Semiconductor industry is at risk

Government must support this sector, where today's research is next week's product. Mark Wilsey reports.

Leaders of the U.S. semiconductor industry presented the Congress with a devastating picture of the state of this vital strategic industry, which was once a world leader, in hearings before the Science, Research, and Technology subcommittee of the House Committee on Science, Space, and Technology on March 29. The testimony took up the issue of what the federal research policy should be for the industry. Overwhelmingly, the experts showed the desperate need for low-cost capital to conduct research and development, as well as to promote manufacturing.

The semiconductor has revolutionized the electronics industry. Enormous amounts of computing power and data storage are concentrated in the microcircuitry of the semiconductor "chip." Today, all manner of electronic devices from personal computers and television to the military hardware that defends us, depends upon these "chips." In the United States, the semiconductor industry is a multibillion-dollar concern, employing millions. Once dominating the world market, the U.S. semiconductor industry has fallen behind other nations, especially Japan, where the cost of capital for new ventures is one-half to one-third that of the United States.

Within the last year, a number of reports have been issued concerning the government's role in supporting "critical technologies." The Massachusetts Institute of Technology, the National Research Council, and the Office of Technology Assessment have each released reports on the productivity and competitiveness of American industries.

The report by the National Advisory Committee on Semiconductors (NACS), "A Strategic Industry at Risk," was the basis of this past spring's subcommittee hearing. This report spelled out the deteriorating condition of the U.S. semiconductor industry, and made clear recommendations for its recovery. In his testimony Glenn McLoughlin, an analyst in science policy for the Congressional Research Service, characterized these recommendations "as a series of flashing red warning lights, all important, all serious." The NACS was formed by an act of Congress, as part of the 1988 Omnibus Trade Act. Made up of 13 business and governmment leaders, it was charged with the task of developing a national semiconductor strategy. The chairman of NACS is Dr. Ian Ross, the president of AT&T Bell Laboratories, in Murray Hill, New Jersey.

In his testimony, Dr. Ross pointed out that the semiconductor companies in the U.S. have seen their share of the $52 billion world market fall from over 60% in 1980 to less than 40% today. In addition, the top five Japanese semiconductor firms annually invest twice as much as the top five U.S. firms do on R&D. Japan spends $2 billion more in capital spending than the U.S. industry's annual $3.5 billion. He also noted that "it is important to realize that semiconductors are not sold to you and me, they are sold to equipment manufacturers." Some 2.6 million American jobs are supported by the U.S. semiconductor business, and electronics products, of all kinds; that is double the number of workers in the U.S. steel and auto industries combined. The U.S. has lost most of the business in consumer electronic products, like TVs and VCRs, and with it, the U.S. semiconductor industry has lost that market for semiconductors.

Dr. Ross outlined many of the recommendations of the NACS: establishing R&D and investment tax credits; reducing the legal risk associated with the joint activities of companies by reforming anti-trust laws; and strengthening protection of intellectual property rights, which will increase the incentive for making inventions and developing technology. The report also recommended the U.S. revitalize the education, to develop a well-educated workforce, and work to open new markets by developing new technologies, such as high-definition television, and a national fiber optic network for home and business communications.

However, his greatest concern is the cost of capital. Dr. Ross said, "Of the recommendations for the longer term, none is more important to the semiconductor industry than the availability of low-cost, patient, capital. Making semiconductors is one of the most capital-intensive businesses that exist. It is not coincidence that foreign competitors with access to low-cost capital have targeted the steel, automobile, and semiconductor industries as places to focus their competitive efforts. Successful participation in these businesses demands large long-term capital commitments on a continuing basis. In the current U.S. capital market, that is very risky." The NACS recommends establishing an Consumer Electronics Capital Corporation, which would provide a pool of "low-

cost, patient, capital" for the smaller entrepreneurial U.S. equipment makers, so they can continue to develop the competitive technology in the world market. It is conceived that semiconductor firms would contribute to the fund, while the government's support would be to "insure" the funds that are issued. It was commented that the whole Japanese government functions like a "capital corporation."

Ensuring the industry's future

In the area of basic research, there are organizations such as the Semiconductor Research Corp., founded in 1982. SRC is a research consortium made up of the major semiconductor manufacturers, some equipment and software companies, as well as government agencies and other industry consortia. The SRC program accounts for more than half of all the silicon-related research conducted at U.S. universities. Through this effort, strong industry ties with the universities have been developed, helping assure a future supply of scientists.

Since 1982, the industry has supported SRC with over $135 million since 1982. This year's budget for SRC is $34 million. Government participation has been a total of $14 million since 1986. SRC President Larry W. Sumney recommended to the subcommittee that the government match industry funding of SRC's research activities—at a cost of about $20 million in 1991. Sumney stated, "We have not been the cure-all for the ills of the U.S. semiconductor industry. The problem is too large for the SRC . . . [and] in better times, generic semiconductor research was carried out by the government. The industry, through the SRC, has now assumed much of this responsibility." With respect to export controls, Sumney told the House members that the United States has "shot itself in the foot." He continued, "Technology is global, and attempts to establish an enclave of superior technology through erection of barriers have the effect of converting superiority to inferiority."

Another research consortium that is generally regarded as a success is Sematech. The NACS recommends that federal funding for Sematech be increased from $50 to $100 million.

Post mortem of a joint venture

Dr. George E. Bodway of Hewlett-Packard gave the subcommittee a graphic post mortem of U.S. Memories, which was proposed to be a profitable joint venture to produce DRAM (dynamic random access memory) chips. Its failure goes to show how difficult the environment is for joint ventures in the U.S. "It took three tries over several years to get the formula right for Sematech. . . . Thus, it should be no surprise that U.S. Memories did not get started on the first try." Dr. Bodway stated.

Going into 1989 the computer industry was suffering a shortage of DRAM chips, which U.S. Memories was put forward to supply. U.S. Memories determined it would need the participation of 20 to 30 companies. Those purchasing companies that managed "to weather the storm" had found other sources of DRAMs, mostly from Japan, and were locked into long-term purchase commitments. By late 1989, however, the computer industry DRAM supply was no longer a problem; the real problem was sales. As sales fell, so did production, and with it, the demand for these chips. Companies were laying off people, and freezing hiring and spending. In this environment, companies found it difficult to consider an investment in a start-up venture like U.S. Memories. Dr. Bodway said, "No company could be, or was, expected to make a bad investment out of a sense of patriotism." You cannot get a company to "share the vision," if the payoff is unclear. He cited problems in the business plan, uncertainty over anti-trust laws, and questions of manufacturing quality with an unproven chip, as factors leading to failure. Also, companies were requested both to invest in and commit to purchase from U.S. Memories, which was counter to several of their policies. In the end, only 11 companies were still considering U.S. Memories, too few to make a go.

Dr. Bodway testified, "From the outset it was evident that a major challenge for U.S. Memories to overcome was the cost of capital in the United States. Most price-competitive chips are produced in Japan where the cost of capital at the time of the business analysis was one-half to one-third of the cost in the United States." He went on to draw out the implications: With interest rates of 4-5% in Japan, and 10-12% in the U.S., U.S. Memories would have had, in 1991, a 16% higher operating cost, and by 1993 would still be 13% higher, that a comparable similar venture in Japan. Hence, costs would have to be comparably cut in order to be competitive. Bodway concluded, "That is the challenge U.S. Memories faced. It is the challenge any such venture will face until the U.S. government gets the cost of capital down."

U.S. leads in X-ray lithography

The tools for the United States to regain its leadership are within our grasp, if we would but resolve to use them. The next higher level of technology for semiconductor performance lies in X-ray lithography. In this area of research the U.S. has the lead. The X-ray, with its shorter wavelength, has higher resolution than the "light" sources used to make integrated circuits today. X-ray lithography would allow for a placing more "circuitry" on a chip, allowing production of the next generation of very high-speed, high-precision chip. The country that achieves this breakthrough and establishes a "first-to-market" position with this technology would set the standards for all other suppliers. This is the goal that the NACS recommends. However, as Bell Labs' Dr. Ross warns, "There is no point in being successful at developing X-ray lithography for 1995, if there is not a healthy U.S. semiconductor industry left in 1995 to use it. Likewise, there is no point in opening markets and raising capital in 1991 if we don't plan for success for the industry in the long term."