Policy Issues in Aerospace Offsets: Report of a Workshop

ISBN
978-0-309-05840-7

44 pages
6 x 9
1997

Charles W. Wessner and Alan Wm. Wolff, Editors; National Research Council

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REPORT OF A WORKSHOP

Charles W. Wessner and Alan Wm. Wolff, Editors

Based on a National Research Council Workshop
held on June 9, 1997, in Washington, D.C.

Board on Science, Technology, and Economic Policy
National Research Council

NATIONAL ACADEMY PRESS
Washington, D.C. 1997

NATIONAL ACADEMY PRESS • 2101 Constitution Avenue, N.W. • Washington, DC 20418

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and Economic Policy
National Research Council
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Additional copies are available for sale from:

National Academy Press
Box 285
2101 Constitution Ave., N.W.
Washington, DC 20055
800-624-6242
202-334-3313 (in the Washington Metropolitan Area)

International Standard Book Number 0-309-05840-6

Printed in the United States of America

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Program Support for the Board on Science, Technology, and Economic Policy is provided by a grant from the Alfred P. Sloan Foundation

THE BOARD ON SCIENCE, TECHNOLOGY, AND ECONOMIC POLICY WISHES TO ACKNOWLEDGE *the many fine contributions of the symposium speakers and participants from universities and thinktanks, the aerospace companies and unions, and the government agencies concerned with the future of this strategic industry. The Board would particularly like to thank the White House National Economic Council for its leadership. The Board also wishes to express its appreciation to one of its members, Ambassador Alan Wm. Wolff, who generously made himself available to serve as chairman of this project. Special recognition is due to Dr. Charles Wessner and Mr. George Georgountzos for their exceptional effort in developing the workshop program and preparing the summary report in what was, by any measure, a remarkably short period.*

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Preface

In February of this year the National Research Council Board on Science, Technology, and Economic Policy was asked to consider a request by the White House National Economic Council (NEC) to organize a major workshop to examine the pressures facing U.S. companies to grant offsets in the increasingly competitive global aerospace markets for both defense and commercial aircraft and related products.[1] While cognizant of the definitional and analytical challenges associated with this subject, the Board accepted the NEC's request.

In accepting this task, the Board's principal concern was that in the timeframe required for this report, the Board would not be able to work through the analytical difficulties and overcome the data limitations associated with offsets. Consequently, the Board agreed to organize a comprehensive workshop and prepare a summary report of the workshop which would not, however, include recommendations or findings. Planning for the workshop began in earnest at the beginning of May and the workshop was held at the National Academy of Sciences building on June 9. The agenda for the meeting is reflected in the table of contents. A list of speakers and participants is available in the appendix to this report, as is an issues paper distributed at the workshop.

The overarching objective of the workshop was to provide a forum in which the various parties with an interest in aerospace offsets could come together to express their views on the practices, rationale, and current or future impact of offsets on U.S. national security, the competitiveness of the U.S. economy, and domestic employment in the aerospace industry. As requested by the NEC, specific attention was directed to the impact of offsets on key suppliers and sub-tier producers in this important part of the U.S. industrial base.

The workshop did not address a cluster of issues sometimes associated with offsets. Domestic or foreign outsourcing decisions taken on the basis of commercial considerations were outside the purview of the meeting, as were, at the other end of the spectrum, issues of arms control and proliferation. The focus of the meeting was commercial and military offsets, both direct and indirect, which companies are required to grant in order to complete sales of large systems. This area of inquiry proved to be more than adequate for the deliberations of a single workshop.

Indeed, the quality and density of the workshop presentations were a challenge to summarize. Every effort was made to capture the main points and supporting arguments of each speaker within the limitations of the time and space available. We apologize in advance for any inadvertent errors or omissions in the summaries of the participants' presentations.

The objective of this summary workshop report is to provide the reader an overview of the positions of the various participants on this complex and sometimes contentious topic. It is our hope that the report will contribute to a better understanding of what offsets are, why offsets are granted by U.S. producers, the different views of their impact and long-term consequences, and issues which may require further analysis.

Charles W. Wessner *Alan Wm. Wolff*

[1]The chapter entitled "Offsets" in the 1996 National Export Strategy Report describes offsets as compensation packages which are part of contract negotiations for large purchases such as aircraft. This description is elaborated in the issues paper in the appendix. However, it is important to keep in mind that different views on offsets sometimes lead to different definitions.

Introduction

WELCOME

William A. Wulf
President, National Academy of Engineering

On behalf of the National Academies of Sciences and Engineering, and the Institute of Medicine, Dr. Wulf welcomed the participants to the National Academy and briefly described the origins of the workshop which the National Research Council convened at the request of the President's National Economic Council (NEC), which had asked the STEP Board to look into the issue of offsets in the aerospace industry. Broadly put, the goals of the workshop were to:

- assemble a set of people with the expertise to provide a balanced examination of the issue;
- encourage a dialogue among the participants to foster an improved understanding of the issue; and,
- identify potential policy options, where appropriate.

While the scope of the issues covered in the program necessarily limited the time available for discussion, Dr. Wulf observed that the workshop had certainly achieved its first goal of bringing together a wide representation of stakeholders, including representatives from business, academia, labor, and government. In light of the controversial nature of some of the issues to be addressed by the workshop, Dr. Wulf stressed to the participants and the audience that the Academy has a strong tradition of dispassionate examination of the facts and a respect for the views of those with whom one disagrees. He expressed the hope that as a result of this meeting, we would discover areas of agreement as well as identify areas requiring further information and analysis.

After expressing his confidence that the group would have a productive and informative discussion, Dr. Wulf introduced the chairman of the workshop, Ambassador Alan Wm. Wolff, noting that the Ambassador had also chaired the most recent STEP report, *Conflict and Cooperation in National Competition for High-Technology Industry,* which provides a comprehensive review of the issues raised by the competition among nations for high-technology industry.

OPENING REMARKS

Gene Sperling
Director, White House National Economic Council

After an introduction by Ambassador Wolff, Mr. Sperling first emphasized the importance of the conference and described why the NEC had asked the Academy to convene a workshop on offsets. The issue of offsets has been the focus of an interagency working group, coordinated by the NEC, for some time. The Administration has found the question of offsets to be one of the more difficult issues to get a handle on and one on which it has been difficult to reach agreement, even internally within the Administration. Thus, having such a conference will be very helpful to the Administration's policymaking. Mr. Sperling encouraged participants to contribute to a "hardheaded" analysis of this very complex and complicated issue.

He cautioned, however, that the focus of the analysis should not be on one specific industry or union, but on the health of the entire U.S. economy and all U.S. workers. Mr. Sperling stressed that the goal of the Administration is to develop the best policy to create high-wage jobs for American workers. This focus on high-wage jobs naturally leads one to care about the aerospace industry because of its trade surplus and its higher-than-average wages. Job retention and job growth in the aerospace industry is important to achieving the overall goal of a more secure and higher-paid workforce. In that context, Mr. Sperling expressed concern over the decline in industry employment in

the recent past, but pointed to the increase of 40,000 jobs (25,000 in production) in the last year as a sign of renewal in this strategic industry.

Mr. Sperling also underscored the importance of careful analysis of the role of public policy. This is clearly not an area where the market works perfectly, but one in which there is intrinsic government involvement. The market structure is oligopolistic, with significant government involvement in purchasing and supporting the development of technologies for strategic military and economic reasons. Thus, it is not so much an issue of whether government will be involved, but rather what form that involvement should take. One of the main questions facing the workshop should be to determine the appropriate policy of the U.S. government in order to balance the involvement of other governments in this important industry.

However, Mr. Sperling pointed out that the policy cannot be a single-minded focus on simply the reduction of foreign-mandated offsets. It is important, he stressed, to examine the counterfactual situation—what would the world look like under an alternative scenario. Given a world where there will be some foreign government involvement, the Administration will look at a variety of strategies and compare alternative strategies. The goal is to promote a high-wage workforce given the hand that we have been dealt.

In sum, the issue of offsets in aerospace is one that is already being discussed within the Administration and is likely to receive increased attention in the future. It is tied into a number of international economic issues, such as the Administration's China policy, hence the importance of this conference. He emphasized, however, that the workshop is not being convened to promote a particular viewpoint or a particular policy option. On the contrary, the conference is addressing an issue where the facts are in debate and where there is no clear policy direction. As a result, the workshop deliberations will feed directly into the Administration's policymaking process.

WORKSHOP INTRODUCTION

Alan Wm. Wolff
Board on Science, Technology, and Economic Policy

Following Mr. Sperling's address, Ambassador Wolff opened the workshop deliberations with a brief review of the role of the National Research Council's Board on Science, Technology, and Economic Policy (STEP) within the Academy, relevant recent work, and the goals of this meeting. With regard to the STEP Board, Ambassador Wolff noted that it has the general mandate to provide timely information to policymakers on complex issues of science, technology, and economic policy—as its name implies. As an example of the STEP portfolio he cited the recent study, *Conflict and Cooperation in National Competition for High-Technology Industry,* now being translated into German, Korean, and Hungarian. This report gives a general analysis of the challenges posed to the multilateral trading system by the competition among nations for high-technology industry. Partly as a result of the analysis put forward in this report, along with other Academy work,[1] the National Economic Council asked the STEP Board to convene this workshop and prepare a summary report.

Ambassador Wolff also emphasized the timeliness of the workshop, noting the increased concerns over the issue of offsets expressed by representatives of organized labor, government officials, and parts of industry. These concerns include the worry over the transfer overseas of jobs for products that some believe could have been produced domestically, the possible negative impact on the aerospace industry's competitive position, and the loss of technologies important for maintaining military superiority. However, opinions on the impact of offsets differ sharply. Most of those who offered them see offsets as an opportunity, even an advantage, or, at a minimum, a necessity for doing business. They believe that offsets are in fact a means of maintaining the technology base through enhancing revenues and can be used as a sales advantage in the fiercely competitive global aerospace markets. Current government policy has largely been to take a "hands off" policy toward individual offsets, while addressing the issue in various trade agreements.

Reflecting these concerns and these competing views, the NEC asked the STEP Board to convene this workshop in an attempt to address the gaps in our understanding of offsets in the aerospace industry. Specifically, the NEC has asked that the workshop address the following questions:

- What are the pressures on U.S. companies to grant offsets?
- What are the impacts of offsets on the suppliers of first- and second-tier components, particularly with respect to airframes and aircraft engines?
- What are the implications of technology transfer for the primary contractors and the U.S. supplier base?

The conference agenda was structured to frame the key policy questions and bring together knowledgeable individuals with differing perspectives. The first panel presents an overview of the issue. The second

[1]See National Research Council, *Conflict and Cooperation in National Competition for High-Technology Industry.* National Academy Press, Washington, D.C., 1996. See also National Research Council, *High-Stakes Aviation: U.S.-Japan Technology Linkages in Transport Aircraft.* National Academy Press, Washington, D.C., 1994.

panel seeks an operational perspective, asking practitioners to give their views. The third panel looks at the technological and national security consequences of offsets. For the luncheon address, Senator Jeff Bingaman, a leading Congressional authority on offsets, presents his views. The fourth panel looks at the commercial consequences of offsets, and the fifth panel looks at the question of the impact of offsets on the supplier base. The sixth panel tackles the issue of employment, specifically whether offsets help maintain employment in an industry characterized by volatile demand, or whether offsets simply shift work overseas. In the final session, the chairman summarizes the day's proceedings.

Panel 1

Overview of the Offsets Issue

Moderator:
Charles Wessner, Program Director, National Research Council

The first panel was convened by Dr. Wessner who, as the organizer of the workshop, expressed his thanks to the speakers who had come long distances, and to the many who had changed busy schedules in order to participate in the conference. He added that on this panel he looked forward to hearing from senior representatives of the industry as well as from respected analysts of the aerospace industry about the challenges of global competition.

The U.S. Aircraft Industry in a Global Market

Robert Trice
Vice President, International Business Development, Lockheed Martin Corp.

Mr. Trice opened his remarks by emphasizing the importance of Gene Sperling's comment about understanding the hand we have been dealt. The current situation facing the aerospace industry was determined by two factors about ten years ago: record government budget deficits and the collapse of the Berlin Wall. The result of these two factors has been a dramatic reduction in defense spending.[2] Out of a $7.3 trillion economy, the United States now spends $46 billion on defense procurement—about $10 billion less than is spent on tobacco. Indeed, defense has become a niche market, with more spent on snack foods in the United States than is spent on the entire NASA budget.

Since 1989, total spending for defense has declined about 30 percent. But spending in the procurement account has dropped 72 percent. For the aerospace industry, that represents a slowdown greater in magnitude than the Great Depression's decline of 30 percent of GNP. Lower spending means that the number of weapons systems bought by the U.S. government has also declined dramatically—threatening the sustainability of the industry. For example, in 1997 the U.S. government will purchase only 73 aircraft. In these conditions, it is not possible to maintain the same defense base. However, in some areas, such as combat aircraft, foreign sales have increased to make up a part of the difference, thereby enabling the industry to maintain some sustainability and some employment, though 700,000 jobs were nonetheless lost in the 1992–97 period. In these conditions, foreign sales play a crucial role in maintaining the U.S. defense industrial base.

In order to compete internationally in this new environment, the U.S. industry has consolidated into three large, globally competitive companies (Boeing-McDonnell, Lockheed-Martin, and Raytheon-Hughes) and a number of "smaller" companies (e.g., Northrop Grumman) which are, of course, at $10 billion in revenues, still sizable companies in their own right. The only real competitors in the global market are the European companies which are smaller, generally less productive state-owned firms, with the exception of British Aerospace and DASA. State ownership is key. Mr. Trice stressed the importance of understanding that U.S. companies are, in effect, competing against the foreign governments which directly or indirectly own these companies. For these European companies, controlling the European domestic market is extremely important.

At present, U.S. companies can rely on a highly protected core domestic market of approximately $80 billion—defense procurement and R&D combined. No other country can match that, nor do other countries spend more than 50 percent of their defense budget on procurement. On top of that, they must use those funds to feed their own weak, noncompetitive, state-controlled domestic companies. As a result of these realities, the overseas market for U.S. companies is much smaller and more fragmented than many may think.

Arms control critics argue that the U.S. industry dominates the world market. This is true. However, while

[2]The overheads that accompanied his presentation concerning U.S. defense procurement, the structure of the industry and the importance of international markets are reproduced in Appendix 2.

the U.S. industry does have 55 percent of the global arms transfer market, the world market is down 50 percent and the U.S. market is down about 25 percent. The industry is doing well in terms of market share but overall the industry is still in a tough position. It is an industry that has seen a 70 percent decline in its market. It is now emerging from a massive restructuring in a stronger financial position, with a backlog of orders, and sharpened productivity. However, it is an industry that has lost its sense of humor. Competition is fierce.

Staying internationally competitive is where offsets come in. Offsets, such as financing, are an important tool in maintaining overseas business: 100 percent of nothing is not nearly as good as a high percentage of a large number. Moreover, each $1 billion in sales equals 24,000 person years of employment.

The reality facing the industry is of permanently lower defense and space budgets and increased competition. The U.S. industry has gone through its consolidation. Europe has not, and the task will be harder with the recently elected governments. In military sales, Europeans are erecting trade barriers; the U.S. already has them. Thus, one of the issues the workshop should address is how to deal with these competitive conditions.

Another key issue to address is how the industry protects its design and technology base. While observing that some are concerned that the industry will give away its technological crown jewels, Mr. Trice implied that he considers this unlikely, but nonetheless urged that this issue be fully discussed.

In conclusion, Mr. Trice underscored that the U.S. aerospace industry must still compete internationally on the basis of affordability. The U.S. industry is already noncompetitive in some respects. For example, bribes are still tax-deductible in some parts of Europe, something U.S. firms cannot offer. And state-owned firms sometimes can propose economically nonviable projects. U.S. firms cannot. The bottom line is that U.S. companies have to be able to make a return or they will get out of the business.

Origins, Definitions, and Consequences of Offsets

David Mowery
Professor of Business and Public Policy,
University of California at Berkeley

Tasked with helping to define the issues, Dr. Mowery began with a focus on the definitions of offsets before assessing the trends and the complexities of analyzing the impacts of offsets on employment, technology transfer, and the defense industrial base. Referring to the background paper made available at the meeting,[3] Mowery noted that it defines offsets as mandates for technology transfer or incorporation of local production, or a variety of other performance requirements typically requested by the purchasing government. Like the issue itself, these definitions are very complex. Mowery pointed out that the distinction between direct and indirect offsets is especially important in assessing the impacts, since indirect offsets are typically not integrated into the product. In addition, the definition becomes more complex when the question is broadened to the commercial sector. In the commercial sector, government mandates become much more difficult to assess and even to discern than in the military sector.

With respect to the origin of offsets, Mowery stated that much of the international collaboration on the commercial side can be traced to the U.S. policy of licensed production and coproduction in Western Europe and Japan on the military side in the 1950s and 1960s. The purpose of that policy was to promote the purchase of U.S. weapons systems and foster the reconstruction efforts of our allies. The result was, over time, an evolution to increased pressure by foreign governments focusing on specific economic and technology goals, including continued support for the reconstructed defense industrial base. Thus, he suggested there is an interaction between military and commercial sectors in the creation of a workforce and industrial base structure, rather than a direct technology transfer between the two sectors.

On the civil side, the emergence of offsets can be traced more to the 1970s, rather than the 1950s and 1960s as is the case on the military side—and reflects the changing competitive environment of the industry. Government mandates play a role. But other factors, such as the need to share risk and seek financial support, combined with the growing technological capabilities of foreign suppliers, were also important. In addition, there were increased incentives by the prime contractors to support entry of new suppliers in order to strengthen the supplier base and create additional competition.

Reflecting the interest in this topic, Mowery pointed out that trends in the industry have been documented by a series of studies over the past ten years. These studies show a difference of opinion on the impacts of offsets, highlighting the complexity of the issue and the difficulty of analysis. The most recent study by the Commerce Department states that the use of offsets is becoming increasingly important in the Pacific Rim but is not growing generally as a percentage of military export sales. The study also shows that indirect offsets are growing, especially those involving non-aerospace products. This creates even more difficulty in analyzing the employment impact of offsets, since tracing the

[3]See Appendix 1.

impacts of these non-aerospace indirect offsets is especially difficult.

With respect to the impacts of offsets on employment, Mowery stressed the difficulty of reaching definitive answers. First, he pointed out that we need to know what would have happened if the offset had not been given. Would the sale still have taken place? Second, tracing the impacts of indirect offsets is very difficult, especially given that a variety of industries are involved. Third, separating out the effect of government mandates from the broader trends in the globalization of sourcing and employment is very difficult. Government mandates are not the sole, and may not even be a prime, driver of the globalization trend.

Likewise, the impacts of technology transfer are difficult to observe clearly. In part this is because defense offsets have historically involved the sales of completed weapons systems and not, historically, development arrangements where there is a more substantial technology transfer impact. Even on the civilian side, where there is greater involvement of foreign partners in the development process, it is difficult to see much substantial effect on, for example, the probability of entry by the foreign partner into the market as a prime contractor. In part, this reflects the controls placed on the technology by the prime contractors as well as the difficulty of entering the aerospace industry.

Mowery also stated that it is difficult to see any obvious impacts on the industrial base from offsets. However, the anecdotal evidence and the modest amount of statistical evidence show that the impact is felt by the supplier tier, rather than the primes.

In conclusion, Mowery emphasized that the impacts of offsets are dwarfed by the effect of the reduction in defense spending. Thus, in considering policy responses, it is important to recognize that the use of government-mandated offsets is only one factor affecting the industry trends and that the identifiable near-term cost to the U.S. economy appears to be small. Policy options should look at ways to reduce foreign government demands for offsets, support firm and worker adjustment, and take into account the demands by the U.S. government, such as domestic production sites or "Buying American" provisions, that are imposed on foreign suppliers of military equipment.

Strategies for Success in the Commercial Aircraft Market

Raymond Waldmann
Vice President, International Business,
The Boeing Company

Describing the competition in the commercial sector, Mr. Waldmann observed that, over the last ten years, Airbus has increased its market share from 16 percent to 33 percent, while Boeing has remained at approximately 65 percent, and the market share of McDonnell Douglas has fallen from 18 percent to three percent. In addition, there was the demise of Fokker in the 100-seat aircraft market. Consequently, the large aircraft business is now a two-player game. The Russians or someone else may be competitive in the future, but they are not competitive now.

To deal with the issue of offsets, the industry was able to get a trade agreement on large commercial aircraft in the 1979 Tokyo Round that banned government-mandated offsets in commercial sales. However, only 24 developed countries have signed on to that agreement, and it still does not cover most of the developing countries. Nor does it cover non-GATT members, such as China and Russia. U.S. government policy is to require all new GATT entrants to sign on to the aircraft agreement.

However, many see the problem with offsets as not limited to mandatory offsets. Concerns are expressed about voluntary industrial participation agreements—which are often loosely called offsets. For Boeing, the bottom line is that 86 percent of the content of Boeing's aircraft is U.S. made, including an average figure for the engines. That percentage has not changed much over the past few years—nor is it likely to. The number may go down in the future as the company engages in additional international activities; it may go up as the company drops nonperforming foreign suppliers.

Waldmann stressed that regardless of the numbers, Boeing enters into voluntary industrial participation agreements as a means of gaining market access. Boeing sees the ability to place work overseas as an important tool in competing against Airbus, a perspective he affirmed is understood by the union leadership. The questions raised by the union leadership during the recent strike concerned how much work is placed overseas and at what pace. Mr. Waldmann stressed that the company was not shifting massive amounts of union work abroad. Much of the past downturn in employment was due to decreased market demand, not a shift of work overseas. In addition, it is important to note that for every union job that went overseas, 100 others were retained because of overseas sales. According to the Commerce Department, every $1 billion in exports creates 11,000 jobs in the industry—with the multiplier for jobs in other industries, that number may be closer to 20,000 jobs—and Boeing currently exports 70 percent of its commercial jets, up from 60 percent.

In closing, he observed that the commercial and military sectors are very different. Mandatory offsets are still the rule in the military sector. However, in the commercial sector it has been his experience that government requirements for offsets or other arrangements are declining.

Ready or Not: Competing in a Global Economy

William Greider
National Editor, Rolling Stone Magazine

Mr. Greider began by pointing out that he is a reporter, not a policy analyst or an economist, who has written a recent book on globalization. His goal in the book was to try to understand the dynamics of multinationals from a global perspective. He began with what he hoped would be provocative assertions—with a focus on the commercial sector, not the defense industry. First, offsets are a principal mechanism, but not the only mechanism for encouraging and allowing migration of the industrial base from developed countries, primarily the U.S. but also Europe and Japan, to the developing countries. From the point of view of the developing world, this may be economic justice. But, from the U.S. point of view, it raises serious national interest concerns. This process is happening not only in aerospace, but in all areas of advanced technology. The process is also contributing to the vulnerability of the global economic system by creating overcapacity—a phenomenon clearly visible in the automobile industry, but also occurring in aerospace.

In addition, offsets contribute to the vulnerability of the global economy by subverting the trading system. Offsets are political business bargains, usually made with government involvement. They are not based on an economic rationale of comparative advantage. The result is an undermining of support for the trading system, because workers and communities are told that the displacements are simply caused by the economics of free trade, but then they find out that their jobs were traded away in a political deal.

Boeing is a good case example. No one would question Boeing's market advantages. Nor is it an issue of traditional comparative advantage, since wages of Boeing workers are not a factor. But, the buyers say, give us a part of the high value-added production and the technology. And, according to several Boeing officials cited, Boeing has to go along with what the buyers want. Buyers, such as China, play hard ball with Boeing and play Boeing off against Airbus. Boeing, in turn, plays hard ball with its suppliers. Greider cited cases of a number of Boeing suppliers, including Northrop Grumman and Mitsubishi, moving Boeing work to China. He does not fault Boeing for following this strategy, saying that its management is undoubtedly doing what it believes is best in the situation.

But the question must be raised as to what is wrong with this process. Though the number of jobs currently involved is not dramatic, the numbers are growing. In addition, Airbus and other foreign companies are playing the same game, so the advantage that U.S. firms once gained by moving work to China is now gone. The end goal of the Chinese is to make their own aircraft. Boeing clearly feels it needs to be a partner in this process, though it may result in an Asian Airbus—while still trying to block the Chinese from entering the market. Being part of the process may be a good strategy for now. However, at some point the wage differential between the U.S. and China will make a difference in the cost of the aircraft—and the U.S. will lose sales on the affordability criterion.

Greider went on to ask what the rules of the game are. Again citing Boeing officials, he noted that offsets may be illegal under the trade rules, but they are still part of the game. They have just become less explicit. Moreover, Greider suggested that in the international trading system, enforcement of the rules is only done when it is convenient and practical. According to Boeing officials, the company did not take action against Airbus because of pressure from European customers. From this, Greider concluded that companies are caught between their foreign customers and their workers in their home countries. In such a situation, the only way out of the dilemma is through government action. An important part of that action should be a complete debate and airing of the issue.

DISCUSSION

Mr. Trice stated that he agreed with the earlier statement that offsets are trade-distorting and are creating a problem of overcapacity. Companies have moved to indirect offsets in some cases because of the problem of overcapacity—there *is* no production left to give as an offset. Analyzing the issue, he believed, must include the cost of the implementation of the offset versus the trade distortion that occurs.

He did take issue with an assumption that the U.S. industry has a monopolistic position and that taking a hard line on offsets will not result in lost sales. Sales *are* lost when the offset requirement is too onerous to produce an economically viable deal. The real question is whether industry or government is best able to decide how to care for industrial interests.

Mr. Waldmann stated that it was true that Boeing was pressed by European customers not to pursue trade actions against Airbus. But, he pointed out, Boeing did not desist. Boeing pursued a case was pursued against the Germans on exchange rate support in 1989 and in 1990–91 pursued a general subsidies case against Airbus which led to the 1992 agreement.

He also questioned Airbus's claim that it has between 20 and 40 percent U.S. content. Moreover, in light of the jobs that must be allocated among the partners in Europe for political reasons, Airbus does not

seem to have much flexibility to work with other foreign suppliers.

Professor Ted Moran from Georgetown University noted that his recent study of outward direct investment shows that companies that stay at home are less competitive, have fewer good jobs, and a less favorable distribution of "good versus bad" jobs. He suggested that it is likely that a study of offsets would have the same findings.

Another member of the audience, Alan Tonelson of the U.S. Business and Industrial Council, asked whether the issue of offsets represented a massive U.S. foreign policy failure and was a demonstration of U.S. impotence. Given the U.S. defense support for Europe, Japan, and Korea and the fact that the U.S. market absorbs 40 percent of China's exports, why is the U.S. unable to wield more influence in setting the terms of trade? This is a failure of U.S. policymakers to recognize their leverage and use it to promote highly competitive U.S. workers and companies.

In response, Dr. Mowery pointed out that 50 years after the Marshall Plan, we have seen the reconstruction of Europe, the economic development of the Pacific Rim, and the end of the Cold War. Those were goals set out by the developers of that policy. Thus, the problems we are facing today, while not trivial, are the result of policy success—not failure.

Mr. Greider stated that, especially in light of the end of the Cold War, it is of concern that the issue of globalization has been shrugged off. But the issue will continue to come up. For example, a political battle is shaping up over the U.S. Export-Import Bank (Exim) in which exporters want to relax U.S. content rules required to qualify for a government-backed Exim loan. In his view, this proposal goes against the charter and purpose of the Exim, but makes sense to companies from a global operational perspective. He stated that we need to have a debate over what the national interest is in these situations. Such a relaxation of the content rules may be in the interest of the companies but that may not be the same as the national interest. Questions such as this will continue to be raised until there is a clear debate on the issue.

Mr. Trice stated that setting aside U.S. defense purchases, 70 percent of the aerospace industry's total business is international. If international sales produce jobs, then offsets may be the price of getting into the game. He said he did not see offsets as a failure of either will or of foreign or national security policy. Nor did he see the issue as among the top ten foreign policy problems.

Panel 2

Direct and Indirect Offsets

Moderator:
Gregory Martin, Manager of Corporate Offset Administration, Lockheed Martin Corp.

Gregory Martin stated that the purpose of this session was to provide an operational view of offsets from three practitioners. This panel's goal was to understand what offsets are and how they really work before moving on to policy issues. The panelists were to talk about customer demand, the details of offset agreements, the development and implementation of offset programs, and why they do what they do. At the end of the session, the final panelist would highlight assumptions and raise questions. To assure a complete and candid flow of information, the three industry participants would be speaking on background only.[4]

Operational Perspectives

Industry Speaker #1

The first speaker began by stating that industry participants on the panel are practitioners, not analysts. As such, their job is to protect their companies and to provide benefit to the shareholders and employees, adding that they, and many others, are both shareholders and employees.

Reflecting the effect of defense downsizing on the company over the past ten years, international sales have risen from 30 to 70 percent. These international sales are supported by offsets. Companies do offsets not because they love them, but because they have to. The speaker asserted that they believe they are the best in the world in doing offsets and thereby gain a competitive advantage. Because foreign competitors are happy to provide offsets in order to win sales, U.S. firms can no longer compete on just cost, delivery, and quality, but must also compete on offsets. In one case, in a developing country, offsets are 40 percent of the selection criteria. These offsets are part of the procurement laws in many countries and therefore cannot be waived as part of a negotiation. It is important to remember, the speaker stressed, that it is their money, not U.S. government funds, that is spent to acquire these defense systems.

Defining an offset as an agreement between a company and a government to place some degree of benefit in that purchasing country, country requirements vary greatly, from marketing assistance to training to coproduction. Direct offsets are arrangements involving the actual defense article or service. They do not necessarily involve the off-loading of production. An offset could be a training agreement, which does not take production from anyone. It is important to understand that $100 in offset credits does not necessarily equal $100 of actual work. The value of the work could be much less, based on multipliers used by the foreign governments. For example, a foreign government may give a multiplier for work placed in a certain segment or in a high unemployment area.

There are many forms of offsets. Indirect offsets are anything not delivered inside the article. Among direct offsets, coproduction agreements are the most well known, followed by licensed production, often for the production of a particular part. Technology transfer is the least understood. It does not mean giving up the most advanced technology; it could involve something as simple as showing foreign workers how to operate a particular piece of equipment. The speaker stressed that companies do not give away their technological advantage—the stockholders would not allow that.

Other types of offsets include commercial arrangements. These commercial practices do not necessarily displace U.S. domestic products. For example, an offset agreement might involve placing a Swiss product in Luxembourg, displacing a German supplier. Countertrade and barter involve the purchase of other goods—

[4]For this reason, the individual speakers are not identified in this text. They did not speak in the order listed in the table of contents, where they are identified, and the summaries of their remarks are not necessarily in the same order as they were delivered.

jams, hams, etc.—or the taking of goods, such as oil, rather than money, in payment.

Every country, including the U.S., has some form of domestic performance requirements. Even though the U.S. says it does not have an offset policy, the issue of U.S. requirements is often raised by foreign competitors.

The speaker then gave two examples of subcontracts with no direct foreign offsets. These deals require some inventive actions by the company, but do not involve technology transfer or the off-loading of production.

The speaker closed by stressing that offsets are a reality of the international business—and that the international business is very important to the company and its workers.

Industry Speaker # 2

The second industry panelist began by stressing the importance of globalization to the industry and to his company. In this context, the term "offsets" has come to have a negative connotation of "give-aways" and "set-asides," yet, from a businessperson's view, these agreements should be seen as a form of international cooperation. As such, any cooperation agreements must make good business sense before they are accepted. Each deal must involve a strategy, but there is no specific blueprint. There are many one-of-a-kind deals, depending on the needs of the country. Negotiators must be skilled and creative. But all deals must survive the company's rigorous scrutiny.

The bottom line for the company is that if it does not bid, not only does it lose the sale and the profit but also any after-market and follow-on work—which are important to sustain the business in the future. If the company wins, then the company can maintain jobs, make a profit, reduce overhead, and sustain sales in the future.

Offset arrangements are not simple deals, but require the negotiators to base their actions on a great amount of information. They may take five to six years to negotiate and may require political actions—for example, a Swiss parliamentary vote on a particular aircraft sale. Such deals are carefully monitored and reviewed by upper management. After the sale, the company must follow through on its offset agreement. Failure to do so would harm the company's long-term interests.

The use of indirect offsets is clearly increasing. Domestic sales are going down for U.S. companies, and foreign governments are increasing their requirements. This has forced U.S. companies to be more creative in their offset agreements. In one case, a foreign government wanted to develop a medical equipment industry. In response, the company could either outsource the project or work on it in-house, if it felt it had the needed expertise and resources. In another case, a European government wanted help in upgrading its police force's command and control system—which would cost the company $1 million to develop. The manager could ascertain the market value of the system off-the-shelf and then negotiate a 10 times multiplier for an offset credit of $20 million. Or the manager could argue for a higher multiplier because the cost to the foreign government to develop the system domestically would be prohibitive. If a company finds it cannot meet an offset obligation itself, it can go to an offset broker. The broker arranges for the project, possibly finding the technology, securing the license agreement, developing the market and finding the investors. In the end, the company pays the broker a service fee.

The speaker closed by stressing that the process has become very complex. As a result, the measurement of the impact is very difficult. He urged that the dialogue between different perspectives on the issue should continue.

Industry Speaker #3

After giving some background information on the company, the third industry panelist stated that more often than not they are involved in some form of offset in their international sales—which accounts for 40 percent of their business. Negotiations do not begin with an offset offer; they are offered when it is required to get the sale. When negotiating an offset agreement, every attempt is made to minimize the requirement in order to protect the company's domestic labor force, its established supplier base, and its core technologies. It is also important that the offset commitment be completed satisfactorily, as these companies live by their reputations.

Offset negotiations are very complex, with both sides having different goals. For example, the customers want large programs approaching 100 percent offsets; the company wants to negotiate that number down. The customers want work for their domestic aerospace industry; the company wants to spread the projects around to protect their existing supplier base by splitting the procurement or giving indirect offsets. The customers want state-of-the-art technology; the company wants to transfer older technology. The customers want assistance in export sales of their own aerospace products; the company seeks not to be involved. The customers want help in identifying and attracting investments and joint ventures; the company will enter into these types of arrangements only if it makes good business sense. The customers want general industrial benefits; the company tries to be creative. Finally, the customers want all of these benefits at no additional costs; the company wants to use training programs and other soft offsets, which cost the company little, to negotiate high multipliers for their

offset credits, and to make sure that the contract covers the costs of the offsets.

In one example, the company included training at the company's training facility, as an offset at little additional cost to the company. In another case, the company took phosphate ore as payment in a countertrade arrangement. One other case had the company meeting a 100 percent offset requirement through preexisting procurement agreements within the customer's country. A different case had the company transferring old technology, which even the IMF agreed would be a significant economic benefit to the receiving country. In another example, the company transferred old technical documents and surplus equipment at company expense to fulfill an offset requirement. On the other hand, the company has refused to bid on sales in that country when the technology transfer requirements became too high.

The speaker closed with the observation that offsets are an unavoidable part of international sales. Those sales are important, since they are a large percentage of what keeps this company's workers fed. Offset managers, like this individual, try hard and are successful at softening foreign governments' offset requirement in order to protect the interests of the company and its workers.

Assumptions and Questions

Randy Barber
President, Center for Economic Organizing

Mr. Barber characterized his job on the panel as raising questions and looking at underlying assumptions based on his work as a consultant to unions and workers. He stated that his focus was neither on domestic outsourcing of work nor on international outsourcing for economic reasons. He also stressed that members of organized labor are not Luddites, but seek answers to fundamental questions about the roles and interests of unions, workers, and management in negotiating offsets. Likewise, the key is not "how do we make the rest of the world act as we do," that is, an attempt by the U.S. to dictate what the rest of the world should do. Rather, the key issue is what the U.S. should do in the face of mandatory foreign government offset requirements and a global market where U.S. companies find it easier to make sales if they offer "voluntary" offsets.

Questioning the assumption that the choice facing companies is either to grant the offset to obtain 100 percent of the order, or to give no offset and lose the entire sale, Barber suggested there is a point in between. Indeed, we had just previously been told that some offsets are refused and efforts are made to reduce their costs and impact. A more realistic calculation would acknowledge that while some sales may be lost due to a refusal to grant (some) offsets, it is not likely that a company would lose all potential sales. This more realistic calculation could include an estimate of total sales—and jobs—that would be lost if offsets are resisted, compared to the impact on employment, including subcontractors, at a given level of offsets. The problem in making this calculation is the lack of information about how to judge the outcome. The companies are essentially saying "trust us—we will get you the best deal" to the workers, communities, and suppliers. But the assumptions and criteria to be applied are not at all clear.

Mr. Barber pointed out that previous speakers have said that offsets are a necessary evil for some companies, a fact of life for others, and a marvelous marketing tool for still others. This suggests the decision process is unclear. While the argument often given emphasizes the number of jobs saved, no one is suggesting that employment actually is, or even should be, the main criterion used by business in evaluating these decisions. To make a decision on these agreements requires making a judgment on several diverse criteria, such as:

- What is the company's core technology?
- How would such a deal encourage or discourage potential future competition?
- What are the potential future sales resulting from this deal?
- What is the future profitability from this deal?
- What are the potential follow-on deals?

In short, companies make these decisions based on their obligations to shareholders rather than on the basis of concerns about employment. Moreover, companies have no fiduciary responsibility to their suppliers in making or disclosing these judgments.

To illustrate his view of the decision process, Mr. Barber outlined his "salami theory" of how companies make these decisions. In essence, for each deal they give just a little slice (of offsets) to get the sale. The danger is that eventually they slice the salami so many times that the net effect on their own employees, and those of their subcontractors, is a negative one. Other countries seem to be following a "reverse salami theory." In each deal, they take a little bit here and a little bit there and put it all together to create their own "salami," that is, their own industry. From a strategic perspective, the danger is not that one particular company gives away something that in and of itself is the crown jewel, but that they give away pieces that can be combined to make the crown jewel.

China is an example of this gradual building of competencies. They started with Russian technology. Then, they did coproduction for McDonnell Douglas.

Next they started doing minor pieces for Boeing. Now they are doing rear fuselage and tail pieces for Boeing. And they have entered into a memorandum of agreement with the Europeans and other Asian nations to build a 100-seat aircraft—an aircraft for which 43 percent of the market is in North America. This process of competency building could have happened without offsets, but not as quickly.

From the workers' point of view, they are not at the table when these decisions on granting offsets are made, even though these decisions may eliminate a great many jobs. In fact, many workers do not even know that a table exists where jobs are being traded—nor do the subcontractors.

In this context, it is important to challenge what Mr. Barber feels are some unsustainable assumptions. First is the assumption that U.S. companies will lose all sales if they fail to grant offsets. There needs to be a look at what the calculation is between zero and 100 percent. A second assumption concerns the protection of core technologies—a focus on the "latest" cutting edge technology may be missing the point. In some cases, next-best technology, combined with government financial support, control of access to the market, and increasingly competent domestic producers, can lead to a serious erosion of market share for U.S. companies.

Mr. Barber then raised a number of questions:

- First, what are the legitimate interests of the government, the public, and workers in offset "marketing" decisions by companies to transfer technology, production, and/or skills in exchange for sales?
- Second, how can these interests be reasonably, but effectively, asserted?
- Third, what are the threshold criteria for public concern with offsets—the impact on market share? the sensitivity of the technology involved? the strategic importance of the industry? the likely impact on existing productive capacity and employment?
- Fourth, if an industry claims strategic importance, and accepts public support for R&D and export finance as a result, does it not then have certain public obligations as well? What information should be required to be disclosed about these decisions, and how should competitively sensitive information be handled?
- Fifth, is there any reason to believe that we can negotiate with other nations on offsets to stop this economic and technological race to the bottom—and get rid of this trade-distorting activity?
- Finally, and most fundamentally, do offsets really work? Do they really increase net sales and discourage the growth of other competitors?

McDonnell Douglas did *not* expand market share in China when it gave offsets. The use of offsets by Boeing in China did *not* keep Airbus out of the market. In closing, Mr. Barber suggested that, rather than helping the companies make future sales, offsets may only raise customers' expectations and cause them to demand even more concessions the next time.

DISCUSSION

One audience member suggested that the discussion should be expanded to include U.S. production requirements, including state incentive programs. This is common in many industries, and especially common in the auto industry. The U.S. must be careful when complaining about actions of others when we do the same thing. A related question is the impact of offsets on smaller U.S. companies that follow larger U.S. companies overseas. In many cases, this has given smaller companies the chance to access global markets.

One of the industry panelists responded that offsets have given that panelist's company opportunities to get into new markets. Especially important in that regard has been the NATO interoperability requirement, which has allowed the company to penetrate certain NATO procurements that might not have been otherwise possible.

Another industry panelist talked about how his company often goes outside the aerospace industry to meet offset requirements. He cited the example where his company is helping environmental technology companies enter into a joint venture in another country as part of fulfilling an offset requirement.

One industry panelist took issue with Mr. Barber's assertion concerning a lack of information. He pointed out that there have been many studies on offsets. He also expressed his belief that it may not be possible to put the issue into terms of clear-cut economic calculus, given the complexity of the process. In closing, the panelists affirmed that the U.S. economy is doing quite well, and the labor market is good in part because U.S. companies have readjusted to deal with globalization and are succeeding.

Panel 3

Technological Dimensions of National Security

Moderator:
William Keller, Deputy Director, Center for Trade and Commercial Diplomacy, Monterey Institute

Dr. Keller began the session by commenting on how the technology dimensions of national security have changed since the end of the Cold War. In the past, the focus was on technological superiority to overcome Soviet numerical strength. Now the issue is one of national economic security, with a focus on jobs, the balance of technology trade, technology transfer, and the complex interaction between civil and military technology. The impact of offsets on technology dimensions of national security is also part of that focus.

There continues to be much confusion over the definition of offsets. For a definition, Dr. Keller stated that he prefers the work of the GAO. It defines offsets as the entire range of industrial and commercial compensation and practices provided, plus inducements or conditions, for the purchase of military goods and services. These include coproduction, knowledge transfer, training, investment, marketing assistance, and commodity trading.

Dr. Keller also observed that this is not a new topic. A 1991 Office of Technology Assessment study[5] showed that most major arms sales involved some form of coproduction, codevelopment, or technology transfer. The study found that these practices were resulting in the transfer of military technology and the arms industry infrastructure—posing serious national security challenges for the United States. The study also found that the process was accelerating—to the detriment of the subcontractors and even the prime contractors.

Alliance Politics, Defense Trade, and Technology Transfer

Paul Hoeper
Deputy Under Secretary of Defense (International and Commercial Programs), Department of Defense

Mr. Hoeper began by stating that his job at the Defense Department is to equip U.S. military forces with the systems they need for a qualitative edge, within the context of national security needs, budgetary constraints, and domestic and international politics. The world in which he does that job has changed since the end of the Cold War. Former adversaries now sit at the NATO table, and the traditional security threat to the U.S. has diminished. As a result, the military force structure has been reduced by one-third. The defense budget has declined from about $400 billion ten years ago to around $250 billion today (in constant 1997 dollars). The procurement budget has dropped even further—declining by two-thirds. In this new environment, there is a need to rethink how the U.S. fights wars and designs and builds weapons systems, as well as how we trade and compete with our allies.

That re-thinking process is reflected in the Secretary of Defense's recently released Quadrennial Defense Report (QDR).[6] The QDR is a blueprint for matching defense requirements and resources. It attempts to identify potential threats and opportunities facing the U.S. and how the U.S. should respond. The QDR seeks to reallocate resources to achieve the best balance of capabilities. The approach taken here is to trim the force support structure and modestly cut combat power. This allows DoD to stabilize its investments in order to achieve the capabilities needed, as described in the Joint Chiefs of Staff report, Joint Vision 2010. This report lays out operational concepts for future war fighting.

Mr. Hoeper went on to describe the importance of information technology. As outlined in Joint Vision 2010, there are four key operational concepts:

- having a complete picture of the battlefield;
- destroying the key nodes of enemy systems at a great distance with fewer munitions and less collateral damage;
- maintaining freedom of action in deployment and maneuver; and
- delivering the right support at the right place and the right time.

[5]Office of Technology Assessment, *Global Arms Trade: Commerce in Advanced Military Technology and Weapons.* Congress of the United States, Washington, D.C., 1991.

[6]Office of the Secretary of Defense, *Report of the Quadrennial Defense Review.* Department of Defense, Washington, D.C., May 1997.

All these concepts require information superiority.

The QDR underscores the importance of greater international arms cooperation because of the increased likelihood of coalition operations. With the rise of these joint operations, interoperability becomes a guiding principle in the procurement of weapons systems. In addition to allowing for common logistical support, the use of the same equipment fosters a bond between forces.

Budgetary pressures are also contributing to an increase in international cooperation. In a time of needing to do more with less, it is important to avoid duplication of weapons systems. This requires early harmonization of requirements and increased incentives for international teaming. Mr. Hoeper stressed that defense systems cooperation and trade contributes to improved efficiencies and interoperability.

He also pointed out that the view of offsets as necessarily bad is not correct; only bad offsets are bad. Offsets are bad if they destroy economic value and foster weapons proliferation. Good offsets are those which reduce costs and create long-term value.

These issues of offsets become especially important in the task of equipping U.S. forces for coalition operations. Critical here is C4I—command, control, communications, computers, and intelligence. For example, our NATO allies are balking at adopting U.S. C4I standards and equipment for reasons of cost, national sovereignty, jobs, and industrial competitiveness. This moves an important defense issue into the area of industrial policy. It also creates a technical divergence between the defense forces of the U.S. and our allies that should be avoided.

Mr. Hoeper stressed the need to work together with our allies on these issues. He suggested three ideas that should be explored. First, recognize and exploit the world industrial base as a source of important defense components and subsystems. Second, understand that much technology has a short half-life, thus it is better to expend resources to run faster in technological development, than waste them in trying to trip up the other guy. Third, begin cooperation early in the process and compete weapons systems programs among international teams from the partner nations.

Offsets: Drivers and Technological and Policy Consequences

Carol Evans
Assistant Professor of International Business Diplomacy, Georgetown University

Cautioning that offsets have differential impacts, Dr. Evans suggested that the analysis of offsets must go beyond good and bad impacts—and look at offsets "for whom?" In that context, there seems to be less concern about offsets with our NATO allies and more concern about offsets with developing countries—for a number of reasons.

First, offsets encourage indigenous production of weapons systems in developing countries. This production can lead to serious but unintended proliferation problems. For example, technology transferred to Brazil through an offset program ended up improving the targeting capability of the Iraqi Scud missiles. Thus, offsets can have a major impact on U.S. national security through indirect routes. Even if the offset, or the country involved, may seem relatively unimportant, we must take a broad view of proliferation, since aerospace offsets can enhance the platforms used for the delivery of chemical or biological weapons.

The question must also be raised whether we have the capability of monitoring where the technology goes. Companies often fail to keep direct evidence of exactly where the technology is being transferred to and need to have more "due diligence" in tracking offsets. It is clear that offsets have encouraged greater defense capabilities in some developing countries, which now pose a greater defense threat to the United States. In addition, offsets have a spiraling effect, by creating an arms industry in certain developing countries that seeks even further offsets.

A second issue concerns the impact of offsets on the sub-tier supplier base. This sub-tier base is critical. It underpins both the defense and information technology industries that are key for both economic and national security. Consequently, there is a need to be concerned about the continued viability of this critical dual base and the impacts of offsets on that base. Offsets adversely affect the supplier base by aiding foreign competitors at the same time that the supplier base is being hit by shrinking defense budgets. Shrinking budgets then lead to a further squeeze on suppliers to give even more offsets. Yet, the Defense Department does not have adequate information on the companies that make up the sub-tier base and on the impact of offsets on these firms.

On the policy side is DoD's push for greater interoperability. The new report from the Under Secretary for Acquisition makes clear that DoD sees offsets as a means of increasing interoperability. The issue has moved beyond whether offsets are good or bad, to how to make offsets work better. In that respect, DoD is looking at the lessons that can be learned from the commercial sector. For instance, what alliances and joint ventures in the commercial side might be used as models in defense? Of greater importance is the recommendation that DoD should not necessarily get involved in labor issues of job sharing. Instead, these is-

sues should be left to the international partnerships. One of the positive impacts of offsets has been to bring NATO, and now Eastern European, countries into partnerships. But as these partnerships expand, the issue of the criteria for encouraging these partnerships must be addressed. Likewise, we must address the important question of who makes the decisions, business or government.

On the issue of the policy impacts on companies, Dr. Evans pointed out that offsets have been a critical driver in the globalization of the U.S. industry. The result has been a cycle of even more globalization and a deepening of company relationships with the countries in which they are located. Companies are no longer in a set of bilateral business agreements, but in a web of alliances. This raises the questions about what is a U.S. company and where are the allegiances of these webs of alliances. Companies are drawn even more to the defense and foreign policymaking areas to protect their own interests. For example, many companies sought to affect U.S. policy when the U.S. sent warships to the Taiwan Straits. Multinationals are being forced not only to look at business relationships, but also to become even more active political actors, with interests in many countries that must be balanced off. Companies now focus not only on traditional trade issues but also on defense, arms trade, and proliferation issues. Given this more political role, we need to think more about how other countries attempt to use companies as a means of pressuring U.S. policy.

Finally, Dr. Evans remarked that the issue is not just a question of aerospace, but of C4I. As the role of information in the military increases, we need to ask whether platforms are less of a concern. In that case, we may need to reassess the significance of the aerospace industry.

New Technologies: Battlefield Advantage from Not-So-New Technologies

Lee Buchanan
Deputy Director, DARPA

Dr. Buchanan began his remarks with the comment that the discussion of offsets has been framed so far in simplistic terms regarding the benefits of offsets—that is, market share and sales—versus the risks in terms of jobs and the loss of technology. He stated that his remarks would challenge the assumption inherent in that framework with regard to technology.

First, technology is not a commodity. It cannot be inventoried or traded away in any meaningful sense. The value of technology is variable and based on the context. In order to use a technology, you must be able to incorporate it. It must be congruent with your infrastructure and be close to your own state-of-the-art. Therefore, technology that is valuable to one party may not be so valuable to another party. To use the earlier example of the salami theory, the extraction of technology is like trying to go from the sliced salami all the way back to the pig.

Second, technology is perishable. Dr. Buchanan confirmed that the DARPA view of technology is clearly the same as the "run faster" model mentioned earlier by Mr. Hoeper. Control of technology is difficult. As an example, he cited the Norden bombsight—which was subject to all types of security arrangements before and during World War II, for fear that it would fall into the hands of the Germans. However, through effective espionage, the Germans already had a version before the Norden bombsight was ever put into use in Allied bombers. And the Germans decided not to use the Norden bombsight because their technology was already superior. In addition, Dr. Buchanan found a comment from an industry participant concerning the transfer of old technology as an offset especially interesting. He remarked that, given the perishable nature of technology, this might represent a tactic of "technology disinformation."

Dr. Buchanan stated that because technology is not a commodity and not a deciding factor, the use of technology in offsets does not matter much for national security. He made the point that the Cold War was won with a strategy of industrial attrition. Old technology became obsolete as new technology was developed. This strategy, however, only works with a monolithic adversary who adopts the same strategy. That situation has disappeared. Now there is no monolithic enemy, but numerous adversaries with a diverse set of threats—none of which are directly countered by the infrastructure built to fight the Cold War. In the same period, the commercial sector was in its own war. Because commercial interactions were more frequent and often acrimonious, the commercial sector ran faster. So now commercial technology is ahead of military technology in important areas. Thus, the notion of having something to guard—in order to keep it to ourselves—is beginning to go away.

There is, Dr. Buchanan agreed, a revolution going on in military affairs. Agility and diversity of action are now supreme. Information technology is the key to maintaining superiority—and is one of the areas in which defense is behind. Therefore, in order to succeed, the U.S. military must have close ties to the global commercial technology base. The bottom line for Dr. Buchanan is that if offsets help in maintaining and developing those ties, it is a win.

Holding the Technological Edge

James Sinnett
Corporate Vice President, Technology,
McDonnell Douglas Corp.

Mr. Sinnett began by making a number observations based on his experience in the defense side of the aerospace business. First, he noted that information technology has been growing exponentially. Software development costs and cycle-times exceed those required for hardware. Consequently, software is now pacing the development of weapons systems. He pointed to flight control as a good example. In addition, information has created new management tools, including modeling and simulation.

He then went on to point out that competition is growing from European and some Pacific Rim countries. U.S. aerospace companies can no longer think of themselves as domestically based firms with international sales. They are part of a globalized industry.

The nature of offsets has shifted from soft, indirect short-term business transactions, such as countertrade, to being part of a strategy of technology transfer and the thirst for meaningful work. Aerospace products have taken on a value to national pride as countries move from parts and component production to complete systems.

Moreover, neither the costs of aerospace products nor their development costs are going down. This need for resources may be a mitigating circumstance, however, looking at the competitive issue country by country. In contrast, the creation of consortia with investments from many nations may be of significant concern, on the condition that the costs of the consortium can be managed. He also noted that both cost and timing weigh in on technology transfer decisions as either reinforcing or mitigating factors.

Technology transfer concerns within the U.S. have also shifted. In the past, concerns were heavily weighted in terms of commercial releases that could be used for defense purposes. Mr. Sinnett senses that this may be reversed, particularly with regard to supplier base organization. However, concerns remain about the transfer of commercial technologies feeding foreign commercial competitors and about the transfer of certain defense-unique technologies.

From a government perspective, the issue is how to balance national security needs, in both an economic and military sense. For companies, it is an issue of their competitive position and the bottom line. It may even be a matter of survival—with the associated short-term needs. The overall issue facing the industry is how to maintain dominance. Mr. Sinnett stressed that it is important to look at technology transfer to both capable competitors and not-so-capable competitors who can survive in closed markets while striving to become more capable in the future.

To deal with the issue will require a balancing of the various interests throughout the supplier chain and a balancing off of the near-term demands created by offsets with long-term needs of competitiveness. It also requires that all parties look at intellectual property arrangements and technology safeguards as rigorously as they now review a project's financial position. In doing so, each technology transaction must be judged case-by-case on the basis of the technology, the recipient, and the potential impact.

Mr. Sinnett pointed out that technology transfer can also be a resource. It can be used to dominate, to bargain, or to build upon. Technology usefulness is time sensitive—like ice cubes, technologies have a peak value and a limited useful life. Competitive strategy must seek the proper timing for the release of technology, while being linked to a plan to maintain the next-generation technological edge.

It is also important to recognize that technology does not solely flow *out* of the United States. The goal should be to pursue and apply technology from wherever to the benefit of the U.S.—before the technology melts away. Mr. Sinnett gave examples of using foreign technology to improve the U.S. position: the incorporation of Swedish ceramics and Japanese process technologies into machine tools, the utilization of jump jets from the U.K., and the use of Russian composites technology.

Thus, the key question becomes: what is technology transfer? What is skills transfer? Are management, organization, planning, and integration skills really the technology that we are concerned about? Answering the questions about technology transfer will require looking at the types of technology, the transfer patterns, the recipients, and the timing. Our policy must be flexible. It must be able to recognize national security needs, a relative balance of technology in global regions, the importance of timing, and the need to maintain technology investments to continue global leadership.

DISCUSSION

Mr. Hoeper opened the discussion by reminding the participants that much of the conversations seemed to focus on economics, but that economics is not policy.

A member of the audience, Professor Todd Watkins of Lehigh University, brought up the issue of the impacts of offsets on the sub-tier suppliers. He remarked that the speakers mentioned the squeeze on suppliers caught between foreign competitors and shrinking defense budgets. He commented that there is a third force

also squeezing the suppliers—the managerial practice of pushing more and more responsibility for areas such as technology and quality *on* to the suppliers.

Dr. Keller remarked that the issue of international cooperation and interoperability has been a problem for a long time and that past attempts to address the issue, such as the Nunn Amendment programs, have not seemed to progress very far. He asked if there was a new strategy to really get technology cooperation, especially from the Europeans.

Mr. Hoeper responded that a number of the Nunn programs—NATO cooperative R&D programs—were working rather well, with a four-to-one leverage. As far as new strategies, he gave the example in the communications area of a successful five-nation partnership, in part due to the fact that the teaming was done early.

Luncheon Address

The Policy Challenge of Aerospace Offsets

Senator Jeff Bingaman

Senator Bingaman was introduced briefly by Ambassador Wolff, who noted his responsibilities as a senior member on the Armed Services Committee and the ranking Democratic member on the Joint Economic Committee. Describing the Senator as perhaps the most knowledgeable Member of Congress on the issue of defense industry offsets, Wolff noted that the Senator is the author of language addressing offset requirements in the 1988 Defense Authorization Act.

At the outset, Bingaman observed that he would restrict his remarks largely to the issue of defense offsets, although he recognized that civilian commercial offsets were as important as those in the defense sector. He characterized offsets as one of foreign governments' tools to develop and protect their own defense-industrial base, and that they had become a recognized part of our allies' industrial and trade policies. Armaments and related defense purchases from the U.S. had to be viewed in the context of our customers' attempts to increase their own defense and technological capabilities. The use of offsets (and U.S. defense policy support of them) and other types of concessions had initially been designed to create jobs and upgrade capabilities on the part of our allies. However, this practice has continued and expanded. As an example, the Senator pointed to the recent efforts of Malaysia's Prime Minister to use his foreign business advisory group to encourage greater information technologies investment in Malaysia.

While recognizing that it is tough to gauge the negative and positive effects of offsets, Bingaman argued that their potential for weakening the long-term economic health of the U.S. economy makes it necessary to look more closely at offsets. He emphasized that it was crucial that they not be allowed to undermine high-wage job growth in the U.S., but he recognized that some degree of conflict existed with the needs of defense-industrial-base objectives that required foreign sales and, hence, tolerated offsets. The prime question was what could we actually do, effectively, to affect offset requirements? Government must not tie industry's hands in bidding for and concluding deals with foreign customers, but it was not sufficient for government to take a hands-off approach and do nothing. He noted that the issue has received relatively little attention, outside the aerospace industry, until now.

The situation was obviously changing, however, and had prompted a recent Department of Commerce report on offsets which contained a number of recommendations. Bingaman noted that, in defense sales opportunities where there is no foreign competition (i.e., the only bidders are U.S. firms), tighter restrictions could be imposed on allowable offsets. In addition, to better assess the impact of offsets, it would be desirable to have joint meetings of prime contractors, subcontractors, and government officials to discuss offset issues in a forum that would bring these issues into public view, rather than continue to minimize their public visibility. The 1996 National Export Strategy report also recommended more extensive consultations with U.S. trade partners to reduce the use of offsets, following those that have already taken place with European countries.

Bingaman further noted the proposed modifications to DoD policy on offsets to reflect the competing needs of different sectors of the U.S. industry. Countertrade and other non-defense-related investments and assistance by U.S. primes to foreign customers have potentially negative impacts on U.S. non-defense firms which need to be examined. Finally, he noted the recommendation for a review of DoD policy that encourages, or at least permits, foreign offset requirements by countries receiving foreign military sales assistance (FMSA) from the U.S. for military purchases. He emphasized that a serious effort must be undertaken to examine policies and actions taken by foreign customers with regard to offsets that were meant to strengthen their own industrial bases. In some cases, conclusions

that these policies and actions are weakening the U.S. defense-industrial base might lead to a need for reciprocal actions in order to preserve U.S. industry.

Following the Senator's presentation, one participant asked what the view on Capitol Hill is regarding offsets. Bingaman responded that there is never "one view" on Capitol Hill, but at the moment, there are not any strongly expressed views, other than those of several Members who, despite his efforts, continue to support the Buy American legislation.

Panel 4

Can Offsets Create Foreign Competitors?

Moderator:
William Reinsch, Under Secretary for Export Administration, Department of Commerce

Following his introduction by Dr. Wessner, Secretary Reinsch commented that the Bureau of Export Administration (BXA) has been wrestling with this issue for some time and has recently completed the Commerce Department study directed at answering some of the questions posed by offsets. BXA sympathizes with the dilemma faced by U.S. corporations in seeking to gain the benefits of market access and sales, while risking the creation or strengthening of competitors. He noted that while most companies ask the right questions, and most follow up with solid cost-benefit analysis, the end result is that there are a lot of offsets done, particularly involving technology transfers.

Referencing a BXA report to come out next month, covering 1994–95, and looking only at those offset transactions that involve technology transfer, Reinsch observed that the report found they were valued at $863 million, or 14 percent of total offset transactions during the period.[7] That probably underestimates the value because it does not include other categories of offsets in which some technology transfer occurs. About 72 percent of the $863 million involved aerospace, and 56 percent of offsets were of an indirect type. Current information leads to the conclusion that indirect offsets are increasingly the norm, with unfavorable consequences for subcontractors and increased risks for a wide range of companies throughout the U.S. economy. This is a development that will widen the arena of debate about offset trade.

Secretary Reinsch then turned to the first panelist, Dr. Richard Samuels.

Japanese Capabilities and Dynamic Effects

Richard Samuels
Ford International Professor and Head, Department of Political Science, Massachusetts Institute of Technology

Dr. Samuels began by noting that the worst fears of a rapid competitive development of the Japanese aerospace industry during the 1980s have not materialized. Those fears, growing out of the U.S. domestic debate about the future of the U.S.-Japan alliance in the context of the proposed jointly developed FSX fighter aircraft, were fueled earlier by Boeing's plans to jointly develop a 7J7 transport with the Japanese. Despite the decision not to proceed with this program and the lack of any new domestic Japanese commercial aircraft project, Samuels emphasized that there is no reason to suppose the Japanese *cannot* develop a successful and competitive aerospace industry. By focusing on developing competitive advantage in the key components of this industry, the Japanese are currently positioning themselves in aerospace to "succeed without really flying."

Pointing out that the aircraft industry was targeted by MITI in the early 1970s for development, he noted that the effort is widely considered a failure. It is still only 1/15 the size of the U.S. industry, with a value of less than 1 percent of U.S. aircraft exports. As a point of comparison, the entire Japanese aerospace production is less than 10 percent of Toyota's total sales. The Japanese industry has built few complete aircraft, and no modern airline currently flies Japanese-built aircraft. Further, Japanese companies neither design nor build jet engines. There is thus a limit to which U.S. airframe manufacturers should be legitimately concerned about the Japanese as direct competitors. In fact, among the U.S. primes, there is no sense of a threat posed to U.S. firms, especially at the level of systems integration.

While recognizing that the Japanese had in fact not entered the aerospace business as systems integrators, Samuels cautioned that the usual "explanations" of this state of affairs do not withstand careful analysis. Samuels then outlined the conventional litany of reasons why the Japanese cannot succeed in the aerospace business, a litany that the Japanese themselves frequently offer to explain their lack of an aerospace presence:

[7]Department of Commerce, *Offsets in Defense Trade: A Study Conducted Under Section 309 of the Defense Production Act of 1950, As Amended.* Bureau of Export Administration, Washington, D.C., 1997.

- The Japanese got a late start in world aerospace competition.
- They are too dependent on military design and production, and prohibit themselves from selling military equipment in world markets.
- They have too small a domestic airline market to sustain a domestic industry. Thus, they cannot repeat the protected, infant industry strategy that worked for autos and other industries.
- They lack systems integration and design skills and experience, and cannot provide aftermarket support and service of equipment they produce.
- Their industrial structure is inappropriate to finance the heavy capitalization needs of a competitive aerospace industry; big conglomerates do not specialize in aerospace production and see the business as a drain on resources and a diversion from other, more profitable, markets.
- Japanese aversion to high-unit-cost, low-unit-production business (the opposite of semiconductors, for example), makes the high costs of entry into aircraft production difficult for Japanese firms to contemplate.
- Foreign competitors are too powerful for Japanese firms to compete against.

Samuels then dissected this conventional wisdom, arguing that under closer examination, none of these obstacles is, in fact, a serious barrier for the Japanese.

- Late starts can actually be advantageous. It can reduce start-up costs and make clear the best technology path forward, thereby avoiding the technological, production, and marketing mistakes made by early entrants. Late starters can also benefit from opportunities for access to proven technologies via partnerships with established producers.
- Military production can provide flexibility, stability, experience in design, manufacturing, and servicing. When companies have low barriers between the civil and military sides of their business, as in the case of Japan, plentiful opportunity exists for cross-training, for nurturing key technologies, for sharing of experience, and even for sharing design capabilities and production facilities. Examples include dual-use avionics and composite materials.
- The argument that a small domestic market is an obstacle is largely irrelevant. The Japanese emphasis on components has led to a competitive position in the fastest-growing share of the global aircraft market—that is, systems integration and components. In fact, Japan's share of exports as a total share of aircraft production rose from 3 percent in the 1970s to 15 percent by the mid-1990s. This was evidence of near-term positioning to become a highly competitive, low-cost, high-quality provider of components, which will account for 30 percent of all aircraft revenues in the next generation. The Japanese are accomplishing this through international collaboration and with U.S. help—a very familiar pattern for Japanese export-led industrial development.
- The Japanese possess established systems integration and design capabilities, demonstrated across a range of complex manufacturing industries.
- The Japanese industrial structure for aircraft production is a strength, not a weakness. Manufacturing both turbines and jet engines permits economies of scale and scope within single companies, resulting in—among other things—considerable dual-use potential in aircraft and non-aircraft applications.
- As to high entry costs, they are less important for growth in the systems integration and components business. Traditional Japanese advantages of very low capital costs and stable supplier relations help greatly where large-scale production and test facility investment is not necessary.
- Finally, the small number of global competitors can actually facilitate market participation by the Japanese, permitting them to play off the primes against each other in bidding to provide high-quality, lower-cost services and increasingly design capabilities. For a variety of reasons, this strategy has recently proved less rewarding. One complicating element, for example, has been the refusal of Chinese and Korean firms to accept Japanese participation. Though this strategy has not been as successful as Japanese officials expected, Japanese firms are nonetheless far from being a failure in this industry.

The most worrisome aspect of the Japanese industry's growth, Dr. Samuels observed, is that his study of interactions between U.S. and Japanese firms shows that most technology flow is one-way, U.S. to Japan, from both primes and subcontractors. The virtuous cycles are mostly in Japan's favor, while vicious cycles are mostly on the U.S. side. Citing the F-15 case, which is elaborated in *Rich Nation, Strong Army*, there are 130-odd U.S. firms participating in teaching Japanese firms how to do what they do, that is developing new capabilities and utilizing new technologies.[8] This asymmetry in technology flows is something to which we should be paying attention.

[8]Samuels, Richard, *Rich Nation, Strong Army: National Security and the Technological Transformation of Japan.* Cornell University Press, Ithaca, N.Y., 1994.

The Airbus Experience

Sally Bath
Director, Office of Aerospace,
U.S. Department of Commerce

Ms. Bath addressed the issue of the role played by offsets in the emergence of the Airbus Industrie consortium. Did the European companies and their governments employ offset requirements—at first for military programs, but later for commercial ones—to gain expertise in building commercial aircraft?

Historically, coproduction and subcomponent work for U.S. firms was used by European governments to offset the costs of acquiring, for military and later for commercial uses, large transport aircraft and other big-ticket items, as well as to regain and enhance national skills in aerospace engineering and production. While recognizing offsets did play a role in the early development of the European aerospace industry, Bath argued they are not *the* reason that Airbus is a viable competitor with Boeing and McDonnell Douglas in global markets.

In this view, it is important to recognize Airbus for what it is, an innovative international collaboration which maximizes access to available technology and spreads the risk inherent in new product development. Reflecting its success, it has become the model for hopeful new entrants into the aerospace business. For aerospace companies, the rationale for international collaboration includes risk sharing, lower labor costs, access to foreign manufacturing capacity, closer relationships with foreign buyers, and building political relationships with foreign governments to assure access to their markets. Foreign governments look to offsets to increase domestic employment or to build or expand a nascent aerospace industry.

Airbus markets itself as "a new concept of designing, building, and marketing aircraft to take full advantage of the ingenuity and combined productive capabilities of the European industry." Airbus is perhaps the ultimate model of risk-sharing among not only international business partners but also their respective governments.

As noted, offsets did make a contribution to Airbus. In the post–World War II years the U.S. encouraged offsets with European governments to secure NATO and facilitate the rebuilding of Europe. This led to U.S.-European coproduction programs in the areas of combat and other military aircraft, helicopters, and missile systems beginning in the 1950s. Subcontracting and licensed production agreements were undertaken and subsidiaries of U.S. defense companies established. All this was supported by offset provisions intended to train European engineers and employees in design and production techniques, which facilitated generic technology transfer and helped maintain European infrastructure.

However, factors other than the contributions of military offsets played much more important roles in the success of Airbus. Risk-sharing among the state-owned European companies and their governments offered the advantage of much lower capital costs than was available to privately owned companies. The close relationships with the participating governments have also provided easier access for Airbus products to the largely state-controlled markets for commercial aircraft. The launch aid provided by those governments has made them willing to use their considerable leverage to influence potential buyers, especially in other state-controlled markets. Despite multilateral trade agreements intended to remove the exercise of political influence in marketing campaigns, some buyers actually encourage political inducements from governments as part of the competitive package being considered. U.S. aircraft companies generally have been handicapped due to the long-standing policy of the U.S. government, only recently reversed, not to intervene to influence commercial transactions.

Airbus's use of proven U.S. components in the design of aircraft has been another major factor in its success. Components such as engines, avionics, and auxiliary power units, all obtained from U.S. suppliers, are used extensively. Airbus has also made extensive use of available results of NASA research, often in advance of its use by U.S. firms. For example, fly-by-wire technology developed in the U.S. was first used commercially for secondary controls on the A310 and A300-600, and then for primary controls on the A320.

Another principal factor in Airbus's success was the prior existence of indigenous aircraft industries in each of the countries comprising the consortium: the United Kingdom, France, Germany, the Netherlands, and Spain. Some of these companies had prior experience with transnational partnering, such as deHaviland (U.K.) and Sudaviation (France) on the Caravelle. British Aerospace and Aerospatial, successors to those companies, jointly designed and produced the Concorde on assembly lines in both the United Kingdom and France. Thus there was a collaborative history on which to build, along with an advanced technological base, a skilled workforce, and requisite facilities. What the Airbus partners lacked was sufficient low-cost capital, a stable subcontractor/supplier base, and indigenous markets large enough to support independent primes in each of their countries. To compete successfully with U.S. companies, government help was needed to overcome these large obstacles. Thus design, fabrication, assembly, and component work was spread not only throughout the partners' countries but

included other countries in Europe, as well as some 500 U.S.-based companies. It was truly an international effort. U.S.-companies have recognized this, and it is no surprise that U.S. aircraft programs are becoming increasingly international as well.

Ms. Bath then turned to the lessons learned from the Airbus experience:

- Mandatory offsets alone do not guarantee success in the commercial transport industry. Some countries with a long history of offset arrangements have not been able to use them to effectively transfer their experience to a commercial transport industry.
- Attempts to limit mandatory offset programs will not stop the development of new companies and industries, as in South Africa, Russia, and China, which were denied access to Western technology and financial assistance.
- International collaboration may be the way of the future. Alliances to develop new aircraft and engines will include partners from developing countries together with established manufacturers. Cross-border mergers may become the norm, as pressures increase to have access to stable suppliers and subcontractors.

However, the structure of a global industry is still being shaped. The U.S. industry can be a major force in shaping it, if not constrained artificially by rules and regulations that hinder its participation.

Strategic Alliances in Engine Technologies

Richard Ridge
Manager of Civil and International Programs,
General Electric Aircraft Engines

Referring to the issues paper prepared by Kenneth Flamm and the NRC staff (see appendix), Mr. Ridge queried its claim that no institutional mechanism existed within the U.S. government responsible for developing strategy for the aerospace industry. Based on the statements made by the two Commerce Department panelists, Mr. Ridge suggested that such a mechanism might indeed be evolving on a case-by-case basis.

Making reference to strategic vision in industrial and technological development, Ridge recounted how the U.S. Embassy in Tokyo diligently covered Japan's first heavier-than-air craft flight in December, 1909, in which the embassy attaché's cable noted (1) the innovative use of bamboo for the airframe; (2) the on-site assistance provided by a French government representative; and (3) a possible violation of the Wright patent on wing warping. Aside from suggesting some things do not change, the point of the story was that determining "what is strategic" is relatively easy in hindsight, but quite difficult at the initiation of an alliance. Otherwise, the attaché might have focused his attention on the innovations made by the Japanese to the Model T Ford that was used to tow the glider. . . .

Ridge remarked that in the aircraft engine business (military and commercial), there are no "strategic alliances." Even GE's formal alliance with SNECMA of France, dating from 1974 and one of the most enduring in the business, is built around a specific commercial engine designed and built for narrow-bodied aircraft. Other GE relationships with SNECMA have evolved to accommodate shared work on smaller engines, but nothing comparable to the 50/50 joint venture on the CFM56. The alliance has not extended to the military side, or to derivative engine technologies and products for power generation. Ridge observed that almost all business alliances were focused on specific objectives, at specific points in time, and linked to specific opportunities to bring a new product to market. In his view, once the product is on the market, the idea of a strategic vision guiding it takes on life retroactively.

The GE–SNECMA alliance is a revenue-sharing partnership, which is typical of international civil aviation alliances, as was the case with the Concorde consortium. In such a partnership, the participants agree initially to develop different parts of the engine, then work together at the end of the development phase to form the total product. Agreement is reached in the beginning on what percentage of the total value of the product is represented by each partner's contribution and, once the engine is in the marketplace, each participant gets a corresponding portion of the revenue. The issue of whether the revenue is sufficient, for each partner, to cover costs and provide adequate profit is outside the terms of the alliance.

Revenue-sharing partnerships are not necessarily a form of offsets, nor do they flow from military offset programs. For example, there never was substantial U.S. licensed military production in France after World War II. The French developed their civil and military programs fairly independently of the U.S., with assistance from German engineers who were available after the war.

Typically, Ridge noted, GE's revenue-sharing partnerships in the engine business have been with second-tier engine manufacturers, almost exclusively in Europe, who could not otherwise afford to continue participating in the commercial market due to the growing scale and cost of new program development. In addition to SNECMA, principal revenue-sharing partners include Fiat, MTU, and Volvo, which is a good

example of the minor role of offsets. There simply are not enough aircraft sold in Sweden in a decade to build a relationship with Volvo that would justify, or hinge upon, an offset credit for GE. The Scandinavians are not likely to become aerospace powers, and the reason for GE's relationship with Volvo is solely that the latter is very good at what it does. GE's only major non-European revenue-sharing partner is IHI, a recent partner in Japan. But the relationship does not bring offset credits for GE; instead, what GE gets in value is substantially more intimate knowledge of the market and Japanese decisionmakers.

The Special Challenge of China

Greg Mastel
Vice President for Policy Planning and Administration, Economic Strategy Institute

Dr. Mastel, referring to his recent book on China, remarked that the public prefers alarmists or apologists, hence there is a certain lack of excitement about his generally middle-of-the-road assessment of Chinese development and the challenges it poses for the U.S. and the multilateral system. He noted, however, that he had pointed out some areas of concern directly relevant to today's topic that he would address.

China's industrial and economic development strategy, including the use of offsets, is similar to the strategies that have been, and continue to be, pursued by a number of other countries. Moreover, China's aerospace development strategy is not unique within the Chinese development model. The same strategy has been employed in other sectors such as automobiles, electronics, and pharmaceuticals, and follows closely earlier Japanese strategies.

In several ways, however, China is unique, not least because it follows a unique development philosophy. Until very recently, China was an avowed communist society and presently adheres to what its leaders characterize as a *socialist* market economy which, as the Five Year Plan makes clear, is distinctly different from Western interpretations of a market economy. China does not pursue an economic strategy consistent with Western views of the economy. In addition, China's status vis-à-vis the U.S. is ambiguous and uncertain. The Chinese describe themselves as neither an ally nor an adversary. In five years it could be either, with dramatic effects on U.S. thinking about how to deal with China, both on questions of trade and investment, and on questions of international security.

Mastel emphasized the importance of remembering that China's industrial policy is not market driven. Policy goals, and thus factors driving industrial development in some sectors, are determined not by market economics, but by the leadership's desire for national prestige or the acquisition of strategic technologies. Traditional Western economic objectives such as maximization of profits, or even achieving profits, are at best long-term concerns and of low priority to Chinese decisionmakers. Thus, although lacking an economic rationale for producing autos and airplanes, the Chinese may well forge ahead for other reasons. One principal reason is the traditional Chinese belief that China should not be dependent on foreign sources for anything. In the aerospace sector, as in automobiles, telecommunications, x-ray machines, and satellite launch capabilities, the Chinese are engaging in production because they have determined that it is of critical national importance for them to do so.

Many elements of Chinese industrial policy incorporate or depend upon trade barriers and other trade distorting elements, many of which are illegal under current international agreements. For instance, despite the 1992 agreement with the U.S. on market access, in which China agreed not to employ import substitution requirements, the Chinese government subsequently introduced strategic industrial plans for autos and pharmaceuticals that explicitly included import substitution as a component of the strategy.

Subsidies are another element of Chinese policy. Government subsidies are the rule rather than the exception in a communist economy, and while China has moved a great way toward a market economy in the past decade, large-scale economic subsidization still exists. The state owns about 30 percent of economic enterprises, and state-owned enterprises (SOEs) receive monumental financial transfers to stay in business, often simply to maintain employment. However, subsidies are also used extensively in parallel with industrial policy. Likewise, forced technology transfer, in the form of required offsets, is another explicit, avowed element of Chinese industrial policy in aerospace.

Will the Chinese succeed in the aerospace sector? Success has different definitions. It is unlikely China will be an economically viable producer of airplanes in the foreseeable future, but that will not keep the government from pressing forward. The People's Airplane project has been on the drawing board for at least seven years and China has actively pursued international assistance in jointly developing a 100-seat transport. So there is reason to believe that China will actually build and fly an airplane. Whether it will be economically competitive with Western models—and it probably will not—is not the issue. Among the biggest growth markets for aircraft in the next two decades will be China and India. China controls its own national market and it is not unlikely that a comparatively low-tech-

nology, low-priced airplane could be attractive to India as well. Even if such a plane is not built and sold internationally, the Chinese will still have a near-term competitive effect on the regional market. In this huge growth market, the Chinese government will demand, and almost certainly get, a substantial share of manufacturing business—and consequently develop experience and capabilities—from aircraft producers who wish to sell there. The impact will be felt globally.

Should the U.S. be concerned about these developments? Ideally, the largest labor market in the world, i.e. China, should not be in competition with the largest capital-intensive market in the world, i.e., the U.S. However, the Chinese are not content with that balance, and in coming decades there is a possibility for large market disruptions in sectors such as automobiles, pharmaceuticals, and telecommunications equipment due to the sheer size of the Chinese market, the tight control exerted over that market by the Chinese government, and the determination of the Chinese government to become a technologically advanced industrial power.

In conclusion, Mastel observed that probably not much could be done to slow this scenario at the level of individual companies. Companies wishing to do business in China must comply with Chinese demands. At the level of U.S. government policy, however, there are some options. China's application to the WTO means pressure could be applied on issues like subsidies, market access, and technology transfer to make it more difficult for the Chinese to carry out their industrial policy and thereby slow the development of a Chinese Airbus.

DISCUSSION

Secretary Reinsch observed that time remained for questions to the panel. Posing the first one, he noted that foreign governments generally do what they see as in their best interest, and U.S. companies respond in ways that serve their interest. Against that interaction, is there a U.S. national interest separate from the aggregate corporate interest, and if so, who should be responsible for pursuing and overseeing it?

Dr. Mastel—in the context of the Chinese automobile industry—responded that, while no single company provides much in the way of technology transfer, the collective transfers from many companies, U.S. and European, are likely to result in significant acquisitions by China of Western technology. As a huge buyer, with control of the economy and leverage exercised over individual corporate bidders, the Chinese can pick and choose to fill their technology shopping list.

Mr. Ridge commented that, based on his company's dealings with a number of U.S. agencies, it may not be possible to expect that the U.S. government can develop a strategic vision. Rather, companies must deal with agency-specific concerns and act to address them individually, hoping that a government-wide policy stance can be achieved on a few big and very important issues.

Ms. Bath, noting that aerospace technologies represent a dynamic process, observed that putting many roadblocks in the way of its natural development could also retard U.S. technological development. Too much government activism in the arena of technology transfer, with inevitable agency "plodding" in decision-making, would put stumbling blocks in the way of companies' ability to realize revenue from the investments they have already made in technology.

Dr. Samuels commented that, from the perspective of the Japanese, Secretary Reinsch's question would be curious—it would not arise in Japan. The Japanese have a societal method of arriving at a consensus view of national interest, and it revolves around notions of

- absorbing technology through interactions with foreigners and foreign technology;
- moving that technology through the producer system, vertically and horizontally; and,
- nurturing its acceptance and utilization by companies that otherwise would not or could not do so.

Ambassador Wolff observed that the discussion was troubling with respect to the effectiveness of current international agreements and asked the panelists whether international agreements have actually worked. Principally, what impact have agreements in the aerospace sector had in reducing or eliminating offsets?

Ms. Bath replied that the agreements had created a forum in which discussions could take place. Admittedly, the pace of government support for Airbus did not slow during the '80s, but the 1992 agreement has not been tested yet by the introduction of a new Airbus program. However, the U.K. did moderate the level of their investment in the A320, while the French activity became more transparent and loans were repaid, although Airbus received equity infusions via other means. The equity infusion issue has not been resolved. With the Germans, there has been no change. On the whole, however, the primary argument of the Americans—that Airbus should be privatized—which the U.S. has pushed since the early 1980s, is now beginning to be undertaken. The latest bilateral agreement will be tested in the next few months. One major agreement, the Large Aircraft Sector Understanding on Official Export Credit Financing, did get rid of most distortion in official aircraft financing. The Europeans have applied the principles embodied in the Agreement, al-

though they tend to see such financing as an entitlement to Airbus, while the American government tends to view official financing as a tool of last resort. We are increasingly aware of the real nature of the deficiencies in the agreements, but at least they have created a forum for serious discussions.

Dr. Mastel responded to Wolff's question by saying that if the U.S. insisted on the enforcement of WTO provisions, it might have serious restrictive impacts on China's ability to run an industrial policy. Typically, however, as in the case of Japanese industrial policies, the U.S. government has been reluctant to insist on enforcement.

Dr. Wessner asked Dr. Samuels whether the Japanese and Chinese are indeed misguided in trying to acquire Western technology, or whether we in America do not fully appreciate the rationale for their efforts and their relative success. Addressing Ms. Bath, he asked whether U.S. "government support" in its lengthy history and various forms could not be equated to European "subsidies." Additionally, with regard to the nature of the multilateral agreement and recent European charges, do the trade agencies of the U.S. government fully appreciate the extent of U.S. subsidies to the aerospace industry, through NASA for example? And lastly, he inquired whether it was realistically possible to do anything about government support—in its varied terminologies—since all governments do it. Was it not more effective to seek wider market access with fewer constraints?

Dr. Samuels responded that the Japanese are not misguided in trying to acquire U.S. technology, but neither has the U.S. been misguided in assisting them to acquire it. The U.S. has in fact "indulged" the Japanese in the endeavor, originally to assure the U.S. of access to the "unsinkable aircraft carrier," which was seen as a necessary Cold War trade-off up to the 1980s. This indulgence stopped making as much sense to the U.S. after 1990, but the framework of the security relationship has not changed or been reexamined, so the national security foundation of the technology trade-off is still in place.

Ms. Bath responded by acknowledging the extensive interplay between governments and their aircraft industries and the difficulty of differentiating between direct and indirect measures of support. These issues were recognized in the Tokyo Round Agreement. Ms. Bath explained, however, that direct and indirect support measures *are* different, and have different objectives—principally it is a question of whether the measures are intended foremost to serve the requirements and stated missions of the government, as in NASA's long-term aeronautics R&D, or to support a commercial product. She suggested that some discussion of the issue is likely to occur in U.S.=European talks over the next few months. She also reminded the audience that the U.S. has successfully pressed for adherence to the aircraft agreements on several occasions.

Dr. Mastel remarked that both sides could achieve their goals because they have different objectives and a narrow economic definition of those objectives which might, in the case of China especially, miss the more important aims of the subsidies that support those objectives. The WTO could constrain Chinese industrial policy through its provisions on market access, subsidies, TRIMS, and the large civil aircraft agreements. The Chinese are successful at winning technology transfers because of the perceived size of their market; hence market access is the key card they play. Smaller markets generally lack the same inducement. Thus, multilateral and bilateral attempts to open market access could reduce the pressures companies feel to trade technology for access. In this view, subsidies are a lesser issue in the overall picture.

Another questioner asked Dr. Samuels whether U.S. political pressures worked to limit the growth of the Japanese aerospace industry, given the pervasive postwar U.S. presence in Japan. Samuels considered that an interesting view and one that is supported in part by the outcome of the FSX program, in which the Americans insisted on a joint development program rather than one carried out wholly by the Japanese. This resulted in large transfers of American technology and know-how, but the Japanese did not develop, as they had initially intended, an independent Japanese fighter program. Arguably, one of the most important benefits for the U.S. government—for which it never claimed credit—was to forestall the indigenous development of Japanese capabilities in aircraft design and development.

Panel 5

Differing Impacts of Offsets on Key Suppliers and Sub-Tier Producers

Moderator:
Christine Fisher, Director, Industrial Capabilities Support Office, Department of Defense

Dr. Wessner introduced the moderator for the panel, Christine Fisher, the Director of the Office of Industrial Capabilities and Support in the Defense Department, who serves under John Goodman, the Deputy Under Secretary of Defense for Industrial Affairs and Installations. Following the recent round of mergers and consolidations in the industry, the Industrial Capabilities and Support Office has taken a closer interest in sub-tier companies, normally several levels down from the primes. In response to a request from then–Under Secretary Kaminski, the Defense Science Board undertook a study of vertical integration issues in the industry. The Board recently issued a report whose recommendations are now being implemented.[9] As part of this implementation, Ms. Fisher's office will begin more intensive monitoring of subtiers on individual programs and on a cross-Departmental basis.

After brief introductions of each panelist, Ms. Fisher turned to the first member of her panel, Dr. Kirk Bozdogan.

Is Anyone There? Monitoring U.S. Strategic Interests

Kirk Bozdogan
Lean Aircraft Initiative, Center for Technology, Policy, and Industrial Development, Massachusetts Institute of Technology

Dr. Bozdogan opened his presentation with a disclaimer, noting that it represents his personal views, though it draws on research carried out under the Lean Aircraft Initiative at MIT. The purpose of this program is to bring about fundamental performance improvements throughout the defense aircraft value chain. The program seeks to encourage improved efficiency, higher quality, greater affordability, enhanced technological superiority, and a more robust U.S. supplier base. The program involves a working partnership between MIT and 10 U.S. government agencies and 19 aerospace companies, with MIT acting as a neutral catalyst. It derived from MIT's work in the 1980s on the global auto industry, summarized in the 1990 publication *The Machine That Changed the World.*[10] The current aircraft program is well into its second phase.

Bozdogan observed that he intended to provide an "inside-out" perspective (rather than the "outside-in" perspective which had characterized the discussion thus far) in order to frame the debate within the larger context of fundamental changes affecting the U.S. industrial base. He noted that the U.S. aircraft industry supplier base has experienced rapid and fundamental change—caused by a consolidation and reduction of the supplier base, driven primarily by defense cutbacks and a slowdown in the commercial sector. In this larger context, offsets as an issue are "not even on the radar screen." However, he suggested that the situation very likely will change as offsets become a major factor over the next decade or two. The main points of his presentation were:

- offsets will increase and will pose serious risks for the U.S. supplier base, as well as offering some—but not many—opportunities;
- there will be increasing friction between national and private sector interests;
- a disconnect may well occur between U.S. trade and technology policies; and,
- there may be increasing conflict between U.S. national security interests and the demands of alliance politics.

[9]Defense Science Board, *Task Force on Vertical Integration and Supplier Decisions.* Office of the Secretary of Defense, Washington, D.C., May 1997.

[10]Womack, James, Daniel Jones, and Daniel Roos, *The Machine that Changed the World.* Rauson Associates, New York, N.Y., 1990.

With regard to the structural change in the aerospace sector, Bozdogan observed that a deep, sweeping reduction has taken place in the U.S. supplier base. Working from a chart covering the period 1991–95, he pointed to a 50 percent decline of direct production suppliers including sub-tiers per business unit (his survey covered 80 large firms, each with $100 million of revenues per year and/or 1000+ employees), in both the defense and commercial sectors. The same data also showed that the decline was equally severe—a 50 percent reduction in the supplier base—across all aerospace sub-sectors during that period, including airframes, avionics, and engines.

Concurrently, there has been a rationalization of the supplier base. Major firms have adopted a wider approach to supply chain management that goes beyond procurement to strategic supplier integration. Streamlining of business divisions, integration of internal supply chain management functions, and centralization of supply chain management operations have all taken place.

As major firms have reduced the numbers of their direct suppliers, the synchronization of deliveries from, and the assurance of quality by, those suppliers has become more important and has led primes to place a strong emphasis on certification systems and process integration. Majors have devolved increasing responsibility onto their suppliers for inspection, production, and design, based on a reassessment of their core competencies. The central characteristic of this change is the emergence of a sense of close, cooperative, long-term, strategic partnerships—becoming widespread in the industry—that embody more extensive communication, information exchanges, long-term commitments, and the sharing of risks and benefits. A key feature has been early supplier integration into design and development activities, leading to an integrated, virtually seamless team approach.

In this larger context, offsets have played a relatively minor role in the restructuring of the U.S. industry. In the future, however, their importance is very likely to increase as foreign markets come to dominate both commercial and military aircraft sales. Market access, rising costs, and the drive by some countries to create their own aircraft industries will increase both the demand and the opportunities for offsets, pushing established manufacturers to grant offsets. Derivatives will become the biggest growth area, with few new aircraft programs coming on line.

Bozdogan suggested these developments pose substantial risks for the U.S. supplier base, especially subtier suppliers. Foreign programs and offset requirements are likely to exacerbate global overcapacity, increasing cost and competitive pressures on U.S. suppliers. These U.S. suppliers, having already gone through a "leaning down" period, will face increased competitive pressure from new entrants. Particularly in countries such as China and Japan, heavy government subsidies, combined with strategic industrial programs, military/commercial synergies, and the integration of technological and production advances from other sectors, will combine to put U.S. suppliers at progressively increased risk.

Bozdogan concluded by noting the policy implications of the changes he had described:

- a particularly difficult policy challenge will be how to manage increasing friction between private sector and national interests, as individual company interests and core competencies diverge from national strategic interests;
- net technology transfers from the U.S. are likely to grow as primes and suppliers both expand their international alliances, and as the future model of seamless integration between primes and suppliers becomes more conducive to knowledge integration and technology transfer;
- achieving closer integration between U.S. trade and technology policies will become imperative; and,
- the preservation of long-term U.S. national security requires that attention, nourishment, and protection be given to the critical supplier and subtier base of the aircraft industry.

New Technologies: Opportunities and Challenges

John Terranova
Chief Executive Officer, Tolo, Inc.

Taking issue with an earlier description of Litton Industries as "a small company," Mr. Terranova affirmed that his company, with 220 employees, is a "true" small business. Tolo Inc., makes aircraft structures and components, such as APUs, along with providing engineering services. The company has long-term teaming agreements with many of the major aerospace firms.

After suffering through a period of decline in the late 1980s, Tolo looked both to expand its geographic reach and to develop new products. It devised new design structures and offered new engineering services, as well as munitions redesign. It developed an innovative "grid-lock" structure (two opposed surfaces with integral ribbing that interlock with each other) which has been adopted for such uses as simpler bulkhead fabrication. (Mr. Terranova here gave a detailed presentation, accompanied by slides, of the design and fabrication, various uses, and advantages of "grid-lock" and also gave examples of its adoption for specific components of various aircraft.)

Mr. Terranova noted that, as a sub-tier supplier, Tolo's growth was dependent on finding a means to team with aerospace partners. Increasingly, it is necessary to find a means to team with offshore manufacturers, mainly European companies, through collaboration with U.S. firms with business in these markets. Direct sales are difficult—not to say impossible—in light of the structure of the industry and the size of Tolo. Consequently, there are substantial pressures for technology transfer, especially through licensing.

Current Trends in Offsets

Karen Zuckerstein
Assistant Director, Defense Acquisitions Issues,
General Accounting Office

Ms. Zuckerstein summarized a General Accounting Office (GAO) report[11] on defense offsets done in 1996 for the Senate Armed Services Committee and the House Small Business Committee. The study looked at offset goals and strategies of major foreign buyers over the past ten years and how they have changed, as well as at the kinds of offset demands being made and the types of activities undertaken by U.S. companies to meet those demands. Case studies of offset agreements between ten major buying countries and selected U.S. defense firms included evaluation of the specific terms of offset agreements and the written requirements presented by the buying countries.

The GAO report concluded that offset demands had increased, due in part to new entrants to the market, and included growing demands for technology transfer, targeting of assistance to particular sectors, more local content requirements, and greater nonperformance penalties. Also noted was significant variance, from region to region, in the types of offsets requested and provided.

For Canada and Europe, the strongest interest is still in defense and aerospace offsets. Subcontracting and coproduction are key characteristics of agreements. For example, the U.K. will coproduce the Apache helicopter, and $350 million of U.K.-built equipment will be used in the production of U.S.-built aircraft. In Asia, the emphasis is on technology transfer. Korea and Singapore target defense technologies, and coproduction is a major feature of offset agreements. The Persian Gulf countries tend to use offsets in new ways, notably to promote economic diversification by requiring aerospace companies to sponsor many kinds of investment projects, including infrastructure building and environmental enterprises, and other ventures far afield from aerospace. Although the average offset demand was roughly 30 percent of the total sales package, the nature of the offsets required could be extremely demanding in terms of types of technologies transferred and how to value them.

Ms. Zuckerstein observed that, despite these differences, a number of characteristics of offset programs were similar among the countries studied. She enumerated several common expectations of foreign governments relating to the use of offsets. These include:

- long-term benefits to foreign nations' industrial policy goals,
- supplier relationships that extend beyond the life of a single program or procurement,
- more competitive industries as a result of government-induced technology transfer,
- continuing requirements for investment projects, and
- a growing presence by foreign firms in the U.S. market as a result of marketing assistance provided as an offset by U.S. companies.

The critical question is how such offsets affect the U.S. supplier base. To address this, one needs to differentiate among types of offsets. Indirect offsets such as those associated with Persian Gulf countries, while difficult to implement and financially risky for primes, present little threat to U.S. aerospace suppliers. Other forms of indirect offsets, including assistance in the marketing of non-defense products in the U.S. or substituting foreign-made goods for U.S. purchases, may adversely affect U.S. non-defense producers. This occurred in the paper-making machinery case, referred to earlier by Senator Bingaman, where incentive payments were used to subsidize European exporters of equipment. This type of incentive payment is now prohibited by the 1994 Feingold Amendment to the Arms Export Control Act. Other forms of offset include having U.S. firms hire consultants to do market analyses or to help design marketing strategies for the foreign producer. Zuckerstein noted that such activities have begun to spill over from the aerospace sector into other industrial sectors. The result is that American defense companies are assisting foreign governments, through leveraging their resources, to help foreign producers compete with other U.S. firms in non-aerospace markets.

Lower tier U.S. producers in the defense sector are similarly affected. Primes, under the pressures or incentives of offsets, look more closely at partnering with, or procuring from, foreign suppliers of components, not only for export products, but also for systems purchased by the U.S. Defense Department. Primes encourage their suppliers to help them meet offset obligations. Primes also factor supplier willingness to assist in offsets into their supplier evaluation

[11]General Acounting Office, *Military Exports: Offset Demands Continue to Grow*. GAO/NSIAD-96-65, Washington, D.C., April 1996

system. This encourages increased supplier interaction with foreign suppliers.

Ms. Zuckerstein observed, however, that defense offsets can create benefits for lower-tier producers by building foreign political and public support for large, costly offshore procurements in which the subs take part. Offsets also can lead to additional sales and increased foreign market access that would not otherwise have occurred, thus providing more work for the sub-tier firms. The challenge is not to forego the benefit of such sales, but to neutralize the incentives for foreign sourcing created by such sales.

Direct Costs of Indirect Offsets

Lora Lumpe
Director, Arms Sales Monitoring Project,
Federation of American Scientists

Ms. Lumpe began by saying that, as head of the Arms Sales Monitoring Project of the Federation of American Scientists, she shared Secretary Reinsch's concern about whose job it is to weigh potentially competing corporate and national interests, and particularly whether the public has a "seat at the table" in weighing those interests, principally countertrade. The public has a stake and is affected in two ways. First, business opportunities and jobs in both defense and non-defense industries are directly affected by indirect offsets. And second, public monies are used to underwrite the development, marketing, and sometimes the financing of overseas arms sales which can trade away market access and U.S. employment. She affirmed that these are more than sufficient reasons for a more extensive public role in the debate on offsets.

The public's interest is also engaged because foreign arms exports have increasingly been sought and approved on the basis of claims that such sales aid the U.S. economy and employment. Serious questions exist about the validity of those claims. The growth of indirect offsets, particularly in the aerospace sector, is of concern because it appears to lead to countertrade or investments in non-defense products that are directly competitive with U.S.-made goods and U.S. markets. Providing several examples of this trend from different parts of the world, Lumpe noted that U.S. aerospace suppliers have been negatively affected by indirect offsets, judging from their public comments and from data in the Commerce Department's 1996 survey report on offsets. Lumpe observed that American workers were also protesting the practice, as evidenced in recent strikes at Boeing and McDonnell Douglas, in which a key issue was offset-related foreign outsourcing. She also cited several examples from the Commerce study where non-defense firms were negatively impacted by defense company offsets, though in other cases, U.S. firms had benefited from direct offsets. At the same time, she noted that indirect offsets do not always affect U.S. firms.

Improved information is required. In addition to the existing requirement (under the Feingold Amendment) that Congressional notification of pending arms sales include notification as to whether the sale is accompanied by an offset, Lumpe recommended that there be greater public disclosure of offsets as a first step in obtaining more information about them. Another aspect of offsets needing reform is the practice of granting offsets on sales of arms that are financed by the U.S. government. About $4 billion annually is provided in foreign military aid for weapons purchases, the major portion of which must be applied to purchases of U.S.-made equipment. In this situation, it is the norm for U.S. companies to bid against each other with offset packages in order to secure the sales, leading to the bizarre result that the American public is asked to pay for the design, development, manufacturing, and foreign transfer of arms whose "sale" then costs them still more in lost jobs and markets.

DISCUSSION

The moderator opened the floor to questions at this point. The first, to Mr. Terranova, asked whether Tolo was teaming with European firms because of the reluctance of Europeans to buy products made in the U.S., or because of Tolo's small size prevented the company from pursuing effective overseas marketing efforts. Mr. Terranova was also asked whether Tolo's experience was typical of small firms in the aerospace sector.

Terranova responded that, since Tolo was essentially a "job shop," it lacked the marketing staff, financial depth, and experience to compete effectively for overseas sales. It is simply very difficult for small manufacturing companies to do business offshore. Tolo has been successful because it has a proprietary product to sell at precisely the time when there is a window of opportunity in the global market (i.e., a growing recognition by major companies of the need for, and cost-effectiveness of, using Tolo's product). Tolo does not have the wherewithal to produce and market globally; hence, its reliance on teaming with foreign companies that are already in the target markets. He has never encountered resistance due to the fact that Tolo is a California company.

Another questioner asked whether any primes have asked Tolo to participate in an offset by transferring technology or jobs overseas. Terranova replied that Tolo has had opportunities to do technology transfer, and does not feel the technology itself is worth nearly

as much as its testing and the process knowledge of how to use it. Tolo is very loyal to its primes, however, and if one of them could be helped in securing an offshore contract through Tolo's technology transfer—especially if it held the potential of creating new business and jobs at home for Tolo—the firm would gladly pursue the opportunity.

Another participant questioned Ms. Lumpe's use of data in her remarks about the percentage of suppliers who responded, in the Commerce Department survey, that they were negatively impacted by offsets.

Another questioner asked, rhetorically, whether there was a general assumption that the foreign sales, and company revenues and jobs created and sustained by those sales, would have occurred *without* manufacturers' concurrence in offset agreements.

Ms. Lumpe replied that this type of assumption was too black and white; in fact there were "many shades of gray" involved in such sales. While offsets were realistically part of doing business, her concern was that there should be adequate public disclosure of the impact of offsets on non-defense industries, especially to balance manufacturers' claims that offsets were job-sustaining. Since defense manufacturers receive substantial assistance in a variety of forms from the government, it is only fair that the public and policymakers be aware of any potential or actual harm to public interests traceable to offsets.

Panel 6

Do Offsets Cost or Keep Jobs?

Moderator:
Mortimer Downey, Deputy Secretary, Department of Transportation

Following Dr. Wessner's introduction, Secretary Downey opened this panel with the observation that its task is to address the central issue of the impact of offsets on employment. The effects of offsets on jobs are a crucially important question because the aerospace industry contributes so much to total U.S. employment: 1.8 million, mostly high-skill, high-wage jobs, paying on average 45 percent more than manufacturing as a whole. The nation would benefit from more of them, and a priority policy question is how to generate them. One view holds that offsets generate or sustain jobs in the U.S. by increasing worldwide sales of U.S. products; another view is that offsets cost jobs by shipping production overseas and creating stronger foreign competitors. Even if the issue of jobs is subordinate to other concerns, such as national security, it is central to the discussion about offsets and certainly cannot be downplayed.

After introducing each of the panelists, Secretary Downey turned the floor over to Dr. Robert Scott.

Trends and Issues in Aerospace Employment

Robert Scott
Economist, Economic Policy Institute

Referring to the 1995 study carried out in collaboration with Randy Barber, *Jobs on the Wing*,[12] Dr. Scott had updated the trends and analysis of aerospace employment for this worksop on the basis of the most currently available data. His first table showed a loss of approximately 500,000 U.S. jobs in aerospace over the past four years, with employment peaking in 1989 at 1.3 million workers and bottoming out in 1995 at just under 800,000—a decline of 41 percent. The decline had affected all subsectors of the aerospace industry, but has been particularly steep in military aircraft, missiles and space. Among European manufacturers, employment also fell by 28 percent during the period, from 486,000 in 1989 to 350,000 in 1995. In Canada and Japan, employment declined as well, although not as steeply. Thus it appears that, as a share of the world total, aerospace employment has shifted from the U.S. to Europe and other regions. The causes of the relative U.S. decline were shown to be falling revenues in all subsectors, rising imports, limited export growth, and productivity growth in the U.S.

Scott's next chart focused on revenues. Between 1990 (peak year) and 1995, U.S. aerospace industry revenues fell 30 percent, with the decline in the missile subsector reaching 61 percent. Since 1995, there has been a 63 percent recovery in civil aircraft, but revenues from military aircraft and missiles have continued to slide. Concurrently, imports have risen sharply in value, from $1.6 billion in 1979, to $11.8 billion in 1990 and a preliminary estimate of $13.6 billion for 1996. More importantly, imports as a share of the total U.S. aerospace market have continued to climb steadily, at about 0.5 percent yearly. The 1980s trend of sharply rising U.S. exports has flattened over the last few years.

The competitive challenges behind these figures include the rising Airbus market share. The European Union's share of aircraft deliveries to Europe exceeded 50 percent in 1995 for the first time, and rose to 40 percent worldwide. Deliveries have been rising steadily in the U.S. as well, with the Airbus share reaching 30 percent in 1994, before falling somewhat in 1995.

The U.S. has an export problem as well: aerospace exports to Europe fell by nearly half between 1990 and 1995, reflecting Airbus's growth there. Exports to Europe and Japan represent the vast bulk of American foreign shipments; sales to China, declining recently, represent a fairly small portion of the U.S. total.

The relationship of these trends to offsets is revealed in charts indicating that:

[12]Barber, Randy and Robert E. Scott, *Jobs on the Wing: Trading Away the Future of the U.S. Aerospace Industry*. Economic Policy Institute, Washington, D.C., 1995

- the ratio of imports to domestic revenues is rising;
- the ratio of imported parts and components to revenues is also increasing; and
- U.S. employment in the category of Other Related Products (engines, components, parts), as a share of industry total employment, has declined steadily, from 28 percent of the total in 1983, to an estimated 23 percent in 1997.

In conclusion, Scott observed that the offsets problem represents a "prisoner's dilemma." Both Boeing and Airbus have an incentive to give away more offsets than they would if they could cooperate or collude. Thus, both firms lose more jobs and output through offsets than they would prefer.

The total demand for commercial aircraft in the future will be limited by the amount of growth in airline travel which is expected to be outpaced by global growth in production capacity. In this context the problem with offsets, in a climate of intensifying competition, is that they encourage firms to increase outsourcing. For instance, the new Boeing 777 has about 30 percent foreign content, versus an average of 14 percent for all Boeing aircraft. There is some thinking that if the U.S. and the European Union were to conclude a bilateral agreement to restrict firms from engaging in offsets, the result would be increased domestic content of production for both.

Developing Competitors

Chip Block
Director, System Engineering Division, Veda, Inc.

With the caveat that he was speaking only for his own company and its experiences, Mr. Block said he would cover three areas: a medium-sized and small-business market overview; the move from full production programs to systems integration, or mod (modification) programs; and finally, how offsets affect the first two.

The biggest change in the market has been the trend to huge corporate mergers and consolidations by prime contractors. Combined with shrinking defense budgets, this has reduced the number of market opportunities for small firms. The primes have found new work in the international market, and small companies like Veda would like to make the same move. (Block noted that he was quite surprised at the sharp fall-off in suppliers shown in Dr. Bozdogan's presentation.)

A second major change is that, with few new airplane production programs scheduled in the future, both foreign military sales and commercial programs coming on line are mod programs. The issue is becoming not one simply of unit production, but one of services: workers and engineers providing testing and integrated logistics support. These servicing tasks are the most vulnerable at present because they involve the easiest types of tasks and jobs to move offshore; doing so generally does not affect a production line. Hence, with offset programs for training, the nature of the task becomes an important factor itself. Offsets have also migrated into other, non-aerospace defense programs, such as command and control programs, which Mr. Block found surprising, having worked in command-and-control.

From the perspective of small firms, another significant change is that offsets have made the normal "rules" of the aerospace business quite "fuzzy." The impact of terminating a program is quite large for a small business; indeed it can be devastating. Small firms must focus on a few programs, since they lack the financial ability to spread their investments; they cannot participate in many international programs. It is therefore critical that the portion of a program on which the small firm focuses is not subsequently shipped overseas as part of an offset. To the prime that business might be a small bargaining chip, but to the small supplier it represents an important investment. What the small supplier sector wants from the primes is a set of stable, understandable rules under which they can participate and which they can count on in committing their investments and marketing efforts. All the rules, right now, seem to be getting fuzzy, and those for offsets are just a part of the larger picture, in which all the rules are in flux.

Concluding, Mr. Block admonished the audience that closing off markets is not the answer to the offsets problem; shrinking markets are already difficult enough to cope with. Nevertheless, better communications from primes to the suppliers about the impacts of forthcoming program changes brought about by offsets, and about how the "rules" are changing, would make growing internationalism of their markets easier to manage.

Maintaining High Value-Added Exports Amidst Structural Change

Joel Johnson
Vice President, Aerospace Industries Association

Mr. Johnson reminded the audience that the "half-empty glass" described by some speakers is also "half full." He argued we should remember that the aerospace industry:

- produced $112 billion in revenues in 1996;
- employs over 800,000 workers and is hiring once again;
- exported over $39 billion; and,
- enjoys a net trade balance of $26 billion.

This, he suggested, is not "half-bad."

The downside is that there are about 40 percent fewer workers in the industry than there were in 1989. The only country in which aerospace employment fell faster was in the United Kingdom, the only European country which currently does not have a serious unemployment problem. The U.K. is the only other country to have followed the U.S. model with the development of a private aerospace industry; as in the U.S., the British market "went in the tank," and also—as in the U.S.—the British industry restructured.

Johnson observed that there had not been much discussion during the conference about the restructuring of the U.S. aerospace industry during the period of decline of both the airline industry and defense spending. Both the airlines and the government began to demand both performance and cost efficiency. As a result, employment began to drop, evidencing the beginning of restructuring, two years before shipments began to drop with the downturn in the market. The emphasis on lower-cost and higher quality has shown up in better quality control, faster and easier assembly, and less need for some categories of workers, like draftsmen and re-work men, that were previously necessary. As in autos and electronics, technological advances in production have now been incorporated into production programs and, as a consequence, fewer employees are required, which is why employment has risen more slowly than the rate of production in the industry during the recent market upturn. Import and production data for the 1990–94 period demonstrate that declining employment owes relatively little to offsets, as compared with restructuring and lower demand.

Virtually all growth in the future will be in foreign markets. If a foreign customer wants to deal in offsets, companies will have to listen and negotiate. That situation is not unique to the aerospace industry. The typical company response in other industries to offset requests is to put production offshore. In 1996, American companies invested $600 billion overseas, including $27 billion in chemicals, $51 billion in computers, and $21 billion in autos. The aerospace industry, by comparison, invested only $1 billion overseas, almost all in Canada. The aerospace industry instead has approached foreign markets with licensing, coproduction, and other forms of offsets.

Much of U.S. foreign production investment is far from voluntary; it is a requirement often imposed by foreign governments for doing business overseas. Aerospace offset demands pale by comparison with the vast array found in the automobile, chemical, electronics, and other industries. The aerospace industry finds that direct foreign investment, i.e., acquisitions or equity purchases, is generally not an option for several reasons: the industry is too security-related and thus governments do not seek such investment; there is already overcapacity in the industry; moreover, no single country's market outside the U.S. is large enough to justify U.S. aerospace investment, though in the future, the European Union may become the first such market.

In the interest of balance, Mr. Johnson also pointed out that the Europeans have a different perspective on U.S. practices. The U.S. government officially takes the position that it does not demand offsets. However, to the foreign firms engaged in defense sales, it seems clear that if they want to do defense business in the United States, they will have to grant a license for production by a U.S. prime, as in the case of the British Harrier jet, the Italian Bereta, or Swiss trainers. To the European suppliers, such requirements appear to be 100 percent offsets.

Responding to the idea that there is too much outward technology flow from the U.S., Mr. Johnson suggested that that is a good sign; it shows that the U.S. remains the technological leader in the industry. U.S. imports of process and machine tool technologies in the 1980s were indicative of serious U.S. weakness in these sectors. Exporting technology is always better than importing, and we should hope it stays that way for the United States. Johnson was dubious that there is a constructive role for government to play on the issue of international performance requirements and offsets. Instead, he recommended that the industry continue to focus on being competitive and moving quickly in markets.

What Level of Concern Should Government Have?

Owen Herrnstadt
Director, International Department, International Association of Machinists and Aerospace Workers

It is important to remember that, in talking about the effects of offsets on workers, we are talking about real people, individuals and families, communities. Sadly, ways to retrain and find new, high-wage, high-skill jobs for displaced aerospace workers is not a subject of much discussion currently in the aerospace industry. While there are many causes of declining employment in the industry, we must recognize that offsets are one identifiable cause. Calculations of the impact of these offsets, in terms of the costs of lost jobs for individuals and communities, are difficult to make. One major reason is a lack of information available to workers, from the companies or the government, about the exact nature, conditions, and requirements of offsets.

In such an environment, government has a strong role to play in developing a policy for offsets. In a

world where offsets are becoming more the norm—with the numbers, variety, and objectives of offsets increasing constantly—government must become the player that finds and puts together all the pieces of this jigsaw puzzle. Literally hundreds of variables exist in this policy matrix, and the issue is whether all the information necessary to deal constructively with offsets can be assembled and digested. For example, the 1996 National Export Strategy Report found that a "substantial" number of subcontractors had indicated problems stemming from offsets. The report also found that roughly a third of the offset transactions that year involved the aerospace industry. Of those, a third called for investments in production in the foreign customer's country, a situation leading rapidly to global overcapacity in the industry. If that translates to job losses in the U.S., or to the transfer of technology financed by public funds, workers and the public have the right to know.

However, information gathering is not enough. It must be followed by policy changes. This could include, for example, a program for workers who lose a job due to offsets. A task force or commission could be convened to provide a forum where the views of workers and the public could be voiced. Such a task force or commission might consider issues involving R&D, trade negotiations, WTO enforcement, export sales and financing, licensed production and coproduction, subcontractor production, countertrade, and others. Its effectiveness would depend on government's ability to gather and make available sufficient information, as well as to assure a "seat at the table" for all affected groups, not just the companies. As the Barber-Scott study pointed out, Herrnstadt emphasized that "every other serious aerospace nation has a coordinating body charged with nurturing and advancing aerospace manufacturing, technology acquisition, and of course, employment. The United States should do no less."

DISCUSSION

Dr. Wessner, addressing Mr. Johnson, asked if a broad-based forum designed to discuss offsets would meet the expressed need for more information and greater transparency. Mr. Johnson replied that, after ten years of gathering data on the topic, we know a lot about offsets but are no closer to achieving a consensus about their relative importance. In a market that has declined from $140 billion annually to $110 billion, offsets represent about $2 billion of value, according to the Commerce Department. Johnson noted that perhaps labor should accord more importance to that $30 billion decline in the size of the market than to the vastly smaller sum represented by offsets. Exports, having held steady in adjusted value over the past two decades, are the only portion of the aerospace business doing well. In the macroeconomic context, offsets represent a very small portion of American total output, total trade, and even of aerospace trade. Offsets are trade distorting, even an annoyance, but they do not change the mathematics of trade. Every export has a corresponding import somewhere. Offsets may change *who* gets impacted, and they make it clearer *which* jobs are negatively affected by trade. But realistically, *every* U.S. import potentially hurts some U.S. worker. Government may have a responsibility to cushion the social effects of economic change, but that should not be confused with the idea that government ought to try to manage that change, with the risk that it would reduce the flexibility of the U.S. economy to deal effectively with change.

Another speaker raised the point that the American taxpayer, as a shareholder in U.S. technology, should benefit from future yields of having invested in that technology. Many companies are doing well on the fruits of technology that was originally financed through Congressional action, from public coffers. The private sector ought to show some accountability for how it uses that technology. He asked Johnson's response to that view.

In response, Johnson suggested one consider the likely situation *without* offsets, arguing that in the absence of offset-related exports, there would not be a single fixed-wing fighter production line in the U.S. today. The major investment made by the taxpayers in production lines, for the F-16 and F-15 fighters, along with the jobs it created, would no longer exist. Without the continuing revenues from exports, the public investment in those lines would have been lost entirely.

Moreover, Johnson noted that gearing up production would then be much more expensive for taxpayers, because new production lines would have to be built from scratch, and skilled workers would have to be recruited and probably trained in significant numbers. That is the other side of the offsets coin. The U.S. military bought only 20 planes last year, most of them C-17 transports. At a low point in U.S. defense procurement, and with a transition period between mature systems and new ones still in the development stage, it is exports that keep the defense aerospace business alive. That $10–12 billion in revenues keeps U.S. taxpayers from having to pay enormously greater amounts either to purchase unneeded aircraft for the U.S. military, or to restart closed production facilities or build new ones for the next generation of planes. In that sense, foreign sales provide a tremendous financial yield to the American public and the industry workforce.

Robert Scott responded that exports and their value

were not at issue. Rather it was a matter of other countries intervening in the market in ways that progressively cost more U.S. jobs and put the U.S. technological base and future industrial capabilities at risk. Is there a way to change the rules of the game to make it more equitable for U.S. producers and workers?

Another participant remarked that exports are, to some degree, independent of offsets in the sense that a buyer must want the exported product in the first place; otherwise there would be no offsets attached to them. In this sense, offsets and exports are not as inextricably linked as has been claimed.

Johnson responded by saying that no company sets out to do offsets, but rather is forced to grant them in order to make sales. All U.S. *defense* exports are, after all, to other governments; it is foreign governments that insist on offsets. Offsets are in a sense a bundling of a number of activities, which can be bought openly on the market from any number companies and would show up on the balance sheet as exports. Offsets simply bundle those activities in order to make them more palatable to foreign politicians. They are not alone; the U.S. government imposes many "domestic" offsets, $40 billion in fact. The aerospace industry is good at doing domestic offsets—for example, allocating production to ensure Congressional support for defense programs. The Congress also requires them of U.S. companies doing business in the U.S., in the form of minority set-asides, small business set asides, women-owned set-asides, etc. All of these requirements are market distortions placed on industry by government. In the case of offsets, it is just a foreign government introducing the distortion.

With the conclusion of the last panel, Dr. Wessner called on Ambassador Wolff for his summary of the day's discussion.

Overview

An Overview of the Issues: What, If Anything, Needs To Be Done?

Alan Wm. Wolff, STEP Board

As a point of departure, Ambassador Wolff recalled Senator Bingaman's statement that the status quo is unacceptable, because the costs to the U.S. economy are too great to continue accepting offsets as a business necessity. Insofar as his views presumably represent a sampling of Congressional sentiment, it is evident that a real set of issues exists around offsets. While recognizing that a synthesis or summation of the day's proceedings could not do justice to the breadth of opinions represented by the panelists, several observations were nevertheless in order.

A first question: Is there room for improvement? Most of those who spoke were opposed, in varying degrees, to the use of offsets, which were seen as burdensome to economic transactions. The major reason for engaging in offsets is straightforward: there is great benefit in securing a sale. On the other hand, offsets can be harmful to the health of the sub-tier supply base, to aerospace employment, and to the broader competitive edge. Wolff observed, moreover, that there was no representation at the conference of the "innocent bystander," the type of non-defense company whose economic interests may be sacrificed by indirect offsets that distort the normal operation of its market.

The credibility of international trade agreements is challenged by the existence of a significant portion of trade lying beyond the reach of agreements that are designed to ensure that trade occurs on the basis of commercial considerations. Cartels, Wolff noted in passing, are another weak point in the trading system, and discussions are beginning in Geneva on the degree to which cartel behavior distorts normal market operations.

Referring to parallels in the current intense debate about the desirability of regulating the Internet, Wolff observed that there is a widespread feeling that the issues surrounding offsets may be too complex to resolve through government intervention without causing unintended harm to trade. Company goals and missions are, after all, relatively straightforward—chief among them is maximizing returns for stockholders. However, U.S. national goals, and thus the U.S. government's missions, are necessarily broader: national defense, a rising standard of living, and social and economic equity. For other countries, such as Japan, national government missions may come closer to an identity of interests with the corporate and public sectors.

Wolff noted one panelist's observation that offsets are not currently on the U.S. trade negotiations agenda. However, the accession of China to the WTO is on the table, and China is a major offsets practitioner. This underscores the fact that for the WTO, China's accession raises a number of larger questions. These include:

- Market access. What exactly is the value of an open market commitment in a nonmarket economy?
- State-owned enterprise (SOE) behavior. What will be the response of these state enterprises to a Chinese government "Buy Chinese" policy, since the stockholder is also the government? What will be the consequences for fair trade and China's reliability as a trading partner? Does this problem also occur with recently "privatized" entities in other economies?
- Forced technology transfer. Nothing currently in the WTO (GATT) addresses the issue; it might be handled as a Trade-Related Investment (TRIM) issue, but the rules do not cover it.
- Subsidies. The existing rules do not reach nonmarket economies. The international system does not effectively address many forms of subsidy.
- Non-market economy (NME) dumping. How do we treat excess capacity that results from nonmarket transactions?
- The size and political-diplomatic clout of China. As a new member with its own—different—agenda, China will affect WTO interpretations and enforcement actions in ways a smaller new member might not.

There is a window of opportunity now, opened by the White House, to pull together suggestions on creating a national strategy to deal with offsets. Although a national strategy may be lacking, individual agency interests are clearly articulated, and other U.S. "players" have defined their interests as well. However, reliable data is limited and subject to differing interpretations, and there are no obvious conclusions to be drawn from current data. One suggestion would be to create a mechanism, as the European Union has, to funnel comments from industry (on a confidential basis) into a computerized database on obstacles faced in selling abroad. In the absence of a private sector consensus on what approach government should take, what actions to employ, broad government intervention is not likely. However, a variety of public interests—many of which were expressed during the conference—should be recognized and catalogued, and brought into the discussion.

Wolff noted the need for monitoring of foreign industrial policies. These policies go well beyond offsets, which are for some countries just one aspect—one tool—of a multifaceted approach to economic development. This conference demonstrates the importance of having the analytical ability to understand how those countries view such tools as industry-building measures, in order to determine what type of response, if any, the United States should take. An effective response requires consensus, and building a consensus is best attempted domestically first, and only subsequently at the international level. There is hope for creating the necessary consensus. The export credits race was greatly dampened, if not extinguished, through building an international consensus. The process, however, proved that domestic agreement was needed to present a solid U.S. front in the search for a common set of interests on the international level. The U.S. recently agreed with the European Union and countries representing 90 percent of trade in information technology products on duty-free trade in those goods. The consensus was achieved because the participants became convinced that it served their best interests to eliminate tariffs. A similar, common realization of enlightened self-interest underpins the recent agreements on trade in telecommunications services. So there is precedent for finding international concurrence on offsets, but equally so, precedents for establishing it domestically first.

In the case of offsets, this workshop has demonstrated the value of a balanced exchange of views. It has helped many of us understand the pressures industry faces in the international competition for large contracts, rich in follow-on work. We now have a better appreciation of some of the trends in countries' demands for offsets. And equally interesting questions have been raised about the cumulative and long-term consequences of these offsets, particularly when integrated with the other industrial policy tools of U.S. competitors for this and other strategic industries. The discussion has also underscored the challenge these practices and policies represent for current multilateral agreements and, more broadly, for the multilateral trading system as a whole. Integrating countries with different assumptions and priorities into the WTO is a significant challenge, and one that can only be addressed when the U.S. is able to identify its own long-term economic interests.

On behalf of the STEP Board, Wolff noted that it was the Board's hope that today's discussions represent a contribution towards a better understanding of the issues we were asked to address. This type of forum, and indeed more informal gatherings, represents one of the best means of building a consensus among the stakeholders in this industry as to what would constitute appropriate U.S. policy on offsets. At the very least, it could contribute to a better exchange of information, which seemed to be one of the principal needs emerging from today's discussion.

In closing, on behalf of the STEP Board, Ambassador Wolff thanked the panelists, the other participants from the Academy, in particular the president of the National Academy of Engineering, Wm. A. Wulf, and the project director, Charles Wessner and his able assistant, George Georgountzos. Most particularly, the Ambassador thanked all the participants in the conference for their interest, contributions, and attention over the last nine hours.

APPENDIXES

APPENDIX 1

Issues Paper on Policy Issues in Aerospace Offsets

Kenneth Flamm[1]

June 9, 1997

ISSUE 1: WHAT EXACTLY IS AN OFFSET?

When a government intervenes in the terms of a commercial transaction to require an additional transfer of goods, services, or other commitments by a vendor which are not required to support the original sale, this is often referred to as an offset. The 1996 National Export Strategy described offsets as compensation packages resulting from contract negotiations for large purchases, such as aircraft. Offsets include a broad range of activities such as mandatory coproduction, licensed production, subcontractor production, technology transfer, countertrade, and foreign investment. In addition, offsets can be categorized as direct or indirect, though a given transaction may involve both types. Direct offsets refer to compensation directly related to the system being exported, whereas indirect offsets refer to compensation unrelated to the exported item.[2]

Offsets may typically include such things as transfers of technology, agreements by the seller to purchase from local suppliers with some connection to the buyer, agreements to invest in production or other facilities in geographical proximity to the buyers, or agreements by the seller to meet certain performance targets (e.g., export requirements) or undertake other related activities (e.g., countertrade) on behalf of the buyer. One can even point to certain transactions that might be regarded as "reverse offsets," with the vendor reducing price or providing additional services in exchange for commitments by the buyer that would not normally be part of a "straight" sale (for example, agreement by aircraft vendors to reduce prices in exchange for buyer agreements to exclusively purchase their product over some future period).

Offsets, if defined merely as the activities listed above, are not uncommon in purely private arrangements between private companies operating in today's global markets. Many agreements associated with the rapid growth of so-called "strategic alliances" among multinational companies tie other commitments and activities in with the sale of goods and services to strategic partners. The overt or covert intervention by a government into the terms of what otherwise might be a purely private transaction can make an offset a legitimate subject for government policy.

ISSUE 2: WHY IS GOVERNMENT INVOLVED IN OFFSETS?

There are fundamentally five reasons governments get involved in offsets:

I. Industrial Policy. In economies where government has an explicitly developmentalist view of its role in promoting industrial growth, governments often intervene to improve the terms of bargaining between national industry and foreign investors and vendors. Explicit restrictions and a government-run approval process for foreign investment, technology agreements, and access to local markets can be used to reduce or minimize competition among domestic customers in negotiations with foreign sellers, or otherwise increase the bargaining power of the domestic players vis-à-vis foreign interests. The restrictions are designed to improve the terms on which foreign goods and services are purchased. Obviously, in "commodity" markets with many vendors and a price that approximates long-run costs of production, there is little

[1]While the basic content of this Issues Paper was contributed by Dr. Kenneth Flamm, substantial changes and additions were made by the NRC staff to facilitate the workshop discussion.

[2]Trade Promotion Coordinating Committee, *National Export Strategy: Toward the Next American Century: A U.S. Strategic Response to Foreign Competitive Practices.* U.S. Government Printing Office, Washington, D.C., 1996, p. 155.

scope for such policies to accomplish much. In imperfectly competitive markets, however, with small numbers of sellers or buyers, such policies can significantly affect the terms and consequences of final agreements.

II. Jobs and Exports. In economies where government has a major influence on the behavior of certain sectors (because of public ownership or regulation), governments are frequently tempted to impose formal or informal offset requirements on procurement from abroad that are linked to politically popular goals like jobs or export creation.

III. Defense Base. In all countries, defense purchases (closely linked to the aerospace sector) are undertaken by a single customer (the government) with a noneconomic goal (national security). Transactions involving domestic and foreign defense firms (and nondefense goods and services with defense applications) are scrutinized and shaped by all governments to reflect their perceived national security interests. In today's international system, national security often has an explicit economic component, such as protecting or stimulating the defense-industrial base. However, in many parts of the world, national security is seen as synonymous over time with industrial strength and national technological capability. Consequently, these broader economic goals are pursued with the sustained national commitment and breadth of policy mechanisms usually reserved in the United States for national defense.[3]

IV. Public Funding of R&D. Government funds a major portion of the R&D going into defense, including the aerospace sector. While private firms are probably best equipped to secure the deals that capture the maximum return on private investments in new technology, the same may not hold true when it comes to securing the maximum national return on public investments in new technology.

For example, if $15 billion is invested in developing a new engine technology, a firm may logically consider its direct return from licensing the technology and $3 billion in lost profits on possible future sales won by its now more competitive foreign licensee, and decide that $4 billion in licensing fees is a good deal. If the company alone invested in the technology, that would be the end of the discussion. If the government funded the $15 billion, however, and made the resulting know-how available to multiple U.S. companies, it might reasonably want a U.S. company to consider the possible costs of future competition to **other** U.S. firms as well. If this future loss from the new competition to all U.S. firms were, say, $6 billion, the $4 billion licensing deal would be a whole lot less attractive from a national perspective. This is not a calculation that the U.S. company would normally make in evaluating the deal from its own purely private perspective, but might be the appropriate one in considering the transfer of know-how based on publicly funded R&D.

V. Trade Issues: Export Subsidies, Dumping? Offsets might be regarded as a form of subsidy to exports (since other goods, services, and commitments with some economic value are being bundled into a sales transaction). There are restrictions on subsidies and pricing behavior in international trade that discipline the use of such subsidies, and governments therefore are interested in offsets as a trade issue in sectors where they may be used to promote exports by national companies. The defense sector (including much of aerospace) is unique in this regard, in that the national defense exception written into the GATT exempts defense goods and services from some of the effects of these disciplines. The limits on "green-lighting" of R&D subsidies to product development in commercial sectors, for example, arguably do not apply to defense articles. Indeed, one might even argue that what might be labelled as "dumping" (sales of products at prices that do not cover the fully loaded—including R&D—cost of production) is routine practice in international sales of defense articles.

ISSUE 3: WHAT POLICY ISSUES RELATED TO OFFSETS SHOULD BE ADDRESSED BY THE U.S.?

1. Unilateral Action. To what extent should U.S. policy attempt to unilaterally counteract foreign offset policies when these are designed to improve the terms of trade for foreign parties at the expense of U.S. economic interests? What tools could be used to this end? Is the U.S. government equipped to make the economic judgments needed to support an activist policy?

2. Multilateral Rules. The special role of aerospace in discussions of offset policies is clearly related to its close linkages to defense, on the supplier side, and to procurement by government departments, and state-owned or -operated enterprises, on the demand side. Offsets are not a policy issue in other sectors where trade and investment are clearly covered by the GATT or by OECD investment codes. To what extent should the U.S. take the lead in discussions of some international agreement establishing rules of the game on offsets in defense-related trade and government procurement?

[3]National Research Council, *Conflict and Cooperation in National Competition for High-Technology Industry.* National Academy Press, Washington, D.C., 1996, pp. 12-41 and pp. 117-119.

3. Augmented National Security and Competitive Advantage. Offsets are a competitive tool in an increasingly cutthroat global market for defense equipment. The U.S. is alone in being able to sustain a viable, broad-based defense industry solely on the strength of its large domestic market; other countries with advanced arms industries must export substantial volumes of defense goods into a shrinking global market just to keep their industrial base economically sustainable. Similarly, the ability of U.S. civil aircraft manufacturers to extend offsets provides an advantage in the global competition with Airbus, though this advantage may be reduced by the willingness of the government participants in the Airbus consortium to offer other inducements.

4. Current Trends. With the end of the Cold War, the subsequent downsizing of national defense efforts, and the increasing reliance on dual-use technology programs, the importance of the civil aerospace industry has significantly increased.[4] The objectives of offsets, both for the nations (or firms) that accede to them and the nations that impose them, have shifted significantly. Increasingly, the emphasis is on the acquisition of new technologies and manufacturing skills, often with an export objective. In this environment, the goals of equipment commonality and force modernization, while still important, must be weighed against the increasing competition for technological capabilities with both defense and civilian applications. A similar assessment may be useful with respect to offsets in civil aircraft markets.

In a global economy characterized by the emergence of technologically competent competitors, does the U.S. still have sufficient competitive advantage to accept offset requirements that involve shifts in employment and transfers of advanced technologies in order to make today's sale? This question is especially relevant insofar as these transfers are known to constitute integral parts of national programs targeted on strategic industrial sectors such as aerospace. In short, what is the likely long-term impact of offsets on

- the U.S. defense base;
- U.S. industrial competitiveness;
- high-wage employment; and
- the composition of U.S. exports?

5. Assessment Mechanisms and Multilateral Options. Economics and national security are inextricably intertwined in defense industries and civil dual-use technologies. Consequently, any policy on the rules of the game for sales of defense or other high-technology goods may require a framework that addresses a whole complex of linked economic and security issues. The U.S. has historically charted these dangerous waters by making all arms sales policy decisions on a case-by-case basis, that is, by steering clear of anything resembling a coherent, articulated, and explicit resolution of some of these tradeoffs. Should we be thinking about a more coherent policy, including a strategy for negotiating the international arrangements it will require? Are the U.S. government and industry anywhere near the internal consensus required before we attempt to pressure our allies to resolve the same issues we have consistently refused to address?

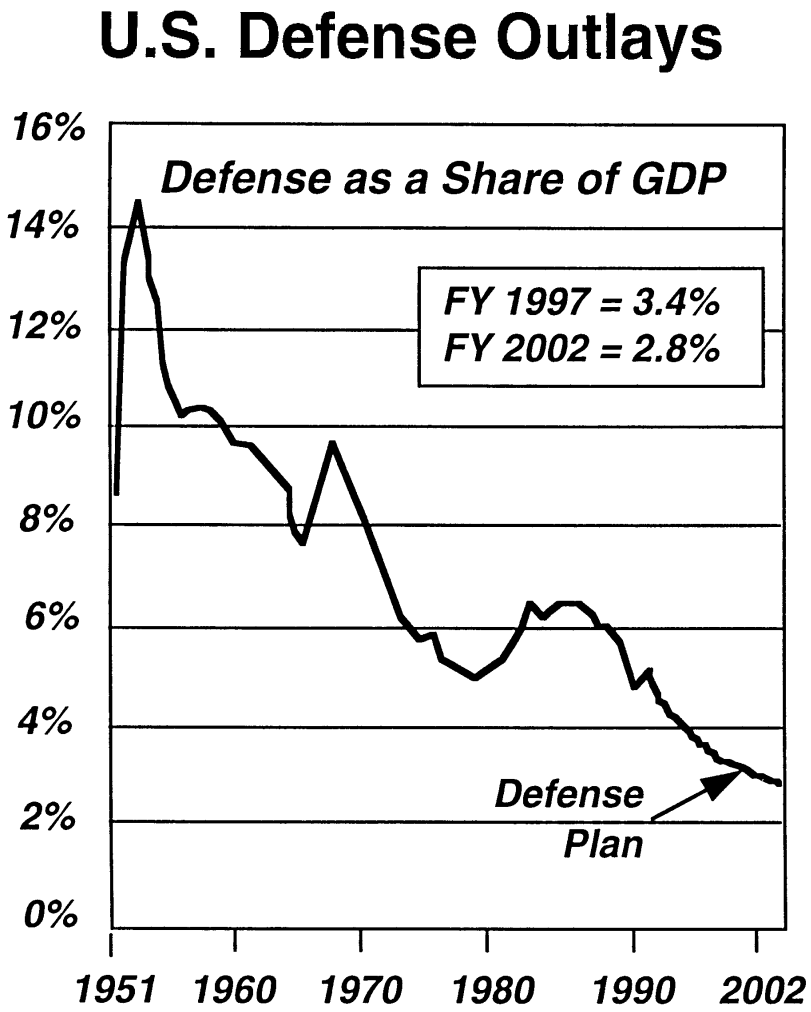
Lastly, there is the question of institutional mechanisms. Does the United States government have a means of integrating the issues associated with aerospace offsets on a sustained basis? The 1994 National Research Council report, *High-Stakes Aviation,* argued that there is no institutional mechanism that is committed to the development of a U.S. aviation strategy and that can understand and include the views of the relevant stakeholders and identify concrete measures to sustain and improve the competitiveness of the U.S. aerospace industry.[5]

[4] *Ibid.,* p. 76 and pp. 152-158.

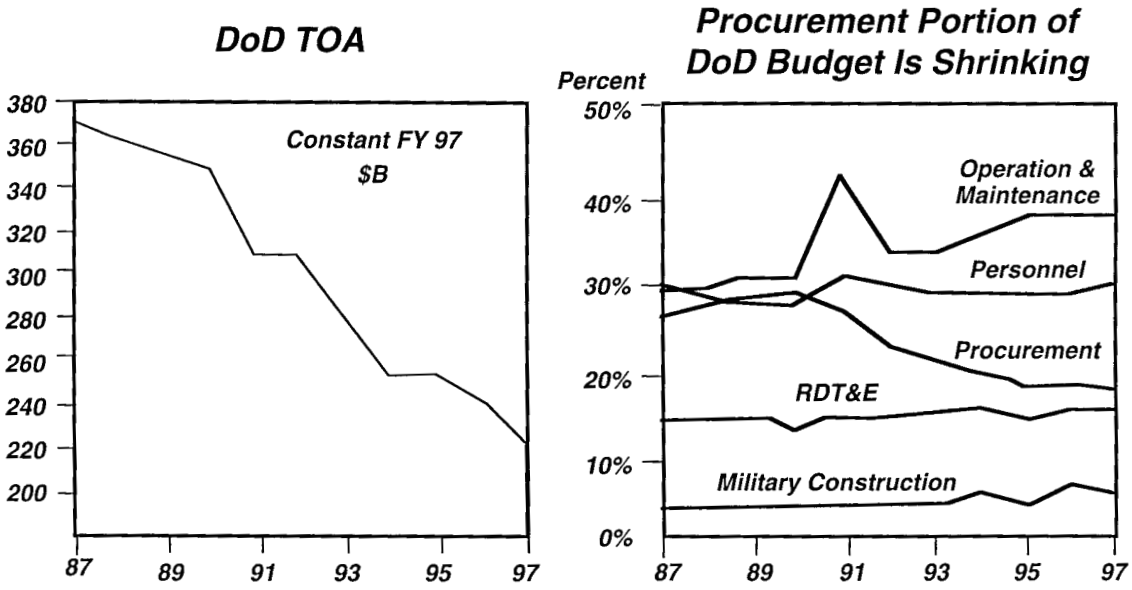
[5] National Research Council, *High-Stakes Aviation: U.S.-Japan Technology Linkages in Transportation Aircraft*. National Academy Press, Washington, D.C., 1994, p. 7.

APPENDIX 2

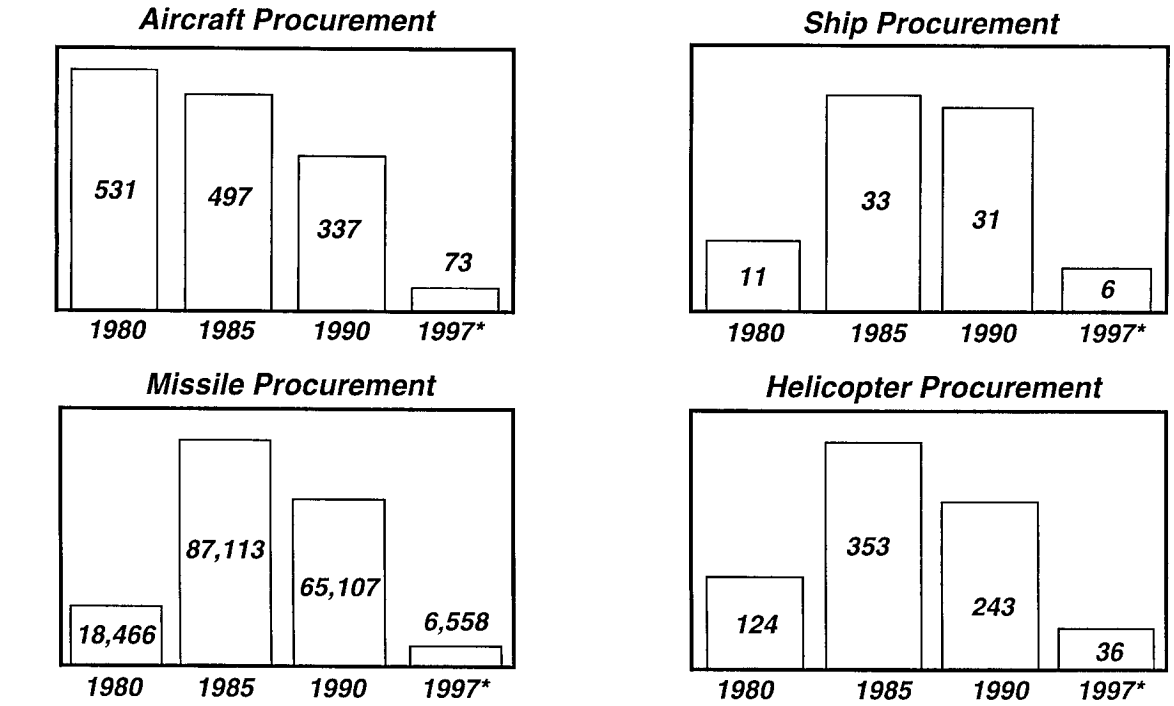
Global Trends in Defense Aerospace



Declines Are Hitting Procurement Hard

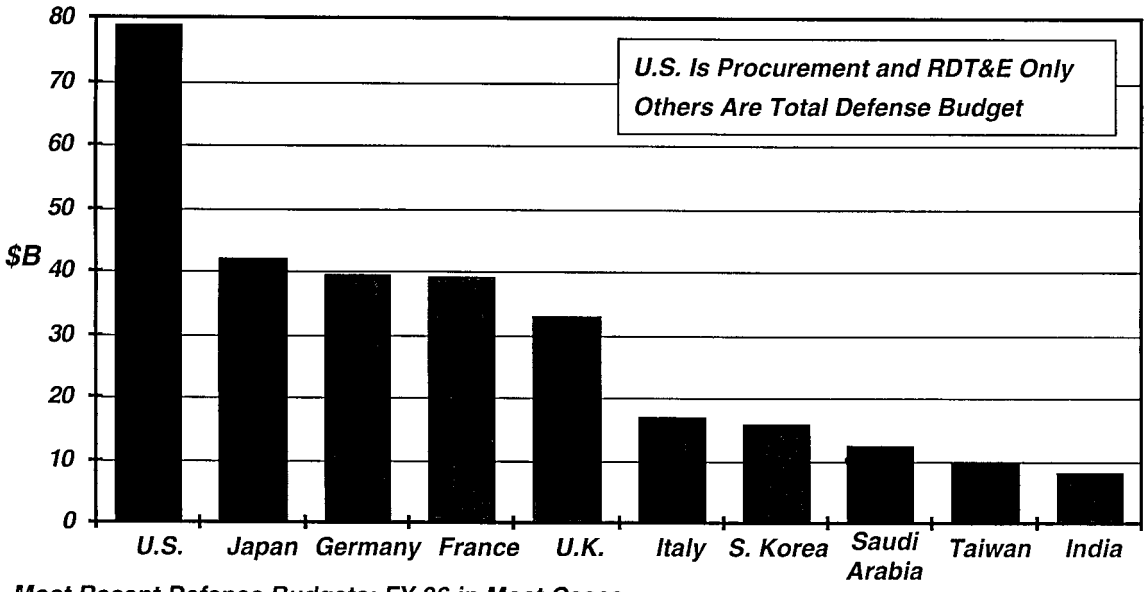


Weapon System Procurement Levels
(Fiscal Year)



*FY 97 Budget Requests

International Defense Market

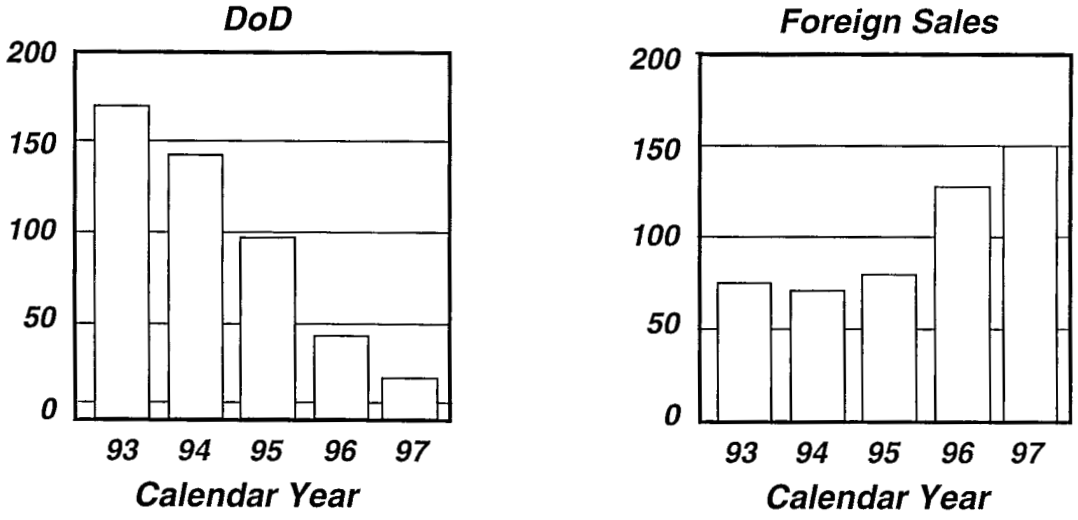


Most Recent Defense Budgets: FY 96 in Most Cases

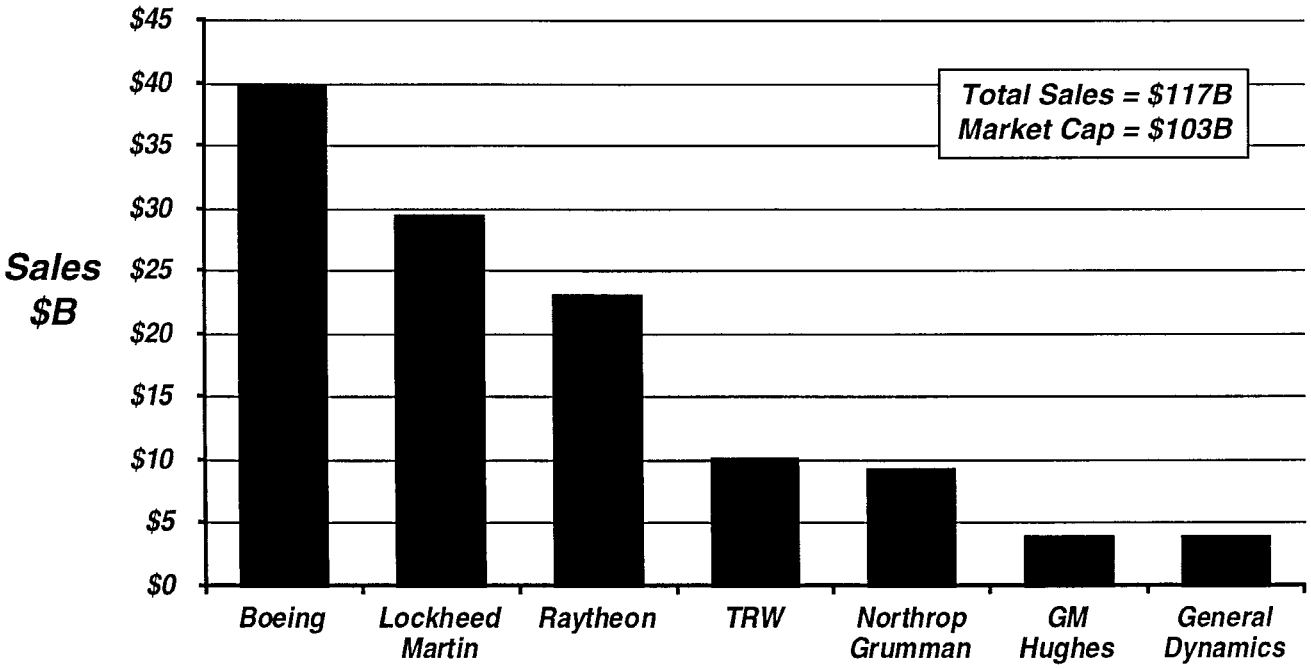
U.S. Procurement/R&D Is At Least Twice the Size of the Total Defense Budgets of World's Other Powers

International Markets Are Becoming More Important

U.S. Combat Aircraft Production



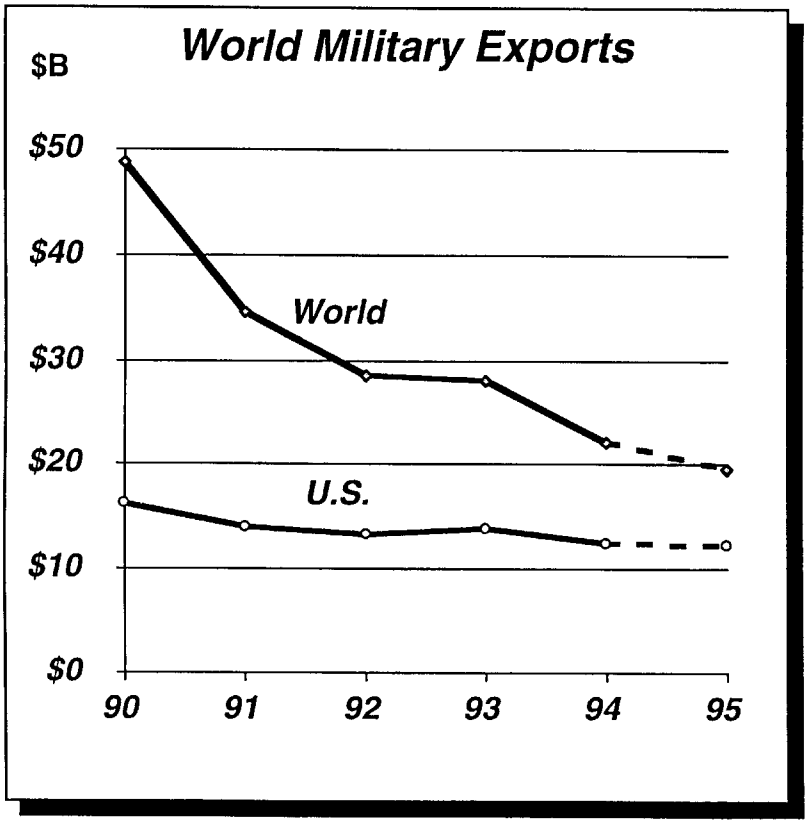
The US Defense Industry - 1996 Pro Forma



The European Aerospace Industry

1995 Sales	Company	
$11.0B	Dassault Aerospatiale	(France)
10.0B	DASA	(Germany)
9.5B	Airbus	(Consortium)
9.0B	British Aerospace	(UK)
7.5B	Thomson CSF	(France)
4.7B	GEC Marconi	(UK)
3.6B	Finmeccanica	(Italy)
2.1B	Celsius	(Sweden)
2.1B	Matra	(France)

Military Export Sales



APPENDIX 3

Workshop Participants[1]

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Steve Austin
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Bruce Bade
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Randy Barber
Center for Economic Organizing

Joyce Bargeman
National Research Council

Lisa Barry
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Sally Bath
Department of Commerce

Darby Becker
General Aviation Manufacturers Association

Jeff Bingaman
United States Senate

Chip Block
Veda, Inc.

Paul Blustein
The Washington Post

Ed Bolen
General Aviation Manufacturers Association

John Boright
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Brad Botwin
Department of Commerce

Kirk Bozdogan
Massachusetts Institute of Technology

Richard Bradshaw
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Lee Buchanan
DARPA

Andrew Button
McDonnell Douglas

Ginger Carney
McDonnell Douglas

Robin Carreras
Rockwell International

Dennis Chamot
National Research Council

Jane Cicala
The Boeing Company

[1]Speakers are italicized.

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National Research Council

Steve Clemons
Office of Senator Jeff Bingaman

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National Research Council

William Cosper
General Dynamics

Michael Daum
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Debi Davis
TRW

William Denk
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Kari Dohn
Department of Commerce

Robert Donovan
Department of Commerce

Mortimer Downey
Department of Transportation

Martin Duggan
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Michael Dupree
General Dynamics

William Eager
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Christine Fisher
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George Georgountzos
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Andrew Gilmour
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William Greider
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James Grimaldi
Seattle Times

John Hager
Alliant Techsystems

Patrick Hall
The Boeing Company

Gerald Hane
White House Office of Science and Technology Policy

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Gordon Healy
Bell Helicopter

John Heere
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Stephen Hull
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Arthur Ismay
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Lauri Kay
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Elliott Kaye
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William Keller
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John Kingery
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Jay Korman
DFI International

Margaret Kostic
Export-Import Bank

Anne-Marie Lasowski
General Accounting Office

Richard Lewis
Department of Defense

David Louscher
Foresight International

Lora Lumpe
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Joel Marsh
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Gregory Martin
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Larry McCray
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Jon Montgomery
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Stephen Moran
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Theodore Moran
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David Mowery
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Peter Muhlrad
AxTrade, Inc.

David Mulholland
New Technology Week

Patrick Mulloy
Senate Banking Committee

Edward Murphy
Department of the Treasury

Thomas Murtagh
Department of Defense

Benjamin Nelson
General Accounting Office

Susan Nelson
Countertrade

John Neumann
General Accounting Office

Brian Nilsson
Department of Commerce

James Nobles
Nobles & Associates

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Bibliography

Alliance Politics and Economics: Multinational Joint Ventures in Commercial Aircraft. Ballinger, Cambridge, Mass., 1987

Barber, Randy and Robert E. Scott, *Jobs on the Wing: Trading Away the Future of the U.S. Aerospace Industry.* Economic Policy Institute, Washington, D.C., 1995

Bracken, Paul, *Non-Standard Models of the Diffusion of Military Technologies: An Alternative View.* Technical report prepared for the Director of the Office of the Secretary of Defense, Net Assessment. Joint Management Services, Dunwoody, Georgia, February 1997

Cole, Jeff, "Report Assails Defense-Sector `Offset' Deals," *Wall Street Journal,* June 22, 1994

Defense Science Board Task Force on *Vertical Integration and Supplier Decisions.* Office of the Secretary of Defense, Department of Defense, Washington, D.C., 1997

Department of Commerce, *Offsets in Defense Trade: A Study Conducted Under Section 309 of the Defense Production Act of 1950, As Amended.* Bureau of Export Administration, Washington, D.C., 1997.

— *Offsets in Defense Trade: A Study Conducted Under Section 309 of the Defense Production Act of 1950, As Amended.* Bureau of Export Administration, Washington, D.C., May 1996

Eisenhour, John H., *Offset: The Political Dimension of Countertrade,* unpublished manuscript, 1994

"Federal Funding of Research Development in Transportation: The Case of Aviation," Presented at the Symposium on the Effects of Federal R&D, National Academy of Sciences, Nov. 19–20, 1985. *The Effects of Federal Research Funding.* National Academy Press, Washington, D.C., 1986

General Accounting Office, *Asian Aeronautics: Technology Acquisition Drives Industry Development,* NSIAD-94-140, Washington, D.C., May 1994

— *International Trade: Long-Term Viability of U.S.-European Aircraft Agreement Uncertain,* GGD-95-45, Washington, D.C., December 1994

— *Military Exports: Concerns Over Offsets Generated with U.S. Foreign Military Financing Program Funds,* NSIAD-94-127, Washington, D.C., June 1994

— *Military Exports: Offset Demands Continue to Grow.* GAO/NSIAD-96-65, Washington, D.C., April 1996

— *Military Sales: Concerns Over Offsets Generated Using U.S. Foreign Military Financing Program Funds (Testimony),* T-NSIAD-94-215, Washington, D.C., June 1994

Greider, William, *One World, Ready or Not: The Manic Logic of Global Capitalism.* Simon & Schuster, New York, N.Y., 1997

Johnson, Joel L., "The United States: Partnership with Europe," in Ethan B. Kapstein, ed., *Global Arms Production: Policy Dilemmas for the 1990s.* University Press of America, Lanham, Maryland, 1992

Louscher, David J., *The Competitive Environment for Future International Defense Systems Sales, Vol. I.* Foresight International, Bath, Ohio, April 1997

Louscher, David J. and Michael D. Salomone, *Marketing Security Assistance: New Perspectives on Arms Sales.* Lexington Books, Lexington, Mass., 1987

Lumpe, Lora, "Sweet Deals, Stolen Jobs." *The Bulletin of the Atomic Scientists,* September/ October 1994, pp. 30-35

Manufacturers Alliance, *Offsets in Foreign Sales of Defense and Nondefense Equipment: A Manufacturers Alliance Review.* Arlington, VA, February 1997

Martin, Stephen, *The Economics of Offsets: Defense Procurement and Countertrade.* Harwood Academic Publishers, The Netherlands, 1996

Maskus, Keith E. and Denise R. Eby, "Developing New Rules and Disciplines on Trade-Related Investment Measures," in Robert M. Stern, ed., *The Multilateral Trading System: Analysis and Options for Change.* University of Michigan Press, Ann Arbor, 1993

Mastel, Greg, *The Rise of the Chinese Economy: The Middle Kingdom Emerges.* M.E. Sharpe, Armonk, N.Y., 1997

Mintz, John, "GAO Report Critical of Military `Offsets,'" *The Washington Post* June 22, 1994

Mowery, David C., ed., *International Collaborative Ventures in U.S. Manufacturing.* Ballinger, Cambridge, Mass., 1988

Mowery, David C. and Nathan Rosenburg, "Government Policy and Innovation in the Commercial Aircraft Industry, 1925-75." In R.R. Nelson, ed., *Government and Technical Change: A Cross-Industry Analysis.* Pergamon, New York, N.Y., 1982

— "Commercial Aircraft: Cooperation Between the U.S. and Japan." *California Management Review,* 1985, pp. 70-92

National Research Council, *Conflict and Cooperation in National Competition for High-Technology Industry.* National Academy Press, Washington, D.C., 1996

— *High-Stakes Aviation: U.S.-Japan Technology Linkages in Transport Aircraft.* National Academy Press, Washington, D.C., 1994

Office of Management and Budget, *Impact of Offsets in Defense-Related Exports: A Summary of the First Three Annual Reports.* U.S. Executive Office of the President, Washington, D.C., December 1987

— *Offsets in Military Exports.* U.S. Executive Office of the President, Washington, D.C., July 16, 1990

— *Second Annual Report on the Impact of Offsets in Defense-Related Exports.* U.S. Executive Office of the President, Washington, D.C., December 1986

Office of the Secretary of Defense, *Report of the Quadrennial Defense Review.* Department of Defense, Washington, D.C., May 1997.

Office of Technology Assessment, *Global Arms Trade: Commerce in*

Advanced Military Technology and Weapons. Congress of the United States, Washington, D.C., 1991

"Partnership: The Price of Entry." *Aerospace America,* June 1996, pp. 29-32

Samuels, Richard, *Rich Nation, Strong Army: National Security and the Technological Transformation of Japan.* Cornell University Press, Ithaca, N.Y., 1994

Scott, Robert E. and Randy Barber, "Aircraft: Offsets Eroding U.S. Technological Lead," *New Technology Week,* October 15, 1996, pp. 5-6.

Sperling, James, David Louscher, and Michael Salomone, "A Reconceptualization of the Arms Transfer Problem." *Defense Analysis,* vol. 11, no. 3, 1995, pp. 293-311

"Tools of the Trade: Offsets, Outsourcing, and Joint Ventures." *Aerospace America,* September 1996, pp. 10-12

Trade Promotion Coordinating Committee, *National Export Strategy: Toward the Next American Century: A U.S. Strategic Response to Foreign Competitive Practices.* U.S. Government Printing Office, Washington, D.C., October 1996

Tyson, Laura, *Who's Bashing Whom: Trade Conflict in High-Technology Industries.* Institute for International Economics, Washington, D.C., 1992

Udis, Bernard and Keith E. Maskus, "Offsets as Industrial Policy: Lessons from Aerospace," *Defense Economics,* vol. 2, 1991, pp. 151-164

Womack, James, Daniel Jones, and Daniel Roos, *The Machine that Changed the World.* Rauson Associates, New York, N.Y., 1990.