIC ECONOMIC IMPACT

Experts disagree over the nature and extent of the effect that expanded cooperation with Russia will have on the U.S. aerospace industry, and particularly on the retention of U.S. jobs. Some industry officials have expressed concern that U.S. aerospace employment could be lost and the technological base adversely affected by use of Russian technology in the U.S. space program. Others have argued that skillful incorporation of Russian technologies into U.S. projects could save taxpayer dollars in publicly funded programs such as the space station and could boost U.S. international competitiveness in commercial programs. Both could happen and have to be weighed against each other.

Russian launch vehicles and related systems have the most obvious potential for U.S. commercial use, but using them could adversely affect the U.S. launch industry. This industry is the subject of upcoming OTA reports.