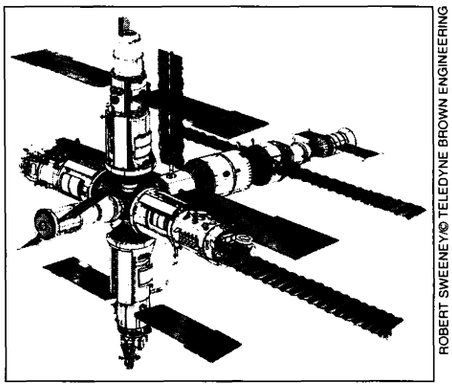

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On offer. The Buran shuttle and Energiya booster *(left)* and Mir space station.

tracking and data relay network as a supplement to NASA's own Deep Space Network, the collection of ground stations the agency uses to control and collect data from its planetary missions; and Mir itself as a testbed for microgravity experiments. But the notion of large-scale deals is far from dead. NASA is also considering the manned Soyuz TM spacecraft as an escape vehicle for the U.S. space station, while American representatives of NPO Energiya, a semiprivate Russian enterprise that operates the Soyuz, Mir, the Energiya heavy-lift booster, and the Buran space shuttle, continue to push their wares for Western partners. These potential large projects, however, may encounter serious impediments in integrating disparate systems and technologies.

Difficult rescue. Take the Soyuz, which the Russians now use to ferry astronauts to and from Mir. Rumors abound that NASA is ready to sign a study contract with NPO Energiya in order to acquire more data on its performance. NASA already knows, however, that it cannot use Soyuz as it currently exists. The U.S. space station requires a rescue vehicle capable of carrying four people and remaining "on station" in orbit for the station's expected 30-year lifetime. The Soyuz, however, can carry only three people and has never remained on station for longer than 6 months. Officials at NPO Energiya have said they could adapt the Soyuz to extend its on-orbit lifetime. But Nicholas Johnson, a longtime analyst of the Soviet space program with Kaman Sciences Corp. in Colorado Springs, says that making such adaptations would amount to designing an entirely new spacecraft. "It may still be a viable option for whatever reason," Johnson told Congress in March. "But you need to understand that you are not buying an item which is off the shelf...for a song."

Making money on Mir. Of all the major elements in the Russian manned space program, Mir is by far the healthiest, and would seem to offer the most opportunities for direct Western participation. First launched in 1986 and manned almost continuously since 1987, the station has produced a prodigious amount of data in materials processing and the life sciences, particularly on the human body's adaptation to microgravity. According to Chris Faranetta, vice president for sales at Energia USA, a company that is trying to market former Soviet space assets in the United States, the Mir program is already sustained largely by the fees Western governments—to date Japan, Britain, Austria, Germany, and France—pay to fly their own astronauts aboard Mir. These amount to about $15 million a shot, he estimates, or $30 million a year—a substantial sum in an economically pinched Russia.

Mir's long-term prospects are somewhat murkier, however, since its rickety infrastructure could dampen potential customers' enthusiasm. Mir is past its design life and already needs constant repair, in the form of time-consuming spacewalks, just to remain operational. As part of its own long-term plan, NPO Energiya hopes to replace Mir's aging main module sometime in 1994 or 1995—a complex operation that might not even be affordable. "Flying a couple of foreign cosmonauts every year at $10 million apiece is not going to cover it," says Johnson.

Big dumb purchase? As for the Energiya launch vehicle itself, a "big dumb booster" that in sheer lifting power rivals the old American Saturn V, there's no clear market in the West. Although promoted by NPO Energiya (and a handful of House Republicans) as an alternative to the U.S. space shuttle for launching parts of the American space station, the Energiya booster suffers geographically: Its launch site is so far north that it can loft only about as much as the U.S. shuttle to the proposed orbit of the U.S. space station. Even if somehow moved farther south, Energiya still isn't a practical alternative for launching the station, which NASA would have to redesign again. And its only foreseeable long-term customer is President Bush's moon-Mars mission, which has so far failed to win congressional support.

In view of these difficulties, observers like Johnson view speculation about grand, joint U.S.-Russian space deals with a skepticism that borders on suspicion. "There are a lot of ideas floating around," he says. "It's kind of like fishing—there's a lot of bait, but not many people biting." Western firms and agencies may well find the prospects brighter among the "little fish"—individual deals for satellite launch services and specific technologies such as advanced materials, life-support systems, or rocket motor components. If so, it may be time for the Russians to change lures.

–David P. Hamilton

EX-SOVIET AID

Societies Try the Direct Approach

To a U.S. researcher used to applying for grants of $100,000 or more, an award of a mere $100 may seem like a joke. But for a Soviet researcher scarcely making ends meet on a salary of $200 a year, it could be a career-saver—enough to keep a project going in the hope that better times lie ahead. That, at least, is what the American Astronomical Society (AAS) and the American Physical Society (APS) are hoping. Both organizations asked their members for donations earlier this year, and they've responded with $45,000 and $30,000, respectively. The societies aim to use most of this money to provide small grants for individual researchers in the former Soviet republics.

Stan Woosley, an astronomer from the University of California, Santa Cruz, who is chairing an AAS committee overseeing the astronomy grants program, says that the society has already selected 210 projects to support. It is being assisted by a 14-strong panel of astronomers based in the republics, headed by International Astronomical Union president Alexei Boyarchuk of Moscow's Astronomical Institute. "We are encouraging the survival of a core group, people with whom we would like to collaborate in the future on international projects," says Woosley. APS has been equally quick off the mark: It is hoping to award its first grants before the end of the month.

The two societies are also collaborating with foundations to supply journals to the leading physics and astronomy centers in the former Soviet republics. The Sloan Foundation has already pledged $100,000 to APS, and the society has now submitted a grant proposal to the National Science Foundation to extend the scheme. The American Association for the Advancement of Science is also preparing a proposal to submit to the MacArthur Foundation to supply journals to research institutes in the former Soviet Union.

The European Physical Society (EPS) is taking a different tack from its U.S. counterpart. Rather than running its own grants program, it hopes to raise $800,000 to help establish a system of peer review in the former Soviet Union and to supply leading European journals to some 60 "centers of excellence." EPS president Maurice Jacob, a high-energy physicist at CERN, says the society is hoping that the European Community will extend its program of scientific aid for eastern Europe to include the former Soviet Union. If so, EPS will try to persuade Brussels to bankroll its program.

–Peter Aldhous