The *Future* of the Semiconductor Computer Robotics and Telecommunications *Industries*

Compiled by the Editorial Staff of Petrocelli Books

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Editors' Introduction

It would be difficult to identify four areas more critical to high technology than semiconductors, computers, robotics, and telecommunications. These four highly interrelated areas in many respects comprise the infrastructure of our entire technological society. Recognizing the importance of these areas, the U.S. Department of Commerce's International Trade Administration sponsored, in 1983, a number of meetings intended to shed some light on the directions in which these four areas were moving. The "high technology meetings," as they came to be known, yielded profiles of the four industries, provided a forum for discussion among government and industry leaders, and identified a set of action items for those committed to progress in the four industries.

The results of the four meetings are integrated here for the first time. This book contains all of the results of the four meetings as well as some insight into how they might interrelate. They are presented here not in the order in which they occurred, but rather in an order that makes the most sense from a high technology perspective.

The first industry covered is the semiconductor industry. This section of the book contains presentations by Dr. Robert N. Noyce, Vice Chairman of the Intel Corporation, Mr. W. J. Sanders, III, Chairman of Advanced Micro Devices, Mr. Gary L. Tooker, Senior Vice President of Motorola, and Mr. Erich Bloch, Vice President of Technical Personnel of the IBM Corporation. Robert Noyce talks about the semiconductor industry in relatively general terms. After developing a short history of the semiconductor industry, he notes that there are currently a number of problems which must be solved if the industry is to endure. One such problem is the shortage of trained personnel. A second involves the lack of attention to long-term financial and industrial goals, while the third concerns export controls and technology transfer. In many respects Noyce's thoughts may be regarded as a warning about the threats to the semiconductor industry. They also lead perfectly into those of W.J. Sanders who examines in some detail the international trade policy that affects the semiconductor industry. Unlike Noyce, Sanders gets very specific and details the nature of the Japanese threat to the American semiconductor industry. He also lists no less than six recommendations for U.S. policymakers, including policies to protect U.S. industry against foreign industrial targeting practices, policies that would establish a monitoring system with respect to major commercial semiconductor product lines, policies that require that U.S. semiconductor firms receive commercial opportunities in Japan that are fully equivalent to those enjoyed by Japanese firms, policies to enforce agreements previously made by Japan regarding international competition, policies that extend our policies toward Japan to other countries, and legislation that provides the authority and means necessary to insure that the U.S. government carries out the above policies and guidelines. More specifically, Sanders suggests that the High Technology Trade Act of 1982 be reintroduced to the Congress.

Gary Tooker's contribution is in the area of investment and tax policy. Like Sanders, Tooker is concerned about the differences between the Japanese and American economic systems and the advantages that accrue to the Japanese because of these differences. He is especially concerned with the role that risk plays in the two economies, citing that Japanese industrialists generally face much less risk than their American counterparts. He bluntly suggests that "the Japanese government has taken the risk out of investing in target industries in Japan." Significantly, Tooker does not suggest that the U.S. government eliminate risk from U.S. investments but rather that it become aware of the competitive environment when considering tax measures that impact high technology industries.

Erich Bloch is less concerned with taxes and risk than he is with research and education. He is concerned that a smaller and smaller percentage of resources is being allocated to research and education in the semiconductor industry. He notes that while the U.S. semiconductor industry spends approximately 10 percent of its sales dollars on research, the Japanese spend between 13 and 16 percent. Bloch suggests that the percentage be increased and that a number of unique arrangements be made with some government agencies to make certain that basic research in semiconductors continues at an aggressive pace. With regard to scientific and technical education, Bloch laments the reduction of government support to universities and suggests that because of the cutbacks new relationships between industry and academia need to be developed.

All in all, the views from the semiconductor industry expressed here are not very optimistic. It is noteworthy that they all point to a number of critical threats on the horizon, not the least of which are traceable to the East. Indeed, in many respects, the four contributions constitute a call to arms in the semiconductor industry.

Part Two of the book looks at the computer industry. Like Part One, this part begins with a profile of the industry at this point in time. This profile, prepared by Mr. Robert Eckelmann of the Office of International Sector Policy of the International Trade Administration, Department of Commerce, diagnoses the competitive position of the U.S. computer industry. It describes the industry and contrasts it with the world marketplace. It also devotes special attention

to the subject of world computer trade. Eckelmann's country-by-country analysis is valuable insofar as he identifies the Japanese, French, West Germans, and British as key competitors with unique advantages and disadvantages vis-à-vis U.S. industry. All of these discussions contain statistics about the size and nature of foreign computer producers and consumers. Eckelmann concludes his study by identifying the key issues likely to affect U.S. competitiveness in international computing. These issues include the continued development and implementation of the systems concept, the shortage of trained personnel, research and development, the design and production of adequate software, and foreign targeting practices.

This excellent discussion is followed by a presentation by Vico E. Henriques who is the President of The Computer and Business Equipment Manufacturers Association (CBEMA). Among other contributions, Henriques presents a statistical tour of the computer industry, noting that industry revenues worldwide have risen dramatically since 1965 and that in all likelihood they will continue to rise just as dramatically through the 1980s and well into the 1990s. He also notes that the number of people employed in the computer industry has risen steadily since 1960.

The next contribution by Edson de Castro of the Data General Corporation looks at the restrictions and performance requirements of the computer industry. Of special interest is the identification of Brazil, Mexico, and South Korea as three of the most current examples of countries that deny or impede access to their markets.

Stephen G. Jerritts, Senior Vice President of Honeywell, develops a response to hostile industry targeting practices. He specifically looks at foreign trade barriers, fiscal policy, government-supported research, and intra-industry cooperation as four areas that can be developed in response to foreign targeting practices.

The last contribution to this section on the computer industry is made by John W. Lacey, Executive Vice President, Technology and Planning, Control Data Corporation. Lacey addresses eleven areas relevant to international trade and export controls as they impact the computer industry. The areas include the need for a positive balance of trade, the importance of multilateral controls, the importance of foreign policy controls, the need to control exports to

COCOM countries, the importance of re-export controls within COCOM countries, the establishment of licensing requirements regarding exports to Third World countries, the importance of foreign market assessments, the role of indexing, the proper administration of unilateral export controls, the development of a list of critical military technologies, and the enforcement of laws and policies.

Nearly all of the contributions in this section of the book express a concern over the international position of U.S. industry. There is a great deal of apprehension about the growing capabilities of the Japanese and Western Europeans to capture more and more of the world computer market. The calls for financial and policy support frequently call for an expanded government role in the management of international trade, a role made necessary by the actions of foreign governments.

Part Three of this book turns its attention to the robotics industry. The first contribution in this section was prepared by Robert Eckelmann whose study deals with the competitive prospects of the U.S. robotics industry. He first addresses some definitional problems, i.e., what is a robot and what are the components of the robotics industry, and then develops a summary of the U.S. robotics market. This analysis is followed by a summary of the world robotics marketplace which is comprised of aggregate trends, and offers a seven-country analysis. The countries examined include Japan, West Germany, Sweden, The United Kingdom, France, Italy, and a few other relatively minor competitors. Eckelmann then looks at the world trade situation in robotics and identifies the key issues affecting U.S. competitiveness in that market. He cites the importance of international agreements between private firms, labor, and automation.

Joseph Engelberger, the well-known President of Unimation, Inc., suggests in the next contribution that the Japanese hold an impressive edge in the implementation of robotics, that the levels of technology in the U.S., Europe, and Japan are approximately even, and that the Japanese, British, German, and French governments have already launched aggressive programs to support robotics technology and to provide both internal and external marketing aids. These and other observations are examined more thoroughly by

Walter Weisel, President of Prab Robots, Inc. More specifically, Weisel suggests that the U.S. needs to strengthen its base of manufacturers, and develop a strategy for combating the aggressive posture of the Japanese vis-à-vis the exportation of robotic equipment. Stanley J. Polcyn, President of the Robotics Institute of America and Senior Vice President of Unimation, Inc., suggests that the U.S. industry/government relationship be strengthened in the following ways: the establishment of robotics as a major strategic industry; the setting of national productivity goals that will enhance the U.S. robotics industrial base; the establishment of an Industrial Policy Board (similar to the Federal Reserve Board) that could take forceful, effective and independent action to strengthen strategic industries; the development of an aggressive, consistent taxation policy that would provide incentives to utilize robotics technology; the creation and funding of a robot leasing company that would provide low cost loans to purchasers of industrial robots manufactured in the U.S.; the allocation of government funds to assist in generic, basic and applied research for advancing robotic developments; and the development of a realistic export program.

Semiconductors, computers, and robots share a great deal in common, but without telecommunications their contributions to industrial productivity are severely constrained. In fact, prudent observers frequently regard telecommunications as the high technology circulatory system. Part Four of this book concentrates on telecommunications and what the U.S. must do to maintain its edge in the industry. The section begins with a contribution by Robert Eckelmann. This opening study examines the international competitive position of the U.S. telecommunications equipment industry. It studies the world market, the nature of telecommunications trade, and the role which the U.S. plays in the world marketplace. It also focuses specifically on Japan and Western Europe, and identifies a number of key issues in the world telecommunications market, including the liberalization of services and equipment, technological change, research and development, and foreign targeting practices, among others. Eckelmann's industry profile serves as the backdrop for John Sodolski's contribution. Sodolski is the Vice President of the Telecommunications Group of the Electronic Industries Associ-

ation. His contribution focuses upon the market for telecommunications equipment, and the processes by which the marketplace evolves and changes. Like so many of his counterparts in the semiconductor, computer, and robotics industries, Sodolski is very concerned about how changes in the character of the marketplace will affect the U.S. position.

Richard Moley, Vice President of Marketing of the Rolm Corporation, suggests that one way to respond to the ever-changing marketplace is to open previously closed markets. He cites at least four major obstacles to opening closed markets. They include political obstacles, where the target government decides who produces what and for how much; economic obstacles, where there are high tariffs and/or local requirements which create a very high risk for U.S. manufacturers; technical obstacles, where either specifications are unavailable to foreign suppliers or the cost of meeting unique specifications cannot be justified due to market size and potential; and technology transfer obstacles, which are being raised more and more frequently by newly industrialized countries. If the U.S. is to continue to succeed in the telecommunications marketplace, it must, according to Moley, learn how to deal with these and other obstacles. Citing a successful Rolm experience with the Japanese, he also suggests that success is by no means impossible. In fact, if anything, Moley's message is basically optimistic.

John F. Mitchel, President of Motorola, is not nearly as sanguine about the future. He bluntly states that "Motorola is doing everything it can to overcome [the] fundamental imbalance in [the] competitive situation." He also feels that existing laws are inadequate to deter foreign targeting practices and that legislation is desperately needed to develop a balance between U.S. and foreign competition. Mitchel concludes with a six-point plan about how to improve the international situation from the perspective of the U.S. telecommunications industry.

The next contribution by John N. Lemasters, Senior Vice President, Communications Sector, Harris Corporation, deals with export financing and licensing considerations in the telecommunications industry. Like many of his counterparts, Lemasters states that the U.S. is at a serious disadvantage versus foreign competition. To

alleviate the situation, he proposes that the U.S. Congress enact a set of specific pieces of legislation. He also suggests that a number of other unofficial measures be taken to create a balance in the foreign competition situation.

The final contribution by Richard E. Horner, Chairman and Chief Executive Officer of the E. F. Johnson Company, consists of a general overview of the state of the U.S. telecommunications industry with regard to international trade. It is very much a policy statement. Among other suggestions, Horner would like to see massive changes in U.S. tax policy. He would also like to see some coordination between tax and money-spending policies. Commercial banking is another area of concern for Horner, as well as a number of pieces of legislation that he thinks would help improve the U.S. situation.

The interesting point about all of the industry profiles and analyses in this book is that they all, to a greater or lesser extent, sound an alarm. There is growing concern within U.S. industry about the policies of foreign governments and, given these policies, the inability of U.S. industry to effectively compete in the world marketplace. There is also a tremendous amount of concern about the U.S. government's lack of initiative in international trade. Time and again, industry leaders can be heard complaining about the U.S. government's failure to support its key high technology industries. Instead, U.S. industry is left to compete unfairly with foreign industries that not only have policy support from their governments but financial support as well.

In addition to the identification of the problems that confront U.S. high technology industries is a snapshot of the state of high technology, at least as it pertains to semiconductors, computers, robots, and telecommunications. These descriptive profiles are of great value to anyone interested in learning more about U.S. high technology.

Our hope is that through the publication of these profiles and analyses we can contribute to a narrowing of the gap between those who make policy and those who must live with the results of ill-conceived policies. There is no question that the issues raised in this book are of tremendous importance to the future of the U.S. econ-

omy. Indeed, if many of the issues raised in this book are not attended to in the very near future, the economic future of the United States might very well remain threatened for decades to come. As many of the contributors to this book have repeatedly stated, the future is now.

The Editors of Petrocelli Books

Introduction

The High Technology Meetings

In the past two decades, economic development in the United States has increasingly depended upon high technology industries. The "high tech" sector has contributed significantly to economic expansion, employment opportunities, and national productivity. It has also become increasingly important to the competitiveness of other sectors. All indications are that its importance will continue and grow in the future.

The same trends are clear in other industrialized countries. Each in turn has recognized that its high technology capabilities may critically influence its long-term economic success. Out of this has grown an atmosphere of intensifying international competition in

most high technology fields, and a keener awareness of the role that public policy plays in shaping and directing this competition.

In order to assess future problems in U.S. high technology competitiveness, the Secretary of Commerce held a series of meetings in January and February of 1983 attended by leading executives of four high technology growth industries and high-level Administration representatives. The four industries chosen were robotics, computers, semiconductors, and telecommunications. These four industries were selected because they are key sources of future growth and productivity for the U.S. economy. In addition, these industries all face significant problems associated with the "targeting" practices of foreign governments.

In his opening remarks, the Secretary stated that the meetings were designed "to explore the problems and challenges you face as an industry and to exchange views with you as to what the U.S. Government should—or should not—do in response to those challenges. We want to know what you see ahead and how you plan to respond as an industry. We also want to know if there are appropriate ways the government can facilitate your competitiveness."

The Department of Commerce found these meetings very useful. Important issues were discussed frankly. The Department regards the meetings as the beginning of a widened and improved process of communication between government and industry. The Department expects to arrange similar meetings with other industries.

This book contains four statements and discussions of the problems these four industries face, as they emerged from the meetings. We believe these issues deserve continued wide discussion by an informed and interested readership. Each Part is devoted to one of the four industries and contains two major sections: an overview of the industry, and a second section presenting the papers given by the industry speakers during the meetings.

Industry Profiles

The industry profiles present a brief assessment of the competitive situation faced by each of the four industries. Each profile is designed to:

1. assess the industry's international competitive position;
2. identify important competitive issues; and
3. present for discussion options to address these issues.

Presentations Made by Industry Speakers

The issues raised by the various industry speakers fell into two categories: first, issues common to more than one of the four industries and second, issues specific to the industry in question. A list of the general issues raised in the meetings as a group appears below, followed by an outline of the issues specific to the semiconductor industry. The industry presentations discuss the specific issues in greater detail.

General Issues Developed from the High Technology Meetings

A total of eleven generic issues emerged from the four meetings. Each industry tended to rank the importance of the issues differently. The list below enumerates the issues raised during all the meetings in no order of priority:

- Access to foreign markets.
- Better U.S. Government response to foreign governments' targeting practices.
- Use of fiscal and tax policy to provide incentives for high technology R&D and applications.
- Dampening effect of present antitrust regulations.
- Export controls and licensing.
- Government support of research and development.
- Formulation of a U.S. industrial strategy covering both the domestic and international markets.
- Need for better technical/scientific education to ensure supply of qualified personnel.
- More assertive U.S. role in multilateral and bilateral trade negotiations.
- Better support for Eximbank.
- Better export promotion.

Each industry's speakers focused on the issues of principal concern to their own industry. Thus, not all of the eleven issues listed above were raised in each meeting.
U.S. Department of Commerce

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