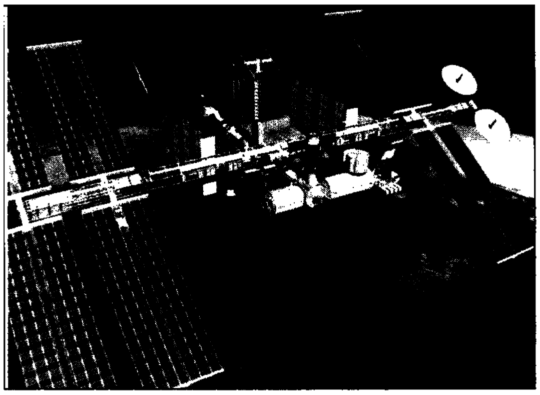
INTERNATIONAL COLLABORATION

Joint Station Leaves Science Up in the Air



NASA

One for all. The space station's latest redesign may pose problems for some scientists.

For years, one thing U.S. space scientists could count on was uncertainty—about the launch vehicles and platforms available for their payloads, about congressional support for their projects, and about the type of science they could conduct. Last week the United States and Russia announced plans for a joint space station, and U.S. researchers found themselves in the uncomfortably familiar position of rethinking the next decade of space science.

The early reaction is mixed: While life sciences research may benefit from Russia's extensive experience with long-duration flights, questions about the physical environment of Russia's orbiting space station cloud the future for such microgravity research as growing protein crystals and forging semiconducting materials. And the collaboration itself seems likely to steal time and payloads away from projects using the space shuttle that are already on the drawing boards.

After a year of negotiations, the National Aeronautics and Space Administration (NASA) and the Russian Space Agency (RSA) agreed last week to a "new relationship" that calls for a joint station called "Alpha." It also expands a program for cosmonauts to fly on the U.S. shuttle and for astronauts to work aboard Mir, the orbiting Russian space station. John Logsdon, director of the Space Policy Institute at George Washington University and a longtime NASA watcher, thinks that move "saves both space programs." That assertion could be tested as early as next week as Congress votes on a series of additional cuts to the recently approved 1994 federal budget (see p. 979).

The first phase of the collaboration calls for the shuttle to dock with Mir 10 times from 1995 to 1997 as part of a program to upgrade the Russian station and conduct some scientific experiments on it. In the next step, between 1997 and 2001, the two countries will launch a total of 31 missions to build the joint space station.

The latest schedule leaves space scientists with the difficult task of choosing which experiments to fly on which vehicle, as well as defining the scope of research aboard Alpha. The increased number of trips to outfit Mir has forced NASA to cancel four flights of the Spacelab research module, which would have accommodated research on the biological effects of space flight, protein crystal growth studies, and materials science experiments. Nevertheless, Robert Phillips, NASA's chief space station scientist, says NASA is not revising "the kinds of science we plan to do."

An increase in the number of experiments aboard Mir should benefit research on human health in space and give scientists a better idea about life on the space station, says Robert Rhome, director of NASA's microgravity science and applications division. But Mir's reputation for temperature fluctuations and vibrations (*Science*, 28 May, p. 1230) leaves protein crystallographers and materials scientists worried. After listening last week to a briefing by NASA Administrator Dan Goldin to the Space Studies Board of the National Research Council (NRC), chair Louis Lanzerotti, a space physicist at AT&T's Bell Labs, says "it was clear that we need to have a much better understanding of conditions on Mir before we know what sorts of research will work aboard the station."

NASA's first step will be to find out more about Mir's environment. In March 1995 the shuttle will drop off a device called the Space Acceleration Measurement System to measure vibrations aboard Mir. "This will allow us to optimize experiments, rather than just put something we only think may work aboard Mir or the space station," says Roger Crouch, chief scientist at NASA's microgravity science and applications division. During the same trip, NASA has plans to send up a liquid-diffusion experiment designed by a team of protein crystallographers led by the University of California, Riverside's Alex McPherson, as well as an experiment to try to solidify samples of gallium-doped germanium, a semiconductor, in a Mir furnace.

In the meantime, scientists are fretting over some nontechnical issues. "It's the worst of all possible situations—NASA's unreliable schedule coupled with a launch site 6000 miles away [Russia's launch pad in Central Asia]," laments Penn State crystallographer Gregory Farber, who's conducting a crystallization experiment on Mir. The NRC, meanwhile, is exploring how to set up a process to choose which experiments will be allowed aboard Alpha. There's also the need for improved language skills. Says NASA crystallographer Daniel Carter, "I'm boning up on my Russian."

–Richard Stone

MEDICAL ETHICS

A Tough Line on Genetic Screening

Today, every child born in the state of Pennsylvania is screened at birth for a battery of diseases including Duchenne muscular dystrophy—an inherited muscle disorder that leads to death in the teens or twenties and for which there is currently no cure. Because of this screening, parents of a Duchenne baby are likely to learn of their child's fate in the first days of its life, whether they want to know it or not. But last week, a panel of experts assembled by the Institute of Medicine (IOM) argued that Pennsylvania's policy—and those of states that have similar involuntary screening programs—is misguided.

In a report* that has generated controversy within the IOM group itself, the panel of geneticists, genetic counselors, pediatricians, ethicists, and lawyers recommended that widespread testing for incurable diseases such as Duchenne's be avoided because it will not benefit those being screened. The report, intended to lay out guidelines for genetic testing in the next decade, put forward two other principles that could have a major impact on newborn screening: Parental permission should be required for all genetic tests, and initial results should always be followed by confirmatory tests, counseling, and treatment. The IOM panel also focused on the need to preserve the confidentiality of genetic tests and the growing need for genetic education and counseling. But its recommendations on newborn screening, established after hours of debate, are likely to be the most controversial.

According to the chairman, geneticist Arno Motulsky of the University of Washington, Seattle, the panel came down in favor of voluntary testing rather than mandatory screening for most genetic diseases because the majority believed that "voluntary participation was the best way to ensure that children would be screened and parental autonomy maintained." Panel member Lori Andrews, a fellow of the American Bar Foundation in Chicago, adds that parents are more likely to follow up on screening

*"Assessing Genetic Risks: Implications for Health and Social Policy," Institute of Medicine, National Academy of Sciences, 1993.

results for treatable diseases if they must give permission for the test.

The IOM panel concludes that screening is "not appropriate" for diseases that cannot be treated, and "in general...testing of minors should be discouraged unless delaying such testing would reduce" the benefits of treatment. And it even argues that requiring parents to give prior consent to have their newborns screened for an incurable disease wouldn't make the practice acceptable. The reason: As the IOM sees it, the risk of harm to the child is greater if parents know the truth than if they don't, because the knowledge might cause parents to "develop a different outlook on a child destined to die," says IOM panel member Neil Holtzman, pediatrician at the Johns Hopkins Medical Institutions.

Much of this reasoning was controversial within the IOM panel itself. Motulsky, among others, disagreed enough with the majority to submit "additional views" on the issue of mandatory testing. He wrote that he and "some committee members" felt that it would be a mistake to discourage all mandatory screening of newborns, particularly because in some cases action must be taken quickly to avoid neurological damage. Motulsky argued that screening should be required for at least two diseases—phenylketonuria (PKU) and hypothyroidism. They can be treated if detected early, but cause permanent damage if they are not. As Motulsky put it, the "simpler solution" would be to require no prior consent in these cases.

Motulsky also differed with the majority on how test results on the sickle cell trait should be handled. The panel decided that information on the recessive trait in infants (as opposed to the actual disease) should not be disclosed to parents, because the child's health is not at issue. Motulsky, however, felt that the information, which is obtained as an incidental result of testing for sickle cell disease, should be given to the mother, since it might be important in future decisions about having a child. In addition, Motulsky, unlike the majority, favored giving genetic information about a child to adoptive parents "once a disease has been diagnosed, or if there is a high risk of a medically significant condition."

Over the next decade, the authors expect a rising clamor for such genetic data as more and more disease-causing genes are discovered. They call for caution, restraint, and increased federal supervision both of testing kits and laboratory services, including those provided by academic researchers. One major recommendation to the government—that it create a standing committee to monitor this area—has already received tentative support from Francis Collins, director of the National Center for Human Genome Research.

–Eliot Marshall

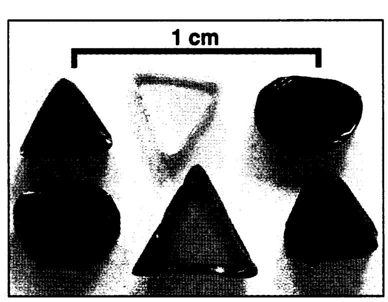
FORMER SOVIET UNION

Diamond Know-How at a Bargain Price

When MIT diamond researcher Michael Geis hosted one of the most renowned researchers in his field, Boris Spitsyn of Moscow's Institute of Physical Chemistry, he realized how badly his Russian colleagues are strapped for cash. After he treated Spitsyn to a meal at a Taco Bell, he says, the Russian lamented that he couldn't afford to match Geis' hospitality. But Geis and many of his U.S. colleagues say that Spitsyn, considered the father of diamond films, has something far more valuable to offer: know-how that could help turn diamond films into a true electronic material—a kind of super silicon.

Because of Russia's economic plight, that know-how comes cheap. Last week, Spitsyn and his colleagues at the Institute of Physical Chemistry in Moscow received a grant of $50,000 to continue their diamond electronics research in collaboration with the University of Missouri, where Spitsyn now spends his time. The money, which comes from the Department of Energy discretionary funds, will support 20 researchers in Moscow for a year, says University of Missouri engineering professor Mark Prelas.

That investment could have a huge payoff, says Prelas, who lobbied for the grant. With more development, diamond circuits could replace silicon in many high-performance applications. The attraction, says Prelas, is diamond's resistance to damage from radiation, heat, chemicals, and stress. That would make diamond components ideal for use in car or jet engines. They could also greatly lengthen the lifetime of satellites, which suffer a hail of radiation that destroys conventional microcircuits.



SPITSYN

A step up from silicon? P-doping stains diamonds blue.

The ex-Soviet team is a world leader in diamond research, says Rustum Roy, a materials scientist at Penn State University. "If we are going to help ex-Soviet scientists, this is one group that shines." Roy says Spitsyn's lab has been responsible for most of the critical breakthroughs in diamond electronics over the past 30 years, including the techniques people now use for creating artificial diamond by depositing a carbon vapor on substrates of natural diamond and other materials.

Prelas is excited by a more recent development: He claims that Spitsyn has achieved a coveted ability to "dope" diamond to tailor its electronic properties, just as silicon is doped to make conventional microcircuits. Other researchers are skeptical, but if the claim holds up, the way would be clear to building diamond-based transistors, diodes, and other components.

With the exception of a few experimental devices, researchers have so far succeeded in using diamond only as a supporting material in circuits made from conventional semiconductors. They have been limited by their ability to achieve only one of two main types of doping: "p-type" doping, in which added impurity atoms (boron, for diamond) steal electrons, creating mobile "holes" that conduct electricity. To make the equivalent of silicon devices, researchers also need a technique for "n-type" doping, in which the impurities surrender some of their electrons to the semiconductor, again making it more conductive. A number of groups have tried in vain to dope diamond with phosphorus, says diamond researcher Jeff Glass of North Carolina State University. But for reasons that are still unclear, they haven't been able to get the diamond to incorporate the phosphorus.

Prelas claims the Russians have succeeded by adding pure red phosphorus during the diamond deposition. But others remain doubtful. Diamond researcher John Angus of Case Western Reserve University says it's hard to prove you have achieved diamond doping because crystal defects can mimic the effects of n-doping. That's where he and other researchers think a Japanese group that announced an alternate technique 3 years ago went wrong. "Evidence for n-type doping is circumstantial at best." says Angus. "I'm not sure there's any credible method."

Prelas responds that he and Spitsyn have already done convincing tests. He thinks the Russian workers face extra skepticism because of the same research group's role in a 1970s debacle involving "polywater," in which the then-leader of the research group, Boris Daryagin, claimed to have found a new molecular form of water. The claim made a worldwide publicity splash but was later discredited, tainting the reputation of everyone associated with it.

Other researchers, though, say they don't hold polywater against the group. "It was pretty embarrassing," says Geis. "[But] people don't make mistakes all their lives." And even if the n-doping claim doesn't pan out, he thinks there's a lot to be gained from the collaboration. "These are world-class scientists," says Geis. At $50,000 a year, "it's a real bargain."

–Faye Flam