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An Assessment of the U.S. Telecommunications Industry Dependence on Foreign Sources as it Impacts the U.S. Telecommunications Infrastructure

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PREFACE

This report is submitted as a prime deliverable for a study conducted for the National Communications System (NCS), Office of the Manager, Technology and Standards Office, Washington, DC, under Reimbursable Order DNRO 26081. This study is an update to previous work done by the Joint Industry-Government Telecommunications Industry Mobilization (TIM) Group, a subcommittee of the National Security Telecommunications Advisory Committee (NSTAC). The TIM Group made an initial assessment, in 1987, of the telecommunications industry's dependence on foreign sources in light of the potential requirement for mobilization.

The objectives of this study were to update the 1987 assessment, and to develop an assessment mechanism that can be used to perform future assessments of foreign source dependence. This report contains data compiled from interviews of representatives of industry, the Government, and available literature. Certain commercial products and company names are mentioned in this report to specify and describe some of the necessary information. Such identification does not imply exclusive recommendation or endorsement of the companies or the products by NTIA or NCS. The views, opinions, and/or findings contained in this report are those of the authors and should not be construed as an official NTIA or NCS position unless designated by other official documentation.

This report is issued in two volumes. Volume I contains a summary of findings during this study. Volume II contains more detailed background information.

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ACRONYMS

ASIC	Application Specific Integrated Circuit
BXA	Bureau of Export Administration
COP	Committee of Principals
DOC	Department of Commerce
DQ	Dataquest, Inc.
DRAM	Dynamic Random Access Memory
DSP	Digital Signal Processor
EOP	Executive Office of the President
E/M	Electromechanical
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
GDP	Gross Domestic Product
GNP	Gross National Product
IDA	Institute for Defense Analyses
Int	Interconnect
ITA	International Trade Administration
ITC	Initial Tax Credit
ITS	Institute for Telecommunication Sciences
Mech	Mechanical
NAFTA	North American Free Trade Act
NCS	National Communications System
NSTAC	National Security Telecommunications Advisory Committee
NTPANCS	Telecommunications Plan of Action
NTIA	National Telecommunications and Information Administration
NS/EP	National Security and Emergency Preparedness
PCB	Printed Circuit Board
RBOC	Regional Bell Operating Company
SMT	Surface Mount Technology
TIM	Joint Industry-Government Telecommunications Industry Mobilization Group
U.S.	United States
USDA	United States Department of Agriculture

AN ASSESSMENT OF THE U.S. TELECOMMUNICATIONS INDUSTRY DEPENDENCE ON FOREIGN SOURCES AS IT IMPACTS THE U.S. TELECOMMUNICATIONS INFRASTRUCTURE

Volume II: Background Information

David F. Peach and Michael D. Meister[1]

The National Communications System (NCS) is responsible for defining operational infrastructures and processes that could be detrimental to the provision of telecommunications equipment and services necessary to the National Security and Emergency Preparedness (NS/EP) needs of the Nation. To this end, the President's National Security Telecommunications Advisory Committee (NSTAC) studied the industry's dependence on various infrastructures within the United States to (1) identify possible impediments to effective telecommunications industry mobilization, and to (2) assist in the development of corrective actions to overcome any identified impediments. This study was published in 1989. The information presented in this report is a result of follow-on investigations that attempt to determine those components and materials used in the telecommunications equipment manufacturing process that are obtained from foreign sources. This report lists those components that are primarily procured from foreign sources. For example, plastic-coated relays, printed circuit mounted transformers, and some types of semiconductors are a few of the components that represent vulnerabilities in the telecommunications switch (Class 5) manufacturing process. A result of this study is an analysis of the trends that are evident between the 1989 study results and the results of this report. This report shows an increase in the components that are obtained almost exclusively from sources outside the U.S. and Canada. A contributing factor to the trend toward more foreign sourcing of components is the general trend toward a more global economy. In the final analysis, one must determine the components, and their sources, that could be the most detrimental to the mobilization of the Nation's telecommunications resources if these sources were no longer available. A determination of the sources that are most likely to be cut off is also important. An analysis of the circumstances that could result in the cut off of foreign sources is not a part of this study.

Key words: telecommunications; telecommunications switch; Class 5 switch, telecommunications manufacturing; foreign source; foreign source dependence

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1. INTRODUCTION

The telecommunication industry plays a critical role in assuring the Nation's ability to maintain continuity of Government and essential private sector functions when faced with national security or emergency preparedness (NS/EP) challenges. The National Communications System (NCS) is the Federal Government's primary agent for planning and coordinating the Nation's NS/EP telecommunication activities. The NCS NS/EP Telecommunications Plan of Action (NTPA) calls for

- The identification of possible impediments to effective telecommunication industry mobilization and mobilization planning, and the recommendation of corrective actions, and
- The identification and recommendation of any Federal Government actions needed to support the telecommunication industry mobilization planning activities.

The Institute for Telecommunication Sciences (ITS) is assisting NCS in fulfilling its NS/EP responsibilities by conducting a study to determine the extent and nature of U.S. dependence on foreign sources for telecommunications systems and components that could affect U.S. telecommunications in a NS/EP scenario. The work involves both identifying current system and component dependencies, and developing mechanisms for assessing ongoing and long-term dependence.

Foreign dependency under a condition of mobility makes sense only if the scenario under which mobility is required is defined. To determine the dependence based on mobility becomes a matter of judging the applicable situation rather than that of applying known or fixed objective parameters to a particular situation. Although the precise type of national security emergency that the U.S. may face may be impossible to predict, it may be beneficial if the general economic and production problems likely to be encountered in any such emergency can be anticipated with some degree of certainty. Effective peacetime planning, focused on the problems likely to arise during a national emergency, and on methods to deal with these problems, can increase the effectiveness of subsequent preparatory and response actions. Different levels and types of response measures will be appropriate depending on the nature of the crisis or emergency and the stage of its development.

Mobilization is fundamentally a civilian agency activity, and as a result the civilian agencies control many of the resources (e.g., critical materials, energy, and transportation), programs (i.e., priorities and allocations and voluntary agreements), and policy decisions (i.e., fiscal, monetary, trade, and regulatory policies) necessary to support increased defense production.

The response time necessary to increase significant production of defense end-items has militated against reliance on production capabilities in a crisis or conflict. Even if major investments were made in industrial base enhancement measures, the industrial base could not respond immediately to mobilization requirements. Some time would be needed to refine plans and focus them on the crisis; develop new production requirements; adjust

existing procurement plans; identify and qualify new sources of supply; let new contracts; and increase the flow of parts and components to end-item assembly and manufacture (FEMA, 1989). This study does recognize a very general definition of mobilization (see Section 2; Definitions) that does not rely on a mobilization scenario to gain a time-based insight into potential shortfalls.

It is difficult to assess on an empirical basis, the extent of dependence on foreign sources in the telecommunications infrastructure, despite the wealth of evidence that the problem exists. Data collection based on varying methodologies limits our ability to identify dependency trends in critical industrial sectors. One of the impediments in this process is the reluctance of the manufacturers to divulge the supply sources.

The results of a Government study, published in 1989[2](NCS,1987, and NCS,1989), were compared to the information acquired during ITS's 1992 study. Several items that were foreign sourced in 1987, are still predominately procured from outside the U.S., such as plastic coated relays, ferrites and ferrite-based devices, connectors using precious metals, and semiconductors. According to reliable sources, there will be little change in the sourcing of any of these items during the next two years. Suppliers in the U.S. will improve their competitive position in the market of 256 kbit and 1 Mbit DRAM memories; however, the usage trend is toward 4 Mbit and 16 Mbit DRAMs, components that are primarily produced in volume outside the U.S.

It is apparent, after discussion with U.S. companies, that to fully understand their foreign dependence and foreign sourcing issues, one must recognize the integral and complex U.S. policies and issues related to economics, politics, technology, import and export laws, taxes, and labor.

2. DEFINITIONS

The definition of terms used in this report is consistent with the definitions in the background reports, upon which some of this report relies. For the purpose of this report, the following terms are herein defined.

Foreign--Foreign refers to those geographical areas not included within the United States and Canada. Areas within the United States and Canada are referred to as North American.

Foreign Dependence--Foreign dependency is defined as a material, part, component, assembly, or subassembly sourced abroad because it is not produced or otherwise available in the U.S. or Canada.

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[2] A National Security Telecommunications Advisory Committee (NSTAC) report entitled "Final Report of the Joint Industry-Government Telecommunications Industry Mobilization (TIM) Group," was published in April 1989. This report consists of two volumes.

Foreign Sourcing--Foreign-sourced items are defined as materials, parts, components, assemblies, or subassemblies manufactured, assembled, or otherwise processed outside the United States and Canada. The distinction should be noted between the issue of *dependence on* foreign sources and the broader, more inclusive issue of *procurement from* foreign sources. Foreign source procurement does not necessarily equate to foreign source dependence. Both foreign dependence and foreign sourcing involve consideration of a range of trade, economic, national security, and foreign relations issues.

Mobilization--The process of marshalling those telecommunications resources needed to make the transition from a normal state to a state of readiness for war or other national emergency.

Mobilization is considered to encompass the interval from peacetime/disaster/crisis through any subsequent conventional military actions external to the continental United States. The impact on the telecommunications industry of a nuclear attack upon the United States was judged by the Group to be outside the scope of its study. The following mobilization time periods are being used for the purpose of analyses:

(1) Pre-Mobilization: Planning and Pre-Positioning

(2) Short-Term: 0 to 90 Days (Reallocation and Reprioritization of Existing Capability and Service)

(3) Mid-Term: 90 to 180 Days (Reallocation and Reprioritization of Products and Services in the Pipeline)

(4) Long-Term: Over 180 Days (Expanded Production of Capacity and Services).

3. BACKGROUND

According to a study performed in 1987 (NCS, 1987), and published in a Government report (NCS, 1989), the extent of the telecommunications industry's dependence on foreign sources for raw materials, components, parts, and equipment is a key area of concern in evaluating the industry's ability to maintain service and production capabilities and accommodate increased service and equipment demands under mobilization conditions. The Joint Industry-Government Telecommunications Industry Mobilization (TIM) Group was established by the President's National Security Telecommunications Advisory Committee (NSTAC) and the National Communications System (NCS) Committee of Principals (COP) to: (1) identify possible impediments to effective telecommunications industry mobilization and (2) assist in the development of corrective actions to overcome any identified impediments. The report entitled Final Report of the Joint Industry-Government Telecommunications Industry Mobilization (TIM) Group (NCS, 1989), documents the Joint Group's final findings, conclusions, and recommendations regarding the industry's overall dependence on foreign sources.

The Joint TIM Group sought information from Federal Government and private research organizations that had previously studied the issue of foreign procurement or foreign dependence. The Group focused initially on the telecommunications industry's dependence on foreign-sourced semiconductors, providing recommendations on semiconductor dependency to the NSTAC in February 1987 and to the COP in March 1987. The Joint TIM Group reached the following conclusions concerning semiconductors:

- At this time, if foreign-sourced semiconductors became unavailable, it would not have significant impact upon the provision of telecommunications service during Short-Term (0 to 90 days) and Mid-Term (90 to 180 days) mobilization. While production of telecommunications equipment would be adversely affected in the Short and Mid-Terms, available equipment could be allocated to meet mobilization-related national security emergency preparedness (NS/EP) needs.

- At this time, to the extent that foreign-sourced semiconductors became unavailable, expansion of telecommunications service capacity would be constrained during Short- and Mid-Term mobilization, and overall capacity would be reduced in the Long-Term because the telecommunications industry would be competing with other entities (e.g., the Department of Defense) for the allocation of available supplies.

The subsequent focus of the Group's study was equipment, materials, and components other than semiconductors. It was determined by the NSTAC that semiconductors were a problem area based on DoC and National Defense University data. A survey of NSTAC member companies was conducted to support this aspect of the study. The Dependence on Foreign Sources Survey was designed to elicit the views of NSTAC companies concerning their own, as well as the industry's, dependence on foreign sources for materials, equipment, and components other than semiconductors. The survey focused on four major types of equipment: digital central office switching equipment, fiber optic electronic terminal equipment, telephone sets, and satellite ground stations. Nineteen NSTAC companies provided responses to the survey.

On the basis of the survey results and other information obtained from the literature, briefings, and consultation with experts in the Federal Government and the private sector, the Joint TIM Group developed its findings, conclusions, and recommendations. The increasing dependence of the telecommunication industry on foreign sources raises significant questions about the industry's ability to respond to and sustain mobilization requirements. The Joint TIM Group reached the following conclusions concerning equipment, materials, and components other than semiconductors:

- In the Short-Term and Mid-Term, the service sector of the U.S. telecommunications industry would not be immediately or severely affected by disruption of the supply of foreign items. Adverse effects would be felt as foreign equipment fails or requires repair parts.

- The manufacturing sector of the U.S. telecommunications industry could be immediately affected by a cut-off of critical foreign-sourced supplies, equip-

ment, or materials. The effects on production would depend, in part, on the quantities of foreign-sourced items in domestic inventories and in the supply pipeline.

- The U.S. industry's foreign dependence presents a changing picture in terms of the specific equipment, components, and materials for which dependency exists as well as the degree of dependence for each. Today's list of foreign dependence items is different from last year's, and next year's will differ from today's. The following conclusions and observations reflect the picture as drawn by the NSTAC Foreign Dependence Survey and related studies in their 1987 report for the period addressed:

  (1) In view of the large number of foreign-made optic terminals embedded in U.S. telecommunications systems (about 35 percent foreign according to some estimates) and the inherent incompatibility between terminals made by different manufacturers, the foreign-made terminals and their interfacing connectors could become a problem if maintenance or expanded capacity is required.

  (2) The U.S. currently imports over 60 percent of the telephone sets it uses. Although the demand or telephone sets during mobilization is not known, the fact that imports have risen to this level suggests that telephone sets could be a problem during mobilization. Therefore, the Joint TIM Group concluded that domestic production and imports status of telephone sets should be periodically monitored.

  (3) The foreign dependence status of ceramic resonators should be studied in depth, with a view toward identifying possible steps to reduce the degree of foreign dependence. The availability status of four other critical items—fiber optic terminals, fiber optic connectors, telephone sets, and ferrite cores should be periodically monitored for the same purpose.

On the basis of its conclusion regarding the impact of semiconductor foreign dependency on the telecommunications industry the Joint TIM Group offered the following recommendation:

> Semiconductors are major components of the equipment used by the telecommunications industry, and industry is almost totally dependent on foreign-sourced semiconductors. Accordingly, the ongoing National Security Council and Defense Science Board efforts in this area are strongly supported. The President should direct action to identify steps to mitigate the impact of the loss of foreign-sourced semiconductors on the telecommunications industry.

Further, on the basis of its collective assessment of the responses to the NSTAC-wide Dependence on Foreign Sources Survey, the Joint Group has identified other dependencies of concern from a mobilization perspective. While these dependencies may not have the same wide-ranging significance to the telecommunications industry as semiconductor

dependency, they are important. Accordingly, the Joint TIM Group offers the following recommendations:

- The Government, in conjunction with NSTAC, should establish a mechanism to periodically assess industry dependence on foreign sources in light of identified Government mobilization needs.
- The NCS and NSTAC should jointly keep the Executive Office of the President (EOP) apprised of any specific foreign dependency issues relating to telecommunications, and identify, if necessary, possible measures for reducing or mitigating these foreign dependencies.
- In conjunction with the above Government action, the NSTAC member firms should ensure that their appropriate internal organizations are made aware of the findings of the Joint TIM Group. Further, their internal organizations should be apprised of the need to plan for contingencies such as cut-off of non-North American supplied material during a mobilization.

In its study, the Joint Group has recognized that concerns about foreign source dependency grow out of the possibility that foreign sources of supply could be cut off under a variety of mobilization conditions. The Group has thus assumed, for purposes of its general investigation, that a cut-off of foreign supplies would occur coincident with the beginning of mobilization.

4. STUDY METHODOLOGY

This ITS study was undertaken in response to the Joint TIM Group's recommendations that the Government (1) investigate more fully U.S. dependence on specific foreign-sourced telecommunications equipment critical to the telecommunications infrastructure, and (2) develop a mechanism to periodically assess foreign source dependence. ITS proposed a three-phase approach to identifying such dependencies:

Phase I--Systems Level Analysis. Analyze each major telecommunications system or group of systems to determine the amount of production within the U.S., the imported quantities, exported quantities, and the U.S. consumption (Appendix A). Flag the cases where significant portions of U.S. consumption come from foreign sources as a possible problem area.

Phase II--Component Level Analysis. Identify specific components of those Phase I systems that are procured primarily from foreign sources. The components included those consumables used in the manufacture of the equipment. For purposes of this study, the systems investigated were limited to Class 5 central office switch equipment manufactured in the U.S.

Phase III--Identification and Prioritization of Vulnerabilities. Investigate the vulnerabilities of U.S. telecommunications infrastructure due to de-

pendence on the identified systems and components. The vulnerabilities are only possible problem areas, and will become problems if that component supply is cut off or in some way reduced. The identification of problem areas is left to Government representatives who can identify the specific supply pipelines that may be eliminated.

The Institute's FY91 activities and accomplishments in Phase I and Phase II of the study are summarized in Appendix B. After evaluating the available data and data sources, ITS and NCS limited the scope of the study to telephone switching equipment (specifically, Class 5 switches) to develop a working approach and then apply this approach to other areas as appropriate. The Class 5 telephone switch was selected because of its widespread use and its significant importance within the telecommunications infrastructure.

4.1 Phase I–Systems Level Analysis

Using import/export data published by the Bureau of the Census[3] (see Appendix A), the general category *Telephone Switching and Switchboard Equipment* was selected to begin the study. Figures 1 and 2 are graphical representations of the data for the *Telephone Switching and Switchboard Equipment* for 1989 and 1990, respectively.

Apparent U.S. consumption is based on monetary values of U.S. production, imports, and exports according to the following formula:

U.S. Production + Imports - Exports = Apparent U.S. consumption

The category, *Telephone Switching and Switchboard Equipment,* includes an overwhelming number of systems. After evaluating the available data and data sources, ITS and NCS limited the scope of the study to the area of telephone switching equipment (specifically, Class 5 central office switches) to develop a working approach and then to apply this approach to other areas as appropriate. The Class 5 central office telephone switch was selected because of its widespread use, its significant importance within the telecommunications infrastructure, the limited number of U.S. manufacturers of this switch, and theperceived ease of collection of component and system-level data. In addition, a fully configured Class 5 central office switch system utilizes nearly all of the components that are used to manufacture smaller telecommunications systems and thus provides a very good representation of the component profile.

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[3] The Bureau of the Census is an organization of the U.S. Department of Commerce. The data used in this report was obtained from the published report entitled "Communication Equipment and Other Electronic Systems and Equipment." The report was published in 1991 for the period of 1984 through 1989. Appendix A contains a copy of this report.

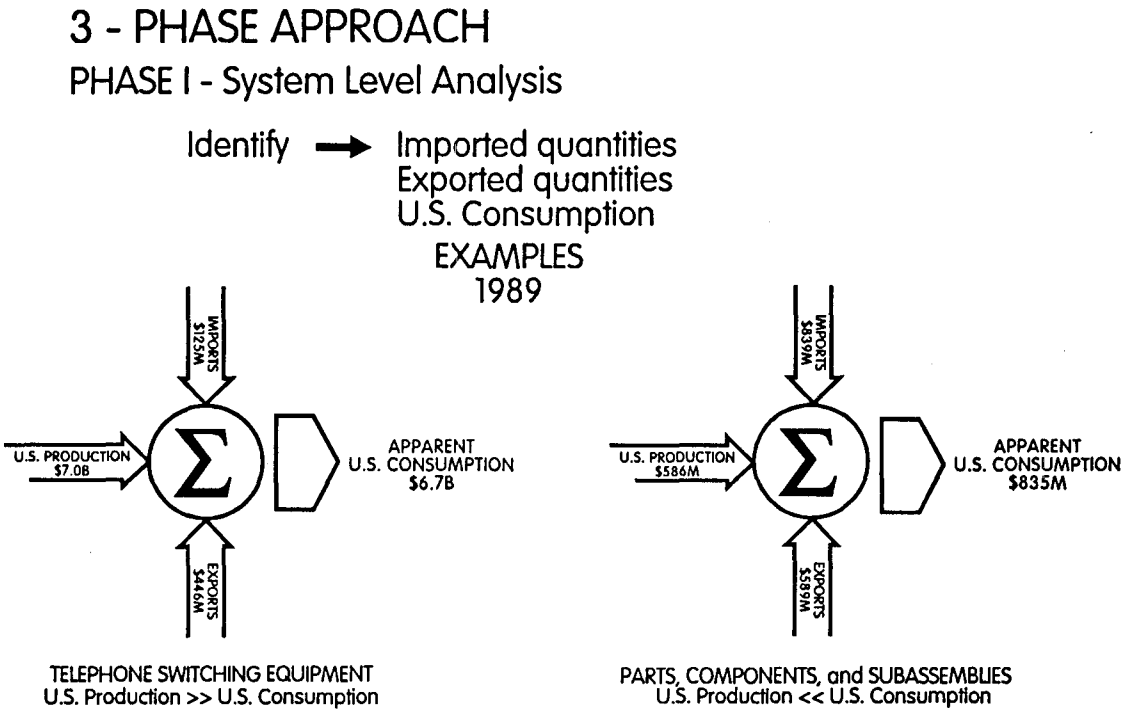

Figure 1. A 1989 analysis taken from the Bureau of the Census Report (Appendix A).

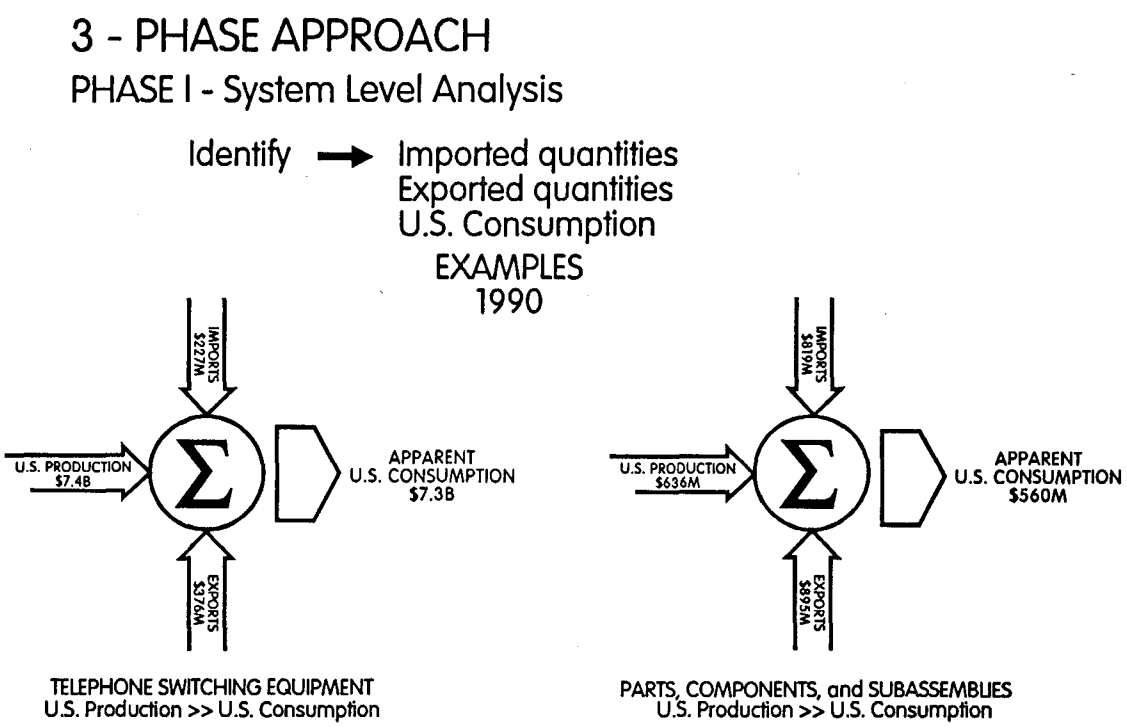

Figure 2. A 1990 analysis taken from the Bureau of the Census Report (Appendix A).

4.2 Phase II–Component Level Analysis

At the component level of the analysis, the goal was to identify components of the Class 5 switch that are wholly or primarily obtained from foreign sources. Published data on specific components is not available from either industry data research firms or Federal Government agencies such as the Bureau of the Census and the International Trade Administration.

The Institute for Telecommunication Sciences teamed with Dataquest Incorporated[4] to develop a method of obtaining the required data at the component level. The Institute and Dataquest Incorporated established points of contact with the manufacturers and developed a questionnaire for collection of data. Manufacturers participating in the study were provided with a brief background report highlighting the background of the project, its purpose, goals, and current status. A copy of the questionnaire is available in Appendix C. The manufacturers reviewed the questionnaire and background report and prepared their response. The Institute and Dataquest Incorporated were then invited to the manufacturer's offices to discuss the information.

Two digital switch manufacturers participated in the pilot study. The names of the particular manufacturers cannot be disclosed due to the nature of the data. It was requested by the manufacturers not to disclose proprietary and sensitive information, which was required for us to know in order to understand the impact of foreign dependency on the manufacturer's products. The Institute signed nondisclosure agreements to this effect. The questionnaire was developed to be sensitive to the limitations related to the release of this information.

At the outset of this project, information was collected from Government and private research organizations that had previously studied the foreign dependency issue, to provide insight in preparing our survey questions and final report. The methods for data collection used during the period 1987-1989 were also investigated. It was not possible to use the Defense Production Act (DPA) for this study as it expired in March 1992, and has not been re-enacted by Congress.

The use of questionnaires to gather such information have proved ineffective. The information needed is considered proprietary, companies are reluctant to release such information without the DPA, requiring release of specific information if justified for Government purposes.

From published data, it is not possible to accurately determine overlap within the Bureau of the Census categories. As an example, a U.S.-manufactured component exported to a foreign source may be used in a subassembly. That subassembly is then imported to the

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[4] Dataquest Incorporated (DQ) specializes in market studies, research, and report writing in several telecommunications areas.

U.S. and then exported for use as a component in system-level equipment. The equipment is then imported to the U.S. for use by the customer. In this case the dollar value of the component has been included three times in the import/export data. Appendix D contains raw import data from an internal report produced by the U.S. Department of Commerce.

Sample responses from the two manufacturers surveyed follows. The manufacturers are referred to as Manufacturer A and Manufacturer B.

4.2.1 Manufacturer A

KEY:

E/M Electromechanical

Mech Mechanical

Int InterConnect

QUESTIONS

1. Of the assemblies and subassemblies identified in the block diagram, what percentage are manufactured by foreign sources?

   E/M 60-70%

   Mech 1%

   Int 10%

2. What percentage of the components in the subassemblies are manufactured by foreign sources?

   E/M 50-60%

   Mech 2%

   Int 40%

3. What percentage of the components and subassemblies are designed by foreign sources

   E/M components - 70-90% sub-assemblies - 0%

   Mech none

   Int 0%

4. What percentage of the subassemblies are assembled offshore?

   E/M sub-assemblies - 10-15% silicon - 70-80%

   Mech none

   Int none

5. In your estimation, how would the unavailability of foreign component and subassembly design affect your company's ability to continue to produce and maintain the switch equipment under consideration?

   E/M Impact up front 12-16 weeks - provided parts could be established domestically. Severely impacted for memory devices due to inability to obtain sufficient memory devices.

   Mech Little or no impact

   Int Significant short-term availability problem and long-term cost

6. Could you identify alternative sources for the identified subassemblies that would sustain production? Do North American suppliers exist?

   E/M yes

   Mech yes

   Int yes

7. In your estimation, how would the unavailability of foreign sourced materials and components for these types of equipment constrain or impair the telecommunications industry's ability to mobilize and/or sustain a long-term (beyond six months) mobilization efforts?

   E/M Short-term impact: significant Long-term: minimal

   Mech none

   Int minimal impact

8. What would be the impact to Said Manufacturer if the supply of consumables were cut off? Consumables would include (as an example):

   Solder Paste great impact

   Fiberglass and ceramics minimal impact

   Connectors (copper/gold) great impact; in-house capability

   Adhesives great impact; short-term only

9. What impact does/would foreign source dependency have on the following business and financial operations:

Just-in-time policy	more inventory and difficult to maintain; cost issue
Warehousing policy	more inventory and cost increase
Warehousing locations	no impact (E/M, Mech), possible increase
Leadtime requirements	longer leadtimes

10. What, if any, assemblies, subassemblies, or components should not be foreign sourced under any circumstances?

    None; all proprietary components manufactured internally

11. Other comments or suggestions (i.e., what other important aspects or dimensions of the dependence on foreign sources issue should be addressed by the joint ITS/DQ study group?)

    ICs Memory; Ferrite Cores - Magnetics

12. Are there identifiable trends toward greater or lesser reliance on foreign sources?

    E/M No; foreign or domestic suppliers are not the sole criteria for making buying decisions - cost reasons usually prevail

    Mech greater for cost reasons

    Int greater for cost reasons

4.2.2 Manufacturer B

1. Of the assemblies and subassemblies identified in the block diagram, what percentage are manufactured by foreign sources?

   Reply: The percent of foreign dependency for assemblies and subassemblies is less than 1%. The only significant assemblies which are not multiple sourced through U.S.A. manufacturing sites are Seagate Disk Drives (100% Singapore), Cooling Fans (Pabst, 80% Germany; Rotron, 20% Mexico), Cable Assemblies (80% Mexico).

2. What percentage of the components in the subassemblies are manufactured by foreign sources?

   Reply: Based on economic content, approximately 4.7% of the systems value is attributed to components from foreign

sources. This is made up of U.S.A. suppliers with off-shore factories and U.S. affiliates of foreign suppliers using some or all manufacturing off-shore.

3. What percentage of the components and subassemblies are designed by foreign sources?

   Reply: Design of system subassemblies are controlled by U.S.A. based R&D organizations. We do not have visibility into the percentage of off-shore produced discrete components as to which components are procured from U.S. based sources that have assembly and test facilities off-shore, we believe the percentage may be extremely small. Lastly, 1.5 % of the system value is purchased integrated circuits (ICs) which have foreign design sources.

4. What percentage of the subassemblies are assembled offshore?

   Reply: The major subassemblies which are assembled off-shore are:

Disk Drives	100%
Cooling Fans	100%
Cable Assemblies	80%

   Assembly capability is duplicated in U.S.A. facilities but needs expansion.

5. In your estimation, how would the unavailability of foreign component and subassembly design affect your company's ability to continue to produce and maintain the switch equipment under consideration?

   Reply: Lack of sub-assembly design from foreign sources would have no effect on the system. Unavailability of off-shore components would impair our ability to produce and/or maintain the system. This is especially true for select discrete semiconductor and dynamic memory ICs.

6. Could you identify alternative sources for the identified subassemblies that would sustain production? Do North American suppliers exist?

   Reply: Alternate sources exist for most components, disk drives, cooling fans, cables, and ICs. North American suppliers also exist with the exception of select discrete semiconductors and limited IC volume capabilities.

7. In your estimation, how would the unavailability of foreign-sourced materials and components for these types of equipment constrain or impair the telecom-

munications industry's ability to mobilize and/or sustain a long-term (beyond six months) mobilization efforts?

Reply: Generally we perceive that there is adequate worldwide capacity of most components to sustain system manufacturing. However, if there are specific restrictions by country, technology, etc., it may take considerable resources to develop domestic capability.

8. What would be the impact to Said Manufacturer if the supply of consumables were cut off? Consumables would include (as an example):

Solder Paste

Fiberglass and ceramics

Connectors (copper/gold)

Adhesives

Reply: Since all consumables are obtained from U.S.A. sources, there would be no negative impact to our company.

9. What impact does/would foreign source dependency have on the following business and financial operations:

Just-in-time (JIT) policy

Warehousing policy

Warehousing locations

Leadtime requirements

Reply: JIT with foreign sourced is not validated for ICs. Other material impact is none.

10. What, if any, assemblies, subassemblies or components should not be foreign sourced under any circumstances?

Reply: None

11. Other comments or suggestions (i.e., what other important aspects or dimensions of the dependence on foreign sources issues should be addressed by the ITS study?)

Reply: There is a specific issue related to Mexican manufacturing relying on and/or resourcing with Asian sources. One of the latest developments in the North American Free Trade Agreement (NAFTA) negotiations is a proposed tariff of up to 20 percent on components/sub-assemblies imported into

Mexico from Asian sources. This issue must be monitored very closely to assure flexible alternative sourcing is maintained.

12. Are there identifiable trends toward greater or lesser reliance on foreign sources?

    Reply: The trend has been to procure material globally from multiple sources. This strategy is enforced to minimize sole source reliance and support our customer's need for low-cost high-reliability products.

A portion of the results, obtained from data gathered during this survey, is summarized in Figure 3. The actual proportion for each segment of the graph will vary for each company. The foreign source dependence discovered in this study is concentrated in the "Pacific Rim" area, as noted in the sample replies from the manufacturers shown above.

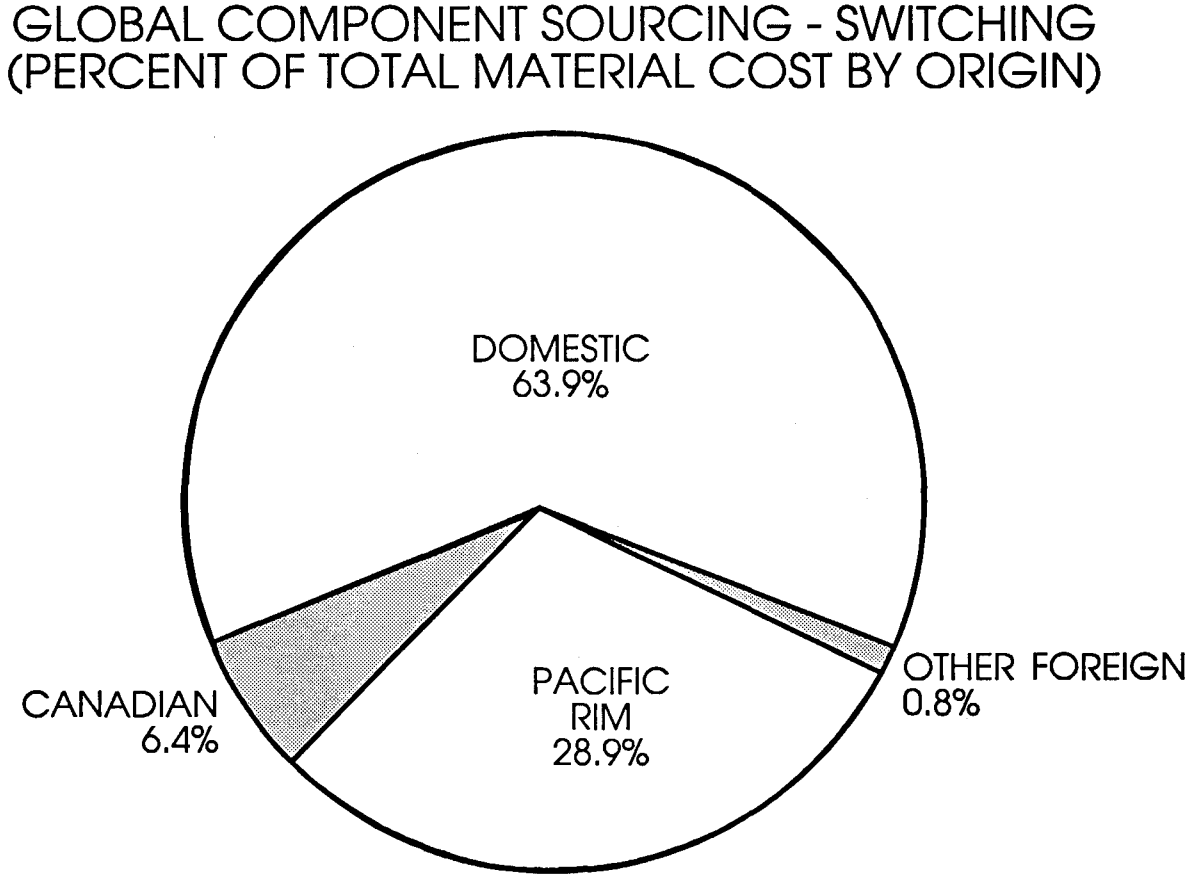

Figure 3. A global source analysis for Class 5 switch equipment.

4.3 Phase III–Identification and Prioritization of Vulnerabilities

The primary thrust of this report is mobilization rather than the trade or economic implications of foreign dependency, however, several of the responses have served to emphasize the strong and complex interrelationships between telecommunications industry economics and foreign sourcing. For example, one reason U.S. companies buy from foreign and domestic sources is price advantage. The competition among several foreign and domestic sources for the same market tends to minimize the cost of fielding new facilities and capabilities. The stimulation of technological development by the diverse foreign competition was also mentioned by the companies interviewed.

The identification of components, subassemblies, and consumables used to manufacture the Class 5 central office switch equipment does not indicate a problem--only a possible problem. If world conditions (e.g., a natural disaster, a hostile action, or a political action) should exist that cut off supply of one or more of the predominately foreign-sourced items, a problem may exist. In some cases, an immediate U.S. source may be available--but, probably at a cost penalty. This report will point out those items (components, subassemblies, consumables, and technology) that can be identified as predominately foreign sourced by at least one company. Some items are clearly foreign sourced by one company, but primarily U.S.-sourced by another company.

4.4 Study Limitations

The data obtained by this study is limited in two distinct ways: in its accuracy over time and by the quantity of manufacturers polled. The information obtained from the manufacturers changes quickly based on several national and international factors, some of which include foreign trade policy, economic issues (both national and manufacturer based), technology, etc. It is necessary to collect and assess data on a periodic basis to be accurate. This study is a pilot project, intended to develop an assessment mechanism. The study limited the number of manufacturers and the area of study. Although the number of manufacturers visited was limited in number, the data is representative of the industry.

Despite these limitations, we believe the study contains significant and valuable information. It is representative of the manufacturer's viewpoint. In some cases, the facts received from two different sources within the same company are in conflict--requiring a judgement of the quality of the source of communication within the company. The ITS staff feels that some company representatives were not in a position to supply the "whole story," thus the difference in responses from sources within the same company.

Data available from Government reporting points is rarely in the form that can be used to extract foreign source dependence data. The coding is such that one cannot separate data in a way that will allow an analysis of a specific telecommunications equipment, or a more narrow hardware classification.

Frequently the data that is periodically published by Government agencies is in the publication process so long that the information in the report is two years old by the time the report is available. The telecommunications technology is a fast paced industry, with technology turn-over of 1 to 2 years. If the data compiled is two years old when available, one is hard pressed to make corrections in strategy using data that has been overcome by time.

The information required to determine foreign source dependence is very guarded (frequently considered proprietary) by most of the companies. Data collected for a specific purpose is often limited by the resources available to perform the collection of data. The data limitations can lead one to arrive at a false conclusion—and frequently the information is interpreted wrongly. Instances like this cause the companies to be reluctant to release information unless they can derive benefit from furnishing the information.

The analysis that is the basis for this report is by no means an exhaustive assessment of all foreign source dependencies for all manufacturers of Class 5 central office switches. ITS did not collect data from all manufacturers of Class 5 switches—only U.S./Canadian manufacturers. This is, however, the first time that data specific to the Class S switch has been collected. The data required for this study was not available as a published report from the manufacturer; however, each manufacturer offered to collect the data necessary for the analysis.

5. A MECHANISM TO ASSESS FOREIGN DEPENDENCE

Any study must be guided by a systematic approach that is designed to fulfill the goals of the task. The staff at ITS has taken a research-oriented approach for this task. The approach was designed to be flexible so that it could be modified and redirected as necessary to achieve the objectives of the study.

5.1 Purpose of the Assessment Mechanism

The approach used by the ITS staff is designed to overcome the reluctance of the companies to release information that, in some cases, is considered to be company proprietary. Justification of the need for the information and the building of credibility with the company representatives is the key to the success of this effort. The company representatives must be convinced that the Government is not just doing another "frivolous" study.

5.2 The Assessment Mechanism

The Assessment Mechanism requires face-to-face conversation with appropriate representatives of the company in question. The questions asked during the visit (1) are of a nature that generates fruitful discussion of the problem, (2) are not too specific, (3) will

result in continued involvement from the company, and (4) are of a nature that result in real and intelligible conclusions with limited statistical information.

5.3 The Reasons for Use of This Assessment Mechanism

Statistics are not meaningful and appropriate unless the conditions under which they are compiled are specified in a way to discover specific results. For example, the use of the data compiled for this study for any other purpose is dangerous without a complete understanding of the data. Collections of general types of statistical data are compiled annually by several Government Agencies [e.g., Bureau of the Census, Department of Labor Statistics (BLS), the National Agriculture Statistical Service, and others] in an attempt to provide the Nation with data that can be used to measure the economy [e.g., the Gross National Product (GNP), replaced recently by the Gross Domestic Product (GDP)], the size and variance of the labor force (e.g., the unemployment rate), and more specific items [e.g., the U.S. Department of Agriculture (USDA) assessment of crop yield]. The use of this data for those specific needs is appropriate; however, this data may not be appropriate for other purposes.

Current sampling techniques used by the Government are limited by the meager budgets for compiling data (Appendix E; Kaminow, 1992); frequently yielding inaccurate results. In addition, the Paperwork Reduction Act limits the number of inquiries that can be made by mail to nine and only about one half of those will respond. This situation suggests a more directed approach such as the one used for this study. Dr. Kaminow also states that response to Government surveys is declining; perhaps due to fatigue in filling out Government forms, or a revolt against Government intrusion, or an effort by businesses to cut costs.

Telecommunications manufacturing is complex and rapidly changing. By the time information is gathered and processed it is most likely out of date. Statistics lose meaning and become convoluted when you consider the assumptions used in developing the statistics. Respondents to questionnaires make assumptions as to the scope of a question when answering the question.

The respondent to a survey or questionnaire may decline to answer the inquiry, therefore deselecting their input and skewing the results. The Government discourages the use of the Defense Production Act of 1950 that can require a company to participate in a Government survey, under certain circumstances.

The ITS staff decided at the conclusion of Phase I of this study that the data required to perform this analysis is not available from any statistical source. A 1989 report written by the Office of Technology Assessment supports this observation (Appendix E; Kaminow, 1992). Based upon the limited tools available to collect the data, the ITS staff selected a research oriented approach for the study. The reason for the study can be explained to each respondent, in an attempt to obtain specific information that would be helpful in understanding the foreign source vulnerabilities within the telecommunications manufacturing infrastructure.

5.4 Factors That Affect the Assessment Mechanism

The gathering of proprietary data from manufacturers is a delicate process. The researcher's credibility must be established with the source, when marketing the needs of the Government. A justification of need for the information is based primarily upon the benefits to the Nation.

The following are summaries of discussions with manufacturers of Class 5 switches. This report does not propose to be exhaustive with respect to all switch manufacturers, as only a limited number of manufacturers (only U.S. major manufacturers of Class 5 switches) were interviewed for this pilot project.

Technical expertise. It is necessary that the interviewer have a technical background—preferably in the telecommunications field. The technical knowledge is helpful in collecting the appropriate information by asking the correct questions and conversing, in depth, about the technical aspects of the manufacturer's product.

Establishment of rapport. A research-oriented approach proved to be necessary in obtaining reliable, useful, and timely information. The use of questionnaires or surveys was not fruitful in obtaining this information, primarily because the companies consider the information sensitive. The Defense Production Act (DPA) of 1950 had expired on March 1, 1992 and was inactive during this study. The DPA allows the Government to require a full response to questions under certain circumstances. The approach began by making contact by telephone with personnel who were directly concerned with U.S. Government procurements to obtain a referral to the appropriate person within the organization who could provide the necessary information. An on-site visit was made to build a rapport with that person and their staff after a set of sample questions was transmitted to the company. In a face-to-face meeting with the manufacturer representatives, up-to-date and accurate information was imparted, and an understanding was gained of the "real" foreign dependency issues faced by the manufacturer.

Information volatility. Foreign dependency information associated with areas of high technology is quite volatile. It is difficult to determine the stability of a sourcing situation—in some cases the sourcing of a particular component may be in a "transition state," i.e., a foreign-sourced component may now be available in the U.S ., or a technology turnover may obsolete a component that is foreign sourced. For example, the replacement of plastic coated relays with solid state relays; a transition that is on the horizon.

Availability of accurate information. Statistical data, published in periodic reports by the Government [e.g., The Bureau of the Census, DoC International Trade Administration (ITA), DoC Bureau of Export Administration (BXA)], cannot be segregated to obtain specific information about the telecommunications industry. Appendix A contains a sample of the global data that is available from The Bureau of the Census.

Currently, the Government-published information is obtained using a global type of gathering mechanism (i.e., questionnaire or request), and reports only end-user products.

The component makeup of each telecommunications product is not reported by anyone in the Government or industry. Private-held companies in the U.S. specialize in data analysis that is directed toward a specific use, e.g., gauging the size of a particular market either within the U.S. or a specific area of the world (e.g., the Pacific Rim, the European Community, South America). Numerous reports are available; however, none of them are of value in determining the source of components used to build any of the equipment integral to the U.S. NS/EP telecommunications networks. "Statistical Stagnation" is the title of a candid analysis of the limitations of statistical programs that are funded by the U.S. Government (Appendix E; Kaminow, 1992).

6. FINDINGS

The components that are sourced primarily from foreign sources were found to be the same for all manufacturers. There are cases where a U.S. manufacturer is dependent on the components from foreign sources due to lack of implementation of a particular technology in the U.S. However, only very isolated cases exist where there are no suppliers of a component or subassembly in the U.S.

U.S. companies are capable in the high-tech arena, and are used as sources for components during the prototype development of a product. However, when a company is looking for a source for procurement of larger numbers of these components, the U.S. supplier is frequently not competitive. The result is that a foreign supplier becomes the source for high-volume supply of some components. The good news in this scenario is that if the foreign supplier is no longer available for some reason, the U.S. supplier can be used as a source—of course, at a cost penalty.

This report lists the components that were designated as primarily foreign sourced by the manufacturers interviewed. The effort to determine the availability of sufficient U.S. capability to provide those components was not a part of the tasking for this study.

6.1 The Erosion of Technology

The U.S. is not as competitive in production of products using emerging technologies, resulting in a predominance of foreign sources for high-end components. These areas include large capacity DRAMs, and RISC technology, narrow line width photolithography, and flat panel displays (Heginbotham et al; 1990). For the most part, U.S. organizations developed these technologies, and foreign companies have applied the technologies and have subsequently developed the process for high-volume production.

The DoD is concerned about the competitiveness of the U.S. with respect to the commercial technology base at a time when the DoD is more reliant on commercial off-the-shelf components and technologies (Appendix F; Van Atta and White, 1992).

The DoC has put in place procedures and personnel to support the DoD in times of NS/EP mobilization situations. Their implementation procedure has been upgraded and further

defined as reported in a recent "white paper" (see Appendix G) in response to a request from the TIM Group. This paper describes the manner in which DoC will use the Defense and Priorities Allocations System (DPAS) as a vehicle for resolution of provisioning conflicts under national security emergency conditions.

A DoC report (DoC, 1990) suggests that the U.S. lags behind Japan in putting in practice most emerging technologies and trails the European Community (EC) in several of them. It is not the intent of the authors of this report to concentrate on the reasons for the lag in development of the emerging technologies or the technology drain from the U.S. Choate provides a discussion of possible reasons for the trend in his book (Choate, 1991).

6.2 The Class 5 Switch Equipment

When analyzing the Class 5 Switch, it was found that there is foreign source dependency on

- Semiconductors (only some types of memory devices),
- Printed circuit board (PCB) mounted transformers,
- PCB assemblies (circuit cards),
- Bare PCBs (substrate),
- Plastic-coated relays,
- Ceramic packages, and
- Ferrites.

Semiconductors. The foreign source dependence for semiconductors varies with the type of device. In mid 1992, when this study was completed, volume shipments of Application Specific Integrated Circuits (ASICs), microprocessors, and memory devices up to 1 Mbit were readily available from U.S. manufacturers at competitive prices. Memory devices with larger than 1 Mbit storage capacity were primarily sourced from outside the U.S. However, U.S. manufacturers are able to produce devices with capacities of 4 Mbits and larger in prototype quantities. It is uncertain who has the lead in the 256 Mbit memory chip race (Appendix E; Pollack, 1992). Japan is a primary supplier of microcontrollers used for automobile antilock brake systems and air bags actuators (conversation with a representative of the DoC International Trade Administration).

PCB mounted transformers. There is near 100-percent dependency on foreign sources for PCB mounted transformers. The assembly of these components is very labor-intensive, thus countries with significantly lower labor rates are able to produce the PCB mounted transformer, in volume quantities, at a lower cost.

Plastic coated relays. The plastic block (encapsulated) packaged relay replaces the older version commonly called a "reed relay." At present, all U.S. manufacturers of the Class 5 switch state that they are purchasing nearly 100 percent of their relays from the Pacific Rim countries.

Bare PCB substrate. A slightly less than 100-percent dependence on foreign sources was noted for PCB substrates (fiberglass material). U.S. manufacturers are capable of producing this material in quantity. No explanation was discovered that would explain the reason that U.S. companies cannot compete.

Ferrites. Ferrite cores (used for transformers, ferrite beads, and noise blocking devices).

Ceramic packages. This type of package is used for ruggedized semiconductor devices used in high-reliability applications. There is recent concern by U.S. manufacturers that the U.S. military is dependent on foreign sources of ceramic packages (Appendix E; Leopold, 1992).

PCB assemblies. The foreign sourcing of PCB assemblies is a result of the use of contractors (or manufacturing plants) outside the U.S. to perform the assembly and test of the PCB subassemblies that become components of the Class 5 switch.

6.3 The Class 5 Switch Manufacturing Process

The manufacturing process used to produce the Class 5 switch equipment consists of the manual and automatic equipment used to assemble and test the hardware, and the consumables used in the process. These items are integral to the capability of the Class 5 switch manufacturer to produce product at a competitive price. In fact, without the automated assembly and test equipment, most manufacturers would not be able to produce any significant quantities of product.

The analysis of manufacturing equipment (i.e., equipment used to assemble and test basic subassemblies of the Class 5 Switch assemblies) noted some dependence on foreign-source conveyors, robotics, test equipment, surface mount technology (SMT) PCB process equipment, certain machine tools, and photolithography equipment (required to manufacture microelectronic chips). The technology necessary for design and use of these equipments is typically U.S. developed, but in some cases the actual manufacturing and implementation of the technology takes place in other countries.

The manufacturing process is dependent on certain consumable materials (i.e., solvents, adhesives, paper products, plastics, specially formulated compounds, and raw materials). The specific items found to be dependent on foreign sources included solder paste, raw silicon ingots, adhesives, gold/silver/copper coated connectors and contacts, copper wire, aluminum, gallium arsenide, and filter glass.

6.4 Other Related Findings

Some foreign-sourced items, identified in Section 7 (e.g., some types of consumables, raw materials, and precious metals), can be critical to the manufacturing process of other items within the telecommunications infrastructure. For example, components such as copper wire, aluminum cable sheath, telephone poles, dies used to color parts within the cable, and the polyethylene used for the cable sheath, all require foreign-sourced raw materials. The manufacturing process for many of the components listed above is dependent on raw materials that are petrochemical based. For example, petrochemicals are used to formulate the creosote used to treat (to retard decay of the wood) telephone poles. Zinc is an important raw material required in the process of galvanizing the mounting hardware used to assemble a telephone pole assembly and attach cable to the pole.

An item as simple as a telephone pole can be a "show stopper." A recent example illustrates this point: the Regional Bell Operating Companies (RBOCs) providing service in the geographic area affected during Hurricane Hugo (along the East Coast in 1990) experienced shortages of telephone poles and the associated hardware. The hurricane traversed through three RBOCs as it passed up the coast. The first RBOC that was hit placed replenishment orders for telephone poles, depleting the supply. Subsequent orders to suppliers required production of more poles, resulting in a depletion of the creosote used to treat the poles. As the chain of events progressed, the resulting shortage was that of petrochemicals to manufacture the creosote. This story illustrates the complexity of the supply chain and the difficulty in identifying possible foreign source problems.

7. SUMMARY OF DEPENDENCIES

This study is an analysis of U.S. dependence on foreign components, assemblies, and subassemblies used to manufacture the Class 5 telecommunications switch. The analysis of data collected from the various manufacturers during this study is collated and presented in summary here. The information is not identified with a particular manufacturer for reasons of confidentiality. In separating the data from its source we are able to provide a more clear picture of foreign dependencies and the reasoning for the dependence based on the manufacturer's perspective.

In general, the dependency, as a total dollar value of components, is not getting any worse (Figure 4). However, several isolated components continue to present a foreign source vulnerability as shown below.

An analysis of the semiconductor market is shown in Figure 5. The penetration of U.S. companies in the Japanese market is slightly lower than the reverse, the penetration of Japanese companies in the U.S. market. The problem is not evident until one discovers that the difference is primarily in the emerging technologies area (i.e., the high-end memory and some types of microelectronic devices).

The foreign-source dependencies are classified in two categories, noting the components that are predominantly (over 50 percent) supplied by foreign sources to at least one

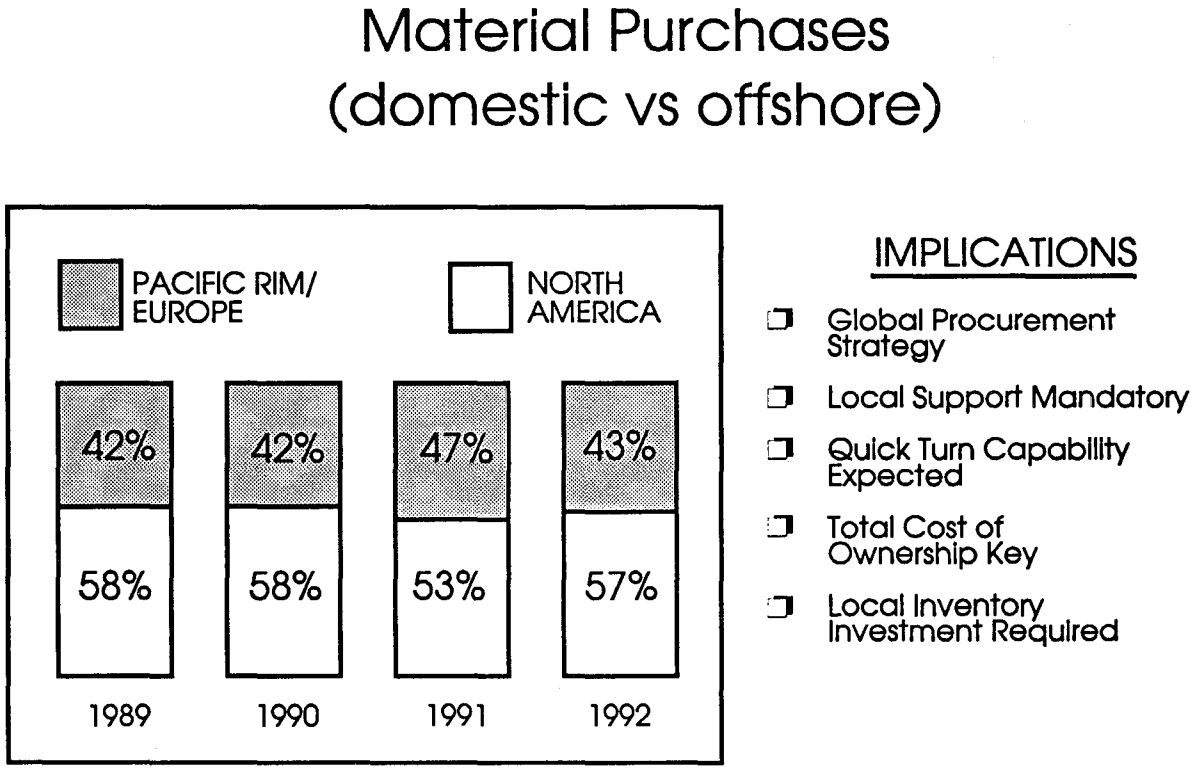

Figure 4. Material purchase source trend analysis for Class 5 telecommunication switch equipment.

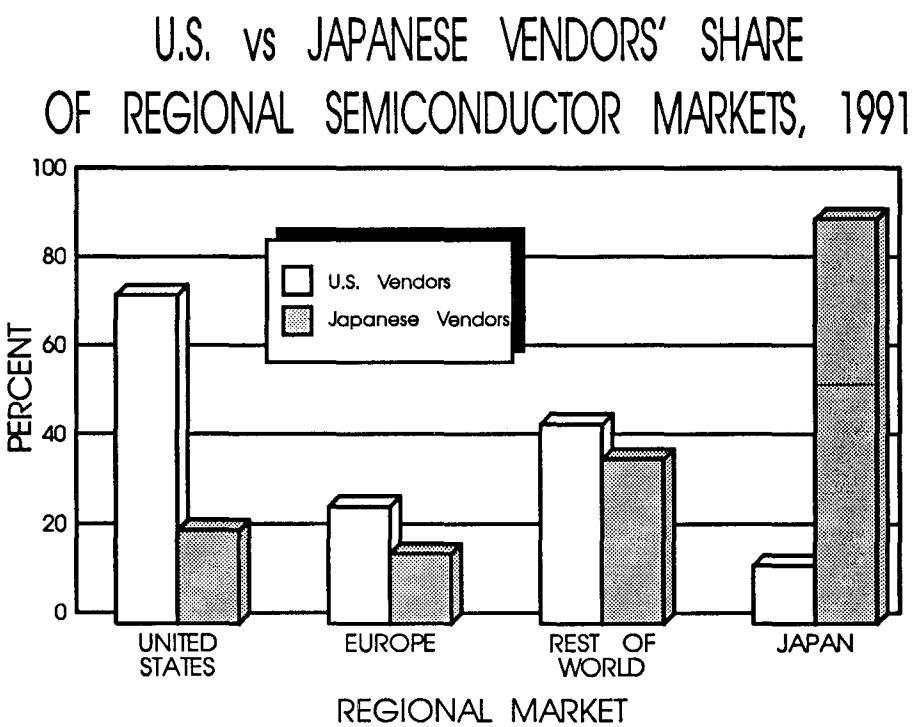

Figure 5. U.S. vs Japanese penetration of various makers.

manufacturer. In some cases, a manufacturer may own a subsidiary or division that manufactures a component "in house" while a competitor must procure from outside the U.S. An attempt was made to list the components below in a descending order of percent of volume from foreign sources.

Category 1--Foreign dependency on Class 5 switch equipment components

a. Printed circuit board (PCB) mounted transformers

b. Plastic coated relays

c. PCB assemblies

d. Ceramic packages used for ruggedized semiconductor components

e. Bare PCBs (fiberglass substrate)

f. Ferrite products

g. Semiconductors (high-capacity memory chips and microcontrollers).

Category 2--Foreign sourcing of materials and technology used in the manufacturing process for the Class 5 switch

a. Consumables (petrochemical-based items such as solvents, solder paste, adhesives, etc.)

b. Raw Silicon (silicon ingots or wafers)

c. Manufacturing Process Equipment (primarily for the microelectronic manufacturing process)

d. Photolithography Equipment and Technology

e. Metals (such as copper, aluminum, gold, silver, and zinc).

7.1 Factors That Affect Levels of Foreign Dependence

Foreign source dependencies in the areas discussed in this study are generally a result of a U.S. company's inability to compete with foreign companies. The answer is not obvious. However, some of the experts contend that U.S. companies, Pacific Rim companies, and European companies are competing on an "uneven playing field." A conspectus of the reasons why U.S. companies are not able to compete follows.

Technology outflow. Commonly referred to as "technology giveaway." A number of examples can be cited illustrating the acquisition of technology by organizations outside the U.S., resulting in a loss of technology and subsequently a loss in the U.S. lead in the system level technology development. A study completed by the Institute for Defense Analyses (IDA) in 1990 (Heginbotham et al; 1990) summarizes the situation very well. The

IDA report states that "dependence on foreign sources should be viewed less in terms of risk of potential foreign denial or disruption, and more in terms of risk of U.S. ability to remain in the lead in system development."

Environmental Protection Agency (EPA) requirements. Many of the countries that are competing successfully (offering components at lower cost) do not have the same restrictions on procedures such as toxic waste disposal, disposal of solvents and other chemicals, safety of employees, etc. that inflate the overhead of doing business in the U.S. The additional overhead must be reflected in the cost to produce the product (DoC, 1992).

Tax laws. Most companies operating in countries outside the U.S. are subject to more favorable tax depreciation limitations than companies in the U.S. For example, a U.S. manufacturer must depreciate a capitalized asset (in this case a factory production line) in no less than 7 years, and there is no Initial Tax Credit (ITC). A foreign counterpart (competitor) can depreciate the full capitalized asset value the first year (similar to a 100-percent ITC), or over whatever period provides the greatest tax benefit. The telecommunications equipment technology turnover (a combination of product technology enhancement and factory automation enhancement) is about 18 months, at present, requiring recapitalization of the production line every 18 months. As a result, the U.S. manufacturer is not able to take full advantage of the depreciation tax benefit.

A similar situation exists for the user of telecommunications equipment (e.g., a Class 5 switch). A major feature turnover (similar to a technology turnover) or upgrade is necessary on a 4- to 6-year cycle. The user is obliged to upgrade to keep up with the latest technology, and remain competitive. Tax law allows the user to depreciate the equipment over no less than 15 years. Recapitalization is required at every major upgrade (major expenditure), or every 4 to 6 years. The end user is in a similar predicament to that of the factory; the full advantage of tax depreciation cannot be realized.

The "hot toy" problem. Commercial products have become increasingly more "high-tech," and frequently use the same type of electronic devices [e.g., microprocessors, memory chips, digital signal processors (DSPs), and displays] that are used in the latest technology telecommunications equipment. Manufacturers of these products compete for the supply (and inventory) of these devices throughout the year. Usually distributors and manufacturers of these devices can factor in the inventory required to supply all of the demand requirements. However, at certain times of the year the demand for these devices is increased to meet the seasonal requirements—for example, during the late summer the decisions are made as to which toys and other commercial products will be "hot items" during the holiday shopping period (December-January). Inventories during this period become very low, or in some cases, may be depleted. If a sudden demand, due to a disaster or hostile activity, for more telecommunications equipment or spare parts coincides with the "hot toy" manufacturing period, the telecommunication production requirement may not be met. Certain manufacturers have stated that their manufacturing process has been affected by a "glitch" of this type in the supply system.

8. CONCLUSIONS

The objectives of this report were developed in response to the NS/EP needs of the Government, including NS/EP telecommunications equipment provisioning, and the resolution of any provisioning conflicts. A significant percentage of dependence on foreign sources, for any component or subassembly, has been identified by the NSTAC to be an area of possible provisioning conflict. The authors of this report recognize that national security emergencies can be vastly different in terms of scope and magnitude. Some may place an intense, short-term demand on a few production sectors while others may require a major mobilization of the entire U.S. economy. Defining the situations relative to the causes for mobilization is not included in the tasking for this study.

The objectives, as defined by the tasking for this study, were twofold: (1) Develop an assessment of the current state of foreign source dependence within the telecommunications manufacturing area, and (2) develop an assessment mechanism that could be used for a periodic update of foreign source dependence. The general conclusions that have been developed, as a result of this study, are presented in the context of the two objectives as follows.

Objective 1--Status of Foreign Source Dependence. When compared to the result of the 1987 report (NCS, 1987), the results of this study can be summarized as stated below:

- The level of dependence on semiconductors from foreign sources to manufacture high-end (i.e., Class 5 switch systems) telecommunications equipment has diminished. U.S. manufacturers have the capability to manufacturer all types of microelectronic devices (i.e., memory devices, ASICs, microprocessors, microcontrollers, etc.) in prototype quantities. However, the Pacific Rim countries continue to supply a larger share of the large-capacity memory devices and microcontrollers.

- In most cases, there are U.S. companies that have the capability to manufacture all of the stated foreign source dependent components; however, they are not currently competitive in supply of volume quantities of these components.

- The dependence on consumables, or the raw materials to manufacture them, is an area that wasn't completely analyzed in this study. Preliminary studies show that some of these items are dependent upon the supply of petrochemicals from outside the U.S. A more in-depth study of this problem is needed.

- The market in which our telecommunications companies are working is becoming global. U.S. suppliers are pursuing partnerships and agreements with foreign entities, making it impossible to recognize whether one is dealing with a U.S. or a foreign company. Figure 6 illustrates, in a simple way, the merging of U.S. and foreign organizations to form a global market. This trend is most prevalent in the semiconductor market, especially for high-end microelectronic devices. This trend will mitigate the risk of a semiconductor foreign source dependence problem.

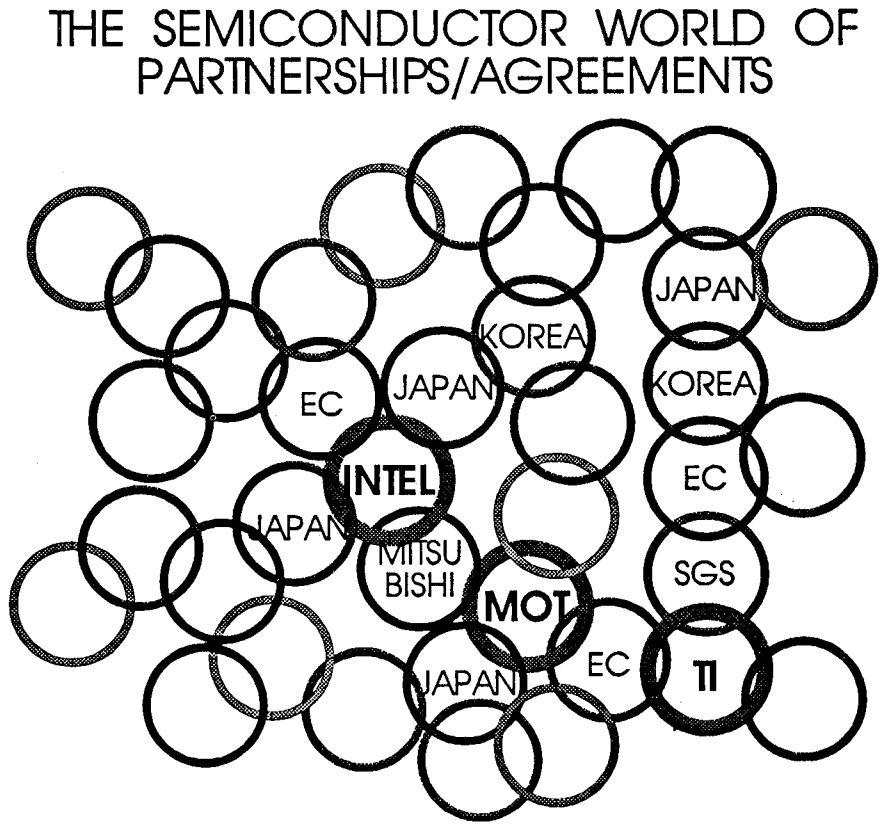

Figure 6. The semiconductor company global alliances.

Objective 2--The Assessment Mechanism. The authors of this study have concluded that the mechanism used to perform this analysis is a successful method to perform the assessment of dependence on foreign sources. The success is attributed to the following factors:

- A research-oriented approach was used to obtain the raw information. An in-depth understanding of the company's process and the telecommunications equipment is necessary to determine which items are truly dependent on foreign sources and why. The transfer of information was done face-to-face, rather than solely via a survey or questionnaire. A technical understanding is important, so that during the interview of the manufacturer's representatives, an in-depth discussion can take place concerning technical aspects of the product hardware. A structured approach is necessary when interviewing the company representatives. The representatives were furnished with advance information about the visit (i.e., a set of questions to introduce them to the kind of information desired). This technique ensured that the appropriate personnel were made available during the on-site visit.

- Companies released guarded information. A typical telephone survey or mail survey of industry is not effective in identifying true item dependency. Procurement information is considered sensitive, and for some companies, company proprietary because the knowledge of this information by a competitor

could compromise their position in the marketplace. Face-to-face interviews with industry representatives allows the researcher to explain the benefits of the foreign dependence study to the Nation, and to build a rapport with the company personnel (by demonstrating a knowledge of their product, their company, and a concern for the country). The confrontation usually results in release of information that would otherwise not be made available. The research process can be a very complex and delicate process.

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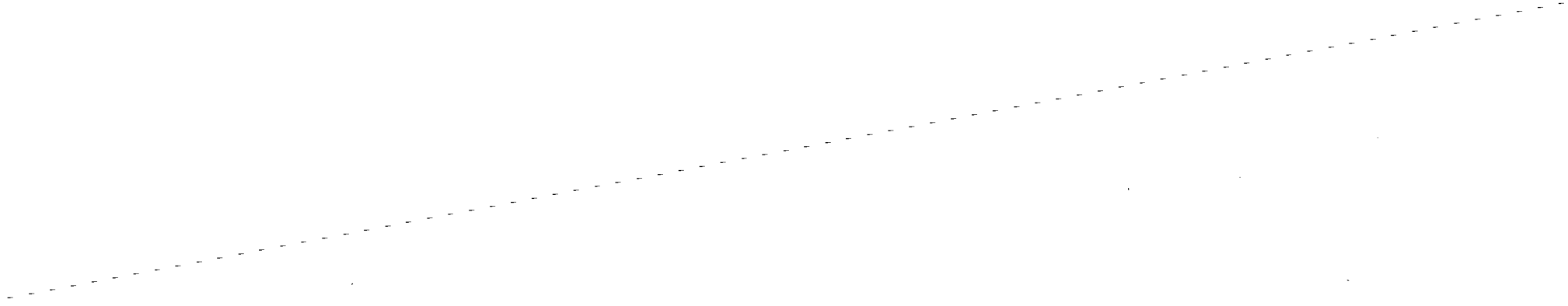
APPENDIX A

Bureau of the Census Report

Communications Equipment, and Other Electronic Systems and Equipment

MA36P(90)–1, 1990

U.S. Department of Commerce
Bureau of the Census
Industry Division
Washington, DC, 20233
(303) 763–5194



Communication Equipment, and Other Electronic Systems and Equipment

U.S. Department of Commerce
Economics and Statistics Administration
BUREAU OF THE CENSUS

1990

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SUMMARY OF FINDINGS

During 1990, shipments of communication equipment totaled $37,999.1 million, an increase of 3 percent from the 1989 figure of $36,941.7 million. Telephone switching switching switchboard equipment, totaled $7,551.0 million, an increase of 8 percent from the 1989 figure of $6,975.5 million. Other telephone and telegraph equipment in 1990 decreased 6 percent from the 1989 figure of 3,061.8 million.

Communication systems and equipment totaled $15,009.8 million, an increase of 7 percent over the 1989 figures of $14,016.3 million. Alarm systems totaled $1,019.4 million, an decrease of 10 percent from the 1989 figure of $1,132.5 million.

A description of the survey methodology and related information appears on page 11.

Table 1. VALUE OF SHIPMENTS OF COMMUNICATION EQUIPMENT, INCLUDING TELEPHONE, TELEGRAPH, AND OTHER ELECTRONIC SYSTEMS AND EQUIPMENT, BY CLASS OF PRODUCT: 1985 TO 1990

(Millions of unadjusted dollars)

Product code	Product description	1990	1989	1988	1987	1986	1985
	Communication equipment, including telephone, telegraph, and other electronic systems and equipment	[1] 37,999.1	[1] 36,941.7	[1] 36,193.9	66,765.9	63,486.4	61,124.5
36611	Telephone switching and switchboard equipment	7,551.0	6,975.5	7,399.7	7,367.1	7,180.0	7,714.3
36613	Carrier line equipment and modems	4,784.7	4,705.7	r5,589.0	5,011.6	4,062.2	8,348.1
36614	Other telephone and telegraph equipment and components	2,886.5	3,061.8	r3,066.5	3,507.8	3,891.1	
36631	Communication systems and equipment (excluding broadcast)	15,009.8	14,016.3	r12,213.0	11,692.4	11,216.5	10,708.0
36632	Broadcast, studio, and related electronic equipment	1,820.4	1,809.6	1,804.2	1,608.6	1,553.5	1,561.9
36691	Alarm systems	1,019.4	r1,132.5	1,164.7	1,235.0	1,028.2	1,114.3
38122	Search and detection systems and navigation and guidance systems and equipment	([1])	([1])	([1])	30,910.9	29,503.7	27,056.8
36692	Vehicular and pedestrian, traffic control systems and electric railway systems and attachments	470.0	451.1	r387.0	426.4	446.2	455.7
36693	Intercommunication systems	343.6	r367.8	r392.6	282.8	195.2	172.6
36991	Electronic teaching machines, teaching aids, trainers and similators	1,070.4	r1,359.6	r1,243.7	1,163.1	1,004.4	([2])
36992 pt.	Laser systems and equipment, except communication	885.8	915.6	r894.7	879.3	766.0	([2])
36995 pt.	Ultrasonic equipment	124.3	r137.7	101.3	93.5	136.5	([2])
36997[1]	Electronic systems and equipment n.e.c	1,482.1	1,398.1	r1,446.0	1,541.5	1,670.7	3,548.8
36998 pt.	Automatic garage door openers, electronic	261.4	252.3	264.6	232.7	202.9	184.4
39992 pt.	Electronic games, arcade and amusement center type	261.1	r335.6	r192.4	258.8	180.1	159.8
39447 pt.	Electronic games, home electronic type	28.6	22.5	r34.5	39.8	31.8	99.8
38295	Meteorological and geophysical electronic equipment	([1])	([1])	([1])	514.6	417.4	([3])

N.e.c. Not elsewhere classified. pt. Partial. rRevised by 5 percent or more from previously published figures.

[1] Product classes 38122, "Search, detection, navigation, and guidance systems and equipment," and 38295, "commercial, geophysical, meteorological, and general purpose instruments and equipment," are now collected on Current Industrial Report Series, MA38B, Selected Instruments and Related Products. Therefore, the 1988 total shown for communication equipment is not comparable to 1987 and earlier years.

[2] Prior to the 1987 SIC revision, product class data for product classes 36991, 36992 and 36995 were included in product class code 36997.

[3] Prior to the 1987 SIC revision, product class data for product class 38295 was included in product class code 38122.

Address inquiries concerning these figures to U.S. Department of Commerce, Bureau of the Census, Industry Division, Washington, D.C. 20233, or call Indrek Grabbi, (301) 763-5194.

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Table 2. QUANTITY AND VALUE OF SHIPMENTS OF COMMUNICATION EQUIPMENT, INCLUDING TELEPHONE, TELEGRAPH, AND OTHER ELECTRONIC SYSTEMS AND EQUIPMENT, BY CLASS OF PRODUCT: 1990 AND 1989

(Quantity in 1,000 units; value in thousands of dollars)

Product code	Product description	Number of companies	1990		1989	
			Quantity	Value	Quantity	Value
3661	Telephone and telegraph apparatus	(NA)	(X)	15,222,220	(X)	14,743,037
36611 —	Telephone switching and switchboard equipment	(NA)	(X)	7,551,013	(X)	6,975,501
	Private branch exchange equipment	(NA)	(X)	915,566	(X)	909,339
	Common carrier:					
36611 21	Manual	-	(X)	-	(X)	-
	Automatic	3				
36611 24	Electromechanical	-				
36611 27	Electronic	3				
	Private carrier:		(X)	915,566	(X)	r909,339
36611 31	Manual	1				
	Automatic	13				
36611 34	Electromechanical	2				
36611 37	Electronic	11				
	Telephone central office switching equipment	(NA)	(X)	4,652,070	(X)	4,439,159
	Local switching:					
36611 61	Manual	1				
36611 63	Electromechanical	1				
36611 65	Electronic	8	(X)	3,973,254	(X)	r3,924,775
36611 67	Specialized switching, including video, digital, and computer controlled	7				
	Toll switching:					
36611 71	Manual	-				
36611 73	Electromechanical	1	(X)	493,202	(X)	r374,281
36611 75	Electronic	3				
36611 77	Specialized switching, including video, digital, and computer controlled	3	(X)	185,614	(X)	140,103
36611 78	Other telephone switching and switchboard equipment n.e.c.	38	(X)	1,861,298	(X)	r1,570,657
36611 89	Parts, components, and subassemblies for telephone switching and switchboard equipment (shipped separately)	20	(X)	122,079	(X)	a r56,346
36613 —	Carrier line equipment and modems[1]	(NA)	(X)	4,784,669	(X)	4,705,744
	Carrier line equipment (office and line repeaters and line terminating carrier equipment)	(NA)	(X)	3,507,391	(X)	3,590,365
	Analog:					
36613 21	High-capacity	2	(X)	7,132	(X)	7,5/
36613 22	Low-capacity	4				
	Digital:					
36613 23	High-capacity	13	(X)	530,832	(X)	r405,029
36613 24	Low-capacity	10	(X)	127,624	(X)	r111,998
	Subscriber loop carrier (terminal and line equipment):					
36613 25	Digital	11	(X)	562,539	(X)	648,919
36613 26	Analog	7	(X)	60,123	(X)	r82,165
	Multiplex equipment:					
36613 30	Analog	9	(X)	247,999	(X)	r287,475
36613 32	Digital	31	(X)	1,971,142	(X)	r2,047,236
	Modems (data sets), including auxiliary sets[1]	(NA)	2,205,954	1,277,278	r1,956,102	1,115,379
36613 72	Up to 300 b/s	10	4,180	2,599	r8,227	r3,675
36613 74	301 to 2000 b/s	21	a286,405	a67,402	r357,509	r88,748
36613 76	2001 to 4800 b/s	30	1,267,659	308,679	r1,113,303	r336,111
36613 78	Over 4800 b/s	27	647,710	898,598	r477,063	686,845
36614 —	Other telephone and telegraph equipments and components	(NA)	(X)	2,886,538	(X)	3,061,792
	Telephone set	(NA)	(X)	223,275	(X)	345,684
36614 33	Pushbutton type (1,000 sets)	14	(D)	98,076	(D)	200,286
36614 35	Dial type (1,000 sets)	5				
36614 36	Cordless handset	-				
6614 39	Other (call directors, key sets, and special purpose)	14	5,482	125,199	a13,842	145,398
	Number of pay stations included in codes 36612 33, 36612 36, and 36612 39	3	(D)	(X)	(D)	(X)
	Number of video sets included in codes 36612 33, 36612 36, and 36612 39	-				
	Voice frequency equipment	(NA)	(X)	90,847	(X)	r90,177
36614 82	VF carrier telegraph	4	(X)	3,270	(X)	r5,369
36614 84	Signaling	10	(X)	b22,026	(X)	r20,111
36614 86	Facility equipment, including subscriber loop and repeaters	10	(X)	65,551	(X)	r64,697
36614 89	Telephone answering devices	8	(X)	31,227	(X)	33,888
36614 88	Telephone key systems	7	(X)	313,532	(X)	344,041
36614 91	Facsimile communication equipment	11	(X)	196,586	(X)	195,635
36614 96	Other telephone and telegraph equipment	80	(X)	1,516,898	(X)	1,505,487
36614 98	Parts, components, and subassemblies for other telephone and telephone and telegraph (wire) apparatus (shipped separately)	21	(X)	514,173	(X)	546,880

See footnotes at end of table.

Table 2. QUANTITY AND VALUE OF SHIPMENTS OF COMMUNICATION EQUIPMENT, INCLUDING TELEPHONE, TELEGRAPH, AND OTHER ELECTRONIC SYSTEMS AND EQUIPMENT, BY CLASS OF PRODUCT: 1990 AND 1989—Continued

(Quantity in 1,000 units; value in thousands of dollars)

oduct code	Product description	Number of companies	1990		1989	
			Quantity	Value	Quantity	Value
3663	Communication equipment	(NA)	(X)	16,830,168	(X)	15,825,924
36631 —	Communication systems and equipment, except broadcast	(NA)	(X)	15,009,786	(X)	14,016,318
	Transmitters, receivers, RF power amplifiers, and radio communications (point-to-point), except amateur and citizens radio, including all components whether shipped as a complete package or shipped separately	(NA)	(X)	2,114,822	(X)	1,976,483
36631 01	VLF and LF (below 300 kHz)	15	(X)	89,713	(X)	127,294
36631 02	Medium and high frequency (300 kHz to 30 MHz)	31	(X)	263,967	(X)	239,213
36631 03	VHF and UHF (to 890 MHz)	54	(X)	1,194,229	(X)	1,010,341
36631 04	Microwave 890 to 1849 MHz	18	(X)	54,190	(X)	r87,736
36631 05	Microwave 1850 to 3699 MHz	12	(X)	29,030	(X)	34,613
36631 06	Microwave 3700 to 6424 MHz	12	(X)	179,301	(X)	166,538
36631 07	Microwave 6425 to 7899 MHz	7	(X)	b8,160	(X)	21,939
36631 08	Microwave 7900 MHz to 12.20 GHz	12	(X)	53,930	(X)	60,699
36631 09	Microwave 13.25 to 19.59 GHz	11	(X)	199,658	(X)	170,400
36631 11	Microwave 19.60 to 56.00 GHz	9	(X)	42,644	(X)	57,710
	Light communications systems and equipment electronic	(NA)	(X)	1,005,645	(X)	772,476
36631 13	Fiber optic systems and equipment	33	(X)	1,005,645	(X)	772,476
36631 14	Other light communication systems and equipment, including laser communication systems and equipment and infrared equipment	9				
	Carrier equipment, not elsewhere classified:					
36631 36	Voice channel multiplex for radio systems	13	(X)	148,687	(X)	r186,621
36631 37	Power line carrier equipment	3				
36631 38	Space satellite communication systems	44	(X)	2,545,462	(X)	2,465,001
36631 39	Telemetering systems and equipment n.e.c., sold separately	25	(X)	204,303	(X)	221,284
	Mobile radio systems, sold as complete package, including transceivers power amplifiers, antennae, repeaters, transmitters, receivers, etc., except amateur and citizens radio equipment:					
36631 49	Airborne and marine	6	219,887	25,870	224,004	30,004
36631 51	Ground	15	21,642,934	1,223,510	21,287,382	1,006,545
	Mobile base stations, transmit/receive, except amateur and citizens radio equipment:					
31 52	Air	2	(X)	827,747	(X)	919,277
o31 54	Marine	1				
36631 56	Ground	10				
	Mobile vehicular, transmit/receive package, except amateur and citizen radio equipment:					
36631 62	Airborne	4	(X)	5,727	(X)	7,508
36631 64	Marine	2				
	Ground:					
36631 65	300 KHz to 30 MHz	4	(X)	185,556	(X)	r213,687
36631 67	30.00 to 72.98 MHz	4				
36631 66	72.99 to 150.7 MHz	5				
36631 68	150.8 to 174.0 MHz	9				
36631 71	406.0 to 512.0 MHz	5	(X)	765,554	(X)	r682,073
36631 72	806 MHz and higher frequencies	7				
	Portable receivers, transceivers, and transmitter/receivers, except amateur and citizens band:					
36631 82	Portable, including pocket size	17	(D)	(D)	(D)	(D)
36631 84	Pager (one way)	9	(D)	(D)	(D)	(D)
36631 85	Parts and subassemblies for mobile, portable, and base station radios	21	(X)	200,735	(X)	195,327
	Transmitters and RF power amplifiers, receivers, transceivers, transmitter/receivers, etc.:					
36631 87	CB transceivers, hand-held, and other	3	(X)	528	(X)	546
36631 86	Amateur radio communications equipment, fixed, mobile	11	(X)	24,229	(X)	r23,444
36631 88	Amateur equipment kits (including receivers, transceivers, transmitter-receivers, transmitters, RF power amplifiers, modulators, and citizens radios)	2				
36631 91	Electronic checkout, monitoring, evaluation, and other electronic support equipment for communication systems	35	(X)	184,044	(X)	211,125
	Antenna systems, excluding structural towers, sold separately:					
36631 92	Communications antennae, below 890 MHz	42	10,291,465	197,192	11,084,411	r198,692
36631 94	Microwave, 890 MHz and above (horns, parabolas, etc.) sold separately	30	260,262	351,241	247,930	312,474
36631 98	Other communication equipment, sold separately, including earphones and headsets (monaural), modulators (AM, FM, pulse), keying equipment n.e.c., electronic megaphones, communication security and cryptographic devices, remote transmitter and receiver control equipment, space and time diversity terminal equipment, and other	132	(X)	a2,993,271	(X)	3,141,076

See footnotes at end of table.

Table 2. QUANTITY AND VALUE OF SHIPMENTS OF COMMUNICATION EQUIPMENT, INCLUDING TELEPHONE, TELEGRAPH, AND OTHER ELECTRONIC SYSTEMS AND EQUIPMENT, BY CLASS OF PRODUCT: 1990 AND 1989—Continued

(Quantity in 1,000 units; value in thousands of dollars)

Product code	Product description	Number of companies	1990		1989	
			Quantity	Value	Quantity	Value
36632 —	Broadcast, studio, and related electronic equipment	(NA)	(X)	1,820,382	(X)	1,809,606
	Audio equipment (excluding consumer and PA types):					
36632 12	Amplifiers and preamplifiers	28	395	193,119	374	r207,110
36632 13	Control consoles and switchers	18	[2]13,152	47,365	[2]10,480	43,681
36632 17	Other audio equipment, including power supplies, terminal equipment, broadcast recorders, etc	28	(X)	154,559	(X)	r161,786
	Video equipment (excluding consumer and PA types):					
36632 22	Amplifiers	8	[2]36,644	58,162	[2]35,497	49,270
36632 24	Television cameras	4				
36632 29	Other (power supplies, synchronization equipment, terminal equipment monitors, video tape recorders, and parts and accessories thereof, telecine chains, control consoles and switchers, film equipment, TV outside vans	28	(X)	401,870	(X)	r430,608
	Transmitters, translators, RF power amplifiers, and related equipment:					
36632 31	AM and FM transmitters	7	(X)	27,540	(X)	r23,742
36632 34	TV transmitters	7	(X)	55,891	(X)	r46,774
36632 37	Other, including broadcast transmission line equipment, phasing equipment, TV boosters and repeaters, etc	17	(X)	40,062	(X)	r33,990
36632 39	Studio transmission links and remote pickup equipment	4	(X)	24,989	(X)	r20,766
	Cable TV (master antennae and CATV equipment):					
36632 41	Head-end equipment (antenna baluns, carrier generators, head-end control units, single and broadband preamplifiers and strip amplifiers, converters, modulators and demodulators, splitting and mixing networks, FM processing equipment, filters and traps, power supplies, switches, etc.)	17	(X)	106,840	(X)	r113,056
36632 42	Subscriber equipment (decoders, converters and switchers, wall outlet taps, distribution amplifiers, power supplies, directional couplers, splitters, alternators, and equalizers)	13	(X)	453,516	(X)	r427,529
36632 43	Broadcasting transmitting antennae and community antennae systems	6	(X)	11,305	(X)	r11,375
36632 44	Closed circuit television systems and equipment, excluding broadcast and consumer products, including specially designed cameras, monitors video recorders, receivers, scan converters, and control consoles	21	(X)	163,609	(X)	r144,846
36632 45	Other broadcast, studio, theatre, and commercial sound equipment, sold separately, excluding studio lighting equipment and radiating and supporting towers	26	(X)	81,555	(X)	r95,073
3669	Communications equipment n.e.c	(NA)	(X)	1,833,051	(X)	r1,951,407
36691 —	Alarm systems	(NA)	(X)	1,019,400	(X)	r1,132,489
	Intrusion detection:					
36691 48	Local	43	(X)	162,933	(X)	r211,745
36691 49	Central station	27	(X)	250,179	(X)	r239,837
36691 50	Direct connect	18	(X)	(D)	(X)	(D)
36691 51	Holdup systems (commercial and industrial)	9	(X)	60,009	(X)	r86,413
36691 52	Automotive	4	(X)	(D)	(X)	(D)
	Fire detection and prevention:					
	Smoke and heat detection alarms:					
36691 53	Ionization chamber type	14	(X)	159,082	(X)	147,951
36691 54	Other, including photocell type	19	(X)	164,436	(X)	r164,453
36691 56	Central station	19	(X)	58,797	(X)	61,788
36691 57	Direct connect	14	(X)	64,541	(X)	81,062
36691 59	Other intercommunication and alarm sirens, and horns (vehicle, marine, industrial and air raid) security locking systems)	4	(X)	(D)	(X)	(D)
36692 —	Vehicular and pedestrian traffic control equipment	(NA)	(X)	470,018	(X)	451,118
36692 42	Signal heads, including parts and accessories	9	(X)	32,256	(X)	30,594
36692 43	Electronic and electromechanical controllers, detectors and sensors, parts, and accessories	25	(X)	142,582	(X)	137,982
36692 45	Railway signals and attachments, electric railway highway grade crossing signals, exclusive of relays and other central apparatus	5	(X)	295,180	(X)	282,542
36692 46	Other railway signal systems and safety control equipment	10				
36693 —	Intercommunications systems, including inductive paging systems (selective calling)	(NA)	(X)	343,633	(X)	r367,800
36693 12	Wired	41	(X)	289,633	(X)	311,074
36693 13	Nonwired	9	(X)	54,000	(X)	r56,726
36693 14	AM/FM home radio intercom systems	5				

See footnotes at end of table.

Table 2. QUANTITY AND VALUE OF SHIPMENTS OF COMMUNICATION EQUIPMENT, INCLUDING TELEPHONE, TELEGRAPH, AND OTHER ELECTRONIC SYSTEMS AND EQUIPMENT, BY CLASS OF PRODUCT: 1990 AND 1989--Continued

(Quantity in 1,000 units; value in thousands of dollars)

Product code	Product description	Number of companies	1990		1989	
			Quantity	Value	Quantity	Value
36991 —	Electronic teaching machines, teaching aids, trainers and simulators	(NA)	(X)	1,070,359	(X)	r1,359,576
36991 78	Electronic teaching machines and teaching aids	9	(X)	44,880	(X)	r56,576
36991 79	Educational electronic kits to be assembled by purchaser	-	(X)	-	(X)	-
36991 81	Electronic trainers and simulators*	35	(X)	1,025,479	(X)	r1,303,000
36992 —	Laser systems and equipment, except communication	(NA)	(X)	885,842	(X)	915,619
36992 83	Laser designator/ranging equipment	7				
36992 84	Laser instrumentation (laboratory alignment devices, surveying equipment, etc.)	14	(X)	352,771	(X)	393,704
36992 85	Industrial laser equipment (welding, drilling, cutting, printing, wirephoto, etc.)	16	(X)	171,088	(X)	r195,436
36992 87	Medical laser equipment	10	(X)	267,130	(X)	r231,986
36992 88	Laser generator, power supplies, and other laser equipment and components sold separately	21	(X)	94,853	(X)	94,493
36995 —	Ultrasonic equipment, (except medical)	(NA)	(X)	124,295	(X)	r137,707
36995 23	Cleaners, drills, welders, and solderers	10	(X)	96,283	(X)	100,320
36995 26	Other ultrasonic equipment	7	(X)	28,012	(X)	r37,387
36997 —	Other electronic systems and equipment n.e.c.	(NA)	(X)	1,482,087	(X)	1,398,118
	Amplifiers, except audio, RF power, and video, sold separately:					
36997 62	Magnetic and pulse	2				
36997 63	Maser	-	(X)	19,496	(X)	r17,789
36997 67	DC	8				
36997 69	Other (differential, facsimile, etc.)	4	(X)	b14,590	(X)	12,747
36997 77	Particle accelerator electronics equipment and subassemblies for betatrons, cyclotrons, synchrotrons, etc.; linear accelerators; dynamotrons vandergraff, traveling wave, etc	6	(X)	(D)	(X)	(D)
36997 81	Electronic kits to be assembled by purchaser	1	(X)	(D)	(X)	(D)
36997 82	Consumer electronic equipment n.e.c.*	17	(X)	314,814	(X)	289,468
36997 84	Scientific electronic equipment n.e.c.*	28	(X)	120,067	(X)	125,831
36997 86	Power supply portion of integrated TWT amplifier package	5	(X)	34,718	(X)	29,158
36997 88	Other electronic systems, equipment, and subassemblies n.e.c.	101	(X)	956,583	(X)	r905,185
36998 04	Automatic garage door openers, electronic	14	(X)	261,372	(X)	252,334
	Electronic games:					
39992 22	Arcade and amusement center types (except coin-operated)	14	(X)	261,077	(X)	r335,561
	Home electronic games:					
39447 12	For attachment to television receiver	2	(X)	28,615	(X)	22,537
39447 14	Other	3				
	Electronic research, development, test, and evaluation (receipts or billings, not reported as shipments of specific products):					
99980 42	Systems	20	(X)	605,706	(X)	r529,824
99980 43	Equipment and subassemblies	28	(X)	691,050	(X)	688,145
99980 44	Component parts	15				
99980 46	Basic scientific electronic research	19	(X)	73,743	(X)	66,421

Note: The percent of estimation of each item is indicated as follows (see "Description of Survey" for a discussion of estimation of missing reports): [a]10 to 25 percent of this item is estimated. [b]26 to 50 percent of this item is estimated. [c]Over 50 percent of this item is estimated.

*Similar products are collected on other Current Industrial Reports. - Represents zero. (D) Data withheld to avoid disclosing figures for individual companies. (NA) Not available. N.e.c. Not elsewhere classified. [r]Revised by 5 percent or more from previously published figures. (X) Not applicable.

[1]Product class code 36613 includes data for communication interface equipment including modems which was previously collected on the MA35R, Computers and Office and Accounting Machines, under product class code 35732.

[2]Quantity in number of units.

Table 3. COMPARISON OF VALUES OF SHIPMENTS OF COMMUNICATION EQUIPMENT, AS REPORTED IN THE MA36P, THE 1989 ANNUAL SURVEY OF MANUFACTURES, AND THE 1987 CENSUS OF MANUFACTURES

(Value in millions of dollars)

Product code	Product description	1989			1987	
			Annual Survey of Manufactures			
		MA36P	Value	Standard error of estimates[1]	MA36P	Census of Manufactures
3661	Telephone and telegraph apparatus	(X)	14,679.3	1	(X)	16,528.5
36611	Telephone switching and switchboard equipment (including military)	6,975.5	6,664.3	1	7,367.1	7,561.1
36613	Carrier line equipment and modems, including auxiliary sets	7,767.5	4,825.5	2	5,011.6	5,091.1
36614	Other telephone and telegraph (wire) apparatus		2,893.5	2	3,507.8	3,548.5
36610 00	Telephone and telegraph apparatus n.s.k., typically for establishments with 20 employees or more	(2)	296.0	2	(2)	215.5
36610 02	Telephone and telegraph apparatus n.s.k., typically for establishments with less than 20 employees					112.3
3663- —	Radio and TV communication equipment	(X)	16,334.5	1	(X)	13,255.9
36631 —	Communication systems and equipment	14,016.3	14,170.1	1	11,692.4	11,600.6
36632 —	Broadcast studio and related electronic equipment	1,809.6	1,996.8	3	1,608.6	1,568.8
36630 00	Radio and TV communications equipment, n.s.k., typically for establishments with 20 employees or more	(2)	167.6	4	(2)	13.3
36630 02	Radio and TV communications equipment, n.s.k., typically for establishments with less than 20 employees					73.2
3669- —	Communications equipment, n.e.c	(X)	2,165.2	3	(X)	2,126.0
36691 —	Alarm systems	1,132.5	1,138.3	2	1,235.0	1,261.2
36692 —	Traffic control equipment	451.1	397.4	1	426.4	427.9
36693 —	Intercommunications equipment, except telephone and telegraph	367.8	371.1	8	282.8	290.3
36690 00	Communications equipment, n.e.c., n.s.k., typically for establishments with more than 20 employees	(2)	258.4	12	(2)	3.8
36690 02	Communications equipment, n.e.c., n.s.k., typically for establishments with less than 20 employees					142.8
3699- —	Electronic and electrical equipment and supplies, n.e.c	(X)	6,149.2	2	(X)	5,525.1
36991 —	Electronic teaching machines, teaching aids, trainers, and simulators	1,359.6	1,627.3	2	1,163.1	1,210.2
36992 —	Laser systems and equipment (except communication)	915.6	988.1	5	879.3	907.1
36995 —	Ultrasonic equipment (except medical and dental)	137.7	97.4	1	93.5	88.0
36996 —	Apparatus wire and cordage manufactured from purchased wire	(X)	209.9	11	(X)	246.7
36997 —	Electronic systems and equipment, n.e.c	1,398.1	1,576.9	5	1,541.5	1,539.7
36998 —	Electrical products, n.e.c	(X)	879.3	5	(X)	78/
36998 04	Automatic garage door openers	252.3	(X)	(X)	232.7	23
36990 00	Electronic and electrical equipment n.e.c., n.s.k., typically for establishments with 10 employees or more	(2)	770.1	5	(2)	540.8
36990 02	Electronic and electrical equipment n.e.c., n.s.k., typically for establishments with less than 10 employees					207.6
39447 pt.	Electronic games, home electronic type	22.5	(X)	(X)	39.8	40.6
39992 pt.	Electronic games, arcade and amusement center type	335.6	(X)	(X)	258.8	274.8

N.e.c. Not elsewhere classified. N.s.k. Not specified by kind. pt. Partial (X) Not applicable.

[1] The annual survey of manufactures percentage standard errors shown are the approximate relative standard errors of estimates of level. A more detailed description of the standard error of estimate is given in the introduction of the annual survey of manufactures, M89(AS)-2, Value of Product Shipments, under "Qualifications of the Data."

[2] Detail data available only for the census of manufactures. A substantial portion of these data are derived from administrative records. See note above.

Table 4. SHIPMENTS, IMPORTS, EXPORTS, AND APPARENT CONSUMPTION OF COMMUNICATION EQUIPMENT: 1990

(Value in thousands of dollars)

Product code	Product description	Manufacturers' shipments (value, f.o.b. plant)	Exports of domestic merchandise		Percent exports to manufacturers' shipments	Imports for consumption, value in foreign country[1 4]	Apparent consumption, value[5]	Percent imports to apparent consumption
			Value at port[1 2]	Estimated producers' value[3]				
36611 21-78	Telephone switching and switchboard equipment..	7,428,934	388,613	375,866	5	226,708	7,279,776	3
36611 89 36614 98	Parts, components, and subassemblies for other telephone and telegraph apparatus, including switching and switchboard apparatus.....	636,252	925,789	895,423	(NA)	819,524	(NA)	(NA)
36613 21-32 36631 36,37	Carrier line equipment.....	3,656,078	(NA)	(NA)	(NA)	204,015	(NA)	(NA)
36614 33, 35, 39	Telephone sets except cordless handset telephones.....	221,275	194,122	187,754	84	1,664,317	1,699,838	98
36614 36	Cordless handset telephones.....							
36613 72-78	Modems, including auxiliary sets.....	1,277,278	(NA)	(NA)	(NA)	95,799	(NA)	(NA)
36614 82, 84, 86, 96	Other telephone and telegraph equipment including voice frequency equipment.....	1,607,745	(NA)	(NA)	(NA)	296,120	(NA)	(NA)
36614 88	Telephone key sets.....	313,532	(NA)	(NA)	(NA)	19,623	(NA)	(NA)
36614 89	Telephone answering devices.....	31,227	65,706	63,551	(NA)	326,128	293,804	(NA)
36614 91	Facsimile communications equipment.....	196,586	(NA)	(NA)	(NA)	827,463	(NA)	(NA)
36631 01-11	Transmitters, receivers, RF power amplifiers, radio communications (point-to-point), except amateur and citizens radio.....	2,114,822	300,251	290,403	14	76,425	1,900,844	4
36632 12	Audio amplifiers and preamplifiers, except consumer and P.A. types.....	193,119	3,068	2,967	2	7,237	197,389	4
36632 34	TV transmitters.....	55,891	(NA)	(NA)	(NA)	92,664	(NA)	(NA)
36631 38	Space satellite communications systems.....	2,545,462	56,794	54,931	2	144,464	2,634,995	5
36631 49-72, 6, 88	Mobile radio systems, base stations, and mobile vehicular transmit and receive package.....	3,058,193	905,217	875,526	29	1,072,072	3,254,739	33
36631 82	Transceivers, and portable receivers, transmitter and receivers, except amateur and citizens band.....	(D)	93,567	90,498	(NA)	176,025	(NA)	(NA)
36631 84	Pager, one way.....	(D)	67,593	65,376	(NA)	119,682	(NA)	(NA)
36631 85	Subassemblies and parts for mobile, portable and base station radios.....	200,735	1,041,832	1,007,660	(NA)	403,254	(NA)	(NA)
36631 87	CB transceivers, hand-held and other.....	528	21,561	20,854	(NA)	99,153	78,827	(NA)
36632 24	Television cameras except consumer and P.A. types.....	(D)	50,107	48,463	(NA)	2,071,349	(NA)	(NA)
36631 92 94, 36632 43	Antenna systems, including broadcast and community antennae systems.....	559,738	414,006	400,427	72	184,449	343,760	54

See footnotes at end of table.

Table 4. SHIPMENTS, IMPORTS, EXPORTS, AND APPARENT CONSUMPTION OF COMMUNICATION EQUIPMENT: 1990—Continued

(Value in thousands of dollars)

Product code	Product description	Manufacturers' shipments (value, f.o.b. plant)	Exports of domestic merchandise		Percent exports to manufacturers' shipments	Imports for consumption, value in foreign country[1 4]	Apparent consumption, value[5]	Percent imports to apparent consumption
			Value at port[1 2]	Estimated producers' value[3]				
36632 31, 41, 42, 44	Cable TV and closed circuit TV systems and equipment including AM and FM transmitters....	751,505	133,254	128,883	17	504,994	1,127,616	45
36693 12, 13, 14	Intercommunications systems, including inductive paging systems (selective calling)..	343,633	5,995	5,798	2	20,373	358,208	6
36691 48-52	Intrusion detection alarm systems.....	570,891	25,292	24,462	4	74,263	620,692	12
36691 53	Ionization heat and smoke alarm systems.....	159,082	18,189	17,592	11	27,601	169,091	16
36691 54	Other smoke and heat detection alarms including photo cell type.....	164,436	25,577	24,738	15	28,369	168,067	17
36691 56, 57	Central station and direct connect fire detection and prevention alarms.....	123,338	54,190	52,413	42	46,860	117,785	40
36692 42, 43	Vehicular and pedestrian traffic control equipment.....	174,838	35,673	34,503	20	11,277	151,612	7
36692 45, 46	Electric railway signals and attachments.....	295,180	12,996	12,570	4	3,364	285,974	1
36991 81	Electronic trainers and simulators.....	1,025,479	255,258	206,606	20	200,452	1,019,325	20
36992 85	Industrial laser equipment.....	171,088	46,117	37,327	22	47,446	181,207	26
36995 23, 26	Ultrasonic equipment except medical and dental.	124,295	11,726	9,491	8	2,651	117,455	2
36997 77	Particle accelerator electronics equipment and subassemblies.....	(D)	13,740	11,121	(NA)	(NA)	(NA)	(NA)
36998 04	Automatic garage door openers.....	261,372	64,744	52,404	20	7,139	216,107	3

(D) Data withheld to avoid disclosing figures for individual companies. (NA) Not available.

[1] For comparison of SIC-based product codes, Schedule B export numbers, and HTSUSA import numbers, see table 5.

[2] Source: Bureau of the Census report EM 545, U.S. Exports.

[3] These values were derived by use of adjustment factors to exclude freight, insurance, and other charges incurred in moving goods to the port of export. This adjustment is made to convert the values to an approximation of the producers' value of exported goods. Current adjustment factors are based on data for 1987 which are published in Exports from Manufacturing Establishments 1987, AR 87-1, appendix B. The adjustment factor for products corresponding to industry group 366, communicationn equipment, is 0.9672, and industry group 369, Miscellaneous electrical equipment and supplies, is 0.8094.

[4] Source: Bureau of the Census report IM 145, U.S. Imports for Consumption.

[5] Apparent consumption is derived by subtracting the estimated producers' price of exports from the sum of manufacturers' shipments and imports for consumption.

Table 5. COMPARISON OF STANDARD INDUSTRIAL CLASSIFICATION-BASED PRODUCT CODES WITH SCHEDULE B EXPORT NUMBERS, AND HTSUSA IMPORT NUMBERS: 1990

Product code	Product description	Export number[1]	Import number[2]
36611 21 36611 24 36611 27 36611 31 36611 34 36611 37 36611 61 36611 63 36611 65 36611 67 36611 71 36611 73 36611 75 36611 77 36611 78	Telephone switching and switchboard equipment.....	8517.30.1080 8517.30.5000	8517.30.2000 8517.30.1500 8517.30.3000
36611 89 36614 98	Parts, components, and subassemblies for other telephone and telegraph apparatus, including switching and swithboard apparatus.....	8517.90.2000 8517.90.5000 8517.90.9000	8517.90.0500 8517.90.1000 8517.90.1500 8517.90.2000 8517.90.3000 8517.90.3500 8517.90.4000 8517.90.5500 8517.90.6000 8517.90.7000 8517.90.8000
36613 21 36613 22 36613 23 36613 24 36613 25 36613 26 36613 30 36613 32 36631 36 36631 37	Carrier line equipment.....	8517.40.4000 8517.40.8090	8517.40.5000 8517.40.7000
36614 33 36614 35 36614 39	Telephone sets except cordless handset telephones.....	8517.10.0000 8518.30.1000	8517.10.0020 8517.10.0040 8517.10.0050 8517.10.0070 8517.10.0080 8518.30.1000
36614 36	Cordless handset telephones.....	8525.20.5000	8525.20.5000
36613 72 36613 74 36613 76 36613 78	Modems, including auxiliary sets.....	8517.40.8010	8517.40.1000
36614 82 36614 84 36614 86 36614 96	Other telephone and telegraph equipment including voice frequency equipment.....	(NA)	8517.81.0020 8517.82.0080 8517.30.5000
36614 88	Telephone key sets.....	8517.30.1040	8517.30.2500
36614 89	Telephone answering devices.....	8520.20.0000	8520.20.0040 8520.20.0080
36614 91	Facsmile communications equipment.....	(NA)	8517.82.0040
36631 01 36631 02 36631 03 36631 04 36631 05 36631 06 36631 07 36631 08 36631 09 36631 11	Transmitters, receivers, RF power amplifiers, radio communications (point-to-point), except amateur and citizens radio.....	8525.10.6010 8525.10.6030 8525.10.6050 8525.10.6070 8525.10.6090 8525.10.8020 8525.10.8040	8525.10.6020 8525.10.6040 8525.10.6060 8525.10.6080 8525.10.8000
36632 12	Audio amplifiers and preamplifiers, except consumer and P.A. types.....	8518.40.1000	8518.40.1000
36632 34	TV transmitters.....	(NA)	8525.10.2040
36631 38	Space satellite communications systems.....	8528.10.8055	8528.10.8055

See footnotes at end of table.

Table 5. COMPARISON OF STANDARD INDUSTRIAL CLASSIFICATION-BASED PRODUCT CODES WITH SCHEDULE B EXPORT NUMBERS, AND HTSUSA IMPORT NUMBERS: 1990—Continued

Product code	Product description	Export number[1]	Import number[2]
36631 49 36631 51 36631 52 36631 54 36631 56 36631 62 36631 64 36631 65 36631 67 36631 66 36631 68 36631 71 36631 72 36631 86	Mobile radio systems, base stations, and mobile vehicular transmit and receive package	8525.20.2000 8525.20.3040 8525.20.3042 8525.20.3045 8525.20.3055 8525.20.6000	8525.20.2000 8525.20.3040 8525.20.3050 8525.20.3070 8525.20.3080 8525.20.6020 8525.20.6060 8525.20.6070 8525.20.6080
36631 82	Transceivers, and portable receivers, transmitter and receivers, except amateur and citizens band	8525.20.3030	8525.20.3010 8525.20.3015 8525.20.3025
36631 84	Pager, one way	8527.90.8015 8531.80.0035	8527.90.8010 8531.80.0035
36631 85	Subassemblies and parts for mobile, portable and base station radios	8529.90.5000	8529.90.5000 8527.90.8020
36631 87	CB transceivers, hand-held and other	8527.90.8025 8525.20.1000	8525.20.0500 8527.90.8020 8525.20.1500
36632 24	Television cameras except consumer and P.A. types	8525.30.0015 8525.30.0060	8525.30.0010 8525.30.0030 8525.30.0040 8525.30.0060
36631 92 36632 43 36631 94	Antenna systems, including broadcast and community antannae systems	8529.10.2020 8529.10.2050 8529.10.4000 8529.10.6000	8529.10.2020 8529.10.2050 8529.10.4040 8529.10.6000
36632 31 36632 41 36632 42 36632 44	Cable TV and closed circuit TV systems and equipment including AM and FM transmitters	8525.10.2000	8525.10.2020
36693 12 36693 13 36693 14	Intercommunications systems, including inductive paging systems (selective calling)	8517.81.0010	8517.81.0010
36691 48 36691 49 36691 50 36691 51	Intrusion detection alarm systems	8531.10.0035	8531.10.0035
36691 53	Ionization heat and smoke alarm systems	9022.29.4000	9022.29.4000
36691 54	Other smoke and heat detection alarms including photo cell type	8531.10.0015 8531.10.0025	8531.10.0015 8531.10.0025
36691 56 36691 57	Central station and direct connect fire detection and prevention alarms	8531.10.0045	8531.10.0045
36692 42 36692 43	Vehicular and pedestrian traffic control equipment	8530.80.0000 8530.90.0000	8530.80.0000 8530.90.0000
36692 45 36692 46	Electric railway signals and attachments	8530.10.0000	8530.10.0000
36991 81	Electronic trainers and simulators	8805.20.0000	8805.20.0000
36992 85	Industrial laser equipment	8456.10.0000	8456.10.1010 8456.10.1020 8456.10.5000
36995 23 36995 26	Ultrasonic equipment except medical and dental	8456.20.0000 8479.89.9075	8456.20.1010 8456.20.1050 8456.20.5000 8479.89.9075
36997 77	Particle accelerator electronics equipment and sub-assemblies	8543.10.0000	8543.10.0000
36998 04	Automatic garage door openers	8302.60.0000	8302.60.3000

(NA) Not available.

[1]Source: 1990 edition, Harmonized System-Based Schedule B, Statistical Classification of Domestic and Foreign Commodities Exported from the United States.

[2]Source: Harmonized Tariff Schedule of the United States, Annotated (1990).

APPENDIX B:

The Institute's Phase I and II Results
An Assessment of the U.S. Telecommunications Industry Dependence on Foreign Sources as it Impacts the U.S. Telecommunications Infrastructure

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An Assessment of the U.S. Telecommunications Industry Dependence on Foreign Sources as it Impacts the U.S. Telecommunications Infrastructure

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EXECUTIVE SUMMARY

The National Security and Emergency Preparedness (NS/EP) of the country depends on the capability of the telecommunications infrastructure to respond to a demand for mobilization. Mobilization is defined as the process of sustaining operation and/or the rapid implementation of an increase in capacity of the Government telecommunication infrastructure. The Federal mobilization preparedness policy is defined in "The Prototype National Option Plan for Graduated Mobilization Response (GMR)[1]," a report published by the Federal Emergency Management Agency (FEMA). In response to the FEMA report, the Joint Industry-Government Telecommunications Industry Mobilization (TIM) Group examined and reported the dependence of the U.S. Telecommunications Industry on other infrastructure systems[2]. Nine infrastructure systems were identified as areas of vulnerability:

- Energy
- Transportation
- Direct and Indirect Support Services to Operating Personnel
- Financial Services
- Government Services
- Local Services
- Mass-Media Communication
- Manufacturing
- Security

The TIMs Study performed a detailed analysis of three of these infrastructures; Energy, Transportation, and Mass-Media Communications. During mobilization, these infrastructures were deemed to be the most critically dependent for Industry.

This study will concentrate on the availability of equipment required for executing the mobilization process. The requirement could include the need to build more capacity, to maintain the availability of spare parts, or to replace equipment destroyed by disaster or hostile action. These requirements will increase the demand for system configured equipment and for components to be used for spare parts or manufacture of equipment.

The study will be completed in three phases:

Phase I -- Systems Level Analysis

Phase II -- Component Level Analysis

Phase III - Identification and Prioritization of Vulnerabilities

Phase I -- Systems Level Analysis. Each major telecommunications system or group of systems will be analyzed to determine the amount of production within the U.S., the imported quantities, the exported quantities, and the U.S. consumption. When significant portions of the U.S. consumption come from foreign sources, that case will be flagged as a possible problem area. An attempt will be made to isolate specific equipment types from the groupings to identify individual equipments that come primarily (e.g., greater than 50%) from foreign sources.

Phase II -- Component Level Analysis. The focus of this effort will be to identify specific components that come primarily from foreign sources. Systems identified in Phase I will obviously use many of these components, however many of the target components will be used in systems manufactured in the U.S.

Phase III -- Identification and Prioritization of Vulnerabilities. After the vulnerabilities have been identified, solutions will be developed to cover the vulnerabilities, as required.

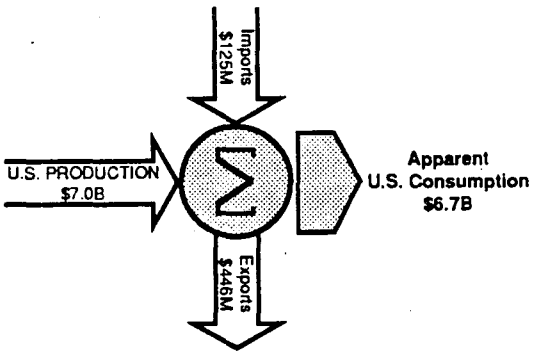
PRELIMINARY ANALYSIS OF AVAILABLE DATA

Based upon data received from the Department of Commerce (DoC) and the Bureau of Census, several systems level equipment groupings have been formulated to provide a preliminary "quick look" at the systems level problem. The data will be presented in pictorial format to succinctly illustrate the availability of U.S. production to cover the need in that category if a mobilization response would be required. The following formula will be used to calculate the baseline for the analysis; the Apparent U.S. Consumption.

U.S. Production + Imports - Exports = Apparent U.S. Consumption

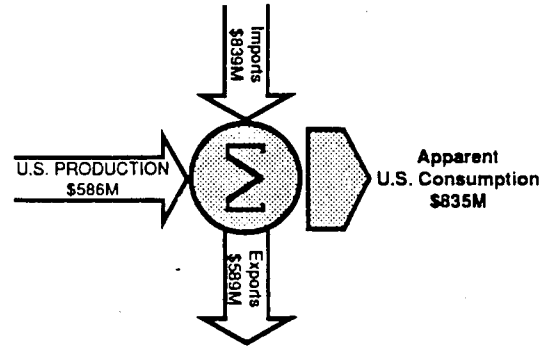
The value of "Imports" as a per cent of "Apparent U.S. Consumption" defines how much we rely on Foreign Sources for that category of equipment. The following is a "quick look" at some of the categories of equipment that is a part of the U.S. telecommunications infrastructure. The analysis begins with the data on Telephone Switching and Switchboard Equipment.

1. TELEPHONE SWITCHING and SWITCHBOARD EQUIPMENT...



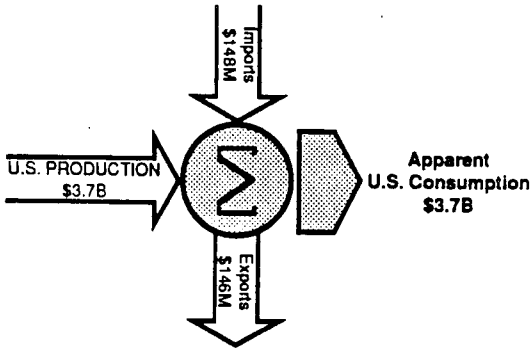
The category, Telephone Switching and Switchboard Equipment, is not vulnerable because the U.S. Production is more than enough to satisfy the Apparent U.S. Consumption. However the next category shows a possible problem area.

2. **PARTS, COMPONENTS, and SUBASSEMBLIES for other TELEPHONE and TELEGRAPH APPARATUS, including SWITCHING and SWITCHBOARD APPARATUS...**



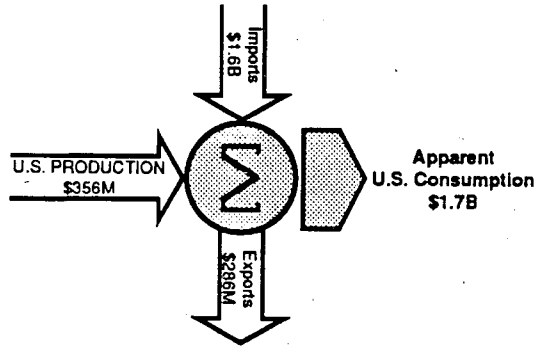
The U.S. Consumption is significantly more than the U.S. Production. One or more of the components included in this category is obtained from foreign sources.

3. **CARRIER LINE EQUIPMENT...**



The analysis of the this category (Carrier Line Equipment) illustrates an area where there is minimal vulnerability because the U.S. production is sufficient to satisfy the U.S. consumption and the value of imports is low.

4. **TELEPHONE SETS including CORDLESS HANDSET TELEPHONES...**



This category is an area of major vulnerability; the U.S. production is only 21 percent of the U.S. consumption requirement, and the import value is a large portion of the consumption--96 percent.

The data obtained on the remaining groups, analyzed so far, will be presented in table format. Some of the categories are not directly related to the telecommunications business, however, as the study progresses may be of value in the later phases of the study.

CATEGORY	U.S. PRODUCTION	IMPORTS	EXPORTS	U.S. CONSUMPTION
5. Modems...	$1.1B	$144M	$248M	$1.0B
6. Other telephone and telegraph equipment including voice frequency equipment...	$1.6B	$255M	NA	NA
7. Telephone key sets...	$344M	$44M	$126M	$262M
8. Telephone answering devices...	$34M	$367M	$40M	$361M
9. Facsimile communications equipment...	$196M	$1.0B	NA	$1.2B
10. Transmitter, receivers, RF power amps, radio communications, except amateur and citizens radio...	$1.9B	$75M	$269M	$1.7B
11. Audio amps and preamps, except consumer and PA types...	$177M	$11M	$13M	$175M
12. TV transmitters...	$40M	$97M	NA	$137M
13. Space satellite communications systems...	$2.5B	$132M	$47M	$2.6B
14. Mobile radio systems, base stations, and mobile vehicular transmit and receive packages...	$2.9B	$948M	$441M	$3.4B
15. Transceivers, portable receivers, transmitter and receivers except amateur and citizen band, and pagers, one-way...	$1.4B	$251M	$115M	$1.5B
16. Subassemblies and parts for mobile, portable and base stations radios...	$195M	$327M	$960M	NA
17. CB transceivers, hand-held and other...	(D)	$110M	$23M	NA
18. Antenna systems, including broadcast and community antennae systems...	$527M	$192M	$383M	$337M
19. Cable TV and closed circuit TV systems and equipment including AM and FM transmitters...	$649M	$487M	$88M	$1.0B
20. Intercommunications systems, including inductive paging systems (selective calling)...	$397M	$18M	$8M	$408M
21. Intrusion detection alarms systems...	$799M	$71M	$28M	$847M
22. Ionizing heat and smoke alarms systems...	$143M	$16M	$12M	$147M

REFERENCES

1. The Prototype National Option Plan for Graduated Mobilization Response (GMR), FEMA TR-5699-3, Office of Mobilization Preparedness, 500 C Street, S.W., Washington, DC, 1989.

2. Joint Industry-Government Telecommunications Industry Mobilization (TIM) Group, NCS 1588/1, April 1989.

APPENDIX C:

Dataquest/ITS Questionnaire

This questionnaire was used by Dataquest and ITS as a preparatory tool before the on-site visit and interview with the companies being surveyed.

Dataquest/ITS Questionnaire

The following background information prepared by ITS and Dataquest Incorporated, was used as a preparatory tool before the on-site visit and interview with the companies being interviewed.

SITE VISITS

BACKGROUND

The extent of the telecommunications industry's dependence on foreign sources for raw materials, components, parts, and equipment is a key area of concern in evaluating the industry's ability to maintain service and production capabilities and to accommodate increased service and equipment demands under mobilization conditions. The Joint Industry-Government Telecommunications Industry Mobilization (TIM) Group was established by the President's National Security Telecommunications Advisory Committee (NSTAC) and the National Communications System (NCS) Committee of Principals (COP) to: (1) identify possible impediments to effective telecommunications industry mobilization and (2) assist in the development of corrective actions to overcome any identified impediments. The report entitled *Final Report of the Joint Industry-Government Telecommunications Industry Mobilization (TIM) Group*, documents the Joint Group's final findings, conclusions, and recommendations regarding the industry's overall dependence on foreign sources. The material from that report serves as background material for this paper.

The driving force behind this study is mobilization, defined as the process of marshalling those telecommunications resources needed to make the transition from a normal state to a state of readiness for war or other national emergency.

Using the work of earlier NSTAC TIM Task Force as a starting point, the Joint TIM Group sought information from Federal Government and private research organizations that had previously studied the issue of foreign procurement or foreign dependence. The Group focused initially on the telecommunications industry's dependence on foreign-sourced semiconductors, providing recommendations on semiconductor dependency to the NSTAC in February 1987 and to the COP in March 1987. The subsequent focus of the Group's study was equipment, materials, and components other than semiconductors. It was determined by the NSTAC that semiconductors were a problem area based on DOC and National Defense University data. A survey of NSTAC member companies was conducted to support this aspect of the study. The Dependence on Foreign Sources Survey was designed to elicit the views of NSTAC companies concerning their own, as well as the industry's dependence on foreign sources for materials, equipment, and components other than semiconductors. The survey focused on four major types of equipment: digital central office switching equipment, fiber optic

electronic terminal equipment, telephone sets, and satellite ground stations. Nineteen NSTAC companies provided responses to the survey.

On the basis of the survey results and other information obtained from the literature, briefings, and consultation with experts in the Federal Government and the private sector, the Joint TIM Group developed its findings, conclusions, and recommendations.

The increasing dependence of the telecommunications industry on foreign sources raises significant questions about the industry's ability to respond to and sustain mobilization requirements. On the basis of briefings received, reports reviewed, and responses to the NSTAC Dependence on Foreign Sources Survey, the Joint TIM Group has reached the following conclusions concerning equipment, materials, and components other than semiconductors:

(a) In the Short Term and Mid-Term, the service sector of the U.S. telecommunications industry would not be immediately or severely affected by disruption of the supply of foreign items. Adverse effects would be felt as foreign equipment fails or requires repair parts.

(b) The manufacturing sector of the U.S. telecommunications industry could be immediately affected by a cut-off of critical foreign-sourced supplies, equipment, or materials. The effects on production would depend, in part, on the quantities of foreign-sourced items in domestic inventories and in the supply pipeline.

(c) The U.S. industry's foreign dependence presents a changing picture in terms of the specific equipment, components, and materials for which dependency exists as well as the degree of dependence for each. Today's list of foreign dependence items is different from last year's, and next year's will differ from today's. The following conclusions and observations reflect the current picture as drawn by the NSTAC Foreign Dependence Survey and related studies in their 1987 report:

- In view of the large number of foreign-made optic terminals embedded in U.S. telecommunications systems (about 35 percent foreign according to some estimates) and the inherent incompatibility between terminals made by different manufacturers, the foreign-made terminals and their interfacing connectors could become a problem if maintenance or expanded capacity is required.

- The U.S. currently imports over 60 percent of the telephone sets it uses. Although the demand for telephone sets during mobilization is not known, the fact that imports have risen to this level suggests that telephone sets could be a problem during mobilization. Therefore, the Joint TIM Group concluded that domestic production and imports status of telephone sets should be periodically monitored.

- The foreign dependence status of the ceramic resonators should be studied in depth, with a view toward identifying possible steps to reduce the degree of foreign dependence. The availability status of four other critical items--fiber

optic terminals, fiber optic connectors, telephone sets, and ferrite cores should be periodically monitored for the same purpose.

Further, on the basis of its collective assessment of the responses to the NSTAC-wide Dependence on Foreign Sources survey, the Joint Group has identified other dependencies of concern from a mobilization perspective. While these dependencies may not have the same wide-ranging significance to the telecommunications industry as semiconductor dependency, they are important. Accordingly, the Joint TIM Group offers the following recommendations:

- The Government, in conjunction with NSTAC, should establish a mechanism to periodically assess industry dependence on foreign sources in light of identified Government mobilization needs.

- The NCS and NSTAC should jointly keep the Executive Office of the President (EOP) apprised of any specific foreign dependency issues relating to telecommunications, and identify, if necessary, possible measures for reducing or mitigating these foreign dependencies.

- In conjunction with the above Government action, the NSTAC member firms should ensure that their appropriate internal organizations are made aware of the findings of the joint TIM Group. Further, their internal organizations should be apprised of the need to plan for contingencies such as cut-off of non-North American supplied material during a mobilization.

Foreign Dependence Defined

For the purpose of this study, foreign-sourced items are those manufactured, assembled, or otherwise processed outside of the United States and Canada. Sources within these countries are referred to as North American sources. The distinguishment should be noted between the issue of dependence on foreign sources and the broader, more inclusive issue of procurement from foreign sources.

Foreign source procurement does not necessarily equate to foreign source dependence and involves consideration of a range of trade, economic, national security, and foreign relations issues that are beyond the scope of the objectives. The Joint TIM Group has focused on the narrower issue of the industry's dependence on foreign sources and the implications of any dependencies for effective industry mobilization. In its study, the Joint Group has recognized that concerns about foreign source dependency grow out of the possibility that foreign sources of supply could be cut off under a variety of mobilization conditions. The Group has thus assumed, for purposes of its general investigation, that a cut-off of foreign supplies would occur coincident with the beginning of mobilization.

Mobilization Defined

The Joint TIM Group has built upon the earlier work of the NSTAC TIM Task Force, working with the following definition of mobilization:

> The process of marshalling those telecommunications resources needed to make the transition from a normal state to a state of readiness for war or other national emergency.

Mobilization is considered to encompass the interval from peacetime/disaster/crisis through any subsequent conventional military actions external to the continental United States. The impact on the telecommunications industry of a nuclear attach upon the United States was judged by the Group to be outside the scope of its study. The following mobilization time periods are being used for the purpose of analyses:

(1) Pre-Mobilization: Planning and Pre-Positioning

(2) Short-Term: 0 to 90 Days (Reallocation and Reprioritization of Existing Capability and Service)

(3) Mid-Term: 90 to 180 Days (Reallocation and Reprioritization of Products and Services in the Pipeline)

(4) Long-Term: Over 180 Days (Expanded Production of Capacity and Services)

In its study of foreign source dependency, the Joint TIM Group assumed that a cut-off of foreign supplies would occur coincident with the beginning of mobilization.

The overall objective concerning dependence on foreign sources reflect the provisions of the TIM Implementation Measure in the NCS's NSEP Telecommunications Plan of Action (NTPA), calling for:

- The identification of possible impediments to effective telecommunications industry mobilization and mobilization planning and the recommendation of corrective actions, and

- The identification and recommendation of any Federal Government actions needed to support telecommunications industry mobilization planning activities.

FOCUS OF THE INSTITUTE FOR TELECOMMUNICATION SCIENCES (ITS)

The reports to date do not address the impact of foreign products and services on the U.S. telecommunications industry, and this nations telecommunications infrastructure. Recommendations of the report were generally focused on the planning and response to infrastructure issues related to domestic suppliers. No specificity accompanied the identification of the "manufacturing" infrastructure system. It is clear that reliance on foreign suppliers must be considered in any analysis of U.S. telecommunications

mobilization. The work from ITS will focus on the bearing of foreign telecommunications and information products and services on the U. S . telecommunications industry and infrastructure. Hardware and software products, systems, and networks will be surveyed and addressed. Specifically ITS will:

- Survey of foreign telecommunications and information products and services which impact the U.S. telecommunications industry and the U.S. infrastructure.
- Analysis of those categories of foreign-supplied items which most affect U.S. mobilization.
- Design of assessment mechanism to define the degree of U.S. dependence on foreign sources.
- Initial evaluation and documentation of assessment mechanism.

CURRENT PROJECT PROGRESS

ITS has developed a preliminary plan for completing the tasking described above. The plan is briefly outlined in the report entitled An Assessment of the U.S. Telecommunications Industry Dependance on Foreign Sources as it Impacts the U.S. Telecommunications Infrastructure (attached). The study will be completed in three phases:

Phase I—Systems Level Analysis

Phase II—Component Level Analysis

Phase III—Identification and Prioritization of Vulnerabilities

Each phase is further detailed as follows:

Phase I—Systems Level Analysis. Each major telecommunications system or group of systems will be analyzed to determine the amount of production within the U.S., the imported quantities, the exported quantities, and the U.S. consumption. When significant portions of the U.S. consumption come from foreign sources, that case will be flagged as a possible problem area. An attempt will be made to isolate specific equipment types from the groupings to identify individual equipments that come primarily (e.g., greater than 50%) from foreign sources.

Phase II—Component Level Analysis. The focus of this effort will be to identify specific components that come primarily from foreign sources. Systems identified in Phase I will obviously use many of these components, however many of the target components will be used in systems manufactured in the U.S.

Phase III—Identification and Prioritization of Vulnerabilities. After the vulnerabilities have been identified, solutions will be developed to cover the vulnerabilities, as required.

Currently, ITS is involved in Phase II as Phase I is complete. The goal of ITS is to identify the systems components of systems identified in Phase I through the interaction will a of the major switching equipment manufacturers. This will be a pilot program which depending upon its success will be continued to other manufacturers either through a face-to-face visit or through a survey built upon the findings of the pilot visits.

POSSIBLE ACTIONS FOR COMPANY VISIT

1. Mail ahead of time, a background briefing and questionnaire for Company's familiarity.

2. Briefly but thoroughly present the background explaining Who, What, and Why through the use of the slides.

3. Contact the Company representative who participated in the Joint TIM Group to determine his potential participation in the site visit. He may have ideas that save us much time and provide us with contacts and sources of information.

4. Has this study been verified or evaluated using Gulf War mobilization effort? If so, has Company participated in the evaluation?

IDEAS IN PREPARATION FOR THE COMPANY SITE VISIT

1. Identify or categorize the equipment staying close to the predefined categories in previous reports.

2. Define dependance (see Background above).

3. Get suggestions from Company on the best way to break down their system.

4. We should be sensitive to concerns about proprietary information in formatting the questions and results.

5. Are we only addressing hardware or do we include areas such as engineering?

6. We are looking for quantitative information versus the general effectual type of information requested earlier.

POTENTIAL QUESTIONS FOR COMPANY VISIT MANUFACTURING

Manufacturing encompasses the design, making, and assembly of components and subassemblies...

Design of Components and Subassemblies

1. Of the components and subassemblies under consideration what percentage are manufactured by foreign sources?

2. What percentage of those components in (1) above are manufactured by multiple sources?

3. In your estimation, what percentage of components and subassemblies are designed by foreign sources?

4. In your estimation, how would the unavailability of foreign component and subassembly design affect your company's ability to continue to produce, operate, maintain or integrate the switch equipment under consideration?

Making of Components

Assembly of Component into Subassemblies

SHIPPING

MARKETING

Just-in-time policy

Warehousing policy

Warehousing locations

Lead-time requirements

Multiple sources for same or interoperable products

APPENDIX D:

Import Data

U.S. Department of Commerce
International Trade Administration (ITA)

Raw Import Data

Table 25.--U.S. trade data
Flow: Imports for consumption
Type: Customs value
HS commodity: SEMICONDUCTORS
(Thousands of dollars)

Time period / Partner	1990					1991
	January-March	April-June	July-September	October-December	Total	January-March
Canada	257,846	233,797	230,952	283,207	1,005,801	330,673
Mexico	82,547	89,963	96,894	97,242	366,646	92,133
Brazil	1,254	2,045	1,391	1,286	5,975	1,341
Western Europe:						
European Community:						
Denmark	489	688	502	668	2,348	439
France	54,845	35,441	49,297	38,531	178,114	40,058
Germany, West	65,649	59,807	59,783	64,821	250,059	55,874
Greece	0	0	0	0	0	6
Ireland	16,052	21,475	19,847	18,162	75,536	17,249
Italy	13,870	10,490	9,294	9,022	42,676	8,569
Netherlands	6,136	5,132	4,967	7,166	23,401	6,498
Portugal	1,872	2,966	2,229	1,613	8,680	965
Spain	7,179	8,243	12,418	17,243	45,083	14,495
United Kingdom	49,552	57,459	60,418	69,521	236,950	53,030
Total EC	216,356	202,304	219,145	227,233	865,039	197,784
Total Western Europe	233,309	215,782	231,943	237,718	918,752	211,251
Eastern Europe:						
Bulgaria	0	0	0	0	0	0
Czechoslovakia	0	0	0	0	0	7
Germany, East	0	16	0	0	16	0
Hungary	14	26	11	30	81	7
Poland	54	179	5	0	237	142
Romania	0	0	0	0	0	1
Total Eastern Europe	68	220	16	30	334	158
East Asia:						
China	104	163	299	589	1,155	330
Hong Kong	56,847	70,989	75,340	60,228	263,404	58,474
Indonesia	2,406	3,949	4,192	3,302	13,849	3,787
Japan	784,575	841,203	772,622	817,939	3,216,338	878,415
Korea, South	434,269	461,570	438,847	432,596	1,767,283	407,626
Malaysia	427,457	400,296	421,497	368,283	1,617,533	356,404
Philippines	137,729	132,734	160,783	135,081	566,327	139,569
Singapore	250,998	268,139	311,214	304,562	1,134,913	268,746
Taiwan	148,686	159,682	174,200	153,790	636,358	149,018
Thailand	87,803	104,048	100,278	86,636	378,765	96,400
Total East Asia	2,330,875	2,442,774	2,459,272	2,363,005	9,595,925	2,358,769
WORLD TOTAL	2,935,699	3,011,491	3,050,631	3,025,517	12,023,338	3,032,708

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 25.--U.S. trade data
Flow: Imports for consumption
Type: Customs value
HS commodity: SEMICONDUCTORS
(Thousands of dollars)

Time period / Partner	1991				1992	
	April-June	July-September	October-December	Total	January-March	Total (partial)
Canada	350,141	389,868	349,061	1,419,743	430,495	430,495
Mexico	76,563	83,928	80,988	333,612	86,541	86,541
Brazil	1,710	1,355	642	5,049	1,190	1,190
Western Europe:						
European Community:						
Denmark	357	377	829	2,001	778	778
France	26,553	28,375	22,230	117,215	33,491	33,491
Germany, West	60,006	70,969	66,926	253,775	70,238	70,238
Greece	12	38	6	63	56	56
Ireland	18,973	19,430	18,865	74,516	23,436	23,436
Italy	7,531	10,157	7,821	34,078	7,607	7,607
Netherlands	8,634	7,956	5,914	29,002	5,506	5,506
Portugal	1,026	1,154	1,812	4,956	1,633	1,633
Spain	16,729	18,990	13,808	64,022	8,833	8,833
United Kingdom	55,989	56,456	62,735	228,211	59,068	59,068
Total EC	196,520	214,344	201,274	809,923	210,954	210,954
Total Western Europe	210,330	228,601	215,432	865,614	223,698	223,698
Eastern Europe:						
Bulgaria	0	0	20	20	0	0
Czechoslovakia	15	27	3	52	8	8
Germany, East	0	0	0	0	0	0
Hungary	6	15	0	28	9	9
Poland	270	60	5	477	73	73
Romania	0	0	13	14	44	44
Total Eastern Europe	291	102	41	592	135	135
East Asia:						
China	300	693	408	1,731	563	563
Hong Kong	63,104	72,581	82,094	276,253	79,994	79,994
Indonesia	4,922	7,734	9,692	26,136	9,626	9,626
Japan	858,710	897,165	940,262	3,574,552	1,030,733	1,030,733
Korea, South	447,963	446,992	475,961	1,778,542	470,170	470,170
Malaysia	382,146	423,964	421,831	1,584,345	416,661	416,661
Philippines	161,067	173,744	175,905	650,286	183,377	183,377
Singapore	281,627	286,962	335,597	1,172,933	314,313	314,313
Taiwan	185,234	171,594	166,973	672,819	189,121	189,121
Thailand	98,030	99,549	88,499	382,477	68,323	68,323
Total East Asia	2,483,103	2,580,977	2,697,223	10,120,072	2,762,882	2,762,882
WORLD TOTAL	3,160,153	3,328,573	3,406,704	12,928,139	3,573,161	3,573,161

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 26.--U.S. trade data
Flow: Imports for consumption
Type: Customs value
HS commodity: TOTAL ICs
(Thousands of dollars)

Time period / Partner	1990					1991
	January-March	April-June	July-September	October-December	Total	January-March
Canada	245,238	222,300	220,426	265,374	953,338	312,494
Mexico	37,751	41,830	45,339	40,056	164,976	38,439
Brazil	1,070	1,768	960	1,092	4,890	1,116
Western Europe:						
European Community:						
Denmark	381	582	274	357	1,595	165
France	11,334	10,913	12,787	14,559	49,593	9,051
Germany, West	45,567	45,042	41,034	44,602	176,244	40,158
Greece	0	0	0	0	0	6
Ireland	12,216	14,552	14,496	12,776	54,041	13,267
Italy	6,152	5,941	5,189	5,494	22,776	5,348
Netherlands	2,144	1,324	722	1,455	5,645	1,239
Portugal	1,562	2,482	2,003	1,162	7,210	559
Spain	916	3,988	12,068	16,769	33,740	10,878
United Kingdom	33,324	36,131	37,998	47,910	155,363	35,929
Total EC	114,086	121,352	126,755	145,421	507,614	117,116
Total Western Europe	126,745	130,980	135,177	152,121	545,023	124,960
Eastern Europe:						
Germany, East	0	2	0	0	2	0
Total Eastern Europe	0	2	0	0	2	0
East Asia:						
China	70	142	194	267	673	119
Hong Kong	48,327	60,415	63,085	46,157	217,985	50,118
Indonesia	2,395	3,940	4,132	3,025	13,493	3,730
Japan	551,745	614,082	554,863	575,441	2,296,131	637,007
Korea, South	398,266	426,151	401,421	390,549	1,616,387	375,950
Malaysia	379,315	350,192	365,401	311,907	1,406,815	305,140
Philippines	123,178	121,937	149,126	124,403	518,644	125,252
Singapore	239,710	257,058	298,194	292,282	1,087,244	258,581
Taiwan	125,534	130,986	144,495	125,467	526,482	122,132
Thailand	87,112	102,973	98,773	85,652	374,510	95,450
Total East Asia	1,955,652	2,067,877	2,079,683	1,955,150	8,058,363	1,973,480
WORLD TOTAL	2,369,207	2,466,918	2,484,722	2,416,482	9,737,328	2,456,616

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 26.--U.S. trade data
Flow: Imports for consumption
Type: Customs value
HS commodity: TOTAL ICs
(Thousands of dollars)

Partner \ Time period	1991				1992	
	April-June	July-September	October-December	Total	January-March	Total (partial)
Canada	328,066	375,374	333,144	1,349,078	403,760	403,760
Mexico	36,106	39,591	38,969	153,106	36,124	36,124
Brazil	1,139	1,092	293	3,641	745	745
Western Europe:						
European Community:						
Denmark	239	232	316	953	546	546
France	9,817	10,702	9,176	38,746	9,150	9,150
Germany, West	47,249	55,775	47,327	190,508	49,899	49,899
Greece	12	38	2	59	56	56
Ireland	14,967	15,376	13,815	57,425	17,858	17,858
Italy	4,421	6,057	5,238	21,064	4,627	4,627
Netherlands	3,407	1,560	1,401	7,608	971	971
Portugal	658	902	1,390	3,508	1,369	1,369
Spain	8,121	14,079	10,951	44,030	5,929	5,929
United Kingdom	38,922	35,225	40,234	150,312	31,282	31,282
Total EC	128,410	140,305	130,100	515,931	121,816	121,816
Total Western Europe	138,051	151,199	140,198	554,408	130,012	130,012
Eastern Europe:						
Germany, East	0	0	0	0	0	0
Total Eastern Europe	0	0	0	0	0	0
East Asia:						
China	193	348	208	869	173	173
Hong Kong	53,308	62,632	72,276	238,335	66,164	66,164
Indonesia	4,900	7,734	9,688	26,051	9,623	9,623
Japan	645,121	653,753	696,588	2,632,468	714,774	714,774
Korea, South	420,135	414,150	443,405	1,653,641	437,654	437,654
Malaysia	332,842	364,561	362,539	1,365,083	352,137	352,137
Philippines	140,149	146,197	150,112	561,710	155,797	155,797
Singapore	266,195	268,073	321,818	1,114,666	281,954	281,954
Taiwan	148,275	132,867	128,971	532,245	153,421	153,421
Thailand	97,066	98,076	86,863	377,456	64,839	64,839
Total East Asia	2,108,184	2,148,391	2,272,468	8,502,524	2,236,537	2,236,537
WORLD TOTAL	2,620,178	2,725,469	2,792,254	10,594,517	2,815,000	2,815,000

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 27.--U.S. trade data
Flow: Imports for consumption
Type: Customs value
HS commodity: MONOLITHIC ICs
(Thousands of dollars)

Time period / Partner	1990					1991
	January-March	April-June	July-September	October-December	Total	January-March
Canada	240,529	219,747	217,612	259,915	937,804	310,484
Mexico	32,755	36,072	38,438	33,755	141,019	34,203
Brazil	1,063	1,766	953	1,092	4,874	1,116
Western Europe:						
European Community:						
Denmark	373	573	269	357	1,573	154
France	9,091	8,688	9,960	10,606	38,345	8,765
Germany, West	43,502	43,393	35,687	40,158	162,741	35,108
Greece	0	0	0	0	0	0
Ireland	12,145	14,444	14,275	12,705	53,568	12,301
Italy	6,004	5,898	5,178	5,478	22,558	5,333
Netherlands	2,017	1,214	697	1,332	5,260	1,066
Portugal	1,562	2,481	2,001	1,159	7,203	559
Spain	914	3,988	12,058	16,760	33,720	10,878
United Kingdom	30,066	33,839	34,206	42,609	140,720	32,195
Total EC	105,903	114,656	114,475	131,416	466,450	106,362
Total Western Europe	117,796	123,118	122,677	137,466	501,057	113,570
Eastern Europe:						
Germany, East	0	2	0	0	2	0
Total Eastern Europe	0	2	0	0	2	0
East Asia:						
China	56	43	123	177	399	67
Hong Kong	45,354	58,906	60,875	43,072	208,208	46,468
Indonesia	2,395	3,940	4,132	3,025	13,493	3,730
Japan	516,409	577,620	518,251	543,515	2,155,795	604,541
Korea, South	394,029	420,054	395,166	385,146	1,594,395	371,953
Malaysia	362,733	329,708	339,385	293,964	1,325,789	290,752
Philippines	120,662	119,095	146,522	122,658	508,937	123,930
Singapore	203,576	219,386	257,178	258,466	938,606	236,455
Taiwan	122,563	128,593	141,292	122,554	515,002	119,015
Thailand	84,799	99,851	96,641	83,942	365,233	93,573
Total East Asia	1,852,577	1,957,195	1,959,564	1,856,520	7,625,856	1,890,484
WORLD TOTAL	2,246,740	2,339,223	2,340,422	2,289,499	9,215,684	2,354,808

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 27.--U.S. trade data
Flow: Imports for consumption
Type: Customs value
HS commodity: MONOLITHIC ICs
(Thousands of dollars)

Time period / Partner	1991				1992	
	April-June	July-September	October-December	Total	January-March	Total (partial)
Canada	325,597	373,262	331,700	1,341,043	403,519	403,519
Mexico	30,172	35,175	35,042	134,592	36,102	36,102
Brazil	1,139	1,091	293	3,640	745	745
Western Europe:						
European Community:						
Denmark	224	217	312	906	487	487
France	9,366	10,262	8,774	37,167	9,016	9,016
Germany, West	43,934	50,996	43,780	173,818	49,684	49,684
Greece	0	36	0	36	56	56
Ireland	14,571	14,845	13,442	55,159	17,777	17,777
Italy	3,908	6,036	5,229	20,506	4,623	4,623
Netherlands	3,154	1,330	955	6,505	960	960
Portugal	656	902	1,390	3,506	1,369	1,369
Spain	8,121	14,069	10,947	44,016	5,929	5,929
United Kingdom	34,454	32,166	34,204	133,018	30,348	30,348
Total EC	118,521	130,935	119,064	474,883	120,339	120,339
Total Western Europe	126,951	140,798	128,674	509,993	128,465	128,465
Eastern Europe:						
Germany, East	0	0	0	0	0	0
Total Eastern Europe	0	0	0	0	0	0
East Asia:						
China	66	175	169	477	173	173
Hong Kong	49,364	59,517	68,167	223,516	66,164	66,164
Indonesia	4,895	7,734	9,688	26,046	9,623	9,623
Japan	617,437	620,512	659,493	2,501,984	707,362	707,362
Korea, South	415,137	409,694	438,011	1,634,795	437,042	437,042
Malaysia	317,248	346,327	338,326	1,292,653	338,859	338,859
Philippines	138,749	143,373	146,777	552,829	155,791	155,791
Singapore	244,715	245,847	300,475	1,027,492	281,935	281,935
Taiwan	145,031	130,562	126,236	520,843	153,005	153,005
Thailand	95,579	96,022	84,332	369,507	64,838	64,838
Total East Asia	2,028,221	2,059,763	2,171,673	8,150,142	2,214,792	2,214,792
WORLD TOTAL	2,520,107	2,619,405	2,674,091	10,168,412	2,791,178	2,791,178

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 28.--U.S. trade data
Flow: Imports for consumption
Type: Customs value
HS commodity: TOTAL METAL OXIDE SEMICONDUCTORS
(Thousands of dollars)

Time period / Partner	1990					1991
	January-March	April-June	July-September	October-December	Total	January-March
Canada	209,466	187,146	184,572	225,902	807,087	268,292
Mexico	23,055	24,258	28,194	25,228	100,734	26,225
Brazil	5	157	14	453	628	864
Western Europe:						
European Community:						
Denmark	18	21	38	69	145	2
France	4,632	4,454	5,781	5,893	20,761	4,907
Germany, West	34,091	36,776	29,100	34,071	134,038	30,490
Greece	0	0	0	0	0	0
Ireland	1,960	2,956	2,686	1,711	9,312	561
Italy	2,536	3,320	2,200	2,823	10,879	2,291
Netherlands	608	352	370	257	1,588	664
Portugal	61	55	90	28	234	8
Spain	70	28	40	79	218	2,544
United Kingdom	16,214	17,162	20,788	28,978	83,142	23,756
Total EC	60,216	65,124	61,124	73,913	260,377	65,225
Total Western Europe	70,974	71,387	67,376	78,338	288,075	70,639
East Asia:						
China	12	18	57	10	97	34
Hong Kong	28,496	44,623	43,188	29,286	145,594	38,669
Indonesia	2,343	3,933	4,132	3,025	13,433	3,675
Japan	386,884	441,380	377,007	411,051	1,616,321	427,519
Korea, South	297,953	292,136	279,272	285,946	1,155,308	265,553
Malaysia	221,384	197,068	214,735	188,758	821,945	208,819
Philippines	92,170	89,081	119,323	93,170	393,744	94,645
Singapore	123,654	136,537	161,979	173,014	595,184	156,353
Taiwan	56,100	61,811	70,301	49,485	237,696	55,757
Thailand	42,911	45,613	43,285	38,226	170,034	40,792
Total East Asia	1,251,908	1,312,200	1,313,276	1,271,972	5,149,355	1,291,816
WORLD TOTAL	1,555,562	1,596,002	1,593,987	1,602,249	6,347,799	1,661,598

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 28.--U.S. trade data
Flow: Imports for consumption
Type: Customs value
HS commodity: TOTAL METAL OXIDE SEMICONDUCTORS
(Thousands of dollars)

Time period / Partner	1991				1992	
	April-June	July-September	October-December	Total	January-March	Total (partial)
Canada	282,498	321,555	295,044	1,167,389	363,917	363,917
Mexico	25,287	27,971	26,546	106,029	27,137	27,137
Brazil	1,063	717	231	2,875	540	540
Western Europe:						
European Community:						
Denmark	35	6	33	76	290	290
France	4,569	6,035	6,403	21,913	5,769	5,769
Germany, West	38,419	42,976	36,907	148,792	43,911	43,911
Greece	0	36	0	36	56	56
Ireland	977	2,011	2,128	5,676	3,877	3,877
Italy	2,194	5,006	3,701	13,193	2,987	2,987
Netherlands	2,335	777	555	4,331	350	350
Portugal	9	49	23	89	10	10
Spain	595	69	2,309	5,517	457	457
United Kingdom	25,290	26,258	27,216	102,520	21,603	21,603
Total EC	74,475	83,291	79,290	302,280	79,369	79,369
Total Western Europe	78,784	89,024	86,200	324,648	85,757	85,757
East Asia:						
China	58	127	133	351	150	150
Hong Kong	40,905	49,163	58,171	186,908	56,594	56,594
Indonesia	4,749	4,930	6,860	20,214	8,606	8,606
Japan	439,063	436,752	475,100	1,778,433	531,455	531,455
Korea, South	317,879	329,178	359,306	1,271,916	373,573	373,573
Malaysia	234,503	255,003	252,637	950,962	254,642	254,642
Philippines	99,702	104,031	102,958	401,337	112,968	112,968
Singapore	139,407	138,601	174,403	608,764	158,123	158,123
Taiwan	64,333	69,722	69,616	259,428	88,620	88,620
Thailand	32,094	37,434	35,372	145,692	25,721	25,721
Total East Asia	1,372,693	1,424,941	1,534,555	5,624,006	1,610,450	1,610,450
WORLD TOTAL	1,765,690	1,872,135	1,947,789	7,247,213	2,094,849	2,094,849

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 29.--U.S. trade data
Flow: Imports for consumption
Type: Customs value
HS commodity: MOS MEMORY
(Thousands of dollars)

Time period / Partner	1990					1991
	January-March	April-June	July-September	October-December	Total	January-March
Canada	142,394	151,326	150,135	180,762	624,616	199,285
Mexico	564	236	61	93	954	940
Brazil	0	12	11	182	205	861
Western Europe:						
European Community:						
Denmark	0	16	0	2	18	2
France	2,066	1,532	2,160	2,449	8,208	2,406
Germany, West	3,715	2,539	3,768	5,655	15,676	10,991
Greece	0	0	0	0	0	0
Ireland	1,838	2,733	2,442	1,534	8,547	505
Italy	949	1,220	389	834	3,392	300
Netherlands	27	3	19	75	125	385
Portugal	57	55	88	16	215	8
Spain	59	22	11	0	92	162
United Kingdom	3,703	4,274	5,072	8,430	21,479	5,072
Total EC	12,414	12,393	13,951	18,998	57,756	19,832
Total Western Europe	14,853	12,782	14,096	19,130	60,861	20,460
East Asia:						
China	2	18	48	10	78	7
Hong Kong	3,266	4,028	2,624	1,760	11,677	9,958
Indonesia	0	2	44	25	70	1,728
Japan	259,433	308,969	245,528	270,671	1,084,601	334,810
Korea, South	227,869	212,974	175,821	179,572	796,235	208,108
Malaysia	76,675	62,315	59,989	52,282	251,261	64,927
Philippines	41,458	38,363	63,139	39,602	182,562	51,670
Singapore	64,794	70,401	98,674	118,766	352,635	111,429
Taiwan	27,550	31,101	38,106	24,357	121,114	32,633
Thailand	8,870	9,115	6,937	4,910	29,831	28,318
Total East Asia	709,915	737,285	690,909	691,953	2,830,063	843,587
WORLD TOTAL	867,754	902,346	855,601	892,198	3,517,899	1,065,544

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 29.--U.S. trade data
Flow: Imports for consumption
Type: Customs value
HS commodity: MOS MEMORY
(Thousands of dollars)

Time period / Partner	1991				1992	
	April-June	July-September	October-December	Total	January-March	Total (partial)
Canada	202,623	230,780	224,740	857,428	271,910	271,910
Mexico	2,720	4,528	5,751	13,940	8,224	8,224
Brazil	1,062	715	231	2,868	540	540
Western Europe:						
European Community:						
Denmark	35	6	20	63	286	286
France	3,448	3,469	3,550	12,872	3,220	3,220
Germany, West	15,009	23,781	17,910	67,691	26,894	26,894
Greece	0	36	0	36	0	0
Ireland	471	364	1,615	2,956	2,394	2,394
Italy	758	717	1,730	3,504	1,099	1,099
Netherlands	707	262	267	1,620	183	183
Portugal	3	35	8	54	10	10
Spain	41	9	27	240	11	11
United Kingdom	5,137	3,003	2,603	15,814	3,572	3,572
Total EC	25,613	31,686	27,732	104,862	37,717	37,717
Total Western Europe	26,593	34,124	30,774	111,951	40,395	40,395
East Asia:						
China	22	17	5	50	21	21
Hong Kong	11,104	14,456	16,101	51,619	12,770	12,770
Indonesia	1,271	2,079	429	5,507	715	715
Japan	351,148	328,032	342,489	1,356,479	388,278	388,278
Korea, South	232,006	202,527	242,623	885,264	265,771	265,771
Malaysia	66,417	76,797	75,108	283,249	69,819	69,819
Philippines	52,820	47,574	44,624	196,687	45,742	45,742
Singapore	88,053	92,616	121,894	413,991	95,488	95,488
Taiwan	37,731	34,782	35,188	140,334	37,490	37,490
Thailand	19,571	21,696	18,633	88,217	12,038	12,038
Total East Asia	860,143	820,574	897,093	3,421,397	928,134	928,134
WORLD TOTAL	1,093,179	1,091,114	1,158,829	4,408,666	1,252,712	1,252,712

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 30.--U.S. trade data
Flow: Imports for consumption
Type: Customs value
HS commodity: DRAM
(Thousands of dollars)

Partner	Time period: 1990 January-March	April-June	July-September	October-December	Total	1991 January-March
Canada	0	0	0	0	0	193,173
Mexico	0	0	0	0	0	1
Brazil	0	0	0	0	0	0
Western Europe:						
European Community:						
Denmark	0	0	0	0	0	0
France	0	0	0	0	0	507
Germany, West	0	0	0	0	0	9,777
Greece	0	0	0	0	0	0
Ireland	0	0	0	0	0	142
Italy	0	0	0	0	0	251
Netherlands	0	0	0	0	0	28
Portugal	0	0	0	0	0	0
Spain	0	0	0	0	0	0
United Kingdom	0	0	0	0	0	712
Total EC	0	0	0	0	0	11,417
Total Western Europe	0	0	0	0	0	11,631
East Asia:						
Hong Kong	0	0	0	0	0	687
Indonesia	0	0	0	0	0	1,227
Japan	0	0	0	0	0	204,220
Korea, South	0	0	0	0	0	64,425
Malaysia	0	0	0	0	0	35,612
Philippines	0	0	0	0	0	705
Singapore	0	0	0	0	0	68,733
Taiwan	0	0	0	0	0	9,235
Thailand	0	0	0	0	0	24
Total East Asia	0	0	0	0	0	384,867
WORLD TOTAL	0	0	0	0	0	589,939

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 30.--U.S. trade data
Flow: Imports for consumption
Type: Customs value
HS commodity: DRAM
(Thousands of dollars)

Partner	1991				1992	
Time period	April-June	July-September	October-December	Total	January-March	Total (partial)
Canada	187,151	212,390	208,203	800,918	254,276	254,276
Mexico	49	7	11	67	3	3
Brazil	0	0	0	0	493	493
Western Europe:						
European Community:						
Denmark	0	0	3	3	280	280
France	1,020	470	308	2,305	747	747
Germany, West	12,945	20,978	13,679	57,379	24,809	24,809
Greece	0	36	0	36	0	0
Ireland	295	239	1,211	1,888	2,245	2,245
Italy	584	481	1,085	2,400	801	801
Netherlands	113	106	45	292	127	127
Portugal	0	35	0	35	2	2
Spain	11	0	0	11	11	11
United Kingdom	1,205	944	1,136	3,998	1,564	1,564
Total EC	16,178	23,289	17,467	68,351	30,587	30,587
Total Western Europe	16,250	24,055	17,918	69,854	31,385	31,385
East Asia:						
Hong Kong	921	898	1,683	4,189	2,763	2,763
Indonesia	1,085	0	0	2,311	0	0
Japan	212,214	191,646	204,923	813,003	243,125	243,125
Korea, South	83,722	85,297	134,523	367,967	178,204	178,204
Malaysia	29,478	34,436	39,346	138,871	35,952	35,952
Philippines	202	45	24	976	24	24
Singapore	61,672	64,307	75,892	270,605	66,148	66,148
Taiwan	10,321	9,753	9,426	38,735	12,227	12,227
Thailand	1,448	7	1	1,481	0	0
Total East Asia	401,063	386,389	465,820	1,638,140	538,442	538,442
WORLD TOTAL	604,534	622,955	692,157	2,509,584	826,122	826,122

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 31.--U.S. trade data
Flow: Imports for consumption
Type: Customs value
HS commodity: SRAM
(Thousands of dollars)

Time period / Partner	1990					1991
	January-March	April-June	July-September	October-December	Total	January-March
Canada	0	0	0	0	0	626
Mexico	0	0	0	0	0	0
Western Europe:						
European Community:						
Denmark	0	0	0	0	0	0
France	0	0	0	0	0	113
Germany, West	0	0	0	0	0	51
Ireland	0	0	0	0	0	206
Italy	0	0	0	0	0	8
Netherlands	0	0	0	0	0	12
Portugal	0	0	0	0	0	0
Spain	0	0	0	0	0	9
United Kingdom	0	0	0	0	0	3,522
Total EC	0	0	0	0	0	3,920
Total Western Europe	0	0	0	0	0	3,938
East Asia:						
China	0	0	0	0	0	0
Hong Kong	0	0	0	0	0	264
Indonesia	0	0	0	0	0	11
Japan	0	0	0	0	0	81,602
Korea, South	0	0	0	0	0	88,091
Malaysia	0	0	0	0	0	17,221
Philippines	0	0	0	0	0	8,036
Singapore	0	0	0	0	0	5,006
Taiwan	0	0	0	0	0	2,235
Thailand	0	0	0	0	0	174
Total East Asia	0	0	0	0	0	202,641
WORLD TOTAL	0	0	0	0	0	207,329

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 31.--U.S. trade data
Flow: Imports for consumption
Type: Customs value
HS commodity: SRAM
(Thousands of dollars)

Time period / Partner	1991				1992	
	April-June	July-September	October-December	Total	January-March	Total (partial)
Canada	1,511	2,353	2,187	6,677	4,555	4,555
Mexico	39	0	0	39	13	13
Western Europe:						
European Community:						
Denmark	0	0	3	3	0	0
France	242	565	466	1,386	282	282
Germany, West	189	267	91	598	949	949
Ireland	11	48	6	271	45	45
Italy	49	7	414	477	13	13
Netherlands	252	125	194	583	42	42
Portugal	2	0	4	6	0	0
Spain	18	0	0	27	0	0
United Kingdom	2,419	1,126	345	7,411	758	758
Total EC	3,182	2,140	1,524	10,766	2,088	2,088
Total Western Europe	3,201	2,924	2,704	12,767	3,104	3,104
East Asia:						
China	0	0	0	0	2	2
Hong Kong	363	494	355	1,477	367	367
Indonesia	89	1,680	207	1,987	402	402
Japan	81,145	68,997	71,707	303,451	82,129	82,129
Korea, South	89,171	63,911	54,383	295,555	39,020	39,020
Malaysia	17,019	20,217	17,858	72,316	16,341	16,341
Philippines	8,946	8,426	7,806	33,214	10,236	10,236
Singapore	1,516	1,634	1,366	9,522	775	775
Taiwan	3,393	3,572	2,998	12,198	3,461	3,461
Thailand	136	151	313	774	199	199
Total East Asia	201,778	169,082	156,993	730,494	152,932	152,932
WORLD TOTAL	206,541	174,586	161,890	750,347	160,613	160,613

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 32.--U.S. trade data
Flow: Imports for consumption
Type: Customs value
HS commodity: EEPROM
(Thousands of dollars)

Time period / Partner	1990					1991
	January-March	April-June	July-September	October-December	Total	January-March
Canada	0	0	0	0	0	62
Mexico	0	0	0	0	0	222
Brazil	0	0	0	0	0	75
Western Europe:						
European Community:						
Denmark	0	0	0	0	0	2
France	0	0	0	0	0	41
Germany, West	0	0	0	0	0	88
Ireland	0	0	0	0	0	40
Italy	0	0	0	0	0	19
Netherlands	0	0	0	0	0	160
Portugal	0	0	0	0	0	1
Spain	0	0	0	0	0	153
United Kingdom	0	0	0	0	0	215
Total EC	0	0	0	0	0	719
Total Western Europe	0	0	0	0	0	1,013
East Asia:						
Hong Kong	0	0	0	0	0	501
Indonesia	0	0	0	0	0	71
Japan	0	0	0	0	0	3,159
Korea, South	0	0	0	0	0	11,387
Malaysia	0	0	0	0	0	2,365
Philippines	0	0	0	0	0	2,610
Singapore	0	0	0	0	0	13,855
Taiwan	0	0	0	0	0	4,823
Thailand	0	0	0	0	0	16,404
Total East Asia	0	0	0	0	0	55,176
WORLD TOTAL	0	0	0	0	0	56,547

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 32.--U.S. trade data
Flow: Imports for consumption
Type: Customs value
HS commodity: EEPROM
(Thousands of dollars)

Time period / Partner	1991				1992	
	April-June	July-September	October-December	Total	January-March	Total (partial)
Canada	11	23	6	102	3	3
Mexico	185	476	265	1,147	320	320
Brazil	0	0	0	75	16	16
Western Europe:						
European Community:						
Denmark	30	1	2	36	1	1
France	9	75	234	359	226	226
Germany, West	318	502	316	1,224	212	212
Ireland	19	0	3	62	36	36
Italy	41	13	43	116	19	19
Netherlands	134	11	11	316	3	3
Portugal	0	0	0	1	0	0
Spain	12	7	27	199	0	0
United Kingdom	141	175	268	798	327	327
Total EC	704	783	904	3,111	841	841
Total Western Europe	881	906	959	3,759	869	869
East Asia:						
Hong Kong	274	99	60	934	17	17
Indonesia	73	91	178	413	288	288
Japan	2,940	4,927	7,781	18,806	6,109	6,109
Korea, South	10,414	11,569	10,252	43,622	9,436	9,436
Malaysia	2,506	1,586	1,623	8,080	905	905
Philippines	5,138	4,603	5,054	17,405	5,976	5,976
Singapore	2,349	2,127	4,445	22,777	1,799	1,799
Taiwan	7,542	8,376	8,403	29,143	7,685	7,685
Thailand	571	475	96	17,545	40	40
Total East Asia	31,806	33,851	37,892	158,726	32,256	32,256
WORLD TOTAL	32,883	35,257	39,126	163,814	33,501	33,501

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 33.--U.S. trade data
Flow: Imports for consumption
Type: Customs value
HS commodity: EPROM
(Thousands of dollars)

Time period / Partner	1990					1991
	January-March	April-June	July-September	October-December	Total	January-March
Canada	0	0	0	0	0	44
Mexico	0	0	0	0	0	28
Brazil	0	0	0	0	0	0
Western Europe:						
European Community:						
Denmark	0	0	0	0	0	0
France	0	0	0	0	0	1,590
Germany, West	0	0	0	0	0	83
Ireland	0	0	0	0	0	15
Italy	0	0	0	0	0	6
Netherlands	0	0	0	0	0	2
Portugal	0	0	0	0	0	0
United Kingdom	0	0	0	0	0	292
Total EC	0	0	0	0	0	1,987
Total Western Europe	0	0	0	0	0	2,041
East Asia:						
China	0	0	0	0	0	7
Hong Kong	0	0	0	0	0	1,126
Indonesia	0	0	0	0	0	419
Japan	0	0	0	0	0	8,217
Korea, South	0	0	0	0	0	18,528
Malaysia	0	0	0	0	0	6,041
Philippines	0	0	0	0	0	32,752
Singapore	0	0	0	0	0	17,215
Taiwan	0	0	0	0	0	3,435
Thailand	0	0	0	0	0	11,184
Total East Asia	0	0	0	0	0	98,923
WORLD TOTAL	0	0	0	0	0	101,058

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 33.--U.S. trade data
Flow: Imports for consumption
Type: Customs value
HS commodity: EPROM
(Thousands of dollars)

Partner \ Time period	1991				1992	
	April-June	July-September	October-December	Total	January-March	Total (partial)
Canada	267	94	39	444	100	100
Mexico	8	6	53	96	15	15
Brazil	0	9	0	9	0	0
Western Europe:						
European Community:						
Denmark	4	4	0	8	5	5
France	1,809	2,253	2,438	8,091	1,663	1,663
Germany, West	176	32	768	1,059	98	98
Ireland	5	6	10	35	7	7
Italy	16	117	175	313	105	105
Netherlands	3	20	8	32	2	2
Portugal	2	0	2	4	0	0
United Kingdom	265	299	211	1,067	409	409
Total EC	2,280	2,731	3,612	10,609	2,298	2,298
Total Western Europe	2,712	3,037	4,185	11,975	2,525	2,525
East Asia:						
China	22	17	0	45	0	0
Hong Kong	1,738	1,990	227	5,080	504	504
Indonesia	25	308	40	792	23	23
Japan	10,711	14,797	13,529	47,255	11,798	11,798
Korea, South	20,322	16,630	21,487	76,967	18,883	18,883
Malaysia	14,108	15,578	11,377	47,103	13,789	13,789
Philippines	30,472	23,632	22,416	109,271	17,594	17,594
Singapore	17,024	18,349	31,878	84,466	21,184	21,184
Taiwan	3,940	5,155	6,247	18,777	6,354	6,354
Thailand	17,401	21,043	17,927	67,554	11,791	11,791
Total East Asia	115,762	117,498	125,128	457,311	101,920	101,920
WORLD TOTAL	118,755	120,652	129,411	469,875	106,412	106,412

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 34.--U.S. trade data
Flow: Imports for consumption
Type: Customs value
HS commodity: MOS LOGIC
(Thousands of dollars)

Partner	1990					1991
Time period	January-March	April-June	July-September	October-December	Total	January-March
Canada	221	110	433	808	1,572	69,007
Mexico	21,981	23,588	27,799	24,845	98,213	25,285
Brazil	0	0	0	8	8	3
Western Europe:						
European Community:						
Denmark	0	5	0	0	5	0
France	288	696	684	1,503	3,171	2,501
Germany, West	11,098	11,528	10,215	14,362	47,203	19,499
Greece	0	0	0	0	0	0
Ireland	26	55	49	72	201	56
Italy	13	33	199	121	366	1,991
Netherlands	438	115	219	25	797	280
Portugal	0	0	0	0	0	0
Spain	6	0	25	65	95	2,382
United Kingdom	3,299	5,304	6,788	4,702	20,091	18,684
Total EC	15,167	17,735	18,178	20,849	71,929	45,393
Total Western Europe	20,158	21,365	21,896	23,379	86,797	50,179
East Asia:						
China	10	0	8	0	19	27
Hong Kong	5,597	5,009	3,920	5,112	19,638	28,711
Indonesia	0	0	0	0	0	1,947
Japan	14,623	15,639	17,192	20,821	68,275	92,709
Korea, South	18,982	20,959	32,198	25,307	97,447	57,445
Malaysia	80,670	70,130	85,105	80,107	316,013	143,892
Philippines	10,792	10,828	10,154	11,082	42,857	42,975
Singapore	10,770	12,873	17,043	17,264	57,950	44,924
Taiwan	3,737	3,123	7,404	3,286	17,550	23,124
Thailand	5,595	4,807	5,950	4,197	20,548	12,475
Total East Asia	150,777	143,370	178,975	167,176	640,297	448,230
WORLD TOTAL	193,143	188,471	229,149	216,229	826,993	596,055

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 34.--U.S. trade data
Flow: Imports for consumption
Type: Customs value
HS commodity: MOS LOGIC
(Thousands of dollars)

Time period / Partner	1991				1992	
	April-June	July-September	October-December	Total	January-March	Total (partial)
Canada	79,875	90,776	70,303	309,961	92,007	92,007
Mexico	22,566	23,443	20,795	92,089	18,913	18,913
Brazil	2	2	0	7	0	0
Western Europe:						
European Community:						
Denmark	0	0	13	13	4	4
France	1,122	2,566	2,853	9,041	2,549	2,549
Germany, West	23,410	19,194	18,997	81,100	17,017	17,017
Greece	0	0	0	0	56	56
Ireland	505	1,647	512	2,721	1,482	1,482
Italy	1,437	4,289	1,972	9,689	1,888	1,888
Netherlands	1,628	515	287	2,711	167	167
Portugal	6	14	15	35	0	0
Spain	554	60	2,281	5,277	446	446
United Kingdom	20,153	23,255	24,613	86,706	18,031	18,031
Total EC	48,862	51,605	51,557	197,418	41,652	41,652
Total Western Europe	52,192	54,900	55,426	212,697	45,362	45,362
East Asia:						
China	36	110	128	301	129	129
Hong Kong	29,801	34,708	42,070	135,289	43,824	43,824
Indonesia	3,478	2,852	6,430	14,707	7,890	7,890
Japan	87,914	108,720	132,611	421,954	143,177	143,177
Korea, South	85,873	126,651	116,683	386,652	107,802	107,802
Malaysia	168,085	178,206	177,529	667,713	184,823	184,823
Philippines	46,883	56,458	58,335	204,650	67,226	67,226
Singapore	51,355	45,985	52,509	194,773	62,634	62,634
Taiwan	26,602	34,940	34,428	119,093	51,130	51,130
Thailand	12,523	15,738	16,740	57,476	13,683	13,683
Total East Asia	512,550	604,367	637,462	2,202,609	682,317	682,317
WORLD TOTAL	672,511	781,021	788,960	2,838,547	842,137	842,137

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 35.--U.S. trade data
Flow: Imports for consumption
Type: Customs value
HS commodity: MOS MICROPROCESSOR
(Thousands of dollars)

Time period / Partner	1990					1991
	January-March	April-June	July-September	October-December	Total	January-March
Canada	0	0	0	0	0	161
Mexico	0	0	0	0	0	19,140
Brazil	0	0	0	0	0	3
Western Europe:						
European Community:						
Denmark	0	0	0	0	0	0
France	0	0	0	0	0	1,083
Germany, West	0	0	0	0	0	694
Greece	0	0	0	0	0	0
Ireland	0	0	0	0	0	3
Italy	0	0	0	0	0	37
Netherlands	0	0	0	0	0	4
Portugal	0	0	0	0	0	0
Spain	0	0	0	0	0	0
United Kingdom	0	0	0	0	0	6,384
Total EC	0	0	0	0	0	8,205
Total Western Europe	0	0	0	0	0	9,869
East Asia:						
China	0	0	0	0	0	18
Hong Kong	0	0	0	0	0	5,545
Japan	0	0	0	0	0	17,592
Korea, South	0	0	0	0	0	11,777
Malaysia	0	0	0	0	0	74,373
Philippines	0	0	0	0	0	205
Singapore	0	0	0	0	0	8,196
Taiwan	0	0	0	0	0	1,566
Thailand	0	0	0	0	0	3,342
Total East Asia	0	0	0	0	0	122,616
WORLD TOTAL	0	0	0	0	0	155,095

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 35.--U.S. trade data
Flow: Imports for consumption
Type: Customs value
HS commodity: MOS MICROPROCESSOR
(Thousands of dollars)

Partner \ Time period	1991				1992	
	April-June	July-September	October-December	Total	January-March	Total (partial)
Canada	291	808	1,289	2,550	2,030	2,030
Mexico	22,450	23,045	20,386	85,021	18,898	18,898
Brazil	0	0	0	3	0	0
Western Europe:						
European Community:						
Denmark	0	0	0	0	4	4
France	254	390	683	2,410	682	682
Germany, West	715	1,187	389	2,985	444	444
Greece	0	0	0	0	56	56
Ireland	75	228	38	343	224	224
Italy	367	105	2	511	37	37
Netherlands	767	440	28	1,239	37	37
Portugal	1	10	0	12	0	0
Spain	5	0	15	21	36	36
United Kingdom	5,072	6,766	8,534	26,756	5,446	5,446
Total EC	7,256	9,125	9,690	34,276	6,965	6,965
Total Western Europe	9,149	11,310	13,077	43,405	10,167	10,167
East Asia:						
China	36	110	51	215	120	120
Hong Kong	5,189	10,189	11,641	32,564	13,635	13,635
Japan	20,251	25,651	31,435	94,929	22,914	22,914
Korea, South	10,621	14,546	14,624	51,568	12,535	12,535
Malaysia	79,448	83,119	85,180	322,120	89,260	89,260
Philippines	6,209	11,762	8,552	26,727	12,252	12,252
Singapore	10,583	7,908	10,973	37,661	11,639	11,639
Taiwan	3,177	8,011	6,692	19,446	16,346	16,346
Thailand	3,600	5,362	5,415	17,719	2,351	2,351
Total East Asia	139,112	166,657	174,563	602,948	181,052	181,052
WORLD TOTAL	175,836	208,919	213,766	753,616	215,238	215,238

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 36.--U.S. trade data
Flow: Imports for consumption
Type: Customs value
HS commodity: BiCMOS
(Thousands of dollars)

Time period / Partner	1990					1991
	January-March	April-June	July-September	October-December	Total	January-March
Canada	0	0	0	0	0	669
Mexico	0	0	0	0	0	36
Western Europe:						
European Community:						
France	0	0	0	0	0	38
Germany, West	0	0	0	0	0	5
Ireland	0	0	0	0	0	2
Italy	0	0	0	0	0	0
Netherlands	0	0	0	0	0	11
Portugal	0	0	0	0	0	2
United Kingdom	0	0	0	0	0	186
Total EC	0	0	0	0	0	243
Total Western Europe	0	0	0	0	0	243
East Asia:						
China	0	0	0	0	0	0
Hong Kong	0	0	0	0	0	21
Japan	0	0	0	0	0	9,308
Korea, South	0	0	0	0	0	1,590
Malaysia	0	0	0	0	0	5,023
Philippines	0	0	0	0	0	7
Singapore	0	0	0	0	0	3,899
Taiwan	0	0	0	0	0	592
Thailand	0	0	0	0	0	61
Total East Asia	0	0	0	0	0	20,500
WORLD TOTAL	0	0	0	0	0	21,447

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 36.--U.S. trade data
Flow: Imports for consumption
Type: Customs value
HS commodity: BiCMOS
(Thousands of dollars)

Time period / Partner	1991				1992	
	April-June	July-September	October-December	Total	January-March	Total (partial)
Canada	3	1,727	48	2,446	187	187
Mexico	0	0	4	39	0	0
Western Europe:						
European Community:						
France	72	78	267	454	140	140
Germany, West	12	585	2	604	321	321
Ireland	5	7	108	122	49	49
Italy	6	2	0	8	0	0
Netherlands	79	2	0	92	2	2
Portugal	0	0	0	2	11	11
United Kingdom	547	186	1,393	2,313	1,341	1,341
Total EC	721	860	1,771	3,595	1,864	1,864
Total Western Europe	721	860	1,776	3,600	1,875	1,875
East Asia:						
China	6	17	0	22	0	0
Hong Kong	6	85	38	150	40	40
Japan	25,578	40,264	39,101	114,251	36,770	36,770
Korea, South	2,460	2,674	1,951	8,676	1,273	1,273
Malaysia	2,856	1,793	1,139	10,812	1,188	1,188
Philippines	30	50	20	107	306	306
Singapore	2,811	1,081	453	8,244	2,749	2,749
Taiwan	1,286	483	598	2,959	1,403	1,403
Thailand	42	28	24	154	24	24
Total East Asia	35,074	46,475	43,325	145,374	43,753	43,753
WORLD TOTAL	35,798	49,062	45,153	151,460	45,816	45,816

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 37.--U.S. trade data
Flow: Imports for consumption
Type: Customs value
HS commodity: MONOLITHIC IC, NOT SILICON
(Thousands of dollars)

Time period / Partner	1990					1991
	January-March	April-June	July-September	October-December	Total	January-March
Canada	0	0	0	0	0	193
Mexico	0	0	0	0	0	0
Western Europe:						
European Community:						
Denmark	0	0	0	0	0	3
France	0	0	0	0	0	341
Germany, West	0	0	0	0	0	204
Ireland	0	0	0	0	0	286
Italy	0	0	0	0	0	11
Netherlands	0	0	0	0	0	8
Portugal	0	0	0	0	0	2
Spain	0	0	0	0	0	2
United Kingdom	0	0	0	0	0	1,542
Total EC	0	0	0	0	0	2,399
Total Western Europe	0	0	0	0	0	2,535
East Asia:						
China	0	0	0	0	0	0
Hong Kong	0	0	0	0	0	737
Indonesia	0	0	0	0	0	0
Japan	0	0	0	0	0	27,714
Korea, South	0	0	0	0	0	36,750
Malaysia	0	0	0	0	0	791
Philippines	0	0	0	0	0	980
Singapore	0	0	0	0	0	454
Taiwan	0	0	0	0	0	4,618
Thailand	0	0	0	0	0	2
Total East Asia	0	0	0	0	0	72,046
WORLD TOTAL	0	0	0	0	0	74,800

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 37.--U.S. trade data
Flow: Imports for consumption
Type: Customs value
HS commodity: MONOLITHIC IC, NOT SILICON
(Thousands of dollars)

Time period / Partner	1991				1992	
	April-June	July-September	October-December	Total	January-March	Total (partial)
Canada	320	136	61	709	206	206
Mexico	7	3	3	13	7	7
Western Europe:						
European Community:						
Denmark	0	3	2	9	1	1
France	1,116	718	151	2,325	587	587
Germany, West	959	473	888	2,523	944	944
Ireland	183	318	195	981	261	261
Italy	11	4	0	26	29	29
Netherlands	92	132	9	242	71	71
Portugal	0	0	1	3	0	0
Spain	0	27	0	29	60	60
United Kingdom	1,090	375	1,003	4,010	2,070	2,070
Total EC	3,451	2,051	2,260	10,161	4,024	4,024
Total Western Europe	3,960	2,265	2,395	11,155	4,361	4,361
East Asia:						
China	0	0	0	0	3	3
Hong Kong	352	1,891	2,225	5,205	1,261	1,261
Indonesia	0	0	3	3	0	0
Japan	31,635	6,686	7,427	73,462	5,458	5,458
Korea, South	29,011	4,477	4,944	75,182	4,967	4,967
Malaysia	515	363	186	1,855	493	493
Philippines	1,341	451	408	3,180	326	326
Singapore	356	52	259	1,121	315	315
Taiwan	5,115	2,428	1,335	13,496	1,942	1,942
Thailand	9	66	0	77	0	0
Total East Asia	68,334	16,414	16,786	173,580	14,765	14,765
WORLD TOTAL	72,624	18,845	19,256	185,525	19,347	19,347

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 38.--U.S. trade data
Flow: Imports for consumption
Type: Customs value
HS commodity: LINEAR
(Thousands of dollars)

Time period / Partner	1990					1991
	January-March	April-June	July-September	October-December	Total	January-March
Canada	8,480	7,094	11,760	6,121	33,455	12,129
Mexico	2,858	3,311	2,894	3,240	12,303	982
Brazil	296	446	128	217	1,087	155
Western Europe:						
European Community:						
Denmark	354	416	226	284	1,280	0
France	1,782	2,093	2,720	1,848	8,443	634
Germany, West	3,190	1,569	3,167	3,641	11,567	134
Ireland	9,436	10,452	11,212	10,547	41,647	0
Italy	620	1,129	810	1,057	3,616	15
Netherlands	852	598	232	290	1,972	184
Portugal	55	42	67	124	288	0
Spain	51	116	0	60	227	0
United Kingdom	3,019	4,128	4,153	3,836	15,136	1,522
Total EC	19,546	20,648	22,677	21,756	84,626	2,490
Total Western Europe	19,891	21,803	23,284	23,140	88,119	2,531
Eastern Europe:						
Germany, East	0	2	0	0	2	0
Total Eastern Europe	0	2	0	0	2	0
East Asia:						
China	44	9	31	161	245	0
Hong Kong	11,921	9,284	10,848	6,831	38,884	594
Indonesia	52	8	0	0	60	0
Japan	33,504	28,391	28,693	34,496	125,084	3,127
Korea, South	44,060	47,804	53,039	43,865	188,768	21,021
Malaysia	36,559	38,987	44,367	41,660	161,573	24,113
Philippines	18,933	18,954	18,022	19,849	75,758	5,526
Singapore	34,867	39,310	45,742	39,050	158,970	10,942
Taiwan	36,349	35,707	35,265	35,305	142,626	9,097
Thailand	4,561	4,933	5,251	3,750	18,495	3,463
Total East Asia	220,851	223,387	241,257	224,968	910,463	77,883
WORLD TOTAL	253,785	256,437	279,840	257,858	1,047,921	93,683

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 38.--U.S. trade data
Flow: Imports for consumption
Type: Customs value
HS commodity: LINEAR
(Thousands of dollars)

Time period / Partner	1991				1992	
	April-June	July-September	October-December	Total	January-March	Total (partial)
Canada	18,707	25,995	13,184	70,015	15,082	15,082
Mexico	253	74	87	1,397	4,928	4,928
Brazil	32	37	15	240	203	203
Western Europe:						
European Community:						
Denmark	0	0	0	0	180	180
France	836	1,075	1,145	3,690	1,760	1,760
Germany, West	216	194	45	590	3,212	3,212
Ireland	73	187	391	651	13,357	13,357
Italy	144	23	23	206	323	323
Netherlands	284	287	260	1,016	495	495
Portugal	0	0	0	0	80	80
Spain	9	0	74	83	235	235
United Kingdom	1,904	1,210	2,023	6,659	3,184	3,184
Total EC	3,469	2,977	3,962	12,897	22,829	22,829
Total Western Europe	3,556	2,977	4,149	13,213	24,054	24,054
Eastern Europe:						
Germany, East	0	0	0	0	0	0
Total Eastern Europe	0	0	0	0	0	0
East Asia:						
China	0	0	0	0	0	0
Hong Kong	1,046	1,351	1,362	4,353	5,544	5,544
Indonesia	53	1,207	1,278	2,538	1,012	1,012
Japan	5,359	5,396	9,278	23,160	56,906	56,906
Korea, South	25,857	26,249	28,686	101,813	32,454	32,454
Malaysia	25,355	36,642	34,692	120,803	48,609	48,609
Philippines	6,087	5,705	7,307	24,625	24,723	24,723
Singapore	11,467	13,912	12,189	48,510	53,003	53,003
Taiwan	9,925	9,868	9,637	38,527	37,475	37,475
Thailand	3,993	4,959	3,738	16,153	4,179	4,179
Total East Asia	89,142	105,289	108,168	380,483	263,905	263,905
WORLD TOTAL	111,702	134,380	125,626	465,391	308,299	308,299

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 39.--U.S. trade data
Flow: Imports for consumption
Type: Customs value
HS commodity: BIPOLAR
(Thousands of dollars)

Time period / Partner	1990					1991
	January-March	April-June	July-September	October-December	Total	January-March
Canada	21,024	23,290	19,335	25,380	89,028	25,927
Mexico	1,205	996	953	1,939	5,094	722
Brazil	758	1,163	800	414	3,137	6
Western Europe:						
European Community:						
Denmark	0	134	0	0	134	28
France	2,160	1,303	354	1,864	5,681	389
Germany, West	5,319	4,123	2,672	1,579	13,693	1,447
Ireland	40	163	73	112	388	122
Italy	2,848	1,429	2,109	1,416	7,802	2,046
Netherlands	237	7	3	626	872	56
Portugal	1,423	2,293	1,838	985	6,539	527
Spain	163	0	0	0	163	0
United Kingdom	1,695	1,561	1,645	2,040	6,942	2,065
Total EC	13,885	11,013	8,695	8,622	42,215	6,682
Total Western Europe	14,238	11,291	9,540	8,741	43,810	7,151
East Asia:						
China	0	0	0	6	6	0
Hong Kong	2,789	2,854	3,965	2,892	12,500	4,124
Indonesia	0	0	0	0	0	55
Japan	83,452	92,178	91,373	78,802	345,804	69,576
Korea, South	38,201	63,396	49,388	44,556	195,540	19,663
Malaysia	87,938	72,241	63,591	45,341	269,110	38,878
Philippines	9,029	10,184	8,612	8,702	36,527	9,148
Singapore	32,837	30,255	29,672	28,019	120,783	21,713
Taiwan	24,302	24,255	25,036	30,851	104,444	20,389
Thailand	28,027	36,206	33,705	26,109	124,047	30,123
Total East Asia	306,574	331,569	305,341	265,277	1,208,762	213,669
WORLD TOTAL	344,068	368,342	336,066	301,951	1,350,426	248,442

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 39.--U.S. trade data
Flow: Imports for consumption
Type: Customs value
HS commodity: BIPOLAR
(Thousands of dollars)

Time period / Partner	1991				1992	
	April-June	July-September	October-December	Total	January-March	Total (partial)
Canada	21,491	21,593	21,308	90,320	24,092	24,092
Mexico	130	58	160	1,070	83	83
Brazil	0	32	0	38	2	2
Western Europe:						
European Community:						
Denmark	52	0	0	80	8	8
France	938	340	203	1,870	498	498
Germany, West	1,305	2,043	487	5,282	545	545
Ireland	34	50	137	343	105	105
Italy	850	608	700	4,205	1,227	1,227
Netherlands	175	8	19	258	33	33
Portugal	622	776	1,314	3,238	1,196	1,196
Spain	99	5	0	104	0	0
United Kingdom	3,252	1,593	1,522	8,431	1,693	1,693
Total EC	7,405	5,423	4,381	23,890	5,306	5,306
Total Western Europe	7,577	5,433	4,440	24,600	5,325	5,325
East Asia:						
China	0	16	0	16	0	0
Hong Kong	3,440	3,772	3,105	14,442	2,360	2,360
Indonesia	40	654	425	1,173	4	4
Japan	51,732	54,420	45,962	221,689	38,236	38,236
Korea, South	16,384	21,656	22,647	80,350	20,677	20,677
Malaysia	41,289	38,709	34,471	153,347	33,507	33,507
Philippines	14,112	14,241	18,192	55,694	15,517	15,517
Singapore	26,406	28,333	37,926	114,377	44,723	44,723
Taiwan	28,059	18,270	15,618	82,336	20,089	20,089
Thailand	24,462	19,368	17,487	91,440	11,791	11,791
Total East Asia	205,923	199,439	195,833	814,865	186,904	186,904
WORLD TOTAL	237,264	227,635	222,897	936,238	216,731	216,731

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 40.--U.S. trade data
Flow: Imports for consumption
Type: Customs value
HS commodity: HYBRIDS
(Thousands of dollars)

Time period / Partner	1990					1991
	January-March	April-June	July-September	October-December	Total	January-March
Canada	3,873	2,445	2,415	5,362	14,094	2,103
Mexico	2,888	3,137	4,169	4,904	15,100	3,504
Brazil	0	0	0	0	0	0
Western Europe:						
European Community:						
Denmark	6	9	29	57	102	0
France	503	413	1,039	587	2,542	495
Germany, West	1,552	1,346	5,109	4,410	12,417	5,094
Ireland	74	89	201	112	476	606
Italy	149	8	3	19	178	8
Netherlands	149	102	49	129	428	166
Portugal	0	3	0	0	3	0
Spain	1	0	0	9	10	0
United Kingdom	3,528	2,770	5,308	5,649	17,255	4,235
Total EC	6,228	5,151	11,948	11,151	34,478	11,106
Total Western Europe	7,625	5,590	12,469	12,363	38,048	13,358
Eastern Europe:						
Poland	54	179	0	0	232	142
Total Eastern Europe	54	179	0	0	232	142
East Asia:						
China	19	0	34	75	128	37
Hong Kong	2,022	1,463	2,278	2,972	8,735	3,686
Indonesia	0	0	0	0	0	0
Japan	29,492	28,714	28,665	25,479	112,350	24,967
Korea, South	6,379	5,671	5,778	4,351	22,180	3,704
Malaysia	6,186	6,420	10,809	8,338	31,753	5,312
Philippines	2,194	2,800	2,597	1,654	9,246	1,330
Singapore	35,488	37,697	41,182	33,946	148,313	22,284
Taiwan	3,145	2,259	3,668	2,483	11,555	3,012
Thailand	2,083	2,819	2,016	1,640	8,559	1,757
Total East Asia	87,008	87,844	97,027	80,939	352,818	66,089
WORLD TOTAL	102,045	99,921	117,926	105,410	425,302	86,260

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 40.--U.S. trade data
Flow: Imports for consumption
Type: Customs value
HS commodity: HYBRIDS
(Thousands of dollars)

Time period / Partner	1991				1992	
	April-June	July-September	October-December	Total	January-March	Total (partial)
Canada	2,184	1,983	1,412	7,682	1,923	1,923
Mexico	5,099	3,572	3,887	16,063	3,450	3,450
Brazil	0	1	0	1	0	0
Western Europe:						
European Community:						
Denmark	18	18	25	60	10	10
France	495	338	296	1,624	548	548
Germany, West	3,197	4,644	3,196	16,131	2,122	2,122
Ireland	399	539	365	1,908	305	305
Italy	509	14	3	534	130	130
Netherlands	258	138	218	781	705	705
Portugal	2	4	0	6	0	0
Spain	0	10	3	13	110	110
United Kingdom	4,462	3,740	6,788	19,226	4,399	4,399
Total EC	9,748	9,705	11,152	41,712	8,438	8,438
Total Western Europe	11,868	11,601	12,591	49,417	10,378	10,378
Eastern Europe:						
Poland	270	52	5	470	0	0
Total Eastern Europe	270	52	5	470	0	0
East Asia:						
China	114	151	34	336	14	14
Hong Kong	3,989	2,991	4,068	14,734	3,828	3,828
Indonesia	6	0	0	6	0	0
Japan	22,978	25,023	27,762	100,731	34,606	34,606
Korea, South	4,207	4,191	5,112	17,213	4,772	4,772
Malaysia	5,599	7,607	11,037	29,556	6,975	6,975
Philippines	1,401	2,793	3,400	8,924	2,896	2,896
Singapore	21,674	22,361	21,518	87,836	19,199	19,199
Taiwan	3,117	2,176	2,861	11,165	3,014	3,014
Thailand	1,484	2,041	2,531	7,813	1,959	1,959
Total East Asia	64,570	69,333	78,324	278,316	77,263	77,263
WORLD TOTAL	84,375	86,909	96,518	354,061	93,298	93,298

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 41.--U.S. trade data
Flow: Imports for consumption
Type: Customs value
HS commodity: OTHER INTEGRATED CIRCUITS
(Thousands of dollars)

Time period / Partner	1990					1991
	January-March	April-June	July-September	October-December	Total	January-March
Canada	2,416	2,458	2,415	2,668	9,957	118
Mexico	7,747	10,128	9,128	4,745	31,749	766
Brazil	10	2	18	8	37	0
Western Europe:						
European Community:						
Denmark	3	1	5	5	14	12
France	2,303	2,708	3,015	4,468	12,495	9
Germany, West	1,427	1,246	998	998	4,668	96
Greece	0	0	0	0	0	6
Ireland	709	893	335	342	2,278	472
Italy	0	54	68	183	305	13
Netherlands	322	268	93	161	844	13
Portugal	23	93	7	25	148	0
Spain	631	3,843	12,027	16,621	33,122	0
United Kingdom	9,359	11,173	7,759	8,121	36,411	297
Total EC	14,870	20,339	24,328	31,109	90,647	948
Total Western Europe	15,659	22,166	24,884	31,280	93,989	990
East Asia:						
China	0	114	73	18	205	15
Hong Kong	3,199	2,252	2,901	4,238	12,591	105
Japan	20,419	24,507	30,531	26,776	102,234	9,412
Korea, South	14,540	17,175	13,976	11,901	57,593	373
Malaysia	27,304	35,597	31,987	27,956	122,843	9,242
Philippines	852	921	576	1,044	3,393	0
Singapore	12,980	13,417	19,789	18,397	64,583	0
Taiwan	5,982	7,001	10,866	7,419	31,268	147
Thailand	9,529	13,401	14,517	15,927	53,374	120
Total East Asia	94,805	114,386	125,216	113,676	448,084	19,414
WORLD TOTAL	120,979	149,293	161,783	152,497	584,552	21,400

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 41.--U.S. trade data
Flow: Imports for consumption
Type: Customs value
HS commodity: OTHER INTEGRATED CIRCUITS
(Thousands of dollars)

Time period / Partner	1991				1992	
	April-June	July-September	October-December	Total	January-March	Total (partial)
Canada	344	163	126	751	241	241
Mexico	835	872	61	2,534	22	22
Brazil	0	0	0	0	0	0
Western Europe:						
European Community:						
Denmark	0	0	0	12	58	58
France	18	112	123	262	134	134
Germany, West	138	177	362	773	215	215
Greece	12	2	2	24	0	0
Ireland	0	0	9	481	81	81
Italy	5	7	5	30	4	4
Netherlands	3	92	228	336	11	11
Portugal	0	0	0	0	0	0
Spain	0	0	4	4	0	0
United Kingdom	1,049	693	908	2,946	935	935
Total EC	1,285	1,105	1,664	5,003	1,477	1,477
Total Western Europe	1,363	1,159	1,725	5,236	1,547	1,547
East Asia:						
China	13	23	5	56	0	0
Hong Kong	27	181	94	407	0	0
Japan	5,783	9,577	11,048	35,821	7,412	7,412
Korea, South	823	463	564	2,223	612	612
Malaysia	10,124	10,703	13,214	43,284	13,279	13,279
Philippines	0	30	18	48	6	6
Singapore	12	25	61	98	18	18
Taiwan	191	204	96	638	417	417
Thailand	3	14	0	136	2	2
Total East Asia	16,976	21,219	25,101	82,711	21,745	21,745
WORLD TOTAL	19,739	23,569	27,217	91,925	23,821	23,821

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 42.--U.S. trade data
Flow: Imports for consumption
Type: Customs value
HS commodity: DISCRETES
(Thousands of dollars)

Time period / Partner	1990					1991
	January-March	April-June	July-September	October-December	Total	January-March
Canada	3,248	4,180	3,250	5,286	15,964	4,065
Mexico	36,378	40,039	42,824	47,179	166,420	44,505
Brazil	182	276	426	194	1,078	217
Western Europe:						
European Community:						
Denmark	38	45	17	12	112	21
France	3,191	2,586	2,750	3,230	11,756	3,116
Germany, West	5,865	5,309	7,671	9,315	28,160	9,228
Greece	0	0	0	0	0	0
Ireland	3,130	6,103	4,984	4,677	18,894	3,654
Italy	1,578	2,091	2,410	2,448	8,527	2,068
Netherlands	3,309	3,745	4,141	5,646	16,841	4,998
Portugal	262	380	222	428	1,293	398
Spain	231	183	166	225	804	103
United Kingdom	7,936	10,373	9,793	10,763	38,864	9,628
Total EC	25,562	30,815	32,172	36,771	125,319	33,229
Total Western Europe	28,142	33,572	34,953	38,965	135,632	35,055
Eastern Europe:						
Bulgaria	0	0	0	0	0	0
Czechoslovakia	0	0	0	0	0	0
Germany, East	0	14	0	0	14	0
Hungary	4	8	2	20	35	7
Poland	0	0	5	0	5	0
Romania	0	0	0	0	0	1
Total Eastern Europe	4	22	7	20	54	9
East Asia:						
China	4	20	51	112	188	202
Hong Kong	5,629	6,158	6,227	10,109	28,123	4,850
Indonesia	0	0	16	2	18	5
Japan	53,325	51,745	54,560	59,730	219,360	59,203
Korea, South	27,710	27,015	25,981	24,898	105,604	20,364
Malaysia	42,806	46,464	50,614	50,716	190,599	43,599
Philippines	8,321	7,546	7,706	6,998	30,572	10,962
Singapore	6,515	5,645	4,173	4,169	20,502	3,318
Taiwan	16,448	21,973	21,814	19,714	79,949	17,423
Thailand	227	569	752	558	2,106	485
Total East Asia	160,984	167,136	171,894	177,006	677,020	160,411
WORLD TOTAL	232,989	250,177	259,141	274,301	1,016,608	250,294

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 42.--U.S. trade data
Flow: Imports for consumption
Type: Customs value
HS commodity: DISCRETES
(Thousands of dollars)

Time period / Partner	1991				1992	
	April-June	July-September	October-December	Total	January-March	Total (partial)
Canada	3,740	3,618	5,716	17,139	4,291	4,291
Mexico	31,968	36,094	36,749	149,316	42,238	42,238
Brazil	570	262	349	1,398	422	422
Western Europe:						
European Community:						
Denmark	5	12	23	61	8	8
France	3,155	4,089	3,657	14,017	4,117	4,117
Germany, West	7,827	10,917	10,331	38,303	11,714	11,714
Greece	0	0	4	4	0	0
Ireland	3,877	3,733	4,840	16,104	5,071	5,071
Italy	1,938	3,185	1,550	8,741	1,734	1,734
Netherlands	4,953	4,887	4,098	18,936	3,752	3,752
Portugal	295	129	422	1,245	263	263
Spain	46	139	110	398	100	100
United Kingdom	10,970	10,833	13,036	44,467	12,880	12,880
Total EC	33,161	37,936	38,073	142,399	39,673	39,673
Total Western Europe	35,057	39,076	39,432	148,620	40,682	40,682
Eastern Europe:						
Bulgaria	0	0	20	20	0	0
Czechoslovakia	0	27	3	31	8	8
Germany, East	0	0	0	0	0	0
Hungary	6	12	0	26	9	9
Poland	0	3	0	3	65	65
Romania	0	0	13	14	44	44
Total Eastern Europe	6	42	36	93	126	126
East Asia:						
China	104	305	192	803	297	297
Hong Kong	4,764	5,142	4,659	19,414	4,649	4,649
Indonesia	0	0	0	5	0	0
Japan	50,162	59,460	72,016	240,840	74,214	74,214
Korea, South	20,582	22,786	23,322	87,054	21,103	21,103
Malaysia	44,656	53,202	50,309	191,766	47,835	47,835
Philippines	17,362	23,009	20,041	71,375	19,531	19,531
Singapore	3,749	2,822	2,290	12,179	2,740	2,740
Taiwan	19,090	17,799	19,924	74,235	19,646	19,646
Thailand	722	952	938	3,096	1,057	1,057
Total East Asia	161,191	185,476	193,691	700,769	191,071	191,071
WORLD TOTAL	239,787	269,863	282,899	1,042,843	283,754	283,754

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 43.--U.S. trade data
Flow: Imports for consumption
Type: Customs value
HS commodity: DIODES AND RECTIFIERS
(Thousands of dollars)

Time period / Partner	1990					1991
	January-March	April-June	July-September	October-December	Total	January-March
Canada	184	873	130	328	1,515	130
Mexico	12,573	13,178	15,798	14,192	55,741	11,313
Brazil	104	117	117	128	466	217
Western Europe:						
European Community:						
Denmark	3	0	0	0	3	3
France	1,987	1,463	1,618	2,034	7,103	1,691
Germany, West	1,914	1,782	2,925	3,463	10,084	2,638
Ireland	2,694	4,893	4,211	3,678	15,475	3,115
Italy	661	810	906	1,189	3,566	933
Netherlands	2,298	2,344	2,100	2,737	9,479	2,888
Portugal	226	258	169	339	993	256
Spain	203	180	156	177	716	101
United Kingdom	1,556	1,980	1,904	1,969	7,410	1,877
Total EC	11,546	13,711	13,989	15,588	54,834	13,503
Total Western Europe	12,203	14,641	14,787	16,615	58,246	14,280
Eastern Europe:						
Czechoslovakia	0	0	0	0	0	0
Hungary	4	6	0	0	10	6
Poland	0	0	0	0	0	0
Romania	0	0	0	0	0	1
Total Eastern Europe	4	6	0	0	10	7
East Asia:						
China	0	5	27	24	56	52
Hong Kong	2,014	2,086	2,549	3,835	10,484	2,027
Indonesia	0	0	0	0	0	5
Japan	11,936	12,542	14,976	13,295	52,749	13,188
Korea, South	8,435	7,422	8,005	7,262	31,124	6,101
Malaysia	5,499	6,658	8,562	10,178	30,897	6,351
Philippines	1,771	1,393	1,267	1,113	5,543	1,117
Singapore	433	656	718	736	2,542	627
Taiwan	8,302	13,714	12,606	11,795	46,417	10,103
Thailand	5	22	2	17	46	84
Total East Asia	38,394	44,497	48,712	48,255	179,858	39,655
WORLD TOTAL	65,127	74,947	81,621	82,165	303,859	68,529

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 43.--U.S. trade data
Flow: Imports for consumption
Type: Customs value
HS commodity: DIODES AND RECTIFIERS
(Thousands of dollars)

Time period / Partner	1991				1992	
	April-June	July-September	October-December	Total	January-March	Total (partial)
Canada	82	207	159	576	108	108
Mexico	9,626	12,452	13,694	47,085	14,063	14,063
Brazil	482	232	257	1,188	325	325
Western Europe:						
European Community:						
Denmark	3	0	0	5	0	0
France	1,863	2,201	1,548	7,303	2,039	2,039
Germany, West	2,513	4,128	4,493	13,771	4,577	4,577
Ireland	3,496	3,265	4,216	14,092	4,393	4,393
Italy	1,041	1,745	785	4,505	824	824
Netherlands	3,152	2,726	2,848	11,613	2,917	2,917
Portugal	87	74	213	630	156	156
Spain	46	98	101	346	76	76
United Kingdom	1,721	846	712	5,157	799	799
Total EC	13,922	15,083	14,914	57,422	15,783	15,783
Total Western Europe	14,566	15,656	15,469	59,972	16,031	16,031
Eastern Europe:						
Czechoslovakia	0	7	3	10	8	8
Hungary	6	0	0	12	3	3
Poland	0	0	0	0	63	63
Romania	0	0	0	1	44	44
Total Eastern Europe	6	7	3	23	119	119
East Asia:						
China	13	22	11	98	168	168
Hong Kong	1,949	2,126	1,756	7,858	1,762	1,762
Indonesia	0	0	0	5	0	0
Japan	11,366	12,174	12,120	48,848	12,859	12,859
Korea, South	5,607	6,883	6,916	25,507	6,573	6,573
Malaysia	5,958	8,698	8,889	29,897	7,165	7,165
Philippines	970	1,450	1,819	5,355	1,516	1,516
Singapore	672	573	637	2,509	316	316
Taiwan	10,538	12,025	11,768	44,434	12,055	12,055
Thailand	121	112	254	571	72	72
Total East Asia	37,193	44,063	44,170	165,082	42,485	42,485
WORLD TOTAL	65,880	75,645	76,712	286,765	75,683	75,683

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 44.--U.S. trade data
Flow: Imports for consumption
Type: Customs value
HS commodity: SIGNAL TRANSISTORS
(Thousands of dollars)

Time period / Partner	1990					1991
	January-March	April-June	July-September	October-December	Total	January-March
Canada	30	29	91	8	158	2
Mexico	1,584	1,582	1,635	1,323	6,123	1,294
Brazil	15	11	0	13	39	0
Western Europe:						
European Community:						
Denmark	2	16	0	0	18	0
France	205	169	106	84	564	49
Germany, West	640	466	702	800	2,608	786
Greece	0	0	0	0	0	0
Ireland	12	2	7	203	223	57
Italy	57	22	100	413	591	20
Netherlands	30	82	53	61	226	75
Portugal	13	28	21	26	88	15
Spain	0	0	0	0	0	2
United Kingdom	369	616	290	229	1,505	334
Total EC	1,340	1,401	1,279	1,817	5,837	1,338
Total Western Europe	1,360	1,414	1,435	1,855	6,064	1,338
Eastern Europe:						
Bulgaria	0	0	0	0	0	0
Total Eastern Europe	0	0	0	0	0	0
East Asia:						
China	4	0	4	0	8	3
Hong Kong	2,938	3,551	2,627	5,235	14,351	2,331
Japan	6,061	3,973	5,912	6,686	22,632	7,488
Korea, South	8,389	9,104	7,870	6,663	32,025	5,412
Malaysia	4,829	6,087	6,910	6,622	24,448	5,761
Philippines	4,920	4,556	5,029	3,858	18,362	5,487
Singapore	351	352	302	268	1,272	386
Taiwan	799	696	1,168	838	3,500	819
Thailand	1	0	0	0	1	4
Total East Asia	28,291	28,318	29,821	30,169	116,600	27,691
WORLD TOTAL	31,403	31,473	33,136	33,429	129,441	30,419

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 44.--U.S. trade data
Flow: Imports for consumption
Type: Customs value
HS commodity: SIGNAL TRANSISTORS
(Thousands of dollars)

Partner \ Time period	1991				1992	
	April-June	July-September	October-December	Total	January-March	Total (partial)
Canada	10	70	3	85	37	37
Mexico	1,289	421	125	3,128	51	51
Brazil	0	13	52	65	3	3
Western Europe:						
European Community:						
Denmark	0	0	0	0	0	0
France	28	230	169	476	20	20
Germany, West	494	802	362	2,445	322	322
Greece	0	0	4	4	0	0
Ireland	23	7	0	87	10	10
Italy	0	28	4	53	3	3
Netherlands	183	179	181	618	53	53
Portugal	61	13	94	184	45	45
Spain	0	0	0	2	0	0
United Kingdom	187	673	1,998	3,192	1,588	1,588
Total EC	976	1,932	2,813	7,060	2,041	2,041
Total Western Europe	976	1,932	2,827	7,074	2,041	2,041
Eastern Europe:						
Bulgaria	0	0	20	20	0	0
Total Eastern Europe	0	0	20	20	0	0
East Asia:						
China	8	32	4	46	6	6
Hong Kong	2,040	2,386	2,186	8,943	2,122	2,122
Japan	5,596	6,760	6,300	26,144	6,792	6,792
Korea, South	5,853	7,520	8,336	27,120	7,153	7,153
Malaysia	5,824	7,675	7,176	26,436	7,526	7,526
Philippines	8,919	14,108	13,648	42,162	12,255	12,255
Singapore	506	292	262	1,445	253	253
Taiwan	1,013	934	765	3,531	424	424
Thailand	10	0	22	36	11	11
Total East Asia	29,768	39,707	38,698	135,864	36,540	36,540
WORLD TOTAL	32,381	42,169	41,784	146,752	38,701	38,701

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 45.--U.S. trade data
Flow: Imports for consumption
Type: Customs value
HS commodity: POWER TRANSISTORS
(Thousands of dollars)

Time period / Partner	1990					1991
	January-March	April-June	July-September	October-December	Total	January-March
Canada	59	70	45	38	211	28
Mexico	9,813	10,617	12,418	15,460	48,309	14,401
Brazil	0	2	21	0	23	0
Western Europe:						
European Community:						
Denmark	8	0	0	0	8	0
France	624	427	493	517	2,061	643
Germany, West	336	546	628	514	2,024	193
Ireland	390	1,086	689	717	2,880	469
Italy	97	191	365	181	833	108
Netherlands	843	1,015	1,670	2,741	6,270	1,647
Portugal	21	45	0	33	100	75
United Kingdom	2,780	4,179	3,531	3,781	14,271	3,646
Total EC	5,100	7,490	7,375	8,488	28,453	6,780
Total Western Europe	6,043	8,388	8,090	8,705	31,226	7,026
Eastern Europe:						
Germany, East	0	14	0	0	14	0
Hungary	0	2	0	0	2	0
Romania	0	0	0	0	0	0
Total Eastern Europe	0	16	0	0	16	0
East Asia:						
China	0	13	21	24	57	0
Hong Kong	409	271	787	736	2,203	225
Japan	17,700	18,613	17,394	21,340	75,047	18,573
Korea, South	8,171	7,528	7,303	8,440	31,442	7,102
Malaysia	20,950	22,851	23,461	22,416	89,678	21,982
Philippines	551	682	686	1,194	3,112	2,976
Singapore	192	105	294	58	649	209
Taiwan	4,568	4,866	5,880	4,744	20,059	4,549
Thailand	0	23	0	55	78	0
Total East Asia	52,541	54,952	55,826	59,006	222,324	55,616
WORLD TOTAL	69,021	74,871	77,685	84,776	306,353	78,618

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 45.--U.S. trade data
Flow: Imports for consumption
Type: Customs value
HS commodity: POWER TRANSISTORS
(Thousands of dollars)

Time period / Partner	1991				1992	
	April-June	July-September	October-December	Total	January-March	Total (partial)
Canada	60	18	25	131	47	47
Mexico	10,152	11,042	10,957	46,553	13,023	13,023
Brazil	0	8	0	8	0	0
Western Europe:						
European Community:						
Denmark	0	0	1	1	0	0
France	737	1,306	1,427	4,112	1,486	1,486
Germany, West	413	377	214	1,197	310	310
Ireland	353	431	561	1,815	490	490
Italy	161	294	133	696	234	234
Netherlands	1,493	1,369	958	5,467	636	636
Portugal	99	8	39	220	6	6
United Kingdom	4,890	5,117	5,139	18,792	4,925	4,925
Total EC	8,223	8,904	8,477	32,383	8,091	8,091
Total Western Europe	8,275	8,947	8,513	32,762	8,103	8,103
Eastern Europe:						
Germany, East	0	0	0	0	0	0
Hungary	0	0	0	0	5	5
Romania	0	0	13	13	0	0
Total Eastern Europe	0	0	13	13	5	5
East Asia:						
China	0	0	0	0	0	0
Hong Kong	451	204	266	1,145	225	225
Japan	14,604	18,183	22,875	74,235	25,830	25,830
Korea, South	6,730	5,744	4,711	24,287	4,092	4,092
Malaysia	23,415	24,826	22,080	92,302	19,706	19,706
Philippines	6,051	5,051	2,665	16,743	3,813	3,813
Singapore	126	309	424	1,068	218	218
Taiwan	5,553	2,296	4,909	17,307	4,629	4,629
Thailand	0	4	2	6	103	103
Total East Asia	56,930	56,616	57,930	227,093	58,617	58,617
WORLD TOTAL	76,545	77,391	78,841	311,393	80,973	80,973

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 46.--U.S. trade data
Flow: Imports for consumption
Type: Customs value
HS commodity: THYRISTORS
(Thousands of dollars)

Time period / Partner	1990					1991
	January-March	April-June	July-September	October-December	Total	January-March
Canada	36	19	4	8	66	4
Mexico	9,886	10,053	8,871	10,135	38,944	10,659
Brazil	3	0	25	14	42	0
Western Europe:						
European Community:						
Denmark	15	0	3	2	19	0
France	248	265	290	244	1,046	469
Germany, West	2,126	1,555	2,262	3,099	9,042	3,635
Ireland	0	0	0	2	2	3
Italy	632	831	872	564	2,898	880
Netherlands	16	11	28	11	66	185
Portugal	2	46	15	30	93	48
Spain	18	3	0	11	32	0
United Kingdom	2,533	2,043	2,001	2,597	9,174	2,377
Total EC	5,588	4,755	5,472	6,558	22,373	7,596
Total Western Europe	6,425	5,521	6,448	7,266	25,660	8,226
Eastern Europe:						
Hungary	0	0	0	6	6	2
Total Eastern Europe	0	0	0	6	6	2
East Asia:						
China	0	0	0	0	0	8
Hong Kong	56	20	0	0	75	4
Japan	2,063	1,414	1,251	1,350	6,078	1,422
Korea, South	658	589	326	293	1,867	263
Malaysia	560	726	656	471	2,413	454
Philippines	766	745	547	512	2,569	947
Singapore	109	108	142	115	474	111
Taiwan	28	2	9	32	71	28
Total East Asia	4,238	3,603	2,932	2,774	13,547	3,237
WORLD TOTAL	21,628	20,365	19,517	21,103	82,613	22,798

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 46.--U.S. trade data
Flow: Imports for consumption
Type: Customs value
HS commodity: THYRISTORS
(Thousands of dollars)

Partner \ Time period	1991				1992	
	April-June	July-September	October-December	Total	January-March	Total (partial)
Canada	9	3	17	33	18	18
Mexico	4,987	6,555	5,672	27,873	8,437	8,437
Brazil	10	0	0	10	67	67
Western Europe:						
European Community:						
Denmark	1	3	7	12	0	0
France	202	155	275	1,102	208	208
Germany, West	2,192	2,376	2,046	10,248	2,281	2,281
Ireland	0	2	16	21	9	9
Italy	519	891	442	2,732	527	527
Netherlands	1	0	6	193	0	0
Portugal	49	35	58	190	53	53
Spain	0	0	0	0	7	7
United Kingdom	2,408	2,161	2,007	8,954	2,661	2,661
Total EC	5,380	5,625	4,859	23,460	5,749	5,749
Total Western Europe	6,415	5,896	5,467	26,004	6,129	6,129
Eastern Europe:						
Hungary	0	12	0	14	1	1
Total Eastern Europe	0	12	0	14	1	1
East Asia:						
China	34	5	0	48	0	0
Hong Kong	18	82	38	142	2	2
Japan	1,237	1,614	1,463	5,735	1,454	1,454
Korea, South	522	399	436	1,619	423	423
Malaysia	454	459	418	1,784	472	472
Philippines	944	1,036	878	3,806	1,083	1,083
Singapore	105	33	9	258	2	2
Taiwan	5	0	18	52	86	86
Total East Asia	3,319	3,627	3,260	13,443	3,523	3,523
WORLD TOTAL	15,734	17,326	15,658	71,516	19,054	19,054

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 47.--U.S. trade data
Flow: Imports for consumption
Type: Customs value
HS commodity: OPTOELECTRONICS
(Thousands of dollars)

Time period / Partner	1990					1991
	January-March	April-June	July-September	October-December	Total	January-March
Canada	2,405	2,788	2,974	4,891	13,058	3,869
Mexico	557	2,683	3,308	6,034	12,581	6,775
Brazil	0	2	0	2	4	0
Western Europe:						
European Community:						
Denmark	5	3	14	10	31	19
France	123	231	240	351	946	264
Germany, West	664	836	1,091	1,262	3,853	1,915
Ireland	35	120	78	78	311	10
Italy	119	225	167	101	612	127
Netherlands	82	291	291	95	758	204
Portugal	0	2	17	0	19	4
Spain	3	0	10	36	49	0
United Kingdom	363	458	2,059	2,180	5,060	1,322
Total EC	1,397	2,166	3,985	4,136	11,684	3,879
Total Western Europe	1,512	2,291	4,111	4,338	12,252	4,046
Eastern Europe:						
Czechoslovakia	0	0	0	0	0	0
Hungary	0	0	2	14	16	0
Poland	0	0	5	0	5	0
Total Eastern Europe	0	0	7	14	21	0
East Asia:						
China	0	2	0	65	67	139
Hong Kong	209	216	231	281	938	171
Indonesia	0	0	16	2	18	0
Japan	14,408	13,807	13,240	14,804	56,259	15,749
Korea, South	2,010	2,358	2,478	2,239	9,085	1,487
Malaysia	9,368	9,875	10,742	10,688	40,674	8,854
Philippines	313	172	178	322	985	431
Singapore	5,408	4,374	2,546	2,798	15,126	1,822
Taiwan	2,553	2,646	2,141	2,292	9,632	1,852
Thailand	221	524	750	479	1,974	396
Total East Asia	34,490	33,974	32,321	33,970	134,756	30,901
WORLD TOTAL	39,019	41,947	43,389	49,690	174,045	46,328

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 47.--U.S. trade data
Flow: Imports for consumption
Type: Customs value
HS commodity: OPTOELECTRONICS
(Thousands of dollars)

Time period / Partner	1991				1992	
	April-June	July-September	October-December	Total	January-March	Total (partial)
Canada	3,545	3,274	5,448	16,136	4,058	4,058
Mexico	5,896	5,528	6,127	24,325	6,537	6,537
Brazil	77	9	40	126	25	25
Western Europe:						
European Community:						
Denmark	1	9	14	43	8	8
France	326	195	228	1,014	348	348
Germany, West	1,850	3,230	3,189	10,185	4,203	4,203
Ireland	5	27	45	87	171	171
Italy	217	217	185	745	131	131
Netherlands	124	613	100	1,041	138	138
Portugal	0	0	18	22	2	2
Spain	0	41	5	46	16	16
United Kingdom	1,754	1,972	3,169	8,218	2,893	2,893
Total EC	4,287	6,312	6,954	21,432	7,934	7,934
Total Western Europe	4,432	6,515	7,087	22,079	8,291	8,291
Eastern Europe:						
Czechoslovakia	0	20	0	20	0	0
Hungary	0	0	0	0	0	0
Poland	0	3	0	3	1	1
Total Eastern Europe	0	23	0	23	1	1
East Asia:						
China	49	232	177	597	123	123
Hong Kong	181	236	305	893	328	328
Indonesia	0	0	0	0	0	0
Japan	14,909	18,221	25,716	74,595	24,831	24,831
Korea, South	1,871	2,241	2,921	8,519	2,862	2,862
Malaysia	9,002	11,541	11,746	41,143	12,942	12,942
Philippines	476	1,364	1,032	3,303	865	865
Singapore	2,099	1,336	765	6,021	1,736	1,736
Taiwan	1,970	2,447	2,412	8,682	2,368	2,368
Thailand	591	835	660	2,483	871	871
Total East Asia	31,147	38,454	45,733	146,235	46,925	46,925
WORLD TOTAL	45,807	54,036	65,456	211,628	66,094	66,094

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 48.--U.S. trade data
Flow: Imports for consumption
Type: Customs value
HS commodity: PARTS OF SEMICONDUCTORS
(Thousands of dollars)

Time period / Partner	1990					1991
	January-March	April-June	July-September	October-December	Total	January-March
Canada	9,298	7,283	7,200	12,459	36,240	14,048
Mexico	8,343	7,994	8,680	9,933	34,950	9,118
Brazil	1	1	5	0	8	8
Western Europe:						
European Community:						
Denmark	69	61	211	293	635	252
France	40,284	21,934	33,722	20,742	116,683	27,890
Germany, West	13,859	9,343	10,946	10,620	44,768	6,093
Ireland	644	783	365	709	2,501	328
Italy	6,137	2,447	1,692	1,066	11,343	1,143
Netherlands	620	53	73	51	796	204
Portugal	43	104	4	22	173	4
Spain	6,033	4,073	185	249	10,540	3,514
United Kingdom	8,251	10,911	12,597	10,836	42,596	7,394
Total EC	76,138	49,914	59,968	44,710	230,730	46,879
Total Western Europe	77,846	50,983	61,538	46,301	236,669	50,538
Eastern Europe:						
Czechoslovakia	0	0	0	0	0	7
Hungary	9	18	9	9	46	0
Poland	54	179	0	0	232	142
Total Eastern Europe	63	197	9	9	278	149
East Asia:						
China	30	1	53	209	294	9
Hong Kong	2,887	4,388	6,011	3,952	17,238	3,504
Indonesia	11	9	45	273	338	52
Japan	179,178	174,933	162,374	182,425	698,910	181,825
Korea, South	8,119	8,216	11,013	16,923	44,271	11,119
Malaysia	5,320	3,626	5,464	5,622	20,032	7,611
Philippines	5,617	2,304	3,056	2,569	13,546	2,640
Singapore	4,086	4,087	7,092	7,106	22,370	5,980
Taiwan	6,525	6,687	7,886	8,608	29,705	9,439
Thailand	464	506	753	426	2,148	464
Total East Asia	212,237	204,756	203,746	228,112	848,851	222,644
WORLD TOTAL	330,523	290,647	302,178	331,254	1,254,602	322,637

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 48.--U.S. trade data
Flow: Imports for consumption
Type: Customs value
HS commodity: PARTS OF SEMICONDUCTORS
(Thousands of dollars)

Time period / Partner	1991				1992	
	April-June	July-September	October-December	Total	January-March	Total (partial)
Canada	18,157	10,751	9,836	52,792	20,349	20,349
Mexico	8,335	8,049	5,129	30,631	4,581	4,581
Brazil	2	0	0	9	23	23
Western Europe:						
European Community:						
Denmark	112	132	490	987	225	225
France	13,569	13,579	9,331	64,368	19,703	19,703
Germany, West	4,857	4,139	9,131	24,220	6,399	6,399
Ireland	120	308	205	961	238	238
Italy	1,168	915	1,030	4,255	1,149	1,149
Netherlands	239	1,495	401	2,340	95	95
Portugal	73	123	0	200	1	1
Spain	8,562	4,771	2,747	19,594	2,699	2,699
United Kingdom	6,072	10,136	9,227	32,828	12,682	12,682
Total EC	34,791	35,670	32,636	149,977	43,238	43,238
Total Western Europe	37,055	37,882	35,276	160,752	46,431	46,431
Eastern Europe:						
Czechoslovakia	15	0	0	22	0	0
Hungary	0	3	0	3	0	0
Poland	270	57	5	475	9	9
Total Eastern Europe	285	60	5	499	9	9
East Asia:						
China	3	39	8	59	88	88
Hong Kong	5,032	4,802	5,151	18,490	5,456	5,456
Indonesia	23	0	5	80	3	3
Japan	162,943	183,369	170,629	698,766	207,611	207,611
Korea, South	7,006	9,911	8,997	37,033	6,488	6,488
Malaysia	4,585	6,192	8,968	27,357	9,710	9,710
Philippines	2,573	3,240	4,858	13,311	4,308	4,308
Singapore	10,487	14,872	10,239	41,577	10,278	10,278
Taiwan	17,846	20,922	18,040	66,247	13,274	13,274
Thailand	242	521	682	1,909	468	468
Total East Asia	210,740	243,869	227,576	904,829	257,684	257,684
WORLD TOTAL	296,541	329,169	327,025	1,275,372	384,281	384,281

Source: Compiled from official statistics of the U.S. Department of Commerce.

APPENDIX E: Periodical References

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Statistical Stagnation

The government's economic statistics programs tell us more about watermelons than about semiconductors. The reasons: a devotion to agriculture at the expense of the modern economy, and an inability to drop outdated surveys.

BY IRA KAMINOW

When President Bush in January proposed a 20 percent increase in the budgets of federal statistical agencies for fiscal 1993, the news was welcomed by economists who had spent a decade lamenting the chopping of statistics programs.

But the increase, even if Congress grants it, will not bring rationality to an economic statistical system that tells us most about farms and least about the service industries that are at the core of today's economy. Such archaic priorities reflect an absence of leadership and direction, and the domination of politics and inertia. Statistics with strong political constituencies are collected for decades after they cease to be useful, while research on increasingly important developments waits in the wings for funding.

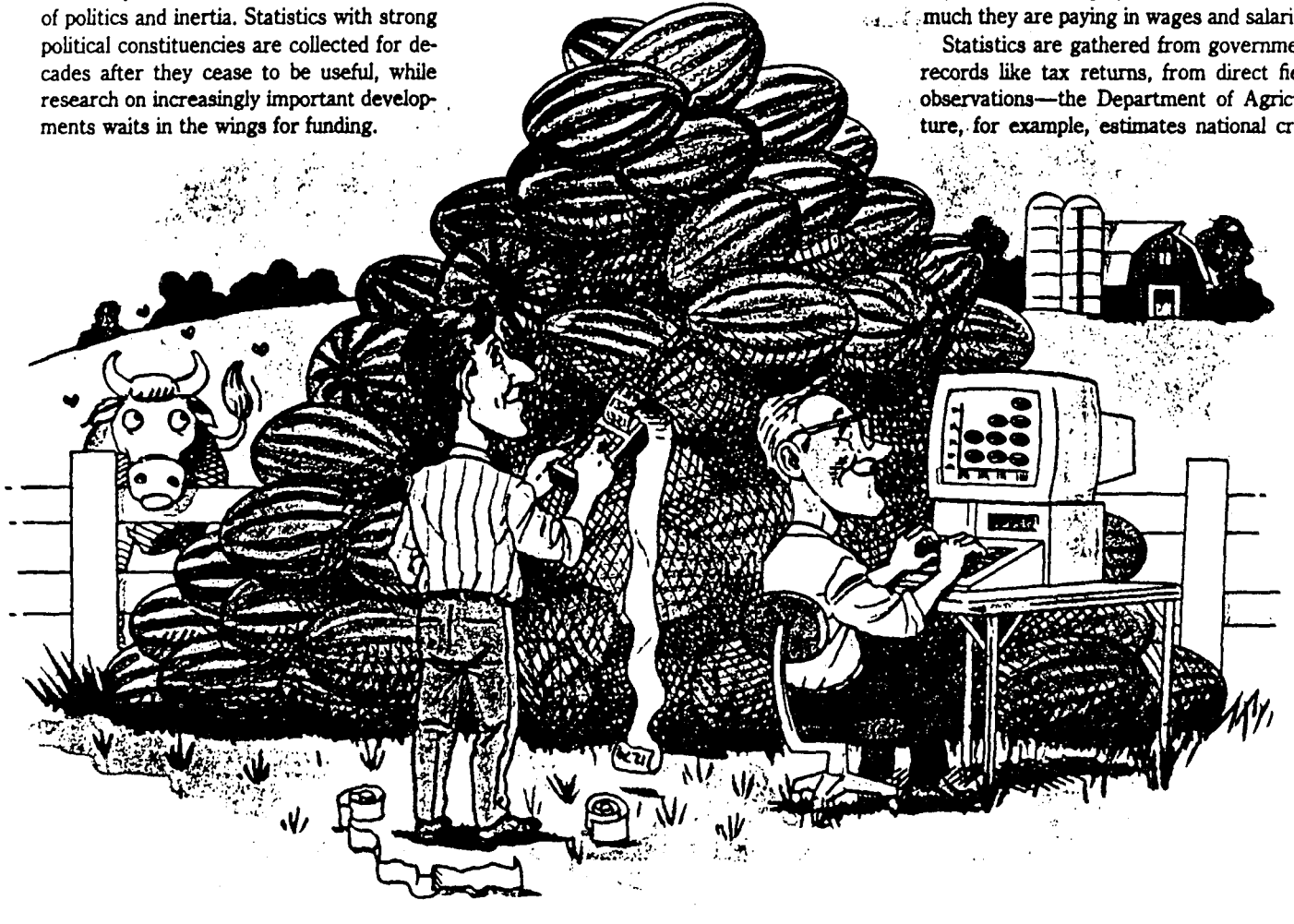
While the poor quality of economic statistics is often blamed on Reagan-era budget cuts, some experts say the problems in fact reflect longstanding systemic failures.

An Inaccurate Science

Ask a city boy where eggs come from, and he's likely to tell you the supermarket; ask a businessman where Gross Domestic Product figures come from, and he'll likely answer, *The Wall Street Journal.* The truth is that GDP figures, like other economic statistics, are the work of a modest bureaucracy that faces a massive job measuring the complex and highly dynamic U.S. economy.

Agencies like the Bureau of Labor Statistics (BLS), the National Agricultural Statistical Service, and the Bureau of the Census gather millions of bits of information about the economy from consumers, workers and businesses. BLS calculates the unemployment rate by asking 60,000 households who has a job and who doesn't; it calculates the consumer price index by checking prices at 76,000 retail outlets and rental units; it surveys 340,000 employers to find out how much they are paying in wages and salaries.

Statistics are gathered from government records like tax returns, from direct field observations—the Department of Agriculture, for example, estimates national crop



RAY DRYER

RICHARD A. BLOOM

Output in the service sector is difficult to measure, says Michael Boskin, chairman of the Council of Economic Advisers.

yields by sampling individual farms—and, most importantly, through surveys. Hundreds and thousands of telephone, mail and in-person surveys inquire of workers, consumers, savers, farmers and businesses who is working and who is not; what businesses produce and how much people make; how many cars they own; how much they spend and how much they save.

In other words, collecting economic statistics is much like taking the population census. With this difference: The government lavishes more care, planning time and resources on the decennial population census than on any other statistical count. If, even with all these resources, the 1990 count was off by some five million people, it is beyond hope to expect complete accuracy in each of the thousands of economic statistics that are collected with far less preparation, with less care and with far fewer resources.

The safest thing that can be said about economic statistics is that they are, to one degree or another, wrong. And that's fine. Total accuracy is too expensive. Unfortunately, inaccuracy in government numbers too often goes beyond the acceptable. In May 1991, Gail Fosler, chief economist of the Conference Board, a New York-based business research group, told a House subcommittee that one federal survey was showing that sales of capital goods were running 15 percent behind a year earlier, while another indicated that sales were up by 5 percent. At least part of the discrepancy, Fosler believes, was due to inaccurate or missed responses to the surveys.

Indeed, the quality and rate of responses to government surveys has been declining. The reasons can only be guessed: perhaps fatigue with filling out government forms, or a revolt against government intrusion, or an effort by businesses to cut costs.

The government could obtain more accurate information through more careful—and more expensive—surveys. For example, government data show that between 1965 and 1981, American men cut their time on the job by about 90 minutes a week, according to weekly summaries provided by the workers. A survey performed by the University of Michigan's Institute for Social Research, on the other hand, showed the reduction was more like a full eight hours. The difference was that the Michigan study asked respondents to keep *daily* diaries of how they spend their time, a measurement more sensitive to the difference between scheduled hours and actual hours.

It is meaningless to use numbers alone to compare standards of living or national output over time.

Slow growth in the productivity of American workers is a continuing national concern, but if Americans have actually reduced their hours on the job by more than we thought, part of our productivity problem will turn out to have been not inefficiency, but a statistical illusion.

The way official statistics are reported gives the impression that they are extremely accurate even though they are not. GDP is calculated to the nearest $100 million, which is the rough equivalent of guessing your height to within the width of a single hair on your head. This would be a joke if it were not taken so seriously. An example came last year when the Commerce Department lowered its estimate of second-quarter 1991 growth in the Gross National Product (GNP), the statistical series that was replaced recently by the GDP estimates. After Commerce said the second quarter was characterized by "a small decline" rather than the "slow growth" reported earlier, *The Wall Street Journal* said that "the revision suggests that the recession didn't end in the second quarter . . . and it may be continuing even now." The paper went on to credit the revision for igniting "a steady rally in the bond market." But the difference between the original GNP figure and the revised number was one one-thousandth of the nation's output, an amount that fits easily into the GNP's margin of error. It would be better and more honest if such statistics were published to the nearest $10 billion. Similar adjustments should be made in all statistics.

Measuring Quality

Dr. Seuss's principle that "a person's a person no matter how tall; a person's a person no matter how small" is fine for the population count, but not for economic statistics where quality, as well as quantity, counts. Cars, cures, computers and symphonies are not all alike. Something crucial would be lost if automobile production statistics did not take into account improvements in pollution control, air conditioning, power steering and safety features.

Quality measurements are messy and imprecise. Statisticians can measure quantitative improvements like bigger houses or faster computers. But as goods change their very character it becomes more difficult to represent the improvements through one-dimensional, dollars-and-cents economic statistics. Eventually, products and services evolve so that they can no longer be meaningfully compared to earlier models or designs. What conceivable adjustment could make today's desktop personal computers comparable to the room-sized, vacuum-tube computers that required better air conditioning than the programmers who ran them?

Measuring quality advances is most difficult when it comes to services. In Senate testimony last year, Council of Economic Advisers chairman Michael Boskin summed it up this way: "In the service-producing sector, it is often difficult even to define a unit of output. For example, should the number of lines in a computer program be the standard unit of output?"

Like almost everyone else, Michael Darby, who served President Bush as Commerce undersecretary for economic affairs, claims that such definitional problems lead to understatement of the growth in American output. Darby asks, rhetorically, "whose services would you pay more for"—a doctor trained in the medical technology of 1950 or one trained in the technology of 1990? "The quality difference between the 1950 doctor and the 1990 doctor is not captured in our statistics," he says.

But the difficulties with measuring ser-

Ira Kaminow, who holds a Ph.D. in economics, is president of Capital Insights Group, a Washington-based public policy research firm. He was a vice-president at the Federal Reserve Bank of Philadelphia from 1969-79.

SHEPARD SHERBELL

Definitional problems lead to an understatement of growth in American output, says former Commerce official Michael Darby.

vices should not be used as an excuse to neglect them. During the same hearings at which Boskin testified, Courtenay M. Slater, chief economist for the Department of Commerce from 1977 to 1981 and now a Washington consultant, pointed out that "measuring the real output even of traditional manufacturing industries is not always simple, but techniques for doing so are well developed . . . Doubtless the real output of financial institutions also can be measured, but to do so will require detailed study."

What Slater says about financial services is true also of other services. The Bureau of Labor Statistics recently completed a massive analysis of computers that for the first time allows a measure of the breathtaking technological advances. The same kinds of careful analysis for services would give us a vastly improved picture of the economy.

Not Just a Money Problem

Boskin's initiative to press in 1991 for a $230 million increase spending on economic statistics over five years has wide support in the statistical community, and for good reason: It will provide modest spending increases in areas that are beyond a doubt in need of repair.

This year's federal budget boasts, for example, that in 1991 the government reinstated estimates of GNP broken down by industry that had been discontinued in 1989, and undertook to produce, for the first time, annual data on the $200 billion communications industry. Boskin's program, the budget says, aims to recognize such trends as the shift from manufacturing to services and the growing importance of international markets. Among goals for 1992-93 is upgrading the federal statistical work force through establishment of a specialized graduate-level program to teach survey skills.

The statistical agencies and consumers of their data welcome this renewed interest, yet the proposals for increased funding permit little more than triage among the government's statistical programs.

The problems with America's statistical system are deep and longstanding. The system drifts, with neither a clear mission nor firm leadership. Statistical resources are too often misdirected toward activities which enjoy the support of the administratively and politically powerful.

Hermann Habermann, chief statistician at OMB, has responsibility for "general policy guidance" to government statistical agencies. His office is as close as the government comes to having a coordinator of the federal statistical function. "Our [statistical] system is designed to collect information about an economy that was in place 30 years ago," Habermann wrote in a 1989 article.

In many ways the system is more like a century out of date. For example, the government recently improved statistics on U.S.-Canada trade by using Canadian data, a technique used by private-sector economist Matthew Simon back in 1960. U.S. authorities were aware of the underreporting of exports to Canada as early as 1867, according to professor Robert Lipsey of the City University of New York. "It took 120 years to solve this problem, which seems an unduly long time," he told a meeting of the American Economic Association.

Jack Triplett, chief economist of the Bureau of Economic Analysis (BEA), points out that even 50 years ago, the service sector employed half the workforce. Yet economists still complain that statistics for this sector are inferior to manufacturing statistics. At the other extreme, agriculture, which even 30 years ago accounted for only 5 percent of GNP, gets almost 27 percent of the statistics pie. The government collects far more detailed data about watermelons than about semiconductors.

No one has calculated exactly how much is spent on agricultural statistics. As a rough measure, the budgets of the Agriculture Department's Economic Research Service and National Agricultural Statistics Service totaled about $120 million in 1990. This compares with Commerce's bureaus of Economic Analysis and the Census which together also spend about $120 million on economic statistics. The difference is that Commerce is responsible for statistics in *all* sectors of the economy.

The heavy spending on farm statistics reflects the demands of America's agricultural policies. Farm programs require statistics to calculate support payments. But that is not the whole story. Much data is also collected for commodities not supported by farm programs. More than for any other sector, the government collects statistics not just *about* farmers, but *for* farmers. USDA publishes highly detailed data on plantings, production, inventory, demand and prices for scores of individual commodities, as well as general information on the business of farming: farm income, assets, credit and the like.

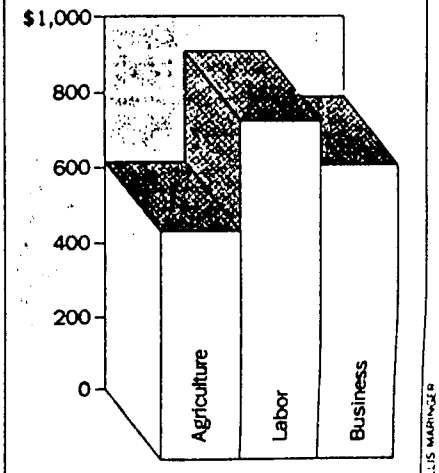
The first agricultural census was conducted 150 years ago. Since then, the government has grown accustomed to providing agricultural statistics, and farmers have grown to expect them. Farmers know how to exploit the political process to pressure the government to collect the statistics they want. Charles Caudill, administrator of the National Agricultural Statistical Service, notes, "When they want data we don't have, they go to Congress." Among the interest groups that have gone over Caudill's head to Congress are producers of mink, cattle, flowers and catfish, and cotton ginners.

Support for agricultural statistics is strong not only in Congress, but also among Agriculture Secretaries. They have been more committed to statistics than have the Secretaries of Commerce and Labor, who oversee statistics on the overall economy. Caudill says, "Support from the department has been critical to maintaining budgets."

Farmers aren't alone in pressing for sta-

TILTING TOWARD AGRICULTURE

Of the roughly $2 billion per year that the government spends gathering statistics on all manner of subjects, about 30 percent is devoted to "economic" statistics on agriculture, labor and business. Though farms account for about 1.5 percent of economic activity in the United States, agriculture garnered 27 percent of the money spent on these three topics between fiscal 1986 and 1990. The chart below shows outlays for economic statistics over the five-year period, in millions of dollars.



Source: Office of Management and Budget

PHYLLIS MARINGER

tistical programs, though they are particularly successful. Representatives of service industries have recently been lobbying for better data on their sectors of the economy, and with notable success. In its 1992 economic census, the Census Bureau will cover 98 percent of the economy, up from 75 percent in 1987. Most of the increase is due to the inclusion of service sectors like finance, insurance and real estate. Charles Waite, associate director for economic statistics at Census, says the Coalition of Service Industries deserves much credit for bringing about the broader coverage.

A Need for Trimming

This and other desirable expansions of statistics programs would be more affordable if outdated programs could be dropped. Indeed, agencies regularly review programs and conclude that some should be canceled, observes Katherine Wollman, executive director of the Council of Professional Associations on Federal Statistics and president of the American Statistical Association. Yet the agencies don't often press to cancel programs, Wollman says, because they know that "for any statistical program that exists, there is a user" who will lobby Congress to prevent cancellation. Agencies fear, moreover, that dropping programs from their budget requests will tempt Congress to reinstate the program but not the funding.

The BEA's Triplett denounced waste of statistical resources in a speech to a recent convention of the American Economic Association. "Marginal or counter-productive statistical activities may soldier on for decades," said Triplett, "sapping budgetary resources that could be used more productively, adding to respondents' burden, thus provoking resistance to new collection, and distorting statistical agency staffs' own perceptions of policy-related needs for economic data." Triplett blames failures not on Congress but on the agencies themselves. The problem, he says, is that many agency program managers and administrators follow current fads and politically popular agendas rather than responding to the economy's more fundamental data needs.

Triplett is by no means alone in his views. In a written comment in the *Journal of Economic and Social Measurement*, Fritz Scheuren of the IRS's Statistics of Income Division argues: "The federal statistical system can be out of touch with what may be fundamental in the long run, because of its connection to the political arena."

Triplett also argues that government statisticians can be indifferent to the needs of basic research. "Too frequently, statistical agency program managers and administrators are unfamiliar with economic policy analysis, and have neither the inclination nor the ability to fathom data needs for basic economic research," he says.

The problem is mitigated by the use of government grants to private-sector institutions which then design surveys, with the help of government analysts, more suitable for research purposes. For example, the Bureau of Labor Statistics funds an annual survey of a fixed pool of 9,000 respondents. Researchers can follow their activities over time, tracking such qualities as wage levels and persistence of unemployment.

But economists and other professional data users do not always contribute to the solution either. They are too often cheerleaders for more government spending on statistics, too rarely reasoned advocates for cost-cutting and efficiency. Two members of the National Association of Business Economists' Committee on Statistics echoed this thought when they dissented from the majority view of a 1988 report. Jay Woodward of Bankers Trust Co. was concerned about the "impression left with the reader that we're just another special-interest group pleading for more federal spending to alleviate what we regard as a problem." Ed Fiedler of the Conference Board complained that the report "comes close to taking the attitude that the government's statistical programs are a failure for not providing all the high-quality, problem-free statistics that economists think might be useful."

Fiedler's criticism is particularly stinging for being aimed at economists, whose stock-in-trade is supposed to be weighing benefits—such as higher quality—against their costs. There have been only a few attempts—mostly among agricultural economists—to study the value of economic data and to compare the value of programs against their costs.

And these attempts have not been impressive. For example, Martin Fleming, chairman of the National Association of Business Economists' statistics committee in March 1991 attempted to show Congress's Joint Economic Committee "that significant problems can be attributed to [inferior] economic statistics." As evidence, he implied that the last recession might have been avoided if the Federal Reserve had gotten solid information on the economy more quickly than it did in 1989. Asked about this in an interview, Federal Reserve Board governor Wayne Angell said that the best monetary policy aims ahead of the target. It takes six months or a year for Federal Reserve policy to affect the economy, he noted, so when the Fed makes policy errors, it is because the future, not the past, is obscure.

To expand on Angell's point a bit, economic policy is made against the backdrop of great uncertainty about the future and about the workings of the economy. It is made in a rough-and-tumble world of political compromise, which must balance pressures from competing interest groups. For most public policy makers, it is enough to have a general idea of the broad contours of the economy; excessive detail or precision is a waste.

BRUCE REEDY

Less relevant statistical surveys often sap budgetary resources, argues Jack Triplett of the Bureau of Economic Analysis.

The amount and kinds of information the government should collect, the appropriate level of detail and timeliness will vary from program to program. Policy makers, academics and private-sector businesses all have different requirements, and all can use economic statistics with different levels of payoff. Study of these issues can help establish a clear view of the needs and priorities of the whole system, which, as a 1989 Office of Technology Assessment report said, "is not now available from any source."

But a thoughtful, cost-conscious needs assessment is only a start. In a published reply to Triplett's criticism of statistical administrators, University of Michigan economics professor Thomas Juster said the system, not individuals, was to blame. The problems faced by statistical agencies are "generic to federal agencies generally, which at the policy level will always be more concerned with quick solutions to short-term problems rather than with laying the groundwork for better-formulated solutions to longer-term problems," Juster wrote.

The quality of economic statistics is lower because they are financed through the political system. This is one of the smaller costs of democracy. Those who want better statistics had better start to work within today's political realities, which include constraints on government spending. It is time to argue and vote not just for more spending, but for smarter spending, to devote as much attention to weeding out marginal programs as to supporting worthwhile additions. □

U.S. Probe Targets Japanese Chip Imports

By GEORGE LEOPOLD
Defense News Staff Writer

WASHINGTON — The results of an investigation of the security implications of Japan's importing of a key electronic component could help domestic producers gain a foothold in the multimillion-dollar defense market.

On Nov. 18, the Department of Commerce launched an investigation of the impact on U.S. national security of imports of ceramic chip packages, a market dominated by Japanese suppliers. Commerce Department officials said a decision is expected next summer.

The probe by the Commerce Department's Bureau of Export Administration was initiated in response to a petition by two U.S. producers, Coors Electronic Package Co., Chattanooga, Tenn., and Ceramics Process Systems Corp., Milford, Mass.

More than 90 percent of the ceramic packages used by the U.S. military are supplied by Japanese manufacturers, U.S. and industry officials said.

The U.S. military's primary source of ceramic packages is Kyocera Corp., Kyoto, Japan, which has plants in Japan and San Diego. Other Japanese suppliers include NTK Ceramics and Narumi Ceramics.

The U.S. ceramic package makers filed a petition on Nov. 10 alleging that the U.S. military is dependent on foreign sources of ceramic packages used to mount and connect chips to other electronic components. They also asked that the Commerce Department take steps to adjust Japanese imports.

The department has 270 days to conduct its investigation to determine whether such a dependency exists and whether it adversely affects U.S. national security.

U.S. military specifications require that manufacturers mount delicate computer chips used in weapons on ceramic packages to protect them from moisture and dust. The packages are used in virtually all modern U.S. weapons.

The Commerce investigation is being conducted under the national security provisions of the Trade Expansion Act of 1962. The law gives the president the authority to adjust imports if the investigation finds they are harming national security.

Remedies being sought by the U.S. companies in their petition include changes in federal acquisition regulations to stimulate the domestic industry and government assistance to U.S. firms trying to qualify as Pentagon suppliers.

"We're trying to ferret out through discussions with the government and industry . . . the kinds of remedies

See CERAMICS, Page 36

Inquiry Could Spur U.S. Chip Market

CERAMICS, From Page 34

that would be beneficial to everyone," Grover Coors, Coors Ceramics' vice president for national affairs, said in a Nov. 30 interview.

The military segment of the estimated $1.2 billion global market for ceramic chip packages totals between $250 million and $400 million annually, according to U.S. industry estimates.

The Commerce Department investigation is the latest in a series of government studies examining growing U.S. dependence on foreign suppliers of critical electronic components. The Pentagon has identified ceramic materials, of which ceramic packages are a part, as a critical technology.

A Pentagon-sponsored study of U.S. dependence on foreign suppliers released in April 1991 found "exceptionally high U.S. dependence on foreign ceramic packaging." Among the U.S. weapon systems found to be almost totally dependent on foreign sources for packaging materials were the APG-66 and APG-68 fire control radars used in all U.S. and most foreign F-16 fighters.

The study, performed by the Institute for Defense Analyses, a government-sponsored think tank in Alexandria, Va., recommended that the Defense Advanced Research Projects Agency conduct research on advanced packaging materials, processes and manufacturing technologies to meet the military's most-stringent quality and reliability requirements.

Also, the study called on acquisition officials "to consider efforts to drive down . . . ceramic packaging costs for [weapon components] to help make U.S. products more competitive with offshore products."

If the investigation finds that reliance on Japanese packages is harming national security, U.S. suppliers could get government help in qualifying as domestic suppliers of ceramic packages. Remedies include changes to U.S. acquisition regulations to stimulate domestic sources and Pentagon assistance to U.S. firms retooling their production lines to qualify as domestic suppliers.

A Commerce Department official said Dec. 1 that funding to help U.S. companies become qualified suppliers could come from a Defense Department manufacturing technology program. Technical assistance could come from the National Institute of Standards and Technology, a branch of the Department of Commerce that focuses on strengthening U.S. industrial competitiveness.

The Commerce investigation is the 11th in 12 years, and the department has yet to dismiss an industry petition filed under the national security provision of the 1962 trade law.

The decision to launch the investigation "doesn't telegraph any judgment about the case," cautioned the Commerce Department official.

Japanese may have early lead in mega-megabit chips

By Andrew Pollack
The New York Times

TOKYO — Four Japanese companies have separately produced the first prototypes of a memory chip that is likely to become the main means of storing information in computers around the turn of the century, one of the companies disclosed yesterday.

The silicon chip, known as a 256-megabit dynamic random access memory, or D-RAM, can store 256 million bits of information, the equivalent of 10,000 or more pages of typed text. That is 64 times more capacity than that of the four-million-bit

chip now commonly used in computers.

Such a chip would probably be used in powerful hand-held computers and for storing sound and video images in computers and consumer electronics products like high-definition television sets.

The four companies, which worked independently, are: Fujitsu Ltd., Hitachi Ltd., NEC Corp., and Toshiba Corp. The descriptions of the prototypes provide a hint that the Japanese companies will maintain their traditional dominance of the memory chip business.

But analysts said it was almost meaningless which company produced the first prototypes since the chips will not even begin to be sold in large volumes until about 1998. The industry must first proceed through the 16-megabit chip, which is just starting to appear on the market, and the future 64-megabit generation. Analysts also say that a few handcrafted prototypes, which are relatively easy to produce, often end up bearing little resemblance to the product that can be manufactured by the millions.

"At this point in time, it doesn't really matter whether you're in the lead or not," said Peter G. Wolff, electronics analyst with Kidder, Peabody & Co. in Tokyo.

Toshiba, NEC and Hitachi, which are Japan's three largest chip producers, will announce their prototypes at the International Solid-State Circuits Conference, a technical meeting to be held in San Francisco in February. The conference prohibits companies from talking about their work before they present their papers. Fujitsu's paper was not accepted for the conference, so the company was free to describe its work first.

Japanese companies have long dominated the memory business, but have been receiving more of a challenge of late. Samsung, a South Korean company that often does not present papers at technical conferences, is considered to be roughly on a par with the Japanese. American companies like IBM and Texas Instruments Inc. also produce memory chips.

The circuits in the 256-megabit chips have features ranging from two-tenths of a micron in the case of Fujitsu to four-tenths of a micron in the case of Toshiba. A micron is one-millionth of a meter.

APPENDIX F:

The Institute for Defense Analyses Report

Technology, Competitiveness & Security: Summary of Findings and Recommendations

By: R. H. Van Atta and R. White

Institute for Defense Analyses
1801 N. Beauregard Street
Alexandria, VA 22311-1772
April, 1992

TECHNOLOGY, COMPETITIVENESS & SECURITY

SUMMARY OF FINDINGS AND RECOMMENDATIONS

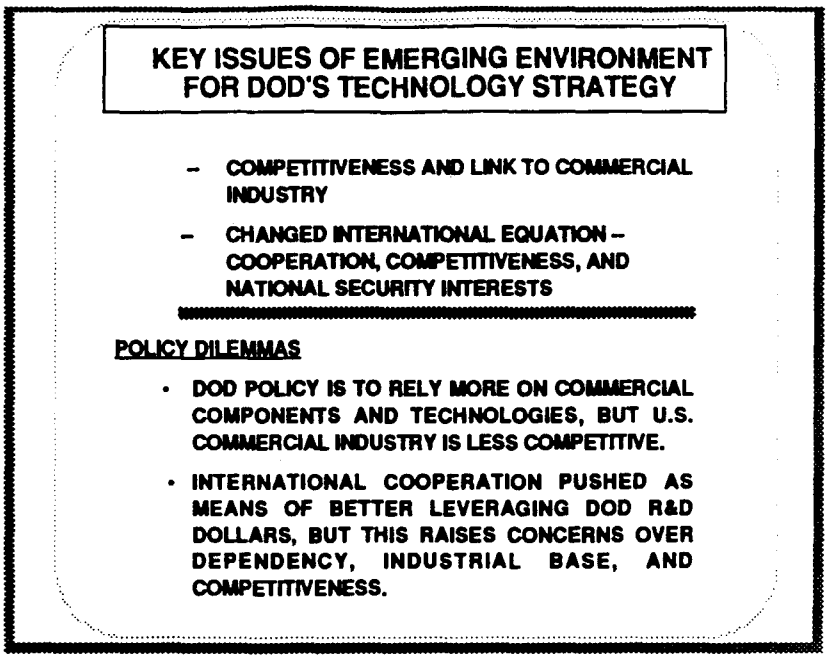
Richard H. Van Atta

Richard White

Institute for Defense Analyses

April 24, 1992

Note: The views stated in this presentation are those of the presenter and do not necessarily represent those of IDA.



Today, there are different views on what DoD's technology policies and strategies should be. In our view the technological competitiveness of the US economy overall has become the major challenge for Defense R&D. Some tough issues must be addressed that will not just go away. Two of these are: [1] DoD's link to a commercial technology base that is decreasingly competitive and [2] the impact of the changed world balance of technology leadership on DoD's technology strategy.

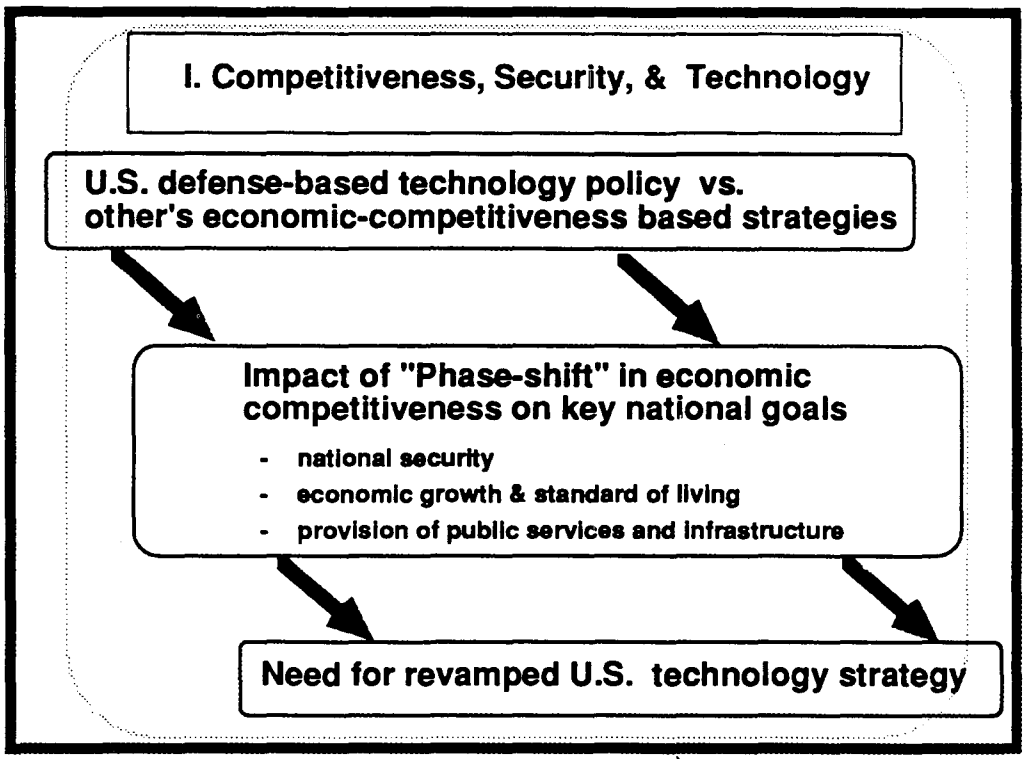
These issues of commercial technology and international competition reflect realities that, in our view, must be addressed through a coherent national technology strategy.

Recently much has been said about the need to appreciate that the country can afford only one industrial and technology base – a national technology base unifying defense and commercial industry. DoD must for economic and efficiency reasons rely more on commercial components and technologies, but at the same time U.S. COMMERCIAL INDUSTRY IS DECREASINGLY COMPETITIVE. This raises some major policy concerns.

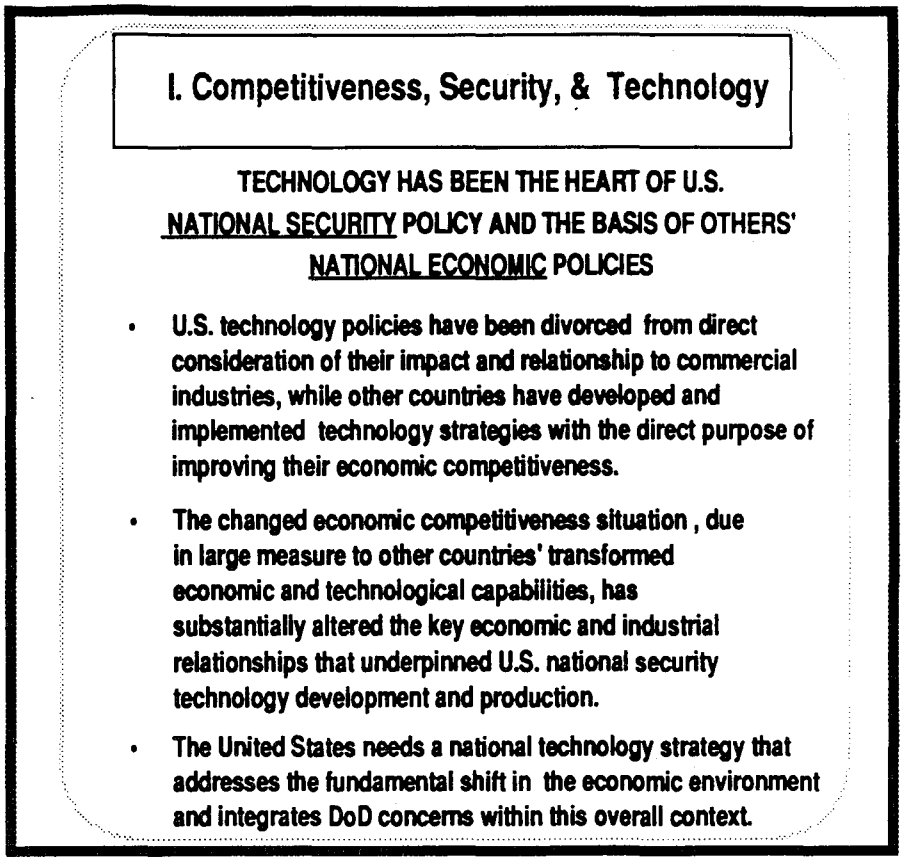
The implications are stark. The more we seek efficiency, the greater we become dependent upon foreign components and technologies, unless, the competitiveness of U.S. high-tech industry is turned around. Does DoD have a role in this, or does it rely on others or just hope for the best?

International cooperation has been touted as a "mature" way of better leveraging DoD R&D dollars, BUT THIS RAISES CONCERNS OVER DEPENDENCY, INDUSTRIAL BASE, AND COMPETITIVENESS. Cooperating with industrial economies that target our most advanced commercial (dual-use) sectors such as advanced computing and aerospace is at best a risky business. International cooperation without a clear and integrated approach that links and develops that cooperation with U.S. technology goals and objectives puts us in real jeopardy.

I. Competitiveness, Security, & Technology



This paper summarizes the results of a research project supported by IDA Central Research Funding, on *TECHNOLOGY, COMPETITIVENESS, AND SECURITY: U.S. TECHNOLOGY STRATEGY FOR A CHANGING WORLD*. This study examines the issues linking "competitiveness" with security and technology. Competitiveness is a key aspect of, indeed a central element of both economics and geopolitics—as well as technology development itself. The study focuses on [1] defense technology as the primary driver of U.S. technology policy and strategy; [2] technology strategies and policies of other countries and how they impinge upon our competitive posture; and [3] concepts for national technology policies and strategies as these relate to rapidly changing national security concerns.



In the first part of our study, we observe that since the end of WW II the United States has pursued a technology policy focused on national security objectives, while Europe and Japan have pursued technology policies mainly emphasizing industrial technology as the basis for economic competitiveness and well-being. The United States explicitly supported these policies and saw them as contributing to a larger secure order that helped achieve U.S. national security and economic objectives. When these policies were first formulated they were seen as responsive to the world conditions that prevailed at the time—they were correct strategic concepts for their era. But these policies have succeeded. Now a new set of political, economic and technological relationships has emerged that foreshadows a new era. These new relationships are so intrinsic to DoD's technology goals, strategy and approach, that we have focused effort in our study at trying to define them and assess their implications.

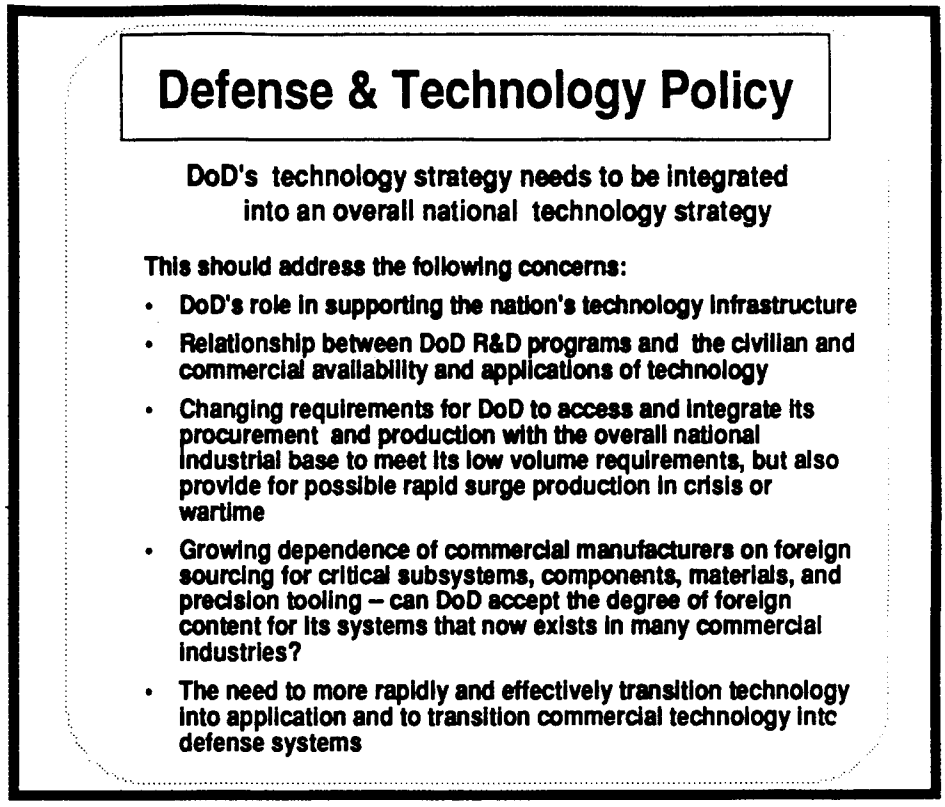
How the U.S. sees its security in relationship to other countries, how it sees itself developing, acquiring, and using technology to provide for its security, and in what relationship it sees itself to others in being able to develop, produce, and access these technologies, cannot be treated as static. If we are to develop appropriate strategies and policies about technology, it is important to understand the dynamics that underlie the changing context of security and competitiveness.

Defense Technology Strategy: Changed Requirements

YESTERDAY	TODAY	FUTURE
• Soviet threat drives DoD R&D [with imperative for highest technical capabilities to compensate for USSR quantity] • US leads in all key technologies • US dominates most industrial & hi-tech markets worldwide • DoD develops & uses advanced tech ahead of commercial sector • DoD R&D defense focused w/ spinoff orientation	• Soviet threat gone – unclear focus for R&D [imperative for highest capabilities gives way to affordability] • US technology leads dissipated – particularly in application and processing • US position declining in industrial & hi-tech markets worldwide • Commercial sector leads in using advanced dual-use technology • DoD looking for spin-on of technology from commercial	?

Against this historical perspective we can see the fundamental changes in the nature of DoD's technology requirements and the ability to produce capabilities to meet these requirements. For the first time in 50 years the basic tenets of DoD's technology strategy have come into question. DoD now is trying to understand and respond to a changed, but highly unclear and uncertain environment. Key givens of the past 50 years have changed. The problem is that they have changed simultaneously and challenge some of the basic policies and predispositions within DoD and the larger political arena.

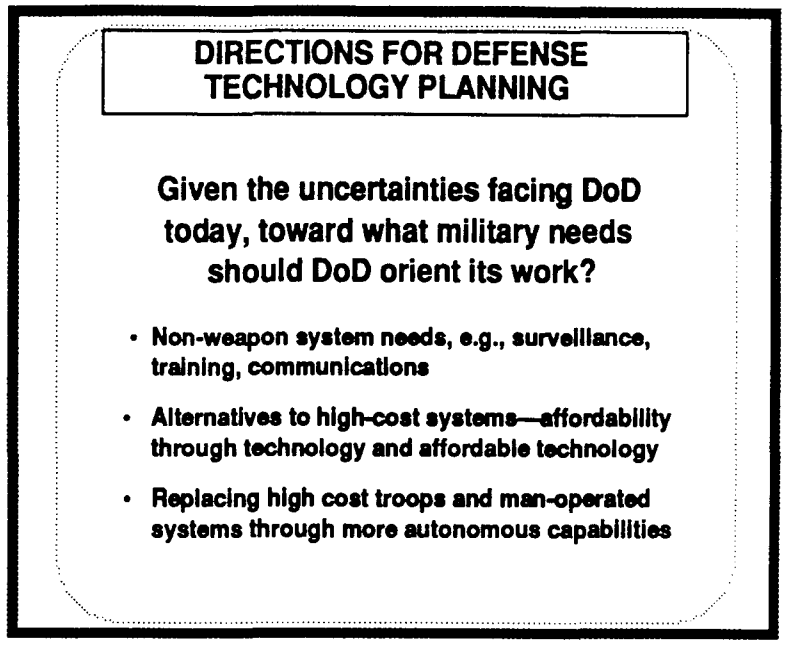
Our study delves explicitly into Defense and Technology Strategy. It assesses national security as the driver of U.S. technology policy and presents our views on what the key issues regarding technology policy that need to be addressed from a national security perspective.



In 1957 the orbiting of the Sputnik satellite by the USSR raised the specter of the Soviet Union as a technological, as well as political, threat to the United States. The "surprise" of Sputnik evidenced a lack of attention to Soviet technological capabilities and priorities in space and missiles, and their implications for national security. The Soviet threat symbolized by Sputnik raised the issue of scientific and technological expertise at high levels in DoD, providing the impetus for the creation of the Advanced Projects Research Agency, ARPA, and the creation of the position of Director, Defense Research and Engineering. These developments were to have substantial impact on the evolution of technology policy and programs within DoD.

ARPA was specifically a creation of the Sputnik challenge. Our study pays special attention to ARPA, as it evolved into DARPA, as a key element of our current technology strategy debate. In many ways the role of DARPA as the vanguard of Defense R&D crystalizes the issue of DoD technology policy in the changing world. ARPA was created in response to a very clear threat, and then evolved and adapted as the threat changed. We raise the question: what should be DARPA's focus in the new world environment that we are facing? Is DoD and DARPA strategy addressing key technology issues that affect DoD today? Is a refocusing of priorities and programs required? Are new mechanisms needed for DoD to address its interests and involvement in technology competitiveness? What should they be?

Defining DoD's technology future role

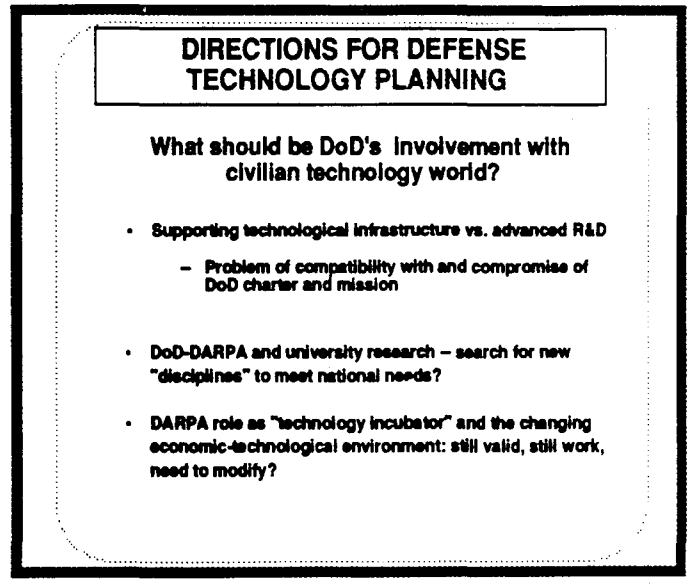


Not all "competitiveness" problems in the military or civilian arenas are technology problems. Not all technology R&D problems are necessarily those that DARPA and its "unique style" are best suited for. In viewing the efforts that have already sought to expand and refocus DARPA, and those that recommend even greater re-orientation in the future, our suggestion is prudence and caution in revamping or redirecting DARPA.

Arguments have been put forward that the changing environment provides a substantially reduced security threat, and therefore DARPA should be focused on broader economic and technological competitiveness concerns. The Brown Panel states that DARPA should emphasize dual use technology. The Carnegie Commission suggests changing DARPA to NARPA. It is our view that changing DARPA to NARPA raises serious concerns and may not be advisable. In our view the primary question is not with what DARPA does, but how should what it does be properly integrated into an overall national technology strategy.

The Soviet threat is replaced now by an uncertainty of where threats to this nation's security will arise in the future. This places premiums on DARPA's more enduring programs—surveillance, information processing for command and control, training for rapid response—and it also increases the importance of bringing technology to bear on achieving very rapid but effective responses to threat situations. The changing world situation also raises the need for redirecting technology away from providing the "most advanced" technology to meet the threat, toward using technology to make effective defense less costly. <u>This provides DARPA a new thrust or motif—technology for affordability and achieving affordable technology.</u>

DARPA should focus efforts on issues of weapons systems costs, and the related time it takes to design, develop, and produce weapons systems. This puts greater emphasis on its programs associated with manufacturing technology and the more generic programs in information systems that could affect the industrial production infrastructure. Based on DARPA's sustained support for the development of infrastructure technologies, particularly materials and information processing, DARPA might champion "manufacturing science" in a similar manner.

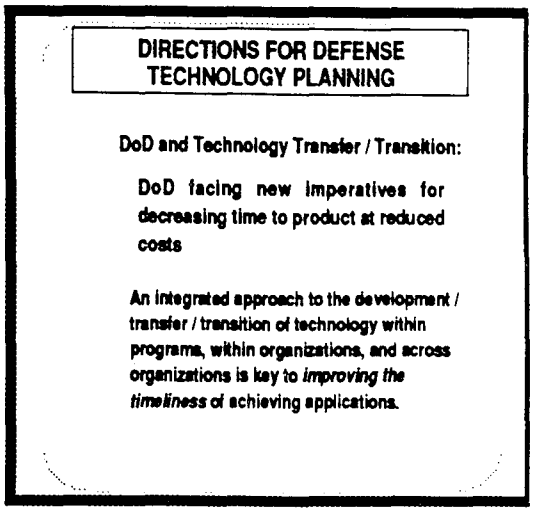


Such a program would build a base in the research universities and other research institutions, push technology demonstration programs, seek ways to encourage "bootstrapping" amongst programs, and provide incentives for early application of the research. Making this an attractive prospect is that two key areas important to advancing manufacturing technology are materials and information processing—thus, such an emphasis could be seen as an extension of some of DARPA's most successful efforts.

DARPA could foster the development and legitimization of manufacturing as an academic research field. By providing the funding and imperative for this research, DARPA could hope to achieve the type of self-propelling technology developments that were characteristic of the information processing area, where technology developments fed back and enabled one another. Like information processing, manufacturing science is an integrative field, combining the knowledge of more basic and accepted disciplines toward a particular type of application. For information processing this application was the integrated processing of different types of data through an array of electronic hardware and associated software medium into useful information. For manufacturing science a similar paradigm would be the integrated processing of material and component inputs through an array of production medium into useful products. Just as in information processing, manufacturing entails not just the physical equipment, but an array of nested, interlinked support and infrastructure technologies. The result of DARPA's investment in information processing has been an explosion of knowledge transforming the uses of information in both civilian applications and military operations. The goal would be that a similar, sustained effort in manufacturing could provide substantial benefits for DoD's ability to affordably develop, produce and upgrade weapons systems to support its future requirements.

DoD and Technology Transfer

Providing mechanisms for commercial application of DoD developed technologies benefits DoD directly. Such cooperation can extend the application base of DoD R&D, and thus reduce the cost of defense applications and make available a broader base of experience regarding application potentials. However, for DoD to benefit from such relationships, new approaches to the *development* of the technologies themselves are needed.



The relationship between military and civilian R&D must be considered as part of the defense technology development process, rather than being a post hoc program in which DoD attempts to "spinoff" research that commercial industry can use. A two-way street that is mutually supportive must be developed, or else the so-called technology transfer program will be primarily contrived and ineffective.

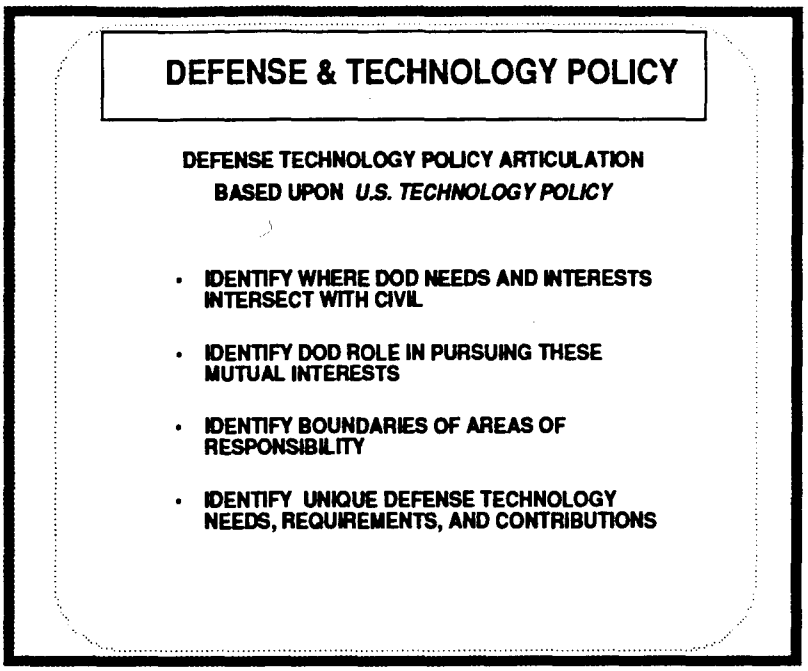
DoD's concerns regarding the transition of technology to application are broader and much more fundamental than those contained in technology transfer legislation. In fact, the "tech transfer" concept embedded in the legislation continues an emphasis on "spin-off" approach to DoD-civilian relationships, which becoming less important, and less relevant to overall technology competitiveness. This concept presumes DoD's R&D enterprises are developing technologies that [i] lead the developments of the commercial sector, and [ii] have commercial potential. These assumptions, perhaps true in the 1960s and 70s, are decreasingly valid today.

Moreover, DoD has a strong interest in commercial industry's ability to transition technology to practice and DoD can benefit by learning and adapting commercial industrial practices in its own developments. In commercial industry there have been major efforts to redefine the interrelationships between product development and transition to production. In our view

- **DoD has a stake in U.S. industry learning how to do this better. What programs should DoD foster to see this happens?**
- **What can DoD do to improve transfer of technology FROM industry TO DoD developments and applications?**

Congress required the mission agencies to actively foster technology transfer -- Our assessment is that it is in DoD's interest to define and develop a technology strategy that embraces technology transfer, but places it within the broader need to expedite the application of technology to meet security needs.

DoD & A National Technology Strategy

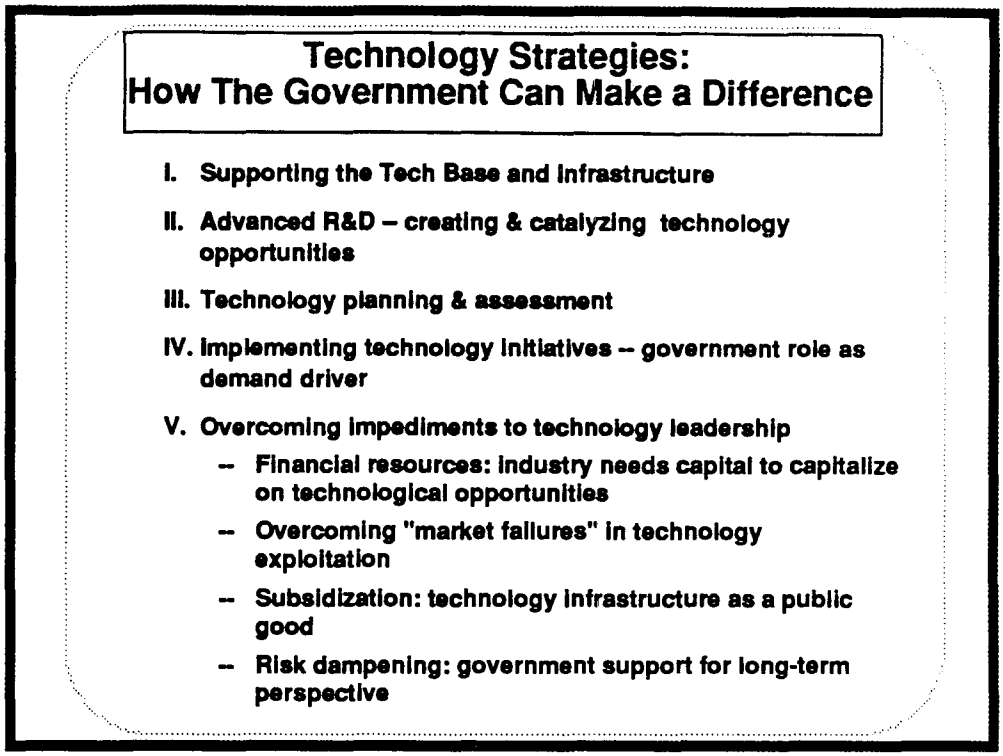


For over forty years DoD has played a key role in fostering technology development and has exercised this role effectively. In doing so, DoD has been innovative and flexible. However, with the radically changed threat environment, and the shift in the relative technological leadership of the U.S. -- particularly regarding the ability to effectively bring technology to fruition as new, competitive products -- DoD must re-evaluate the basic premises it has used to foster technology development.

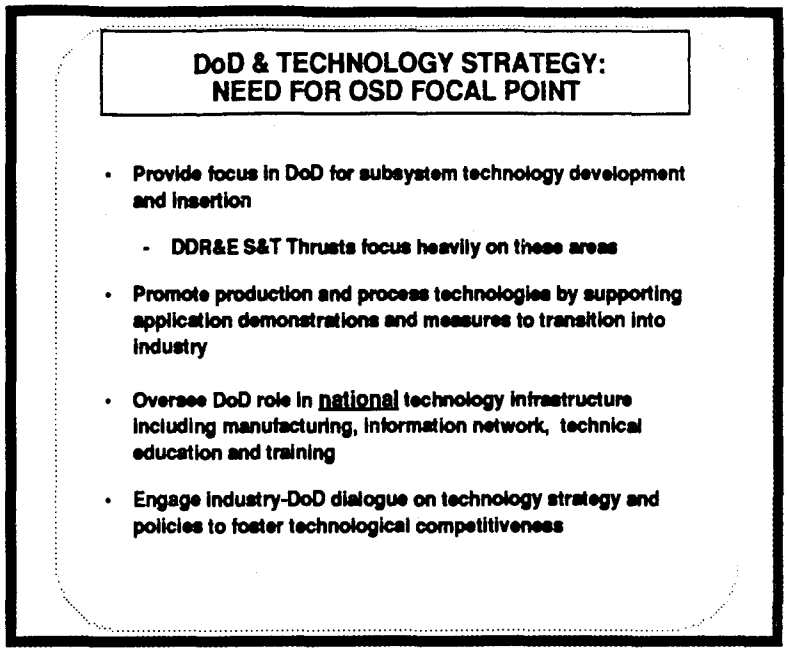
DoD must work to formulate a cooperative strategy within the national government overall and with U.S. industry—a NATIONAL technology strategy. DoD needs to emphasize that while it depends upon the NATIONAL technology and industrial base, it cannot be unilaterally responsible for its health and well-being. Congress and the Executive branch must appreciate the limits of scope and effectiveness of DoD as it moves beyond its mission-specific role. As we showed in our review of DARPA, DoD can be effective in selectively and judiciously supporting technology development beyond DoD's immediate charter. But, there are clear limits to its effectiveness and clear costs to DoD being asked to assume too large a role.

In our view, from a national security perspective, a national technology strategy is necessary if DoD is to be effective in defining and meeting its needs. Without a broader strategy, DoD is buffeted in an incoherent, often contradictory mode of operation, being pulled by Congressional mandates one way and Executive dictates the other.

Elements of Technology Strategy

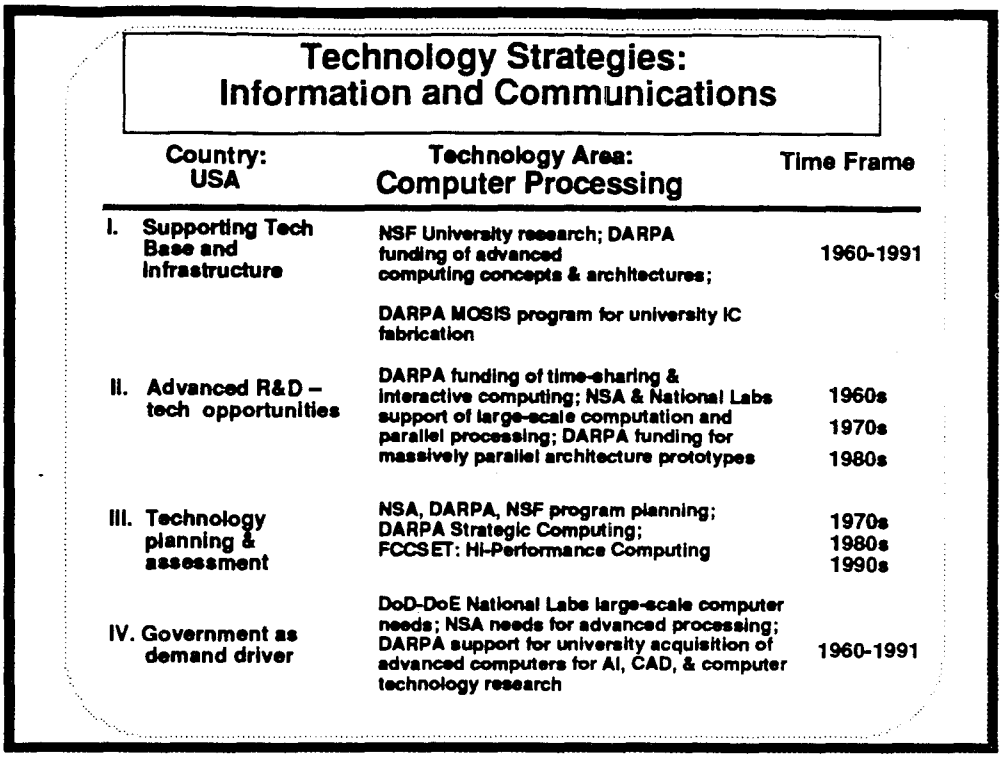


The U.S. needs to establish a technology strategy that is responsive to the technological and economic realities of what others in the world are doing. We do not have to copy their programs or policies, but we do have to be realistic about their implications, and take actions regarding them that support U.S. competitiveness. This list presents the elements of technology strategy. All of these have been pursued and applied effectively by the U.S. for specific technology developments and needs. While often the rationale for employing these measures was national security, often the rationale was broadly applied. This is true of the use of federal funds for supporting the highway infrastructure, and the National Defense Education Act. While national security was the rationale for government support for developing information processing technology, the strategy explicitly realized that success required civilian and commercial development. When technologies are "dual-use," or perhaps more aptly "omni-use," the role of the federal government in supporting their development and movement toward application becomes increasingly justified in itself. The fact that the technology is pervasive, and thus likely to substantially improve capabilities broadly, implies that the government ought to care about the competency and capability of its institutions and firms in developing and using the technology.



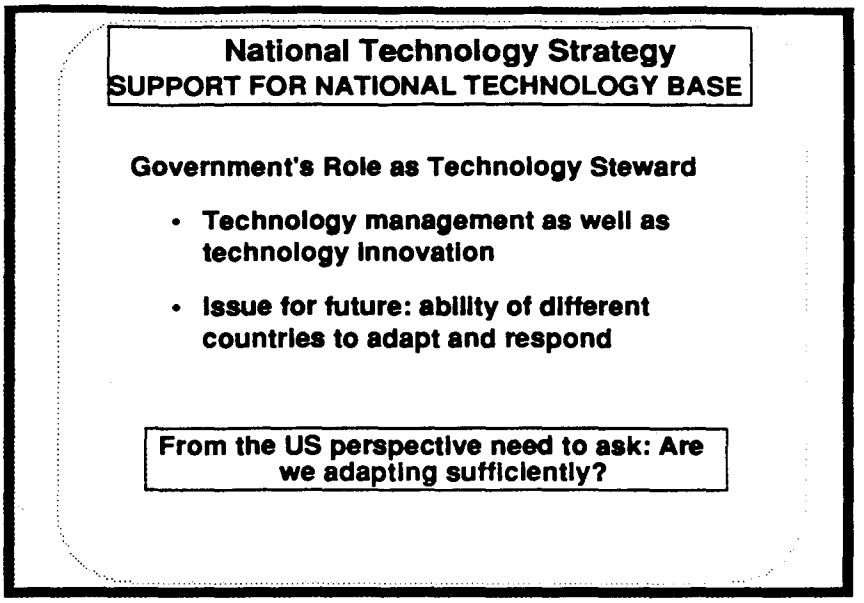
DoD is in the process of developing an S&T strategy focusing on subsystems and components, as opposed to systems. This is seen, in times of scarce resources and uncertain threats, as a more efficient way to inject needed capabilities into military systems. The thrusts emphasize non-systems capabilities including surveillance, precision strike, training, and affordability. Conceptually these S&T thrusts are a fundamental part of an S&T strategy, but are not themselves a complete strategy. What we are seeing is the beginning of a process that first asks what are the key applications capabilities do we think we need in the future, and then asks: what do we need technologically to achieve these. It is in asking the second level of questions that DoD confronts the technology base. What is the capability of the country to develop and produce -- and produce efficiently -- the advanced components and subsystems that will be needed. Will the technology infrastructure be there that can deliver these components competitively?

DoD's broader technology strategy must move toward addressing the national technology base and find ways to drive applications that foster the overall national capability -- dual-use capabilities -- that give DoD a reasonable expectation that there will be a strong, economically competitive industry to draw upon. DoD must find an effective way to interact with industry and with the rest of the federal government to realistically appraise this nation's technological capabilities and seek to support those technology developments that underpin productivity and innovation within U.S. industry. Throughout the past 50 years the DoD has taken on a role of responsibility, stewardship, for key technologies that were identified as intrinsically important to future national security needs. Today, as technology spreads rapidly throughout the world, and as commercial applications often outstrip DoD's ability to employ technology, DoD must integrate its technology strategy with a broader national strategy.



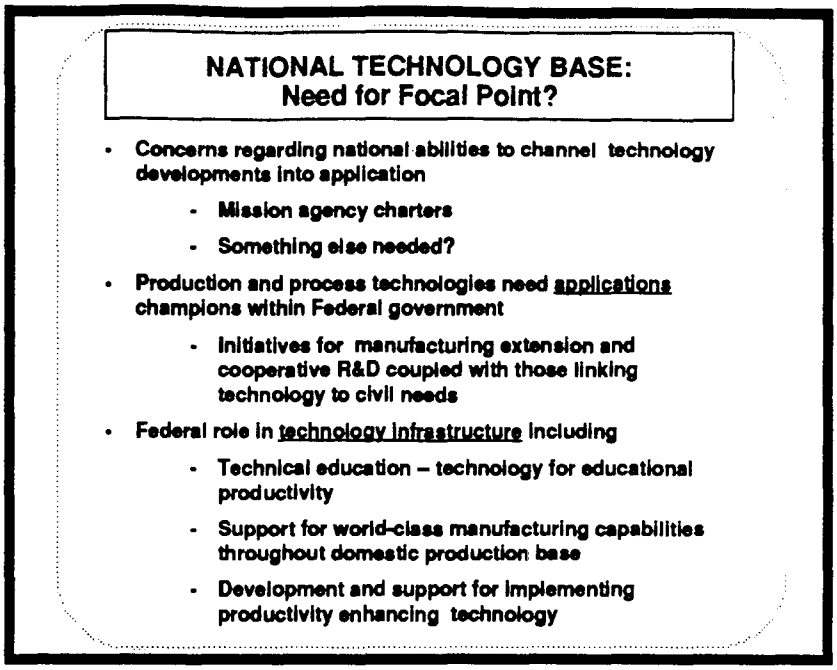
The federal government has supported information processing technology in the U.S. for over thirty years with the objective of assuring U.S. industry remains paramount. Where there were seen to be impediments, "market failures," to the development of technology -- particularly into products that potentially obsoleted vested products of existing firms — the federal government provided a range of opportunities and incentives for their development, including the first demand for the products themselves. Federal government support has built an infrastructure of technical capabilities and knowledge, particularly within the universities, that has been instrumental in developing new product areas and applications. Importantly, the strategy itself has not been static, but has responded to opportunities and changed as the technologies and the information industry itself has changed.

This national security-based strategy for information processing technology now confronts new realities—substantial international competition in a range of the technologies important to future information processing. Key aspects of the U.S. information processing industry no longer are in a position where the domestic private sector can be counted upon to further develop and apply the technologies fostered with federal funding. Increasingly, the technologies are being developed, and more importantly turned into products, by foreign enterprises. This raises issues that directly link the national security-based rationale to broader concerns regarding economic competitiveness. The national technology strategy must address these issues, define what role DoD should play in trying to respond to them, and lay out an overall, coordinated plan of for the the government's support for the information processing technology and its application.



The government role as "technology steward" extends well beyond that of national security. We have had the comfortable, and uncontroversial rationale of national-security to provide a basis for the technology policy that we have pursued for the past 40 years. This has given us reasonable basis to pursue fairly broad, and often very innovative technology support. Our ability to innovate and create new technology developments remains excellent—we invested in it. Yet, the collapse of the Soviet threat, while our economic competitors have progressively dominated industries and now are paramount in many aspects of commercial high technology electronics, exposes a major weakness in our policies and strategies. That weakness is that it has paid little attention to mechanisms and approaches for transferring technology innovation into application. In essence, with a vibrant domestic market, and a dominant capability to innovate, we relied upon market forces, via venture capital and equity capital, to propel technology into product. Where "market failures" appeared to impede technology transition, the government provided the opportunity "seed bed" for ideas to develop outside of large corporations--often through universities and small start up ventures.

But, this was in an environment that did not include strong foreign participation and presumed that the infrastructure of technology development—the suppliers, the equipment makers, and the financiers—was intact. Today that environment is very different, and technology policy and strategy must recognize these differences. Dealing with technology innovation as a *system* rather than some discrete problems that must be individually "fixed" is perhaps the key challenge for U.S. technology strategy.



In our work we have concluded, as have others who have looked at the issue of technology policy, that some sort of broader focal point is needed. The ability of the U.S. economy to compete in leading edge technology is intrinsically important to national security and defense. Yet, despite this interest, DoD has limited capabilities and a limited charter to affect this competitive capability. More importantly, there are legitimate and important reasons other than defense to support technological competitiveness. A key question is how to best identify, formulate and implement technology policies and strategies that deal with those aspects of technology that are of greatest concern. Mission agencies all have charters that overlap in the area of advanced technologies. Their responsibilities for implementation become murky where such overlaps occur. Moreover, implementation generally requires the participation of the private sector, and the role of government agencies in guiding and providing incentives for industry's activities is often not clear. Inter-agency coordination, along the lines of the FCCSET, provide one mechanism to determine priorities and to avoid duplication. The Science Advisor and the PCAST provide a mechanism for identifying important issues and channeling national attention on the resolution. But these organizations cannot implement.

With the Brown Panel report of the National Academies, the Carnegie Commission, and the Competitiveness Policy Council, we have new ideas and concepts being generated for a national-level technology policy and strategy. Congress is formulating legislation that addresses many of the concerns laid out here. Acceptance of a new federal role in technology development and application appears to be emerging. The question remains are we adapting enough and sufficiently quickly?

APPENDIX G:

The DPAS Recommendation

Implementation of the Joint Industry-Government Telecommunications Industry Mobilization Recommendations:

Priorities and Allocations for Telecommunications Materials and Equipment

U.S. Department of Commerce
Bureau of Export Administration, Room 3837
Defense Priorities and Allocations System (DPAS) Office
Washington, DC 20230

1992

UNITED STATES DEPARTMENT OF COMMERCE
Bureau of Export Administration
Washington, D.C. 20230

IMPLEMENTATION

OF THE

JOINT INDUSTRY-GOVERNMENT

TELECOMMUNICATIONS INDUSTRY

MOBILIZATION

RECOMMENDATIONS

Priorities and Allocations for

Telecommunications Materials and Equipment

Office of Industrial Resource Administration
Room 3837

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IMPLEMENTATION OF THE JOINT INDUSTRY-GOVERNMENT TELECOMMUNICATIONS INDUSTRY MOBILIZATION RECOMMENDATIONS

Priorities and Allocations for Telecommunications Materials and Equipment

Contents

IMPLEMENTATION OF THE JOINT INDUSTRY-GOVERNMENT TELECOMMUNICATIONS INDUSTRY MOBILIZATION RECOMMENDATIONS

Priorities and Allocations for Telecommunications Materials and Equipment

1.0 Introduction

The U.S. Department of Commerce (DOC) was designated as the lead agency to implement several recommendations made by the Joint Industry-Government Telecommunications Industry Mobilization (TIM) Group. These recommendations were presented to the President by the National Security Telecommunications Advisory Committee (NSTAC). This paper describes the manner in which DOC will use the Defense Priorities and Allocations System (DPAS) as the vehicle for (1) implementation of TIM recommendations calling for the establishment of procedures to ensure priority production of telecommunications materials and equipment, and (2) resolution of provisioning conflicts under national security emergency conditions.

1.1 Background

The TIM Group assessed the ability of the telecommunications industry to respond to a national security emergency mobilization situation. Its findings and recommendations were reported in two volumes of TIM Subject Reports and were approved in October 1987 by the Industry Executive Subcommittee (IES) of the NSTAC.

Subsequently, the Office of the Manager, National Communications System (OMNCS) developed the NCS Baseline Mobilization Program to provide for the implementation of policies, plans, and procedures to ensure that necessary telecommunications services and facilities will be available to meet Federal Government emergency communications requirements. The Program Plan sets forth the responsibilities, resource estimates, and schedules for implementation of the TIM Group recommendations.

In a memorandum dated February 7, 1991, the Manager, NCS, solicited the support of the NCS Principals to begin implementing the TIM Group recommendations. Included with that memorandum is a generic action plan and an assignment of the tasks to be performed by specific NCS member organizations and/or the OMNCS. Accordingly, the Manager, NCS, recommended that DOC be assigned as the lead agency for carrying out the TIM Group recommendations related to material and equipment production priorities, U.S. dependence on foreign-sourced materials, and the coordination of provisioning equipment and resolution of provisioning conflicts. This paper addresses the issues of material and equipment priorities, provisioning, and conflict resolution. U.S. dependency on foreign-sourced materials will be addressed in separate documentation.

2.0 TIM Group Assigned Recommendations

The following TIM Group recommendations relative to equipment and material priorities and provisioning were assigned to DOC by the NCS:

(1) Recommendation G.4(a) -- The Federal Government should develop and/or implement procedures that would assign priorities in a timely and coordinated manner to the telecommunications industry during mobilization to ensure telecommunications equipment and material production priorities for NS/EP telecommunications manufacturers.

(2) Recommendation C.5 -- With respect to specific telecommunications mobilization management issues, the Government should clarify the processes and procedures for coordinating the provisioning of NS/EP telecommunications equipment, and the resolution of any provisioning conflicts under mobilization conditions, particularly with respect to the role to be played by the NCS.

3.0 Priorities and Allocations

One of the more important lessons learned from past war experience is that the United States needs to have in place a system both for obtaining timely delivery of critical industrial products and materials to support current defense requirements and maintaining a preparedness capability for industry to respond to any future defense emergency. Accordingly, under Title I of the Defense Production Act of 1950 (DPA), the President is authorized (1) to require that contracts or orders relating to certain approved defense or energy programs be accepted and performed on a preferential basis over all other contracts and orders, and (2) to allocate materials, services, and facilities in such a manner as to promote approved programs. Additional priorities authority to require prompt delivery of articles and materials for the exclusive use of the U.S. armed forces is found in Section 18 of the Selective Service Act of 1948, in 10 U.S.C. 4501 and 9501, and in 50 U.S.C. 82, as implemented by Executive Order 12742.

The responsibility for carrying out these authorities for industrial resources is delegated to DOC, and within DOC, to the Office of Industrial Resource Administration (OIRA). To implement the authority, OIRA administers the Defense Priorities and Allocations System (DPAS). The DPAS is a multifaceted, self

executing regulation (15 CFR 700), designed (1) to assure the timely availability of industrial resources to meet current national defense requirements, and (2) to provide a reguatory framework to support rapid industrial response in a national security emergency.

3.1 Defense Priorities and Allocations System (DPAS)

The DPAS establishes two levels of priority, identified by the rating symbols "DX" and "DO". The DX priority is assigned only to those contracts and orders which support programs designated by the President as being of the highest national priority. The DO priority is assigned to all other contracts and orders which support programs vital to our national defense. DX rated orders take preference over all DO rated orders, and DO rated orders take preference over all unrated/commercial orders as necessary to meet delivery requirements.

DOC has delegated authority under the DPAS to certain designated federal agencies (i.e., DOD, DOE for nuclear weapons, GSA for the Federal Supply Program, and FEMA for civil defense and continuity of government) to use rated orders in support of approved national defense programs. These rated orders are placed with contractors and vendors who are capable of supplying the required product, material, or service. Upon receipt of a rated order, a

contractor or vendor must:

(1) Accept the order except as specifically provided in the DPAS;

(2) Give the order precedence over unrated/commercial (including unrated government) contracts and orders as necessary to meet delivery requirements; and

(3) Extend the priority rating on contracts and orders placed with subcontractors and vendors to obtain timely delivery of needed production items.

The DPAS also provides for special priorities assistance in the event of production or delivery problems. Generally this assistance is used to expedite deliveries or to resolve production or delivery conflicts. It also may be used to request priority rating authority for items not automatically ratable under the DPAS.

During a national security emergency, the DPAS may be expanded as needed to support rapid industrial response to meet defense related emergency requirements, including the acquisition of critical items for essential civilian programs.

3.2 Application of the DPAS to Telecommunications Equipment and Materials During a National Security Emergency

During a national security emergency, the DPAS may be expanded to support the defense related acquisition of telecommunications equipment and materials to meet urgent and essential civilian program requirements. DOC would establish special rules as needed to ensure that critical items of equipment and materials will be available in a timely fashion and to provide for the equitable and orderly distribution of these items. However, such action could not be taken unless an essential civilian program which covers telecommunications equipment and materials is approved by appropriate authority for priorities and allocations support under the DPA or other emergency legislation.

This exercise of expanded DPAS authority would be in addition to the DPAS authority currently exercised by FEMA under delegation from DOC to use rated orders for the acquisition of telecommunications equipment and materials in support of FEMA's civil defense and continuity of government program. Also, it should be noted that no additional DPAS authority would be needed during the emergency to support the acquisition of telecommunications equipment and materials to meet national defense program requirements.

3.3 Procedure for Using the DPAS to Telecommunications Materials and Equipment Acquisition

During a national security emergency, and following the establishment of a defense related essential civilian program which covers telecommunications equipment and materials, any entity (e.g., contractor, supplier, or government agency) requiring assistance in obtaining timely delivery of these items, should request priority rating authority from DOC/OIRA as set forth in the DPAS provisions on Special Priorities Assistance (SPA) using DOC form BXA-999. A sample copy of this form is included as Attachment 1. Such requests must be sponsored by the NCS. SPA can be initiated by the entity who needs assistance to resolve a problem related to the exercise of the DPAS authority.

If placement of a rated order with a supplier will not by itself ensure timely delivery, the entity, with NCS sponsorship, can request additional OIRA assistance. If the problem involves conflicting urgent requirements or some other situation that should be resolved at a higher level, the matter will be referred by DOC through FEMA to the proper authority for adjudication.

4.0 Residual Issue

The DPA lapsed on March 1, 1992, and legislation to extend and amend this authority is presently under consideration by the U.S. Congress. Accordingly, the DPAS is now being administered under the authority of Executive Order 12742. Because this authority is limited to procurement of articles and materials for the exclusive use of the U.S. armed forces, short of war or threat of war, the DPAS currently can only cover the emergency procurement of telecommunications equipment for this purpose.

5.0 Summary

The DPAS was established to help ensure the timely availability of industrial resources critical to the nation's defense, and to provide a framework for rapid industrial response in a national security emergency.

During a national security emergency, the DPAS could be expanded as needed to support the timely acquisition of telecommunications equipment and materials to meet critical and urgent defense related essential civilian program requirements. OIRA would, under such circumstances, take specific case-by-case official action as required to ensure the timely delivery of these items.

Accordingly, it is DOC's position that the procedures available under the current DPAS, supplemented by additional procedures developed in response to a national security emergency, are consistent with TIM Recommendations G.4(a) and C.5. Therefore, DOC believes that the DPAS satisfies the requirements of the NCS Baseline Mobilization Program.

For more complete information about the DPAS, interested parties should review its provisions, including its appendices (e.g., DPAS (draft) Emergency Regulation 1), found in 15 CFR 700. Requests for copies of the DPAS and any questions about its provisions may be directed to Richard V. Meyers, DPAS Program Manager, OIRA, Room 3878, U.S. Department of Commerce; tel. (202) 377-3634 and FAX (202) 377-5650.

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An Assessment of the U.S. Telecommunications Industry Dependence on Foreign Sources as it Impacts the U.S. Telecommunications Infrastructure

Volume I: An Executive Summary -- Volume II: Background Information

ABSTRACT

The National Communications System (NCS) is responsible for defining operational infrastructures and processes that could be detrimental to the provision of telecommunications equipment and services that are necessary to the National Security and Emergency Preparedness (NS/EP) needs of the Nation. To this end, the President's national Security Telecommunications Advisory Committee (NSTAC) studied the industry's dependence on various infrastructures within the United States to: (1) identify possible impediments to effective telecommunications industry mobilization, and to (2) assist in the development of corrective actions to overcome any identified impediments. This study was published in 1989. The information presented in this report is a result of follow-on investigations that attempt to determine those components and materials used in the telecommunications equipment manufacturing process that are obtained from foreign sources. This report lists those components that are primarily procured from foreign sources. for example, plastic-coated relays, printed circuit mounted transformers, and some types of semiconductors are a few of the components that represent vulnerabilities in the telecommunications switch (Class 5) manufacturing process. A result of this study is an analysis of the trends that are evident between the 1989 study results and the results of this report. This report shows an increase in the components that are obtained almost exclusively from sources outside the U.S. and Canada. A contributing factor to the trend toward more foreign sourcing of components is the general trend toward a more global economy. In the final analysis, one must determine the components, and their sources, that could be the most detrimental to the mobilization of the Nation's telecommunications resources if these sources were no longer available. A determination of the sources that are most likely to be cut off is also important. An analysis of the circumstances that could result in the cut off of foreign sources is not part of this study.

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