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The SEMATECH Consortium's Start-up Activities

Statement of
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Subcommittee on Transportation, Aviation
and Materials and the
Subcommittee on Science, Research and Technology
Committee on Science, Space, and Technology
House of Representatives



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Mr. Chairmen and Members of the Subcommittees:

I am pleased to be here today to discuss our report on SEMATECH's start-up activities.¹ This report was prepared at the full Committee's request and is the first of three annual GAO reports on SEMATECH's operations. The report addresses (1) the federal role in SEMATECH, (2) SEMATECH's approach and organization for achieving its overall objectives, and (3) SEMATECH's initial technology transfer activities. In addition, as required by the legislation authorizing federal participation in SEMATECH, we are reviewing the certified public accountant's opinion on SEMATECH's financial statements for 1988. We plan to issue this report later this year to the Senate and the House Committees on Armed Services, as required by the legislation.

I would like to briefly summarize our report on SEMATECH's operations. Management oversight of SEMATECH's activities by the Defense Advanced Research Projects Agency (DARPA) has been viewed favorably by nearly everyone we talked with. However, the industry members of the Advisory Council on Federal Participation in SEMATECH, created by law, have not been appointed; and therefore, the Advisory Council has yet to convene and provide SEMATECH the direction and oversight that the Congress expected. To give a greater cross section of input and opinion from business leaders and senior federal officials, as provided by the authorizing legislation, we have recommended that the Secretary of Defense forward to the President the names of seven individuals from industry for appointment to the Advisory Council. The Department of Defense (DOD) has concurred with this recommendation.

SEMATECH's 1990 operating plan, approved in April 1989, revised its milestone for regaining world leadership in

¹Federal Research: The SEMATECH Consortium's Start-up Activities (GAO/RCED-90-37, Nov. 3, 1989).

semiconductor-manufacturing capability from the end of 1992 to the middle of 1993 on the basis of its analysis of the time frames needed to achieve parity with and then surpass foreign competition. SEMATECH also reduced the scope of its phase-one manufacturing activities and reorganized its operating divisions to emphasize individual projects for developing more advanced semiconductor-manufacturing equipment.

As of September 30, 1989, 181 of SEMATECH's management and engineering positions in SEMATECH's operating divisions were filled with employees from SEMATECH's 14 member companies. These were typically 2-year assignments. In addition, six SEMATECH member companies plan to replicate technology that SEMATECH transferred in a November 1988 workshop to upgrade existing fabrication facilities or construct new ones.

BACKGROUND

Before discussing the details of our work, I would like to present some background on SEMATECH, a jointly funded government-industry consortium.

As you know, SEMATECH's annual operating plans have established an initial three-phased, 5-year approach to first achieve parity with Japan, then regain world leadership in semiconductor-manufacturing capability. This approach is being undertaken to develop semiconductor-manufacturing equipment and materials needed to decrease the linewidth, or diameter, of integrated circuits from the current, phase-one level of technology of 0.8 microns to the next generations of technology--0.5 microns in phase two and 0.35 microns in phase three. (A micron is a millionth of a meter.) This will enable manufacturers to increase the number of circuits on a semiconductor and, therefore, enable computers to increase data storage capacity and decrease processing time.

The National Defense Authorization Act for Fiscal Years 1988 and 1989 required that SEMATECH develop annual operating plans in consultation with DOD and the newly established Advisory Council on Federal Participation in SEMATECH, consisting of seven business leaders and five senior government officials. While ensuring the government an important voice in SEMATECH, this arrangement also was intended to establish a businesslike relationship that would allow SEMATECH a reasonable degree of freedom in its operations and management.

The Congress appropriated \$100 million in fiscal year 1988 and \$100 million in fiscal year 1989 for SEMATECH. In addition, both the Senate and the House Appropriations Committees have designated \$100 million for SEMATECH in DOD's appropriations for fiscal year 1990, which currently are being provided by the Joint Resolution Making Further Continuing Appropriations for Fiscal Year 1990. Member companies are required to provide at least 50 percent of SEMATECH's operating budget of about \$200 million each year.

THE FEDERAL ROLE IN SEMATECH

As you know, SEMATECH is a relatively new organization. Construction of SEMATECH's fabrication facility began in February 1988, and its phase-one operations began about a year ago when the facility was dedicated.

In April 1988 the Secretary of Defense delegated oversight responsibility for SEMATECH from the Office of the Secretary of Defense to DARPA. According to the former Under Secretary of Defense for Acquisition, DARPA is the appropriate organization to oversee SEMATECH because it has the requisite technological expertise and management experience and can best coordinate various aspects of the government's semiconductor research program with SEMATECH. DARPA signed a memorandum of understanding to

participate in SEMATECH in May 1988, after SEMATECH agreed to address concerns that (1) its 1988 operating plan did not sufficiently identify the tasks and milestones needed to accomplish its three-phased objectives and (2) a greater percentage of research and development should be conducted outside SEMATECH. According to SEMATECH's Chief Administrative Officer, SEMATECH has been satisfied with its interactions with DARPA, stating that DARPA has helped improve SEMATECH's strategic planning efforts without micromanaging SEMATECH's activities or influencing it into performing more defense-related research.

The National Defense Authorization Act for Fiscal Years 1988 and 1989 established the Advisory Council on Federal Participation in SEMATECH to provide advice on SEMATECH's technology objectives and operating plan for achieving those objectives. However, the Advisory Council does not have a quorum to conduct business because the Secretary of Defense has not forwarded the names of seven industry members for presidential appointment for a number of reasons, including delays in obtaining and processing the necessary paperwork for the Advisory Council members. To give a greater cross section of input and opinion from business leaders and senior federal officials, as intended by the authorizing legislation, we have recommended that the Secretary of Defense forward to the President the names of seven individuals from industry for appointment to the Advisory Council. DOD concurred with the recommendation and stated that it plans to complete the application and security clearance process for the nongovernment members of the Advisory Council by the end of this year. SEMATECH, in its official comments, while believing that the Advisory Council has merit, expressed concern about the possible duplication of roles of the Advisory Council and the National Advisory Committee on Semiconductors.

SEMATECH has been proposed as a model for other government-industry consortia. In this regard, we agree with the

Congressional Budget Office, which noted in its September 1987 report (The Benefits and Risks of Federal Funding for SEMATECH) that it is appropriate for the government to assist a particular firm or industry if such intervention can be justified on the basis of providing public benefits beyond any benefits to the affected firms. For SEMATECH, the report stated that potential public benefits that justify federal funding were (1) strengthening national defense through SEMATECH's role in sustaining U.S. semiconductor production capability and technological leadership, (2) spillovers within the semiconductor industry because SEMATECH has a longer-term research and development focus, and (3) spillovers to the U.S. economy because any successes in advancing semiconductor technology may translate into lower computer costs and advanced capabilities that benefit all industries.

SEMATECH'S APPROACH AND ORGANIZATION

SEMATECH's 1990 operating plan revised its phase-three milestone for developing the equipment and materials for achieving an integrated circuit linewidth of 0.35 microns from the end of 1992 to the middle of 1993. SEMATECH planning officials told us the new date reflects a new planning approach that establishes intermediate goals and milestones and would, on the basis of their analysis of foreign competitors' capabilities and plans, still enable U.S. semiconductor manufacturers to regain world leadership.

In May 1989 SEMATECH reorganized its operating divisions around project teams, whose members have different experience and expertise, to better advance processes and equipment technology.

SEMATECH is seeking to leverage, or extend, its resources by effectively using the skills and technological resources of its member companies, U.S. semiconductor equipment and material suppliers, U.S. universities, and federal laboratories. SEMATECH has (1) obtained manufacturing technology for phase one from two

member companies and contracted with a third member to develop the manufacturing test devices for phase two; (2) established a Tool Application Program to enable U.S. semiconductor equipment suppliers to install and test equipment in a manufacturing environment; (3) awarded eight contracts to develop advanced manufacturing equipment technology and three contracts to improve existing tools; (4) contracted with Sandia National Laboratories to establish a Semiconductor Equipment Technology Center to improve the reliability of semiconductor equipment and materials; and (5) provided about \$10 million annually for long-term R&D on semiconductor-manufacturing technology through a centers of excellence program involving U.S. universities, Sandia National Laboratories, and the National Institute of Standards and Technology.

SEMATECH'S TECHNOLOGY TRANSFER ACTIVITIES

Attracting qualified assignees from member companies is critical for achieving SEMATECH's objectives because of their role in developing advanced manufacturing technology and then transferring it to member companies. The number of assignees from each member company ranged from 3 to 27, generally reflecting the members' financial contributions to SEMATECH. One senior assignee told us that his company screened seven applicants for every one sent to SEMATECH for interviews. To encourage members to send highly qualified assignees, SEMATECH has agreed with member companies that it will not hire an assignee as a permanent employee without the member's concurrence.

One of SEMATECH's first initiatives was to design and construct a state-of-the-art semiconductor fabrication facility. In November 1988 SEMATECH transferred this technology to its members through a facilities technology package and a 3-day workshop attended by over 200 member representatives. SEMATECH officials stated that 6 members plan to replicate the SEMATECH

technology to upgrade or construct fabrication facilities and all 14 members will use aspects of SEMATECH's technology. The facilities workshop was one of many that SEMATECH conducted during the past year on such subjects as contamination control and its materials and equipment research and development program.

In summary, SEMATECH during its first 2 years has made substantial progress by constructing a fabrication facility, establishing and staffing its organization, and developing manufacturing capability at the current level of technology. While these are important first steps, more time is needed to fully measure SEMATECH's success in developing the next generations of manufacturing technology and in helping the U.S. regain world leadership in semiconductor manufacturing.

Mr. Chairmen, this concludes my statement. I would be pleased to respond to any questions you or Members of the Subcommittees may have.