CHARLES W. WESSNER

Dr. Wessner brings an unusual perspective on Washington policy developments and international cooperation because he has served with three different federal agencies in positions of increasing responsibility. He also has extensive overseas experience, both an as an international civil servant with the OECD and as a senior officer with the US Diplomatic Corps. Since joining the National Research Council, that is the operational arm of the National Academy of Sciences, he has led several major studies, has a rapidly growing list of publications, and works closely with the senior levels of the U.S. government. Currently, his work encompasses topics such as Government-Industry Partnerships for the Development of New Technologies, a White House initiated study on U.S. Aerospace Competitiveness, and a Defense Department study on Small Business Innovation Research Programs.

He began his career in the Treasury Department working as an international economist on North-South negotiations and as a special assistant in the Office of the Secretary of the Treasury. He was then offered a position in Paris with an OECD policy group responsible for formulating developed country positions in the UNCTAD talks.

In the mid-eighties, he rejoined the government as the senior commercial officer in the US Mission to the OECD where he worked in a multilateral environment on sectors such as telecommunications, computers, steel and transportation. He dealt with a range of issues such as trade and quotas, privatization and telecommunication reform, and new transportation initiatives. He was also elected chairman of an OECD working group where he led the first successful effort to collect data on OECD government subsidies to national industries.

At the request of the Secretary of Commerce, he left the Foreign Commercial Service and returned to Washington as director of the Technology Administration's Office of International Technology Policy in the Department of Commerce. In 1993, he left Commerce to work on competitiveness issues with high-technology industries such as semiconductors and telecommunications as they developed their response to the Clinton administration's new technology policies.

Continuing his interest in public policy. he is now the director of the National Research Council's Program on Technology and Competitiveness. In this capacity, he served as study director and principal author for the National Research Council project on *Conflict and Cooperation in National Competition for High-Technology Industry,* now in its third printing. Other publications include: *Policy Issues in Aerospace Offsets (1997), International Friction and Cooperation in High-Technology Development and Trade (1997), Trends and Challenges in Aerospace Offsets (1999).*

Dr. Wessner is now directing a major project on *Government-Industry Partnershipsfor the Development of New Technologies,* with Intel's Gordon Moore. Recent publications of that project include New *Vistas in Transatlantic Science and Technology Cooperation (1999). Industry Laboratory Cooperation: A Review of the Sandia S&T Park Initiative (1999), Small Business Innovation Research Program: Challenges and Opportunities(1999),* and *The Advanced Technology Program: Challenges and Opportunities (1999),* and the forthcoming *Small Business Innovation Research Program: A Review of DoD's Fast Track Initiative.*

Dr. Wessner holds degrees in International Affairs from Lafayette College (Phi Beta Kappa) and the Fletcher School of Law and Diplomacy where he obtained an M.A., an M.A.L.D. and a Ph.D. as a Shell Fellow. Dr. Wessner lectures frequently on international technology policy and high-technology trade at Harvard, George

Mason, Georgetown, and George Washington Universities, Sandia National Laboratories, Helsinki University, and the Foreign Service Institute of the Department of State.

Testimony of

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Technology and Competitiveness
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National Research Council

Public Hearing
U.S. Trade Deficit Review Commission
Aerospace and Other High Technology Exports

Seattle, Washington
November 16, 1999

Testimony of Charles W. Wessner before
U.S. Trade Deficit Review Commission
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Good morning. My name is Charles Wessner. I direct a program on technology and competitiveness at the National Research Council, the operating arm of the National Academies of Science and Engineering. It is a pleasure to appear before the Commission to discuss the causes and consequences of the United States' trade deficit. This is an issue that may appear less in the headlines today than it did several years ago, yet it is important that we understand why the United States has a persistent trade deficit, indeed one that continues to expand. We also need to explore whether this trend is sustainable, and what we might do to constructively address the causes of the deficit.

My task today is narrower than yours, but I do hope to help by addressing two topics that are relevant to the Commission's work, and which also have been explored by the National Research Council's Board on Science, Technology, and Economic Policy in recent years. The first topic is aerospace offsets. My comments will be based on our report, ***Trends and Challenges in Aerospace*** Offsets. The second topic is broader, and touches on a second book-length report entitled ***Conflict and Cooperation in National Competition for High Technology Industry***. This second report examines the yin and the yang of the global economy. That is to say, it reviews the powerful drivers of international science and technology cooperation-cooperation which is particularly important in the

high-tech arena. But the report also takes a candid look at the impact of national programs to promote and protect high-technology industry on international cooperation and on the international trading system.

Backeround

My comments are based on work I directed for the Board on Science, Technology, and Economic Policy (STEP) at the National Research Council. The views I will express are my own. The STEP Board was established in 199 1 to explore the linkages between economic policy issues, growth, and the nation's scientific and technological base. In 1997, partly as a result of STEP's work on ***Conflict and Cooperation,*** the White House National Economic Council asked the STEP Board to convene a group of experts to determine what the impact of aerospace offsets has been on employment and the U.S. supply base, and explore their likely future impact. In responding positively to the White House request, STEP sought not to make specific recommendations, but rather to bring together, for the first time, representatives of labor and industry, concerned public officials, and academic experts to seek a better understanding of the impact of offsets on the aerospace industry.

Trends and Challenges in Aerospace Offsets

In discussing aerospace offsets, perhaps the best place to start is with a definition of what one is. As defined by Berkeley's David Mower-y in his contribution to ***Trends and Challenges in Aerospace Offsets,*** an offset is: "a provision in an international export transaction that commits the seller firm to provide technology, to procure locally produced components, or to provide other forms of technical and other assistance to firms in the purchaser nation that go beyond those deemed economically necessary to support the sale." There are two general types: direct offsets concern products from the aerospace industry itself. Indirect offsets encompass quite a wide variety of products and projects not directly related to the aerospace sector.

One controversial element of the offsets issue is the effect of offset arrangements on employment in the aerospace industry. Employment in the aerospace industry has declined in recent years, and concerns have been raised that demands for offsets by foreign government have contributed to this decline. David Mower-y of the University of California at Berkeley found that offsets have played a role in the decline in aerospace employment. It is important to recognize that offsets were not the dominant cause of the decline. In fact, the main causes were the end of the Cold War, improvements in manufacturing productivity, and international competition.

Offsets can, however, effect employment and sales in the supplier base of the aerospace industry. As Todd Watkins of Lehigh University describes in his paper in ***Trends and Challenges in Aerospace Offsets,*** the supply base is __ increasingly squeezed between two forces. One is competitive demands to be ever more lean as suppliers respond to their customers in the aerospace manufacturing industry. Aerospace manufacturers spent the 1990s outsourcing more sophisticated manufacturing and design tasks to suppliers. This places new pressures on these suppliers to nimbly respond to customer specifications. The other force is foreign competition-companies that may have benefited from offset agreements and from home government subsidies-that now compete with U.S. firms. This places even greater demands on U.S. suppliers. As Professor Watkins points out, these pressures "may end up suffocating the vital middle tiers" of the U.S. aerospace supply base.

Conflict and Cooueration

Professor Watkins' observation about the squeeze faced by second tier suppliers to the aerospace industry points to the double-edged sword of international economic competition and cooperation. On the one hand, fierce competition for major aircraft sales can, in fact, drive cooperative activity such as direct offsets. This cooperation can lead to better markets for U.S. aerospace products - which are largely assembled in and exported from the United States. This is not the case for the U.S. auto industry, for example. On the other hand, as

noted, this cooperation may erode the long term capabilities and capacity of U.S. industry. A key point to keep in mind is that because of changing production techniques and the merging of previously distinct technologies, the impact of offsets in the past may well be a poor guide to the impact of offsets in the future.

THE NEED FOR A SUPPORTIVE POLICY FRAMEWORK FOR AEROSPACE

The second key point that I retain from our work on aerospace is that offsets are only one part of the picture. The way to maintain employment in the industry is to have a healthy industry, exporting products from the U.S. Representatives of labor, industry, and the government need to work together to forge a consensus on what is needed in terms of R&D, test facilities, export incentives, worker training, and restraints on foreign subsidies. Other countries have successfully targeted this industry. If we are to retain our leadership position in this industry, we have to provide a supportive policy framework for the industry and its workers.

You may ask yourself "How does this relate to the deficit as a whole?" The first answer to this question is that the aerospace industry is our largest high technology export industry. It provides high value-added, high wage jobs, through an extensive, nation-wide supply base. The second answer to this question is that the competition for aerospace, like the competition for semiconductors or computing, captures the very essence of the competition among nations and their firms for the high technology industries of the future.

To explore this second, broader question, the National Research Council conducted and published a study entitled ***Conflict and Cooperation in National Competition for High-Technology Industry.*** The title was carefully chosen. It reflects the reality that conflict and cooperation co-exist in the international system, particularly with respect to high technology industries. For example, cooperation in developing new technologies can have many benefits. It enables partners to share risks, pool costs, and draw on increasingly dispersed sources of technical expertise. It can also be essential to develop standards. Many companies cooperate as a means of developing shared standards, local partners, and to ensure market access. But conflict can also arise, because competition for lucrative high-tech markets often takes place at the national or regional level today, notwithstanding the globalization of economic activity. The competition may be global; the benefits are local.

WHY DO HIGH TECH INDUSTRIES MATTER?

Why are countries so concerned with their high-tech industries? Why does it matter whether we make computer chips or potato chips? The answer is that one industry has a much more dynamic growth pattern. Semiconductors are an industry of future jobs and future opportunities, one which will provide a gateway to other industries. Potato chips, by the way, also involve high tech manufacturing techniques, and indeed rely directly or indirectly on advances in software and

computing. Fortunately, the consumption of computer chips is rising much more rapidly.

WHY GOVERNMENTS CARE ABOUT HIGH TECH INDUSTRY

Why are governments concerned about their high technology industries? There are many reasons. Many are based in the ground-breaking work in on new trade and growth theory in the economics profession. Among the reasons cited[1]:

1. High-tech firms are more closely associated with **innovation** than traditional firms.
2. High-tech firms perform **larger amounts of** R&D than other firms. It is important to understand that there are **substantial societal returns** to such R&D.
3. The **positive spillovers** from R&D benefit other commercial sectors by creating know-how that contribute to productivity gains.
4. The positive spillovers are often **locally concentrated.** Countries or regions performing high-tech R&D generally capture the high social ret-urns the R&D generates.

[1] For a more complete discussion of these issues, see Appendix A to my remarks submitted for the record, which can also be found on pages 33-35 of ***Conflict and Cooperation,*** copies of which have been provided to Commissioners.

5. High-technology sectors experience **higher overall growth rates** than other sectors, thereby contributing to countries' overall economic health.

6. High-technology firms are associated with high value-added manufacturing and, therefore, **the creation of high-wage employment**.

7. Many high-technology industries have **important consequences for core government missions,** with defense being the most prominent, but energy development, environmental protection, and health care are directly affected as well.

HOW GOVERNMENTS SUPPORT HIGH TECH INDUSTRY

The second set of issues has to do with how governments support high-technology industries. The STEP study found that governments employ a wide range of policy measures to ***support*** high-tech industries. Among the types of measures that governments use to promote industries are measures such as:

1. **Direct financial measures** such as direct grants to companies, preferential loans, and government loan guarantees. Governments also employ equity capital infusions, often to cover recurrent losses, or to provide start-up capital for new firms in targeted sectors.
2. **Government procurement policy** is also a rich source of support, both to encourage new industries and to provide lucrative contracts for national firms that, in effect, serve as a means of subsidizing competition in foreign markets.

3. **Targeted tax concessions** for specific sectors or activities, e.g., R&D, are also frequent.
4. Other policy objectives such as worker training or assistance to underdeveloped regions may also provide important means of subsidizing favored industries.

Importantly, these measures are most powerful in combination, and governments often us them with the objective of spurring the development of new technology by domestic industries and strengthening the competitive position of national firms.

HOW GOVERNMENTS PROTECT HIGH TECH INDUSTRY

Governments also employ a wide variety of measures to ***protect*** high technology industries within the national borders. In addition to offsets, these include:

1. Restrictive import policies, such as tariffs, quotas, import licensing, and customs barriers.
2. Standards, testing, labeling, and certification requirements.
3. Government procurement, such as "buy national" requirements.
4. Export subsidies
5. Lack of adequate intellectual property protection.
6. Investment barriers, such as limits on rights to establishment.

7. Anticompetitive practices that are tolerated or encouraged by governments.

Direct investment has a powerful effect on trade patterns – barriers to investment have a correspondingly high impact on trade. The privatization of protection through cartels and other discriminatory practices can effectively close markets and make market opening agreements ineffective. These measures to support, protect, and nurture high tech industry, especially when working in concert, can be quite powerful'. In these circumstances, countries with open markets have to be prepared to use internationally recognized trade remedies, such as anti-dumping, to preserve domestic industry.

The U.S. Approach to Trade Policy

My own impression of US. trade policy, based not only on my time at the National Academy of Sciences, but also years of government service prior to that, is that we often assume that other nations share our views about the goals of economic activity and the nature of a rules-based international trading system. We tend to assume that consumer welfare is the common objective of participants in the world trading system. Yet other countries, in fact, have adopted quite explicit

[2] For a more detailed discussion of these measures and practices, see Appendix B (pages 39-40 of ***Conflict and Cooperation)*** of my remarks submitted for the record.

national economic strategies designed to augment national economic strength, through producer, rather than consumer oriented policies,

From this perspective, other countries-in the face of superior U.S. products-may be quite willing to encourage their own high-tech industries by protecting their home markets and encouraging the development of local products. This can and does apply to computers, semiconductors, medical equipment, and pharmaceutical products. Protests of inefficient resource allocation simply fall on deaf ears, as they should. Many of the producer-oriented countries have enjoyed sustained, high growth over several decades. Collectively, these economies, by their scale, rate of growth, and impact on the world economy pose a significant challenge to the current international trading system, a challenge which I believe has been in part masked by the willingness of the United States to maintain a large and growing trade deficit.

Given the persistence of the U.S. trade deficit, I suspect that significant portions of the U.S. deficit have become structural. For example, an appreciation of the yen of 100 percent may do very little to the relative market share of U.S. and Japanese automakers. For computer disk drives, we have a deficit in the production of this product because manufacturing for this industry is located almost entirely in Singapore-in no small measure because Singapore's government provided incentives to the industry to locate there. But there are important nuances. The R&D and ownership of the industry remain largely U.S.-

based, although disk-drive R&D in Singapore is increasing – precisely because it is advantageous to locate the R&D, engineering, and design near the manufacturing.

Given the often fundamental differences in perspective and objective of international economic relations, especially trade, it is important that we bring as much constructive analysis to the question of the deficit as we can. Having a "bumper sticker" debate in which people pretend there is a "free trade" camp versus a "protectionist" camp may be satisfying to some, but it is neither accurate nor productive to address the Commission's charge in these terms.

The fact is, there are few countries with completely open economies in all sectors. And there are few who seriously advocate closing off trade. But a liberal trade regime, like globalization, is crucially dependent on the terms and conditions in which it takes place. It can be mutually beneficial. There can also be winners and losers. And the determination of those winners and losers in some cases has nothing to do with free market forces. In these circumstances, it is important that the United States show a willingness to actively enforce existing agreements, and to use national policy measures, such as anti-dumping actions, when required. Paradoxically, an American government which takes the necessary actions to block the predatory practices of countries and companies seeking to unfairly expand their market share, or simply export their unemployment, is also taking the steps necessary to sustain a liberal, international, trading system.

By holding this and other hearings, this Commission can contribute to a productive dialogue on the US. trade deficit and U.S. trade policy more broadly.

We need pragmatic, well-informed approaches to trade policy, taking into account the need for improved enforcement of existing trade agreements, better organization of the government's trade policy apparatus, improved access for investment – a key determinant of trade patterns – and progress on government procurement. Points all covered in the ***Conflict and Cooperation*** report. I know that the Commission is committed to seeking out constructive approaches. I am pleased that I have been able to offer my personal perspective on these issues.

Appendix A

BOX A: Why are countries concerned about their high-technology industries?

Throughout this report, attention is focused on firms that develop and produce advanced technological products. As noted above, not all economists accept the view that high-technology industries are significantly different than traditional industries (potato chips versus computer chips) and therefore deserving greater attention by policymakers. There is, however, a growing body of economic thought that argues that the composition of the economy matters and that high-technology industries bring special benefits to national economies.

The benefits attributed to high-technology industries rest on a number of interlocking observations.

First. **high-technology** firms **are associated with innovation.** Firms that are innovative tend to gain market share, create new product markets, and use resources more productively. This proposition is supported by the findings of a recent National Academy conference on the impact of innovation on productivity, wages and employment.

Second, high-technology **firms perform larger amounts of R&D than more traditional industries.** High-technology firms are identified by the very high percentage of their revenue devoted to research, often more than 10 percent, as compared with a 3 percent level for more traditional industries. Collectively, high-technology industries constitute a

Disproportionate share of total private R&D spending in the U.S. And the social returns of such R&D spending are widely believed to far exceed the private returns.

Third, **these positive spillover effects benefit other commercial sectors by generating new products and processes that can lead to productivity gains and generate new manufacturing opportunities. Advances in** electronics have made it a key enabling industry responsible for new methods of manufacturing in steel, automobiles, aerospace and even agriculture, in addition to the creation of a whole gamut of consumer electronic and defense related products. There is substantial economic literature underscoring the high returns of technological innovation with private innovators obtaining a rate of return in the **20 to 30% range with the** spillover (or social return) averaging about 50%.

Fourth, **the positive spillover effects are often locally concentrated.** Firms frequently concentrate in particular locations to benefit from the externalities associated with a qualified labor supply with appropriate skills, specialized suppliers of inputs and supporting services, and informal horizontal information networks for the exchange of the "tacit" knowledge required for the exploitation of new techniques and processes. These 'network systems flourish in regional agglomerations where repeated interaction builds shared identities and mutual trust while at the same time intensifying rivalries." Because these local externalities tend to be self reinforcing, the competitive position of the relevant industry tends to improve over time. Conversely, the decline in an industry's position tends to erode the specialized infrastructure as well.

Box **A** (cont.)

Fifth, high-technology **products are a major source of national economic growth in all of the major industrialized countries,** because the global market for high-technology manufactured goods is growing at a faster rate than the markets for other manufactured goods. For example, in the U.S., sectors such as aerospace, information systems (software, computers and semiconductors), chemicals, pharmaceuticals, biotechnology, and medical equipment are all leading sources of U.S. exports. Moreover, as noted above, these high-technology industries also account for a disproportionate amount of total industrial R&D.

Sixth, as one would expect from the above, **high-technology firms are associated with high value-added manufacturing and. importantly, the creation of high wage employment. The** firms that innovate rapidly, introduce new technologies, develop new products, and expand exports are also the firms that increase employment and contribute disproportionately to the national R&D effort.

Seventh, many **high-technology industries have important consequences for core government missions.** Foremost among these is national defense. Early, assured access to advanced, low-cost technologies is viewed by many as a critical element in a viable defense strategy for the next century. As one informed observer remarked, without technological superiority, military superiority becomes a question of numbers and training. The impact of new enabling technologies can be equally crucial for major government missions in energy development, environmental protection, and health care (where new technologies offer major advances in methods, drugs, devices and equipment).

Appendix B

BOX B: How Do Governments Support High-Technology industries?

Governments **support high-technology** industries through a vast array of policy measures, often addressing seemingly quite disparate policy objectives. Trade related measures continue to play a central role. Though trade measures elude fixed definitions, they include a panoply of laws, regulations, policies and practices that protect domestic products and markets from foreign competition or stimulate exports of selected domestic products. A recent U.S. government report identified nine different categories of government measures that "restrict, prevent or impede" international commerce.

These categories include: **restrictive import policies,** such as-tariffs, quotas, import licensing, and customs barriers; **standards, testing, labeling, and certification;** government procurement, such as "buy national" policies or practices; **export subsidies; the lack of intellectual property protection** as a result of inadequate patent, copyright, and trademark regimes; services barriers; investment barriers involving limitations on foreign equity participation and on access to government-funded R&D programs and other restrictions; **anti-**competitive practices with trade effects which are tolerated or encouraged by governments.

Other common policies, which are either designed or provide the opportunity to improve the competitiveness of national firms, include deregulation. privatization, relaxation of product and environmental standards, encouragement of mergers and strategic alliances, and targeted tax measures designed to encourage innovation and investment.

Governments also support high-technology industry under an exceedingly broad range of policy objectives and Implementing financial instruments. For almost a decade, the OECD has sought to assemble detailed internationally comparable data on national support to industry.

Box B **(cont.)**

Based on this analysis, expenditure by OECD member countries was in excess of $66 billion per annum in the 1986-89 period. The total amount spent on these measures declined in that period, prrmarily due to an overall reduction in targeted tax expenditure. However, government support is increasingly focussed, with greater use of direct grants, government guarantees and support for exports for selected industries. While regular and comparable reporting on subsidies to manufacturing Industries does not yet exist, the OECD work captures the scope and diversity of national policy objectives and instruments.

Policy **Objectives**

In addition to support for investment in particular high-technology sectors, such as microelectronics. biotechnology, and aerospace, governments often pursue what The OECD describes as "horizontal objectives" such as aid to regional development, aid to small and medium sized enterprises, aid for employment and training, support "for enterprises in difficulty", export incentives and other trade related assistance, as well as support for research and development. R&D support includes both traditional government support for research through grants to universities and research institutes as well as through direct subsidies to industry, e.g. in the electrical and aerospace sectors, or more indirectly through defense contracts. Data collection has recently expanded to include government support for energy efficiency and environmental protection. Currently, more than 1500 programs and measures of support are available to manufacturing in OECD countries.

Instruments

Financial instruments include direct grants to companies, preferential loans, government guarantees for loans, equity capital infusions by government entities or government controlled banks (often to cover recurrent losses), preferential government procurement policies, targeted tax concessions for specific sectors, for "underdeveloped" regions (where high-technology industries may be located), and for specific activities, e.g. research and development. Government goods and services, e.g. electricity, are also provided at below cost and domestic industries (especially when they are state-owned or controlled) can be required to purchase domestic products, e.g. electric turbines or telecommunications equipment, at prices exceeding those available on world markets thereby providing an important source of funding for other activities such as R&D investment or export support.

Government policy guidance and the activities of its agencies also contribute to the support of high-technology industry through policies such as government sponsorship of research consortia (with or without financial contributions), selective anti-trust exemptions for joint research and development efforts and cooperative production arrangements (important in countries where there is not a systematic failure to enforce anti-trust policies), transfer to industry of intellectual property resulting from government-financed research in countries with adequate and effective intellectual property protection, the transfer of defense-related technology for civilian use, the setting of industrial standards and the design of rules of origin.

Governments use the above policy instruments in different combinations. Indeed, these measures are most effective in combination as part of an integrated strategy to support a particular industry. Countries deploy these measures differently, reflecting historical differences in systems of corporate governance, levels of direct state intervention in the economy, and relative openness of the national economy towards foreign investment and imports. Whatever the rationale and policy guise under which these measures are deployed, "they all arm at the objective of spurring the development of new technologies by domestic industries and strengthening the competitive position of national (or domestically-established) firms."