Technology Review

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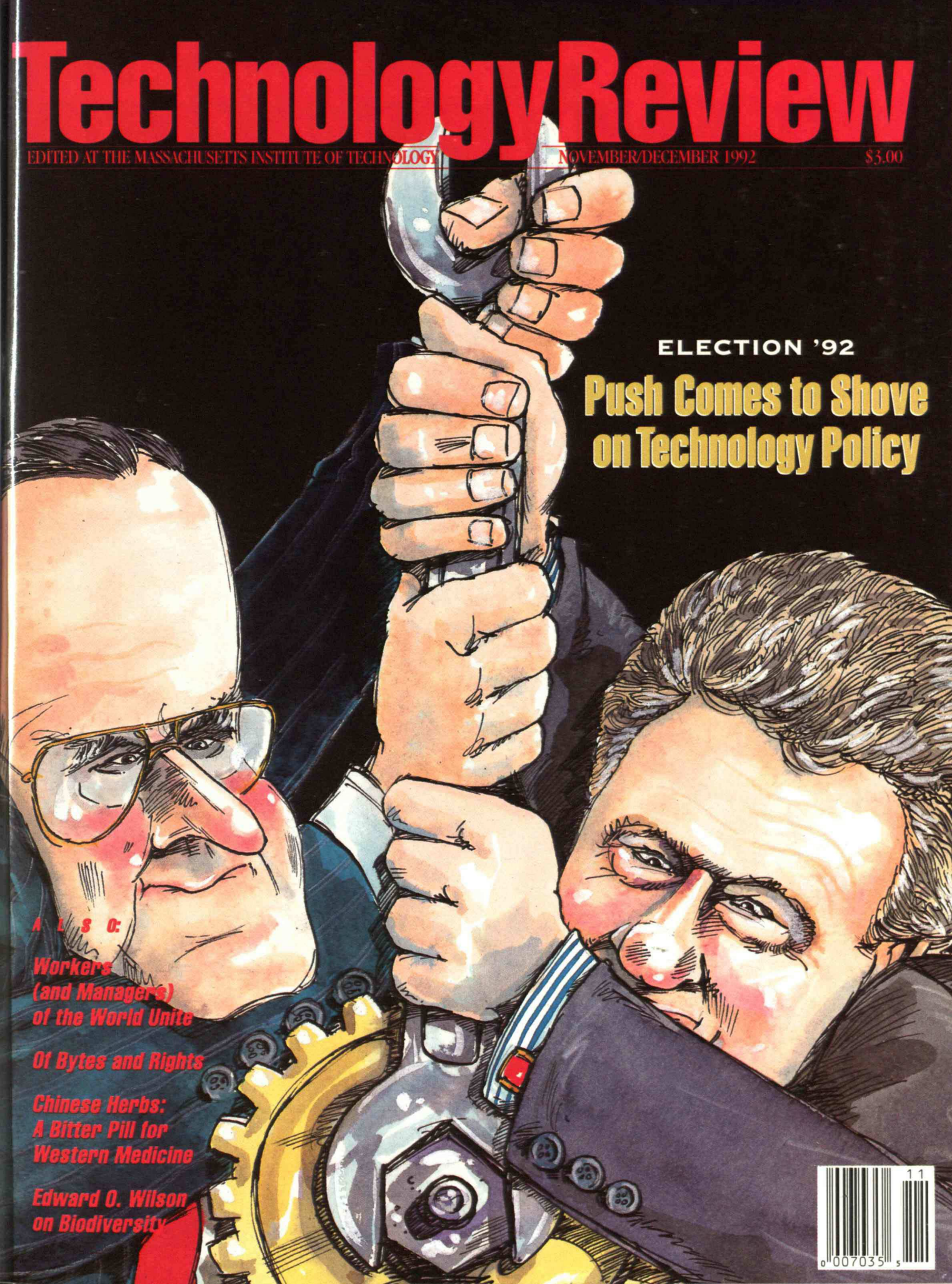

ELECTION '92

Push Comes to Shove on Technology Policy

ALSO:

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Of Bytes and Rights

Chinese Herbs: A Bitter Pill for Western Medicine

Edward O. Wilson on Biodiversity

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A Macintosh to start a

Imagine you could design your own personal computer. What would it be? It would be fast, of course. Faster than your basic 486 machine. Fast enough to handle the rendering, animating, design and analysis jobs that often require a workstation.

The Apple Macintosh Quadra.

It would have immense storage and memory capacity. And it would have features like high-performance networking and accelerated video support built in.

Macintosh Quadra runs all the most powerful engineering software.

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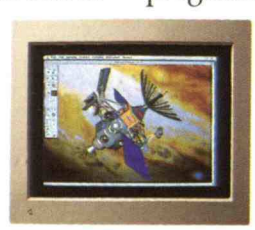
But it's not a fantasy. It's a Macintosh Quadra.™

By any measure, the Macintosh Quadra 700 and 950 are two of the most powerful personal computers ever built. Both are based on the Motorola 68040 (rated at 20 and 25 MIPS, running at 25 and 33 MHz), which integrates the processor, math coprocessor and RAM cache all onto one chip.

They're up to twice as fast as any of their forebears. Fast enough to beat the chips off comparably priced 486 computers from IBM, Compaq and Dell.* And fast enough to make programs like AutoCAD, MicroStation Mac,® MacBRAVO! and VersaCAD perform at a level once seen only in dauntingly complex workstations.



Built-in 24-bit video lets you create photo-realistic images without the expense of an extra card.

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You can add a 400MB hard disk to both

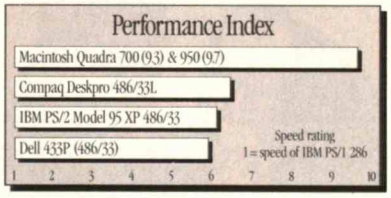
**Comparisons are based on a 1991 independent research study conducted by Ingram Laboratories that tested a variety of personal computers running applications available for both the Macintosh and Microsoft Windows 3.0 environments. **24-bit video support for up to a 1[illegible] product specifications and descriptions were supplied by the respective vendor or supplier. Orbiter images created by Jerry Flynn. ©1992 Apple Computer, Inc. Apple, the Apple logo, A/UX, Mac, Macintosh and "The power to be your best" are registered trademarks and Macintosh Quadra and is a trademark of Wolfram Research, Inc. MicroStation is a registered trademark of Bentley Systems Inc. MS-DOS is a registered trademark and Windows is a trademark of Microsoft Corp. Motorola is a registered trademark of Motorola Corp. NuBus is a trademark of Texas Instruments*

with the power revolution.

communications architecture lets you easily take advantage of features like distributed processing, allowing programs like RenderPro and BackBurner to utilize excess CPU cycles on other Mac computers or workstations for faster renderings.

There are two Macintosh Quadra models. The 950 sits next to your desk; the 700 fits on top of it.

And Macintosh Quadra fits in with the PCs you already own. The built-in Apple SuperDrive,™ used with Apple's new Macintosh PC Exchange software, allows you to share files easily with MS-DOS PCs via floppy disk or over a network. And with Apple's fully compliant version of UNIX®—A/UX®—you can even run UNIX, X Window, MS-DOS and Macintosh programs all at the same time.



Macintosh Quadra significantly outperforms 486 PCs from IBM, Compaq and Dell running Windows 3.0.

It all adds up to the kind of power that moved *PC Week* to give the Macintosh Quadra its highest satisfaction rating in the categories of overall performance, price relative to performance, expansion capability and ease of installation and configuration.†

the 700 and the 950 to accommodate the largest CAD files. And the 950 even lets you add a CD-ROM drive or a removable cartridge drive, and a disk array or more than a gigabyte of internal hard disk storage.

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TECHNOLOGY REVIEW
NOVEMBER/DECEMBER 1992

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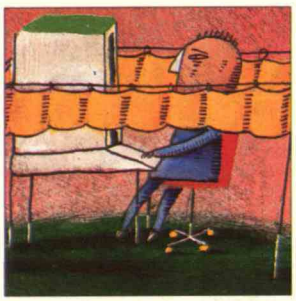

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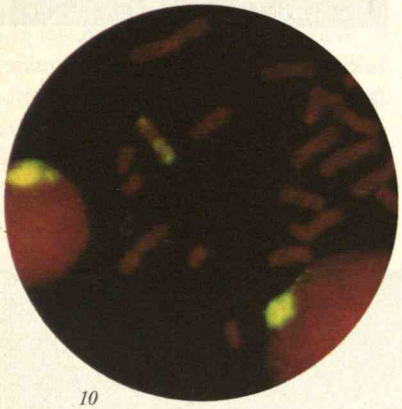

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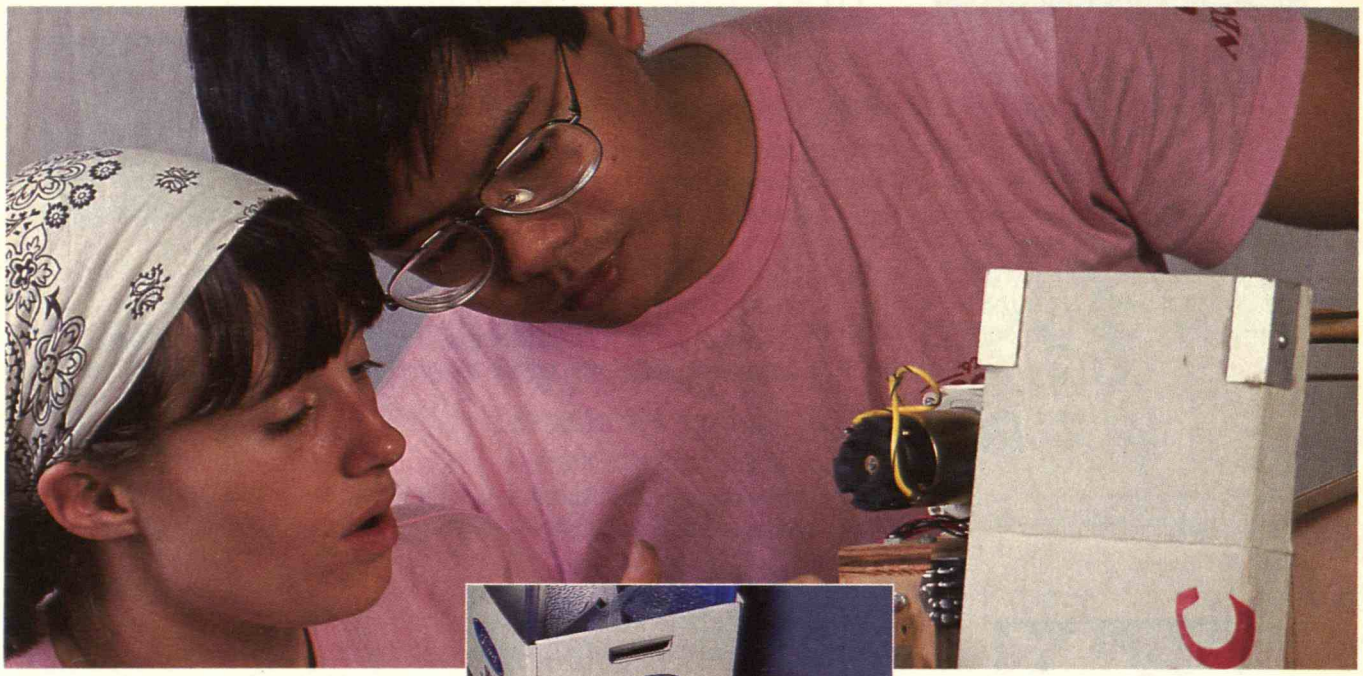
CREATIVE SOLUTIONS for Improved GLOBAL COMMUNICATIONS

'92 RoBoCoN
INTERNATIONAL DESIGN CONTEST

Global communications has led to global economics, global manufacturing and trade. In turn, this global interdependency demands improved communication across cultural and language barriers.

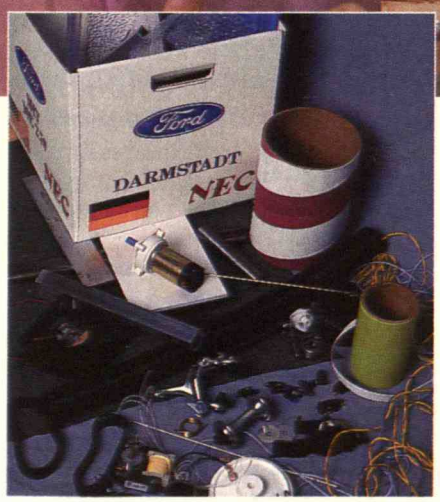
Recently, a group of students from around the world gathered at the Massachusetts Institute of Technology to take part in RoBoCon International Design Contest '92, an experiment in cross-cultural communications.

Forty engineering students, 10 each from the U.S., Japan, the United Kingdom and Germany, were given six days to solve an engineering challenge — move table-tennis balls from a platform, down a ramp and into a raised cylinder.



The task had to be accomplished by using robots built by the students from a box of parts which included electric motors, pneumatic actuators, wheels from toy trucks, printed circuit boards, steel bars, welding rods, plastic tubing — more than 100 parts in all. At the end of the sixth day the completed machines would face off in a contest to determine which robot could gather the most ping-pong balls in a minute.

So, what's this got to do with global communications? The students worked in teams of four — each consisting of students from the U.S., Japan, the U.K. and Germany. Solving the engineering problem would be hard enough. The real challenge would be finding ways for team members to communicate among themselves.



"RoBoCon IDC is a microcosm of the future," says Professor Herbert Birkhofer of Technische Hochschule Darmstadt, Germany. "The challenges presented by a global economy will require close cooperation by professionals, not just engineers, from all over the world." His colleague and friend, Professor Masashi Shimuzu, of the Tokyo Institute of Technology, adds, "RoBoCon IDC is more than a mere competition between engineering students; it's an experiment in developing cross-cultural methods of communicating and cooperating."

Shortly after being issued their parts kits, the newly formed teams gathered to plan and discuss strategy.

"Very early on, the students realized that simply talking to one another wasn't going to work," explains Ken Wallace of Cambridge University. Professor Harry West of MIT adds: "But studies have found that in many engineering projects more than half of what engineers do is talk to one another. When they are of the same culture, the culture is transparent. But when they're not from the same culture, it can be near impenetrable. Our students had to find other ways of communicating." In short order talking gave way to sketching and sign language. "There was a lot of drawing and waving of arms," laughs one engineering student from Cambridge.

Primary in the mind of the students, however, was solving the problem. Because of the drop in elevation, developing a ramp system of some kind to roll the table-tennis balls down into the cylinder was irresistible to more than half the teams. "It was the obvious solution, but not the elegant solution," says an MIT student. "We wanted something that was different, creative," added his teammate from the Tokyo Institute of Technology." The team went on to design and build a machine that gathered up the balls, flung them up to a raised platform, and then rolled them off so that they could bounce with a graceful arc into the cylinder.

"Creativity is what RoBoCon IDC is all about," says Professor West. "In this case, there's an added dimension of learning how to communicate. If anyone can come up with creative solutions, it's these students."

Cultural Obstacles and Creative Communication

An MIT student from Mexico City notes, "Sketching and sign language were very useful for getting our points across, but where we really made progress communicating was during free time. Having a beer at a pub, going to the beach or having dinner together gave us a chance to learn more about each other and the way we think and communicate. Getting to know each other made all the difference. Somehow, we developed our own way of communicating that seemed so perfectly natural."

For six days, the basement shop at MIT was a model of inter-cultural communication with a parade of innovative — and sometimes outrageously clever — designs from some of the best young engineering minds the world has to offer.

"At times I've worried about the future," says Ken Wallace. "Since seeing the way these young people get along, I've been sleeping better than I have in years."

Who won? In the sense, we all did. For at RoBoCon IDC '92, 40 very bright and creative students laid the groundwork for developing improved global communications. NEC, a global leader in computers and communications, strives to help advance societies worldwide toward deepened mutual understanding and fulfillment of human potential. NEC was a proud sponsor of RoBoCon IDC '92 and its quest to foster communication and creativity in our young generation.

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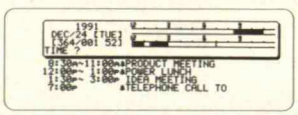

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First Line

Dismantling Barriers to Economic Progress

CONSTANT renewal is now essential for companies' survival in global markets where product lifecycles are often only 24 to 36 months long. But in the United States we hold ourselves back from such renewal with too many self-imposed barriers.

Among the most significant of these barriers are federal antitrust laws. These 100-year-old statutes provided protection during an age gone by, but now—at least at the international level—they are a straitjacket. Recognizing this, Congress passed in 1984 the National Cooperative Research Act, which has since allowed several hundred consortia, involving several thousand companies, to undertake joint R&D.

Two good examples are both located in Austin, Texas. MCC (the Microelectronics and Computer Technology Corp.) is a consortium of about 80 companies that conducts some 35 research projects simultaneously, usually with three to ten companies participating in each project. And Sematech is a partnership between industry and the Department of Defense focused on R&D in advanced semiconductor manufacturing technology.

These collaborative enterprises have begun bearing fruit. Sematech, for example, recently devised new chip-making machinery—"steppers"—to enable development of a 256-megabit chip that is years ahead of Japanese technology. This achievement, which may permit the United States to recapture the mass-memory portion of the semiconductor market, demanded resources that could not likely have been accomplished by any one company acting alone.

MCC, Sematech, and other such research-oriented consortia are a step in the right direction. But additional laws are needed that permit collaborative *production*, which companies in virtually all other industrialized countries are allowed by their governments to pursue. To be competitive, we need greater sharing of resources by American companies in industry-led, industry-managed consortia, partially supported by federal funding and involving our university and government laboratories. Such collaborative efforts could run the gamut from basic discoveries, through development and scale-up, to joint manufacturing operations.

Enormous opportunities would thus be created for making a continuous stream of innovative products in a great variety of industries. Here's one example: During the first two minutes that a car is running, the catalytic converter begins to warm up but does not function at full efficiency. As a result, according to the California Air Resources Board, 80 percent of automobile pollution occurs at that time. A preheater on the converter, now mandated in 11 states, will greatly decrease auto emissions. But given the universal applicability of this device, why should each automobile company, so to speak, "reinvent the wheel?" Cooperative manufacturing of the preheater would render the product more economical to make, decrease its price, improve productivity, and benefit the environment.

Government must permit, even help to support, across-the-board industrial collaboration.

Here's another example: Over the past 20 years, our nation's machine shops have become less and less competitive with their counterparts overseas. We could reverse this trend by allowing them to share flexible computer-integrated manufacturing facilities, which would provide both rapid prototyping and quicker entry into the marketplace for new products, as well as the ability to continually modify and upgrade existing products. Members of such a consortium would have priority access to these facilities, but other companies could buy time on them as available. Or they could start their own in competition.

The range of possible consortia, whether in terms of industry type or institutional structure, is enormous. And all have the potential to deliver the goods. But incentives such as investment tax credits and accelerated depreciation allowances are needed to nurture their growth.

We especially need to revise antitrust laws that were once protective of domestic competition—and should remain so—but that have the ironic effect of stifling it for the United States in the new global marketplace. These days, it takes collaborative effort to move the results of basic research up through the actual manufacture of products.

No other country approaches our potential for technological leadership, because no other country approaches our overwhelming capabilities. Our commitment to basic research comes to almost $25 billion annually. (Great Britain is second highest with less than 10 percent of that amount.) We have more trained scientists, 4.5 million, and more companies, 15 million, than any other country.

No competitor can claim such depth and diversity of industrial competence. We also have the world's largest market with a common language and an entrepreneurial culture that allows failure without devastating personal or social penalty.

With a few thoughtful and well-directed actions by Congress and the White House—both to pass enabling legislation and to simply get out of the way—we can dismantle the roadblocks and resume leadership in virtually all technology-based industries. ■

—D. BRUCE MERRIFIELD

The author is a professor of management at the University of Pennsylvania's Wharton School of Business. During Ronald Reagan's administration, he was assistant secretary of commerce for productivity, technology, and innovation.

Letters

HIGHWAYS IN TRANSITION

"The Case for Smart Highways" by Moshe Ben-Akiva, David Bernstein, Anthony Hotz, Haris Koutsopoulos, and Joseph Sussman (*TR July 1992*) is an excellent primer on intelligent vehicle/highway systems, or IVHS. But it does include a few misleading comments.

First, the authors say the $200 billion, 20-year IVHS investment would benefit society better than upgrades in mass transportation because "Americans are too committed to automobiles to expect massive shifts away from the car." In fact, the mass-transportation movement is growing in this country. From California to Florida, planners are noticing that people are starting to prefer mass transit to cars.

I am also not sympathetic to the suggestion that IVHS "involves fundamentally reshaping the country's transportation system," whereas transportation options like maglev don't. I am not without my own biases. In my current position supporting the National Maglev Initiative, I attribute all sorts of benefits to maglev that others might not endorse. However, I do not build the case for maglev by downplaying the competition. There is a place in the future for advanced transportation options, of which maglev is just one—as is IVHS.

LAURENCE E. BLOW
Argonne National Laboratory
Center for Transportation Research

Dreaming of a high-tech Tomorrowland that transforms the highway system not only defers the problem but accentuates it. No vision of fast-lane technology can stem the runoff, salt, and other pernicious consequences of roadmaking that have helped erode our natural landscape. No car-based solution will end the loss of context and community that we bemoan. "Smart highway" is an oxymoron. A car-centered fix to car-caused problems will only be undermined by increasing car miles, as it has been in the past.

Instead of investing in IVHS, we need to reinstate the automobile as a partner in a human-based landscape—the landscape many of us grew up in. That means altering the post-World War II pattern of sprawl bred by federal highways and federally financed mortgages to one focused on walking, one with a sense of place.

We need to mend the center city, make the suburbs already built more than just bedroom communities, and stop exurban spread. Even at the supposedly desultory rate of 1 million new houses a year, these new structures, many of them on large single lots, are land-depleting and auto-coddling. Some architects have begun to counter that trend by offering what they call "pedestrian pockets" or "neotraditional towns"—new kinds of planning that use zoning and design guidelines to enforce an ease of movement on foot. Such compact patterns could free us from the automobile for many of our needs and enable us to reach mass transit for the rest.

We must make the most of older, more urban communities built before the automobile. We have a heritage of walkable towns, of streetcar suburbs and cities. They hold a vast and lively range of housing types—multifamily wooden structures and brick rowhouses, for instance. To revive these bypassed places is essential. It means more flexible zoning. It also means a social policy attentive to concerns such as local jobs and schools—concerns vital to those who wish to make a real life for themselves in the communities. By accentuating mass transportation and inserting a connective tissue of sidewalks or bikeways and clustered transit stops in such places, we can lessen auto-dependence still more.

In short, we must redefine mobility down to a three-mile-an-hour scale, fostering the capacity to cross the street, to use the sidewalk. We need to have midblock passageways, liberated streets, longer stoplights, narrower roadways. Then we need to enhance the things that encourage travel on foot, looking at step height, street furniture, city trees, and shop windows.