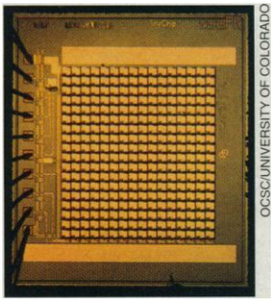
Agreements Set Rules of the Road for Global Collaboration

For years, the U.S. government has been urging high-tech companies to hone their competitive skills. Now, it's pushing a surprising new way to achieve that goal: It's paving the way for U.S. firms to collaborate on R&D with their international competitors, especially in Japan. The vehicle for this new emphasis on global R&D collaboration is a trio of international agreements, recently signed by the Clinton Administration, that aims to lower barriers between companies or universities doing industrial research in different countries.



OCSC/UNIVERSITY OF COLORADO

Crystal gazing. Linking optoelectronic components like this liquid crystal light modulator into complete systems is the goal of a new agreement.

The agreements, which involve a collection of federal agencies including the Commerce Department, the National Institute of Standards and Technology, and the Defense Department's Advanced Research Projects Agency, set up what David Mitchell, a vice president at Rockwell, calls "the rules of the road for international collaboration." These novel accords, say Commerce Department officials, are intended to help companies and universities cut the costs of industrial research by reducing duplication and bringing together labs that have complementary skills.

The first of the agreements, called the Intelligent Manufacturing Systems (IMS) initiative, is intended to boost precompetitive research on energy-efficient assembly lines and other manufacturing technologies in the United States, Europe, Japan, Australia, and Canada. After IMS negotiations were finalized last February, two U.S.–Japan agreements were quickly firmed up, one aimed at optoelectronics—devices for communicating and computing with light—and the other at a grab bag of technologies. The first collaborations within these frameworks are expected to get under way at the beginning of 1995.

The primary beneficiaries are expected to be academic labs and small companies. "The current thinking is that large companies are willing and able [to set up international collaborations], and they don't need government help," says Andy Wan, who heads up the IMS effort for the Department of Commerce. "But everyone has been saying that small companies and universities need help to do international joint ventures because they don't have much resources other than to survive and keep their company viable."

The new agreements don't help with money, but they should lower the overhead costs of setting up a collaboration by establishing international "marriage brokers" to match up partners and help them around potential potholes, such as intellectual-property rights. All three agreements call for parties to a collaboration to sign a "prenuptial agreement" that sets out ahead of time what each group will contribute and how the partners will divvy up the spoils should their research spawn any new inventions. Most company officials regard such agreements as essential to setting up research collaborations in technology areas close to commercialization, notes Mark Bohannan, chief counsel for the Department of Commerce's Technology Administration office.

In the past, two provisions of Japanese law have often prevented foreign companies from entering into such arrangements with their Japanese counterparts. One makes it difficult for foreign companies to sell their portion of intellectual property co-owned with Japanese firms. The other sometimes requires foreign firms to help reimburse the Japanese government for the research funds it gives to their Japanese collaborators. During IMS negotiations in February, Japanese negotiators agreed to suspend both these rules for foreign researchers working under IMS. "These were big wins for us," says IMS negotiator Paul Huray, a professor of engineering and physics as the University of South Carolina. "We were prepared to walk away from the program had they not conceded."

With the breakthrough on intellectual-property rights, IMS negotiations quickly sailed to a successful conclusion. The U.S. and Japanese governments signed off on the accord this summer, and the other 22 potential member countries are expected to do so by the end of the year, according to Deborah Carr, the associate director for the Coalition for Intelligent Manufacturing Systems, a U.S. industry support group. Countries not currently part of the agreement will be allowed to join in the future, Carr adds.

The agreement—the brainchild of Hiroyuki Yoshikawa, now president of the University of Tokyo—aims to help industry and academic researchers around the world work together to solve common problems, such as developing environment-friendly manufacturing processes and computerizing production facilities. It will do so with the help of regional and interregional secretariats, financed by the member countries, that will help potential partners find each other, navigate the rules for setting up a project, and deal with intellectual property.

Prospective partners in the manufacturing research collaborations have already had a chance to sample the benefits of working together through a series of six "test cases," in which researchers from 143 companies and universities participated in collaborations to study problems in areas such as energy-efficient manufacturing and fast prototyping. For Rakesh Mahajan, CEO of Deneb Robotics in Auburn Hills, Michigan, whose company took part in one test case, one of the nicest surprises was the collaboration's low cost. "It ended up costing us one fortieth of what it would normally cost [to do the research]," says Mahajan. It also broadened Deneb's contacts with potential buyers and suppliers.

Optoelectronics researchers are hoping that the Joint Optoelectronics Project (JOP) agreement will give their nascent industry a similar lift. Like IMS, the impetus for the JOP agreement came from Japan—in this case, from a Japanese domestic project called the Real World Computing Partnership (RWCP). The RWCP is a 10-year, $700-million effort to develop the next generation of information-processing technologies, including optoelectronic devices. But the Japanese optoelectronics industry, like its counterpart in the United States, has had difficulty finding its feet. Most research has focused on potential materials and components, such as lasers and optical detectors, with little atten-

DENEB ROBOTICS

Model factory. Collaborators in a new initiative will exploit computer simulations like this one to refine assembly lines.

tion to integrating these devices into larger assemblies.

One problem is that no one company or academic group typically makes all of the different components needed for a complete system. And researchers in need of a particular component often have no idea whether other research groups have already built such devices. JOP's architects hope to address this need by setting up brokers in the United States and in Japan, funded by the RWCP. American researchers looking for a particular device, for example, would simply contact the U.S. broker, who would then work with the Japanese broker to find all of the R&D labs producing that device.

To many researchers in the field, the effort to link devices into working systems is long overdue. "The need for prototyping of optoelectronic [systems] is very obvious to a lot of people in the community," says Stephen Forrest, an electrical engineer at Princeton University. "We want to work in the applications, and the field is ready for it."

The most recent of the three agreements, the Civil Industrial Technologies Cooperation Plan (CITCP), may confer the same benefits on other high-tech areas. The agreement, which was proposed by Commerce Department officials in the fall of 1992 and was signed in June, differs from its predecessors in that it isn't restricted to specific technological applications; instead, says Phyllis Genther Yoshida, the director of the Japan Technology Program at the Department of Commerce, "[CITCP] is an overall framework agreement for conducting cooperative research." For now it includes such areas as synthetic membranes for chemical separations, and chemical vapor deposition, used for manufacturing electronic components. Besides laying ground rules for cooperative research, the agreement calls for an active government role in organizing joint R&D projects and researcher exchange programs.

Administration officials concede that because the new agreements don't provide any money to jump-start collaborations, the first few projects may be slow in coming. But by encouraging companies and government funding agencies to invest in international partnerships, says Elliot Maxwell, the Commerce Department's director of international technology policy and programs, "we hope the agreements will encourage first-rate research activities." If so, competition through collaboration is likely to become Washington's next high-tech policy mantra.

–Robert F. Service

BIODIVERSITY

Ecologists Draft Plan to Dig in the Dirt

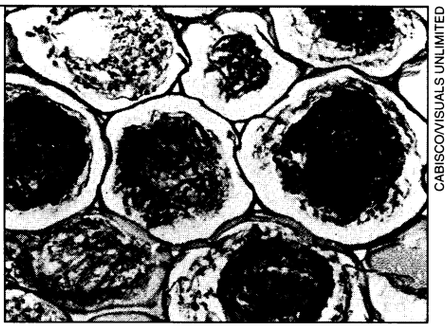
LONDON—For the past few years, tropical ecologist Dan Janzen of the University of Pennsylvania has been touting a big idea: Take a chunk of habitat, say 50,000 hectares of tropical rain forest, and document every single species in it (*Science*, 30 April 1993, p. 620). Most of Janzen's colleagues agree that such an All Taxa Biodiversity Inventory (ATBI) could help achieve many goals, from teasing out interactions among species to prospecting for new drugs. But skeptics point to a major obstacle: Taxonomists have so far identified just a few percent of the millions of species of bacteria, fungi, and other microorganisms that populate the soil. And because these organisms play key roles in important ecological processes such as nitrogen fixation, decomposition, and carbon cycling, that's a serious problem.

Last week, however, at London's Natural History Museum, some 30 leading U.S. and British taxonomists and soil ecologists took the first step toward tackling that problem. After 3 days of debate, they emerged with a rough outline for an international multisite soil biodiversity survey, and their mood was distinctly upbeat. The paucity of data on soil fauna and flora, participants agreed, doesn't reflect any intractable technical difficulties. On the contrary, it's due to nothing more than a lack of cash for soil biodiversity studies. "We've got to get going with the soil," says nematode expert and soil ecologist Diana Freckman of Colorado State University, who led the U.S. contingent. "We can do it."

Maybe so, but none of the attendees underestimates the magnitude of the task. "The soil leaps out as being problematic," says workshop organizer Steve Blackmore, associate director of life sciences at the Natural History Museum. Traditionally, biologists have identified soil microorganisms by culturing washings from a soil sample on a standard nutrient medium. "What you get out are things that like those isolation methods," rather than ecologically significant species, says David Hawksworth, director of the International Mycological Institute in Egham, west of London. Hawksworth says it's easy, for instance, to obtain cultures from spores of fungi like *Penicillium* that are lying in the soil; it's very difficult, in contrast, to culture mycorrhizal fungi, which grow around plant roots and are involved in nutrient uptake. But ask a taxonomist if it's feasible to develop techniques to isolate organisms from his or her chosen group, says Janzen, and the answer is: "If you give me enough money... yes."

The plan mapped out at last week's meeting would focus initially on organisms involved in two key ecological processes: carbon flux through the soil, and decomposition. The idea would be to understand the links between biodiversity and ecosystem function. By treating soil with chemicals that kill a particular group of organisms, ecologists have already gained a rough picture of some groups' ecological functions. But they have been unable to determine how such plots are recolonized over time, and how the addition of each recolonizing species affects ecological processes. "We know what they do, but we don't know who does what," says Colorado State's Freckman.

Freckman says a firm proposal for funding to develop the necessary methods and conduct a multisite soil biodiversity survey should be ready within a year—probably aimed at the U.S. National Science Foundation and Britain's Natural Environment Research Council, which co-sponsored the London workshop. These studies could begin at existing well-studied sites, such as those of the U.S. Long Term Ecological Research network (*Science*, 15 October 1993, p. 334).



CABISCO/VISUALS UNLIMITED

Root of the problem. Mycorrhizas (*stained red*) on plant roots are hard to culture.

Ideally, this survey would be conducted alongside several ATBIs. This, however, is a much more expensive proposition—each ATBI will cost a minimum of $80 million over more than 5 years, according to Janzen. That kind of money has never before been lavished on a single biodiversity study, but Janzen is optimistic that at least one ATBI could soon be under way. On 25 July, the Costa Rican government agreed to conduct an ATBI in a national park called the Guanacaste Conservation Area, working with Costa Rica's National Biodiversity Institute (INBio). Costa Rican President José María Figueres has now applied to the World Bank's Global Environment Facility for a $6-million grant to fund a 2-year planning and setup phase. And given the positive tone of last week's workshop, claims Janzen, the message to the World Bank and other funders is that all that's missing is the money to turn the ATBI concept into reality. "It's not as if we're up against a great intellectual black hole," he argues.

–Peter Aldhous