

**Appendix C:
Private Sector
U.S.-Russian
Cooperative
Projects** | **C**

Private Sector U.S.-Russian Cooperative Projects

Title/description	Business entity and nature of relationship	Russian entity	U.S. entity	Status
LOX-augmented nuclear thermal rocket engine design	Joint design study.	Energopool (Consortium)	Aerojet; Babcock& Wilcox	Pending U.S. government policy decisions on nuclear propulsion.
NK-33 LOX/kerosene engine	Teaming arrangement for utilization of NK-33 family of engines in the U.S. market.	NPO Trud, Samara	Aerojet	Seeking U.S. government funding for engine validation tests,
D-57 LOX/LH engine	Teaming arrangement to improve, market, and co-produce engine for possible use in single-stage-to-orbit (SSTO) sub-scale demonstrator, or in high-performance upper stage for existing launch vehicles.	Lyulka Engine Design Bureau	Aerojet	Seeking U.S. government funding for engine validation tests.
RD-0120 LOX/LH engine	Teaming arrangement for possible modification for either bi-propellant or tri-propellant cycle, to demonstrate SSTO launch-propulsion system.	Chemiautomatics Design-Development Bureau (CADB)	Aerojet	Seeking U.S. government funding for engine validation tests.
Zenit launch services	Proposed TM under which NPO Yuzhnoye and RSC Energia would supply the vehicle, integration would occur in the United States, and launch would take place "from international waters" from a semi-submersible platform built by Kvaerner (<i>Space News</i> , Aug. 8, 1994).	NPO Yuzhnoye (Ukraine); RSC Energia; Kvaerner Shipbuilders (Norway)	Boeing Defense and Space Group	Pending U.S. government licensing of TAA and decision to proceed.
Crystal growth experiment	Commercial contract for flight of Boeing crystal growth experiment on Mir, with return to Earth by Raduga small reentry capsule.	RSC Energia	Boeing Defense and Space Group	Experiment flew successfully in 1994.

Environmental control and life-support systems (ECLS) for spacecraft	Contract research and joint feasibility studies preparatory to International Space Station.	Scientific Research Institute of Chemical Engineering (NIICHIMASH); Institute of Biomedical Problems, Ministry of Health	Boeing Defense and Space Group	Boeing-purchased Mir flight hardware being evaluated at Boeing facility in Huntsville, AL.
Lunar-surface operations using a modified Phobos lander	"Profit-sharing" and marketing agreement.	Khrunichev Enterprise. (ZIKh); NPO Lavochkin; Zvezda	international Space Enterprises (ISE), San Diego, CA	ISE says joint development of lunar landers proceeding toward early 1998 launch.
Interactive audio-video links between Mir and U.S. classrooms	Cooperative venture.	RSC Energia	ISE	Ongoing.
Worldwide marketing of carbon- and graphite-based materials	Kaiser NIGrafit, San Leandro, CA.	Scientific Research Institute of Graphite (NIGrafit)	Kaiser Aerospace and Electronics Corp.	Ongoing
Worldwide marketing of advanced composite and metallic materials	Kaiser VIAM, San Leandro, CA	All-Russia Institute of Aviation Materials (VIAM)	Kaiser Aerospace and Electronics Corp.	Ongoing
Space launch services utilizing the Proton from Baikonur	LKE International Inc.	Khrunichev Enterprise; RSC Energia	Lockheed Commercial Space Co., Inc.	Reported to have orders or options for 15 launches and expectations of eight firm orders by end of 1995.
Specialty metals for aerospace, including beryllium	Joint venture with exclusive rights to market all ULBA beryllium products in North America and Europe.	Ulbinskiy Metallurgical Production Combine (ULBA), Kazakhstan	Loral Corp., NY; Concord Group, CO	Ongoing.
Launch-vehicle activities	Memorandum of Agreement (MOA) on "several possible areas of cooperation in launch vehicle activities, including launch vehicle stages, ground support systems and system components. "	Central Specialized Design Bureau and PROGRESS Factory, Samara, Russia	McDonnell Douglas Corp.	Active.
Unpressurized composite structures and various composite fabrication techniques and materials	MOA.	Central Research Institute for Special Machine Building, Khotkovo, Moscow Region, Russia	McDonnell Douglas Corp.	Active.

Private Sector United States-Russia Cooperative Projects (Cont'd)

Title/description	Business entity and nature of relationship	Russian entity	U.S. entity	Status
Cooperative planetary rover development	Cooperative venture	Space Research Institute (IKI), Russian Academy of Sciences; Babakin Research and Design Center (Lavochkin NPO); Scientific Research Institute of Transportation Machinery (VNIITransmash)	McDonnell Douglas Corp.; Planetary Society; Brown University	Active,
To examine and perhaps utilize Russian expertise in materials, advanced mathematics, space systems, and extended human flight	Agreement to cooperate on a series of space technology research projects	RSA/Mechanical Engineering Research Institute (IMASH), Moscow	McDonnell Douglas Government Aerospace	Active; joint centers established in Moscow and Huntington Beach, CA.
RD-1 70/180 engines	Marketing of RD-170 and RD-180 variant (to be developed 8/93) to U.S. government and ELV manufacturers	NPO Energomash	Pratt & Whitney Government Engines and Space Propulsion, West Palm Beach, FL	Contract signed with NASA Marshall Space Flight Center for tri-propellant engine technology development.
Docking hardware procurement	Rockwell purchasing hardware, spares and technical support for the APAS androgynous docking adapter.	RSC Energia	Rockwell Space Systems Division	Docking assembly, including APAS, delivered to NASA Kennedy Space Center in late 1994.

Stationary plasma thrusters for Western communications satellites	International Space Technology, Inc., development and marketing joint venture (later joined by SEP/France)	Fakel Experimental Design Bureau; Research Institute of Applied Mechanics and Electroynamics, Moscow	Space Systems Loral, CA	Company funding R&D to develop and qualify power processing units utilizing Western electronics, to qualify Russian thrusters to Western spacecraft requirements, and to life test the entire system.
Resurs data	Digitization and marketing of 2m-resolution data from the Resurs series of Russian photographic satellites	Priroda Center	WorldMap International, Ltd.	Delivering digitized data to customers; no 1994 Resurs flights, but next mission expected in March 1995.

APAS = Androgynous Docking Adaptor (Russian acronym)
 ELV = Expendable Launch Vehicle
 LH = Liquid Hydrogen

LKE = Lockheed Khrunichev Energia International
 LOX = Liquid Oxygen
 NPO = Scientific Production Organization

RSC = Russian Science Corporation
 SEP = Societe Europeene de Propulsion
 TAA = Technical Assistance Agreement