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THE DEBATE OVER INTERNATIONAL ARMAMENT  
 PROGRAMS: INTEGRATING CURRENT  
 KNOWLEDGE AND THE FSX CASE

THESIS

Thomas P. Griffin  
 Captain, USAF

AFIT/GCM/LSY/89S-6

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AFIT/GCM/LSY/89S-6

THE DEBATE OVER INTERNATIONAL ARMAMENT PROGRAMS:  
INTEGRATING CURRENT KNOWLEDGE AND THE FSX CASE

THESIS

Presented to the Faculty of the School of Systems and Logistics  
of the Air Force Institute of Technology

Air University

In Partial Fulfillment of the  
Requirements for the Degree of  
Master of Science in Contracting Management

Thomas P. Griffin, B.A.

Captain, USAF

September 1989

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Table of Contents

	Page
Acknowledgements . . . . .	ii
List of Figures . . . . .	v
List of Tables . . . . .	vi
Abstract . . . . .	vii
I. Introduction . . . . .	1
Chapter Overview . . . . .	2
General Issue . . . . .	2
Objective of the Research . . . . .	2
Justification . . . . .	3
Scope of the Research . . . . .	5
Sequence of Presentation . . . . .	5
II. Methodology . . . . .	7
Chapter Overview . . . . .	7
Research Method . . . . .	7
Methodology Justification . . . . .	9
Limitations of the Research . . . . .	13
III. Literature Review . . . . .	16
Chapter Overview . . . . .	16
International Cooperative Programs . . . . .	16
Defense Industrial Base . . . . .	34
Technology Transfer . . . . .	60
Trade and Competition . . . . .	75
Chapter Summary . . . . .	100

60 n For	<input checked="" type="checkbox"/>
75 A&I	<input type="checkbox"/>
100 ced	<input type="checkbox"/>
ation	<input type="checkbox"/>

By _____	
Distribution/	
Availability Codes	
Dist	Avail and/or
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	Page
IV. Case Analysis . . . . .	102
Introduction . . . . .	102
Japan . . . . .	102
FSX History . . . . .	124
FSX Negotiations . . . . .	128
The FSX Debate . . . . .	130
Resolution . . . . .	144
V. Findings and Conclusions . . . . .	151
Introduction . . . . .	151
Importance of this Research . . . . .	151
International Armament Program "Realities" . . . . .	152
The International Armament Program "Environment" . . . . .	155
The International Armament Program Framework . . . . .	158
Application to the FSX Case . . . . .	168
Conclusions . . . . .	170
Appendix: Interview List . . . . .	178
Bibliography . . . . .	179
Vita . . . . .	188

List of Figures

Figure	Page
1. Continuum of International Cooperative Projects . . . . .	20
2. Cooperative Project Trends . . . . .	25
3. Decline in the "Lower Tiers" . . . . .	44
4. Foreign Source/Dependence/Vulnerability . . .	49
5. U.S. Civil Aerospace Exports, by Country, 1965 . . . . .	85
6. U.S. Civil Aerospace Exports, by Country, 1985 . . . . .	85
7. U.S. Aerospace Imports, by Country, 1975 . . . . .	86
8. U.S. Aerospace Imports, by Country, 1985 . . . . .	87
9. F-16 Fighting Falcon . . . . .	103
10. Japan: The Scope of the Nation's Defense . .	107
11. Japanese Trade Figures . . . . .	122
12. Worldwide Inventory of F-16 A/B/C/D Aircraft . . . . .	138
13. U.S. Analysis of International Armament Programs . . . . .	167

List of Tables

Table		Page
1.	Total U.S. and Aerospace Balance of Trade, Calendar Years 1973-1987 . . . . .	83
2.	Composition of U.S. Exports . . . . .	84
3.	Composition of U.S. Imports . . . . .	86
4.	International Armament Program Framework . . .	159

Abstract

The purpose of this study was to develop a framework within which future international armament programs can be evaluated, negotiated, and managed.

International armament programs are gaining importance. Global interdependence, skyrocketing weapons costs, and increasingly capable allies make for a great opportunity to employ international programs. However, a fragile industrial base, global competition, and huge trade deficits also make international programs risky for the United States. Consequently, future international armament programs will demand expert and enlightened management. Those involved must be well-versed in the potential benefits as well as the risks of U.S. participation in international programs.

This research provides a solid foundation for the policy maker or the program manager. A comprehensive approach has been taken with the existing literature on international armament programs. Out of this review, a developing framework was derived for the evaluation and negotiation of international armament programs. To further develop this framework, a case study of a current international program was conducted. Through analysis of the FSX agreement between the U.S. and Japan, the framework

was refined to reflect issues arising out of the current economic, political, and military balances in the world.

The resulting framework provides a tool for those involved in the evaluation, negotiation, and management of future international armament programs. By encompassing the major issues involved in today's international arrangements, the framework can be used not only to educate, but also to guide. Tailored to meet a wide variety of scenarios, the framework can be applied to a future international program as an aid in the evaluation of whether the U.S. should participate in the arrangement. For those agreements the U.S. decides to enter, the framework can be applied to negotiations as a tool to help ensure U.S. interests are protected.

THE DEBATE OVER INTERNATIONAL ARMAMENT PROGRAMS:  
INTEGRATING CURRENT KNOWLEDGE AND THE FSX CASE

I. Introduction

The purpose of this research was to thoroughly investigate international cooperative programs for military hardware. Starting with a comprehensive review of the existing literature on the subject, the study was further supported by analysis of a current international arrangement--the U.S.-Japan FSX codevelopment program for an advanced fighter aircraft. Specifically, the research was focused upon assimilating the issues involved in international ventures, and identifying any implications which the FSX holds for future U.S. international armament programs. Having analyzed the FSX program in particular and international cooperation in general, the final objective of the research was to develop a framework of knowledge within which future joint ventures can be evaluated, negotiated, and managed. This study contributes to the developing base of knowledge concerning international cooperative programs, their management, and their interaction with other national issues such as technology transfer, the defense industrial base, and international trade.

## Chapter Overview

This chapter provides a brief introduction to the research subject. The general issue, research problem, and scope of the research are identified. The chapter concludes with an overview of the remainder of the research.

## General Issue

International cooperative acquisition programs for military hardware are growing in number, frequency, and value. Additionally, the defense industrial base of the United States has deteriorated, and its health and viability are uncertain. Little is known about the effects of international armament programs on the defense production base, or other related national issues such as technology transfer and trade. Therefore, it is important not only to compile the issues and concerns over international programs, but also to determine the realized or potential impacts current international programs hold for future arrangements. Identifying and analyzing the economic, political, and military environment in which international programs operate is the general issue of this research.

## Objective of the Research

This study aims to assimilate the issues and factors involved in the evaluation and negotiation of international armament programs, synthesize these findings with the FSX case analysis, and develop a framework in which future

international programs can be evaluated, negotiated, and managed.

### Justification

The United States is becoming more and more sensitized to such national concerns as the growing balance of payment deficits with its trading partners, and the deterioration of its industrial base. In addition, an increasingly interdependent global economy is witnessing the rise of a variety of competitors to America's traditional trading strengths. With such issues dominating the headlines of newspapers as well as the hearings before Congress, the nation is accordingly sensitive to the idea of international cooperative programs. Such arrangements are not new; however, they have become more frequent, larger in value, and more widely publicized. The notion that cooperative programs may involve technology transfer to countries that may also be economic competitors of the U.S. makes for an explosive issue.

The defense industrial base is a vital component of U.S. national security. Not only does it produce the necessary material to wage war, but it also serves as a deterrent to potential aggressors and as a vital component of the overall economy. Also of importance is the growing realization that economic and trade strength are likewise necessary for national security. However, the impact which

international armament programs have on such national security concerns is largely unknown.

Therefore, international armament programs present somewhat of a "two-edged sword". On the one hand, such programs represent a unique opportunity for the U.S. in light of today's skyrocketing weapons costs and increasingly capable allies. However, international programs also present a risk for the U.S. due to the fragile industrial base, global competition, and huge trade deficits. Consequently, international armament programs demand expert and enlightened management. Those involved must be well-versed in the benefits as well as the risks of U.S. participation in international programs.

Further, the U.S.-Japanese FSX agreement to develop a fighter aircraft for Japan presents a unique opportunity to this study. The arrangement focuses on an aerospace product--an area critical not only to defense but to high-tech commercial industry as well. The FSX is a recent program; thus it is deeply entwined in all the national issues mentioned above. Moreover, the FSX is an arrangement with Japan--the United States' most threatening economic competitor. Consequently, the FSX program is an excellent subject for analysis of international cooperative programs and their relationship to other pertinent national issues.

This study will thus assimilate the issues and factors involved in the evaluation and negotiation of today's

international armament programs. Not only will the existing literature be analyzed, but the FSX case analysis will provide data on the most recent influences to the international arena.

#### Scope of the Research

The literature review of Chapter III provides an extensive background on international cooperative programs, the U.S. defense industrial base, technology transfer, trade and competitiveness, and Japan. The research findings of this study attempt to integrate the data developed through this search of the existing literature with that discovered in the FSX case analysis. Through such a synthesis of data, this study attempts to contribute to the developing pool of information on the environment of international programs.

#### Sequence of Presentation

Chapter II presents the methodology of this research, which is that of a case study. The limitations of case study research are also addressed.

Chapter III presents a literature review of the available data on international cooperative programs, the U.S. defense industrial base, technology transfer, and trade and competition.

Chapter IV presents an analysis of the FSX program, its history, the ensuing national debate, and the resolution of that debate.

Chapter V presents the recommendations and findings of this research report. The synthesis of the data obtained from the literature review and case analysis yields a framework which can be used for the evaluation, negotiation, and management of future U.S. international armament programs.

## II. Methodology

### Chapter Overview

This chapter explains the research methodologies employed to gather the data for this study. The research methods used are explained first, followed by the justification for the chosen methodologies. The chapter concludes with a review of the limitations of the particular research methods.

### Research Method

Case study was the primary research methodology utilized. A case study is problem-oriented and "represents an intensive study of phenomena using a variety of data sources and tools" (58:84). This technique requires intensive analysis of either the research subject (58:85), situations similar to the research problem (113:81), or both. "Researchers, however, have no standard procedures to follow. They must be flexible and attempt to glean information and insights wherever they find them" (113:84). Case study requires a dissection and study of the particular subject. This intensive study will yield explanations of the research subject or of similar subjects which can be used comparatively.

One of the "tools" utilized in the case analysis was the historical method. Historical research "is often

defined as the writing of an integrated narrative about some aspect of the past based on critical analysis and synthesis of sources" (58:64). Said another way, the historical method "is the systematic and objective location, evaluation, and synthesis of evidence in order to establish facts and draw conclusions concerning past events" (10:260). As these definitions state, a detailed and extensive search of the available data is the first step in historical research. This data must then be evaluated and synthesized into an accurate account of the subject under investigation. It is this review and analysis of the existing literature which develops the theories and explanations about the research subject.

Another research tool which was used shares common characteristics with the historical method. The documentary research technique was employed as a complement to the historical method. "There is often only a fine line of distinction to be made between [documentary research] and historical research" (58:67-68). However, documentary research

. . .tends to emphasize contemporary sources and present-day issues. It can be thought of as cross-sectional rather than longitudinal, where the data focus is on one point in time or a relatively short period of time. (58:68)

Other than this differing orientation, documentary research shares the historical method's steps of data collection,

synthesis, and evaluation in an attempt to explain the research subject.

A final research methodology tool employed for this study was the personal interview. Emory defines this survey technique as "a two-way conversation initiated by an interviewer to obtain information from a respondent" (35:160). The personal interviews were conducted face-to-face with individuals involved with the research problem. Consequently, this method provided primary data on the research subject. Interviewees were chosen purposely for their involvement or expertise in areas comprising the research subject.

#### Methodology Justification

All of the research methods employed were essential to a thorough analysis of the research subject. Case analysis was particularly applicable to the effort. The study of international programs and their environment is in its infancy. Consequently, the current base of knowledge does not permit the use of traditional survey and statistical methodologies. However, this limitation should not discourage the exploration of this important arena. Case analysis allows the researcher to delve further into the research area in an effort to develop a more mature knowledge base. Obviously, contributing to the existing pool of knowledge on a research topic will not only benefit

the immediate understanding of the subject, but it will also move future research towards survey and statistical research methodologies. Case analysis also allows the researcher to compare findings on a particular example to the existing knowledge base. Elements of the existing pool can then either be corroborated or challenged. New elements can also be expected to be introduced. Additionally, case analysis provides direction to the research. The international program arena is no longer purely exploratory. Some data has been discerned, and case analysis allows concentration on specific issues.

Analysis of the FSX project, as well as other specific international cooperative programs, provided data directly applicable to the research subject. Case study of the specific project involved in the research effort is obviously extremely important. However, study of comparable or similar international programs also proved valuable. As Zikmund explains the use of similar cases:

...even if situations are not directly comparable, a number of insights can be gained and hypotheses suggested for future research. (113:84)

Study of the particular case as well as comparable or similar cases added to the development of the research findings.

The personal interview method was crucial to the gathering of data on the research subject. As previously mentioned, the research problem did not lend itself to the

use of surveys. Therefore, interviews provided an avenue to collect primary data. Lang and Heiss explain that

Generally, research which is non-statistical draws upon two kinds of sources: primary and secondary. Primary sources are the original documents and remains, the first witness to the event, with only the mind of the observer coming between the original event and the user of the source. (58:72)

Interviewees were selected for their expertise and experience with the research topic. Interviews were conducted with many of the participants in the FSX debate, thereby ensuring that the various perspectives of the issue were addressed. Officials were interviewed from the Air Force program office; the Departments of State, Defense, and Commerce; Congressional opponents; and the Japanese government. A complete listing of the interviewees is provided in the Appendix.

Secondary data was obtained from the historical and documentary research methods. This secondary data not only established a solid foundation of knowledge to build on, but also provided corroborating evidence for the primary data. An intensive search and analysis of existing data on the research problem was essential to investigate the dynamic arena of international cooperative programs, the defense industrial base, technology transfer, trade and competition, and Japan. Historical research provided this foundation of existing knowledge on the research subject. Lang and Heiss state:

...through history one can develop a background perspective and insight into a person, problem, event, or institution not obtainable through other types of research. In historical research, which is often most concerned with qualitative results, the historical methodology (i.e. the review and analysis of the literature) does generate the answers. (58:65)

Consequently, the historical method was critical to gathering the information which already existed on the research subject and synthesizing it into an organized body of knowledge. Historical research provided a foundation and overview upon which further study could be based.

The documentary research method was essential to garner recent data on specifics of the research subject. The method permitted a shift in orientation from historical research of past data to a more recent review of the research subject. This move in orientation to an investigation of relatively recent findings provided a complementary tool to the historical method. However, the justification for its use is the same as for the historical method. It provided a foundation to build upon.

The use of these four research methods allowed for a comprehensive investigation of the research subject. The historical and documentary methods developed a broad foundation upon which the research could be continued. The case study method produced insights into not only the research subject but also cases which could be used comparatively. And the interview survey method yielded vital primary data on the research subject.

### Limitations of the Research

The researcher who uses the historical or documentary method of research must ensure the genuineness and truthfulness of sources (58:72). This evaluation of historical and documentary evidence is termed "historical criticism" (10:264). The concept has been divided into internal and external criticism. External criticism is concerned with the determination that the source is authentic. Internal criticism is then defined as determining that the data within the source is accurate (10:264-265). Obviously, the use of respected, well-documented data is essential to freeing historical research from internal and external criticism problems. In addition, Lang and Heiss contend that

...it seems that unless the student is attempting a piece of historiography or a textual study in literature, it should not be necessary to subject the documentary sources to an exhaustive set of maxims of criticism. However, the fundamental task of the researcher is to get as close as possible to the truth.  
(58:73)

In addition, Borg and Gall developed a listing of common errors in historical research:

1. Selection of a research area in which sufficient evidence is not available to conduct a worthwhile study or test the hypothesis adequately.
2. Excessive use of secondary sources of information is frequently found in studies not dealing with recent events.
3. Investigation of a broad and poorly defined problem.

4. Failure to evaluate historical data adequately.
5. Research procedures influenced by personal bias.
6. Recitation of facts without synthesis or integration into meaningful generalizations.  
(10:267-268)

The case study method has been criticized for its inability to derive complete and dependable data (58:85). Additionally, the interview method of research can be "affected adversely by interviewers who alter the questions asked, or in other ways, bias the results" (35:161). However, the foremost prevention against the above limitations and criticisms of the chosen methodologies is to acknowledge their possibility to occur. Knowledge of the pitfalls can then be used to design and conduct research which minimizes the possibility of their occurrence. The following tools were used in this research to avoid the limitations and criticisms cited:

1. Use of complementary research methods concurrently throughout the research process.
2. Broadbased use of respected, well-documented secondary sources of data.
3. Use of different data sources to cross-check the information gathered.
4. Collection of primary data through the interviews to complement the secondary data.
5. Maintenance of a professional, critical perspective to guard against prejudice or bias in the research.
6. Review of the data by more than one expert.

Such techniques can effectively prevent the limitations and criticisms detailed in this section. The case analysis can be an effective method to further an area of research which cannot be easily investigated with the statistical and survey methods of research. Proper use of the case analysis can therefore develop a body of knowledge on which various other research methods can then be used.

### III. Literature Review

#### Chapter Overview

This chapter presents information discovered in the course of reviewing the literature relevant to this study. Information was obtained on international cooperative programs, the defense industrial base, technology transfer, and trade and competition; and is presented in that order.

#### International Cooperative Programs

Definition. The term "international cooperative program" has become a common label for a variety of arrangements. In addition, the term "offset" has come into use to describe a wide array of cooperative agreements as well. Therefore, an explanation of the terms used in the international program arena is necessary to establish a common foundation of understanding.

International cooperative programs have been defined as "the nonrepetitive transfer of technology across international boundaries among collaborating organizations" (36:14). Limiting the focus to international armaments cooperative projects, the idea can be further explained as the sharing of costs and responsibilities between two or more nations or organizations in the performance of a joint program. This may include codevelopment, cooperative research and development, coproduction, or dual production

(36:14-16). The themes common to all cooperative programs are:

- technology exchange
- shared investment
- multiple partners that jointly participate in the work
- shared access to new or expanding markets
- occurs anywhere on a continuum from R&D to production
- a written agreement specifying the terms and conditions of the project
- the agreement may be government to government, industry to industry, or a combination.

(36:18)

Further, the following definitions of specific types of cooperative programs have been suggested:

**CODEVELOPMENT** - Development of a system by two or more nations in which the costs of development as well as the design effort are shared.

**COOPERATIVE RESEARCH AND DEVELOPMENT** - Any method by which governments cooperate to make better use of their collective research and development (R&D) resources to include technical information exchange, harmonizing of requirements, codevelopment, independent research and development, and agreement on standards.

**COPRODUCTION** - Any program whereby a government, international organization, or designated commercial producer acquires the technical information and know-how to manufacture or assemble defense equipment or components developed by another country.

**LICENSED PRODUCTION** - Involves agreements made by U.S. commercial firms with international organizations, foreign governments, or foreign commercial firms for the production of specified items. USG [U.S. Government] involvement is normally limited to administrative processing of the license.

(36:14-17)

However, the term "offset" is often used to describe a variety of these international arrangements. The Department of Defense's Guide for the Management of Multinational

Programs states that "The terms offsets, coproduction, buy backs, barter, counter-purchase, compensation, countertrade and licensed production are often used interchangeably" (64:7-1). Therefore, this guide offered the following definitions:

-Offsets: Refers to a usage of industrial and commercial compensation practices required as a condition of sale for military related exports, i.e., either Foreign Military Sales (FMS) or commercial sales of defense articles and defense services, as defined by the Arms Export Control Act (AECA) and the International Traffic in Arms Regulations (ITAR).

--Direct Offsets: Allows for compensation in related goods, permitting a foreign country to produce in-country certain components or subsystems of a weapon system it is buying from a US supplier as a condition of sale.

--Indirect Offsets: Are associated with goods unrelated to the defense item sold. The supplier agrees to purchase a certain dollar value of the buyer's manufactured products, raw materials, or services as a condition of sale, usually over an extended, open-ended period.

(64:7-1,2)

Any discussion of definitions tends to be tedious. However, for this effort such explanation is truly needed. With the terms "international cooperative program" and "offset" used to describe a variety of arrangements common to both, it is important to identify what this research effort focuses on. It is first necessary to realize that, as the above definitions state, "offset" includes a number of arrangements. Many of the studies and reports utilized in this literature review study offsets as a whole, and thus deal with all the different facets of the term. Second,

because this study attempts to identify implications which international cooperative programs have on the security of the United States, it is most concerned with direct offsets such as codevelopment, licensed production, and coproduction. This is not to imply that indirect offsets, countertrade, barter and the like do not have implications for our national security as well. However, such investigation is outside the boundaries of this study.

Origins. The genesis of the international cooperative program can be found in the post World War II arms production arrangements between the United States and its allies.

Production in foreign countries of portions of US systems (coproduction) began in the late 1950s and early 1960s. This trend originated in Europe and Japan . . . Originally, the desire of the Europeans to produce portions of US systems was based on their needs to maintain domestic employment, create national defense industrial bases, acquire modern technology, and improve their balance of payments. . . . When the process started, it was clearly in the US interest to meet some of these European needs: bolstering their defense and our defense, improving their defense industrial capability, and strengthening their overall economies. (64:7-4)

Cooperative programs have evolved over a period of time. The United States practiced grant aid, or a simple "gift," of finished military hardware to its allies after World War II. This practice evolved into licensed production, then coproduction, and now even codevelopment. The United States and its NATO allies "have indicated a desire for codevelopment, in which the European nations and the U.S.

jointly define system requirements and jointly perform system engineering with eventual arrangements for production in both the U.S. and Europe" (64:7-5). Therefore, international programs now comprise a continuum which Farr identified in his study:

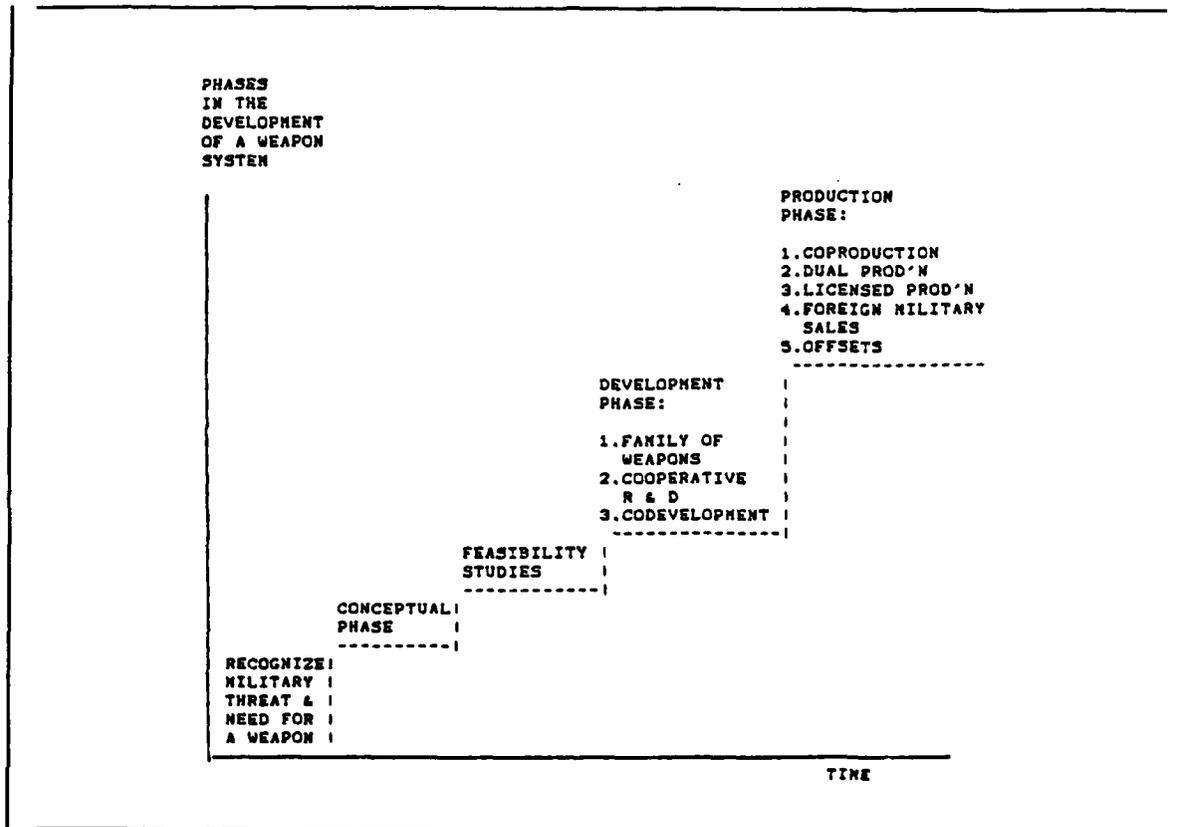


Figure 1. Continuum of International Cooperative Projects (36:11)

Analysis of international armament programs has identified several causes of their expanded role. For the foreign partner, such arrangements satisfy their demand for increased involvement for their domestic industries in weapons development and production. This is an essential

idea behind the pursuit of international projects by U.S. allies. The Aerospace Industry Association maintains that

Governments making defense procurement decisions are likely to take into account objectives other than securing needed products at the lowest costs.

Additional objectives include:

- Limiting reliance on external sources for defense items;
- Lessening the balance of trade impact of non-domestic purchases;
- Increasing domestic employment; and
- Improving the high technology production base.  
(60:55)

In fact, this same source offers the idea that international cooperative arms agreements are "the pursuit of national ends through international means" (60:60), and that such projects are a vehicle allowing the foreign country to achieve its own unique objectives more efficiently and economically. Numerous examples exist of countries pursuing their own objectives through international armament programs, and most are quite up-front about it. In 1983 the U.S. and Turkey reached agreement on a \$4.2 billion coproduction agreement for 160 F-16s. Turkish President Kenan Evren was open in explaining Turkey's goals, "To develop an independent capability to design and produce combat aircraft in Turkey; and, to construct the facilities needed to allow the building of transport aircraft in the future" (99:7).

For the United States, international armament programs likewise serve national objectives. The Office of Management and Budget found that international cooperative agreements fulfill the following U.S. national security objectives:

1. Deterring aggression by enhancing the preparedness of our Allies and friends, both through the actual weapon systems and through the strengthening of the Allied defense industrial base.
  2. Increasing the ability of the U.S. to project power.
  3. Supporting interoperability with the forces of friends and allies.
  4. Enhancing U.S. defense production capacity and efficiency.
  5. Strengthening collective security arrangements.
- (74:23)

International armament programs are therefore entered by both the United States and its foreign partners based on, at least in part, a desire to meet certain national objectives.

In today's environment there also exist several other forces driving international projects. The move in NATO towards increased rationalization, standardization, and interoperability (RSI) has generated many of the recent cooperative programs. The capabilities of the NATO allies for weapons production have increased dramatically since the days of U.S. grant aid.

Recognizing that duplication of weapons development and production among the NATO allies wastes resources and diminishes allied military capability, Congress has enacted

several pieces of legislation aimed at increasing the RSI of NATO forces. The Culver-Nunn Amendment of 1977 declared that it is U.S. policy that American weapons should be standardized, or at least interoperable, with those of the NATO allies (64:1-3). In 1982 the Roth-Glenn-Nunn Amendment sought to further the RSI goal by calling for NATO to develop a strategy for armament cooperation (64:1-3). Even more recently, the Nunn and Quayle Amendments of fiscal year 1986 have continued the U.S. push for increased RSI in the NATO alliance (64:1-4).

The result of such legislation is the unequivocal support of the U.S. for armaments cooperation with the NATO allies. The hope is that such cooperation will not only increase the military effectiveness of the NATO weapons, but also save valuable alliance resources. The Department of Defense recently concluded a study which found that over the last 25 years NATO could have saved \$50 billion (in 1988 dollars) by fully cooperating in the development, testing, and procurement of a number of weapon systems (18:71).

Yet another set of incentives for the international cooperative program involve the economics of state-of-the-art weapon systems. A Department of Transportation study found that:

International collaboration is an outgrowth of the economic and political pressures on industry participants. Major development costs, combined with market and technological uncertainties, result in a drive to share risks. Partners sometimes have complementary resources that can be shared most efficiently in a joint venture. (30:79)

Although this finding was oriented towards the inspiration for cooperative projects between industries, the very same forces are at work in government programs. A recent interview with Robert McCormack, Deputy Undersecretary of Defense for Industrial and International Programs, addressed this reality:

...the need for international cooperation is driven by economics as well as the strengthening of the relationship with the allies. It is sort of a two-track road there. And the more people look at the economics of it, the more apparent it is that we need cooperation. (50:47).

In today's era of ever-increasing weapons costs coupled with decreasing defense budgets, it is not difficult to accept this argument. Consequently, international armament programs are driven not only by factors such as the desire for increased participation by our foreign partners, RSI, and U.S. national security objectives, but also by the sheer economics of high-technology, high-cost weapon systems.

Growth of the International Armament Program. International armament ventures have grown in number, frequency, and value. However, this growth is a fairly recent phenomenon:

Of approximately 163 international military programs identified from 1947 through 1986, 43% have either begun or are projected to begin during 1982-1986 and roughly 60% have occurred since 1977. (36:24)

Recent evidence confirms this growth. In the arena of coproduction, the Defense Security Assistance Agency estimates that from the period of fiscal year 1977 through

1988, the estimated value of U.S.-Foreign defense coproduction arrangements totaled \$24 billion (14:75). The Aerospace Industry Association states that as of October 1987 the United States had signed twelve agreements with allies to pursue cooperative aerospace projects, and that eight more were under negotiation (60:55). Figure 2 illustrates the trend existing for international armament projects.

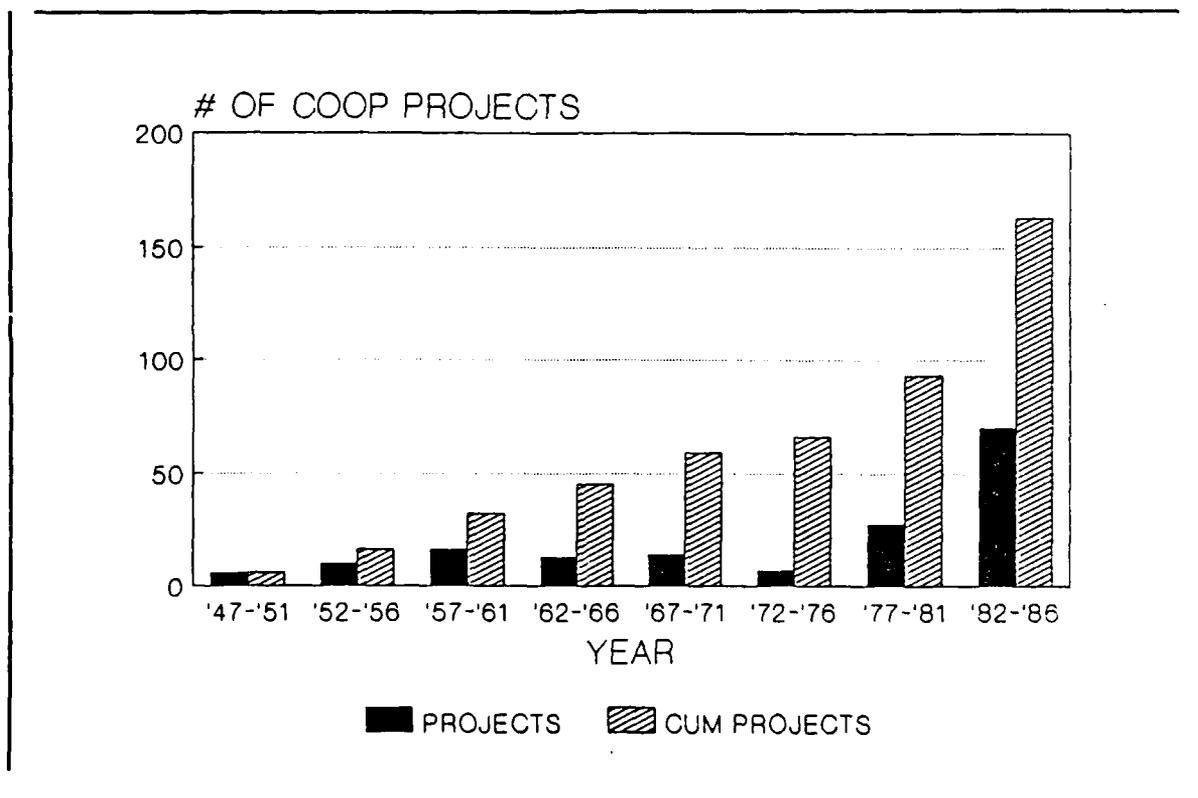


Figure 2. Cooperative Project Trends  
(64:7-7)

This growth in the use of international ventures on weapon programs reflects the aforementioned rationales for

such arrangements. Just as the reasons behind international armament programs continue to be valid, so also is the prospect of continued growth of such programs.

A Growing Concern in the United States. The increase in the United States' involvement in international cooperative programs has been a source of concern to many. Much of this uneasiness can be attributed to an increasing awareness in this country of issues such as the health of the defense industrial base, the growing global economy, trade imbalances, the emergence of numerous competitors to America's economic strength, and the transfer of technology. Consequently, the concept of joint armament programs raises questions as to their effects upon the interests of the United States--and whether the "good" achieved by them outweighs any "harm." A recent General Accounting Office study highlighted this concern:

Foreign countries can use these agreements to counter competitive advantages of some U.S. industries. For example, some offset arrangements require the transfer of specific technology and production management expertise from the United States to foreign countries. . . . through such arrangements, foreign countries seek not only to increase their military capability but also to increase employment, enhance the commercial competitiveness of current and future products, obtain advanced technology in both the military and civilian sectors, promote specific domestic industries, and gain entrance to new markets. Recent U.S. government studies have identified examples of U.S. industry sectors which offset agreements have hurt. An example is agreements related to the gas turbine engine production base, which have resulted in the establishment of offshore manufacturing capacity that may not be available to DoD when needed. Furthermore, the transfer of technology abroad diminishes U.S. ability to compete for future business,

increasing competition and decreasing the business base for subcontractors. (44:17-18)

Embodied in this finding is the essential idea that the country entering the joint agreement with the United States has a different agenda. As discussed earlier, the foreign partner(s) may use the international venture to pursue their own unique national objectives.

It should be noted that, while many in the U.S. associate offset demands with our foreign partners, the United States regularly exercises its own brand of offset requirement:

A number of U.S. trading partners contend that the United States government has an offsets policy with respect to its military imports. The U.S. requires that there be a domestic production capability for each critical weapon system or component in the inventory. . . . The difference between the U.S. policy and those of most other countries is that the U.S. requirements are based on national security concerns rather than economic ones. (74:28)

However, this does not temper the outcries over U.S. involvement in international armament programs. A 1985 statement by the Subcommittee on Economic Stabilization of the House Committee on Banking, Finance, and Urban Affairs is worthy of reprinting:

Increasingly, [offsets] are required by foreign buyers as a condition of the sale in order to counter or offset the economic impact of the sale on the purchasing country. These arrangements take many specific forms, including requiring subcontracting to firms in the purchasing country, coproduction of certain items, technology transfer, or the purchase of goods from the buyer country by the U.S. seller. While the specific mechanisms differ, the purpose is the same: to help the economy of the purchasing country, its industrial base, its employment, and its balance of payments. It is increasingly apparent that the impact

on our own industrial base, our own employment, our own balance of payments, and ultimately, the competitive position of our industries is substantial.

(64:7-11,12)

In addition, testimony to the Senate Armed Services Committee in 1988 offered:

These countries seek not only to augment their military capability, but also to increase employment, to enhance the commercial competitiveness of current and future products, to obtain advanced technology in both the military and civilian sector, to promote targeted domestic industries and to gain entrance into new markets. We are concerned that offsets, particularly coproduction, licensed production, subcontracting and technology transfers have a negative effect on some subsectors of the U.S. industrial base. In the short run, offsets create significant inefficiencies in defense procurement by raising the cost of weapon systems to our allies. Often, the cost of establishing production facilities to coproduce a weapon system or part thereof must be absorbed even though a production facility for this system or subsystem already exists in the United States. Moreover, the administration of offsets is a substantial cost which is passed on, at least in part, to the purchaser. At a time when we are trying to increase our conventional deterrence, offsets erode our ability to field sufficient quantities of defense systems by increasing the cost of weapons systems. Over the long run, offsets could be detrimental to our national security by weakening the competitive position of industries vital to our defense. (104:198-199)

Several more pages of similar testimony, essays and reports could be included, but the point has been made. The growth of cooperative arrangements among international partners has triggered great unease about the possible consequences of such arrangements.

Parameters of the Debate. Yet, there are reasons to exercise caution in these indictments of joint ventures. First, offsets and international cooperative programs

include a vast variety of arrangements. To conclude that offsets are damaging may well be too encompassing in light of the differing agreements. Second, and related, is the fact that because of the variety and number of arrangements, measuring their true effect on industry and the economy is a difficult task at best.

Several pertinent facts should therefore be presented before such attempts are undertaken to measure the impacts of offsets. The Office of Management and Budget (OMB) was tasked by Congress in 1984 to study the issue of offsets and report annually thereafter on the impact of offsets on the defense preparedness, industrial competitiveness, employment and trade of the United States. Although findings of this report are presented later in this literature review, several general conclusions of the OMB are pertinent to the immediate presentation of the international program/offset topic. The OMB found that:

1. It is often necessary for American defense base industries to offer offsets in order to participate in and remain competitive in the international marketplace.
2. Offsets are a factor in the competition for international defense sales and are being used by foreign purchasing governments as a trade management tool for the purposes of preservation of foreign exchange, the targeted development of selected industrial sectors, and the enhancement of the capability of domestic industries through technology transfer.
3. Offsets are increasing foreign competition, particularly at the subcontractor level and could result in some loss of business. However, without offsets, U.S. industry faces the prospect of losing export business.

4. While offset-related sales of defense systems contribute to the marginal income of defense firms, the health of the industry depends primarily upon U.S. Government purchases. (74:48)

Additionally, it is informative to view offsets in a larger perspective. One study found that:

...it is useful to put offsets in some kind of context. Last year [1986] the U.S. had a total GNP of nearly \$4 trillion and exports of \$200 billion. Total defense exports run about \$9 billion a year. The figures contrast with annual performance of offset obligations in the vicinity of \$3 billion. And, as we shall see, that \$3 billion figure is itself an exaggerated number with respect to real impact on the U.S. economy. Thus, relative to the overall economy, trade, and defense trade, offsets are not particularly important. (55:6)

The Defense Systems Management College (DSMC) expands this view:

World macroeconomic conditions make it difficult to isolate and measure the precise impacts of offsets on U.S. trade, employment, competitiveness, and defense preparedness. The size of defense-related offsets relative to the U.S. economy and relative to various sectors of the economy must be taken into consideration in an analysis of offsets. In this regard, the importance of defense-related offsets depends upon the frame of reference. The average annual value of defense-related offset obligations between 1980 and 1984 (\$2.4 billion) is trivial relative to the U.S. Gross National Product (GNP) (\$3,125 billion), total U.S. exports (\$127 billion), or exports of U.S. manufactured goods (\$143 billion). (64:7-14)

These facts are important to any ensuing discussion of international programs and their impacts. Offsets are a reality in the marketplace for defense goods. Foreign governments and industry use international programs to pursue their own objectives. However, offsets are confined to a rather small portion of the economic activity of the United States. The Department of Defense still maintains

the ultimate influence over the revenue of defense industries. These considerations are integral to any discussion of international armament programs.

Potential Advantages/Disadvantages for the United States in International Armament Programs. It is now possible to begin developing a framework within which further study of international programs can be conducted. From the previous discussion, potential advantages and disadvantages of U.S. participation in international ventures can be identified.

Advantages:

o Military/National Security

-Military preparedness of the U.S. and its allies is enhanced through both the weapons systems themselves and the strengthened allied defense industrial base.

-The ability of the U.S. to project its power is enhanced.

-The interoperability of allied military forces is promoted.

-Alliance resources are more effectively utilized than with a duplication of effort.

-Collective U.S. security agreements are strengthened.

-U.S. defense production capacity and efficiency is increased through larger economies of scale.

o Economic/Industrial

-Risks and costs of a program are shared with the foreign partner(s).

-U.S. jobs and revenues are increased through exports or increased work.

### Disadvantages

#### o Military/National Security

-Such arrangements inefficiently use allied resources if compared to the straight purchase of U.S. developed and produced weapons by the foreign partner(s).

#### o Economic/Industrial

-U.S.-Foreign balance of payments may be influenced in favor of the foreign partner(s).

-Competition for U.S. industry may be increased. Foreign industry is strengthened through such factors as increased domestic employment, support of the domestic high-technology base, technology transfer, and entrance to U.S. markets. Such factors may permit the industry of the foreign partner(s) to better compete with those of the U.S. in both defense and commercial markets.

These factors provide the beginnings of a framework for the ensuing analysis of associated issues. Expansion of the framework will be undertaken as this research continues.

Memorandums of Understanding. A final topic should be presented. International partnerships are documented and controlled through an instrument called the Memorandum of Understanding (MOU). The Office of Management and Budget refers to such instruments as Programmatic MOUs. These MOUs can be either bilateral or multilateral, and can cover joint research, codevelopment, and coproduction of some specific weapon system. The program parameters are defined in the MOU, and technology transfers and commercial arrangements are typically delineated in either government-to-government transactions or under an export license approved by the State Department (74:122-123).

On 29 September 1988 the National Defense Authorization Act, Fiscal Year 1989 was signed. Under Section 2505 of this statute, it is mandated that:

No official of the United States may enter into a memorandum of understanding or other agreement with a foreign government that would require the transfer of United States defense technology to a foreign country or a foreign firm in connection with a contract that is subject to an offset arrangement if the implementation of such memorandum of agreement would significantly and adversely affect the defense industrial base of the United States and would result in a substantial financial loss to a United States firm. (74:114-115)

However, it continues by stating that this provision does not apply if the Secretary of Defense, in consultation with the Secretaries of State and Commerce, determines that such a transfer would strengthen national security, and certifies as such to Congress (74:115).

MOUs have established numerous international armament programs over the years. As the main guideline for the program, MOUs assume an important role--they have also been the subject of many "lessons learned" reports. A 1979 General Accounting Office study found that MOUs "should be sufficiently detailed to allow planners to decide whether their governments are willing to financially and politically obligate themselves to a project" (45:11). On the F-16 coproduction program with the European consortium, the Defense Systems Management College found that the MOU "has the force and effect of a contract and should be very carefully constructed" (23:2). DSMC further recommended that in the future negotiations of MOUs, "Great care should

be taken to ensure that no firm commitment is made when the ability to follow through is doubtful" (23:3).

Consequently, the FY 1989 Defense Authorization Act and the "lessons learned" from past MOUs present some interesting points. Not only is the importance of the MOU as a controlling instrument of the arrangement emphasized, but also the belief is embraced that important evaluation of the proposed project is necessary. Not only should the effects of the arrangement be analyzed, but also the commitment of the United States to the project. The MOU was compared to a contract, and therefore the United States must treat the signing of it with a corresponding preparation and straightforwardness.

Summary. This section of the literature review has introduced the concept of the international cooperative program. An explanation and history of the cooperative armament program was provided, as well as a discussion of the growth of such arrangements. The reader was then introduced to the growing concern in this country over such arrangements. A framework was established for further analysis of the impact of international programs, and the section concluded with a discussion of the governing role of MOUs in such programs.

#### Defense Industrial Base

The U.S. Industrial Base. The industrial base of the United States--the industry and its supporting structure--

has been a great source of concern for many. Once highly touted as the greatest economic power on Earth, such accolades are now being drowned-out by "buzz words" like Rust Belt, faltering productivity, and service economy. Deterioration does not appear to be confined to specific economic sectors. A great deal of attention has been focused in the past on the deterioration of America's "smokestack" industries such as steel and shipbuilding. Perhaps some people found comfort in a school of thought that America was graduating from such low-tech, labor intensive industries to the high-tech industries which promised the future. However, the President's Commission on Industrial Competitiveness stated that:

In industry after industry, U.S. firms are losing world market share. Even in high technology--often referred to as the "sunrise" industries--the United States has lost world market share in 7 out of 10 sectors.

(80:13)

The Department of Defense's report Bolstering Defense Industrial Competitiveness found that the long-term loss of key production technologies and equipment was particularly worrisome. In such critical technologies as machine tools and electronics manufacturing equipment, the report found the erosion particularly severe (19:2). High technology industries were studied by the Department of Commerce in 1983 and it was found that:

Over the past 12 years, there has been a decline in the international market position of U.S. high-technology industries from a position of dominance to one of being strongly challenged. Market share for the high-

technology group--and for nearly all individual industries--has fallen. (80:Vol 2,308)

Such findings are ominous. Deterioration in the industrial base is widespread and affects both smokestack industries as well as the high-technology sectors.

Integral to this problem is the faltering capital investment in U.S. industry. A "chicken or egg" problem exists in that a lack of adequate capital investment has damaged the productivity of industry. Likewise, this decline has produced a cyclical problem in that the industrial base in America has been unable to produce the financial returns that attract investment. Real rates of return on manufacturing assets have declined over the past twenty years, thereby discouraging investors from the vital manufacturing sector (80:12-13). Lack of sufficient capital investment has reduced American productivity, and decreased productivity has discouraged capital investment.

U.S. Industry and High Technology. The studies cited above focused heavily on U.S. high-technology industry. This orientation is well-founded. The link between high-technology, manufacturing, and overall economic strength is real. Dr. Alan Shaw, Office of Technology Assessment, testified to the Senate Armed Services Committee that:

It does seem to be the case that technology development tends to correlate with manufacturing; that if manufacturing does not take place in the United States, it is less likely and more difficult for the United States to be at the leading edge of technology.

(104:21)

Likewise,

Technological innovations are vital to the overall strength of the U.S. industrial base. Technological change sparks economic growth by improving manufacturing processes and increasing worker productivity in all industries. (80:Vol 2,351)

High-technology industries have been at the forefront of U.S. industry, and have tended to pace the overall economy. Over the last decade, high-technology industries grew at a rate double the total U.S. industrial real output, have comprised nine out ten of the fastest growing U.S. industries, experienced an average labor productivity growth rate in the 1970's of six times that of total U.S. business, and had an employment growth rate of fifty percent greater than that of total U.S. business employment (80:Vol 2,351). Consequently, the findings on the health of U.S. manufacturing, high-technology industries, and the industrial base as a whole warrant great concern.

The U.S. Defense Industrial Base. The defense industrial base is a subset of the United States' industrial base and is comprised of those industries which provide material and services to the defense forces of this country. It is also highly dependent on high-technology, as reflected in today's state-of-the-art weapon systems. The defense industrial base has been found to be a rather broad sector of the economy as a whole. Ninety-five percent of the manufactured goods purchased by the Defense Department come from a "broad spectrum of 215 industries" (19:v). Like the

overall industrial base, the defense sector has captured its share of headlines as to its health and viability. A 1988 Department of Defense report states:

Many basic industries of importance to defense production have declined, threatening the responsiveness of our industrial base. Left unchecked, such erosion could rob the United States of industrial capabilities critical to national security. An efficient, responsive, and technically innovative industrial base is necessary to develop and produce high-quality, affordable defense systems and to maintain our ability to deter aggression or defeat potential adversaries. (19:1)

This defense industrial base is grounded in the civilian industrial base, which, as discussed previously, is losing both basic manufacturing and high-technology capability.

Roderick Vawter, in his comprehensive survey of the defense industrial base, found that:

A healthy civilian industrial base is critical to the capability of the defense industrial base. That fact is rooted in the production relationship that exists between the two. Military and civilian demand are met by the same general industries which draw from the same basic production input factors such as capital, technology, scientific and skilled manpower, and management. Therefore, weapons production rests on the same foundations as the national ability to produce industrial and consumer goods. Weaknesses and gaps which exist in subtier and basic industries will inevitably affect the national ability to produce weapon systems critical to national defense. (108:vi)

The U.S. defense industrial base and the overall U.S. industrial base maintain a highly symbiotic relationship. Not only does a strong overall economy strengthen the defense industrial base, it also serves as a deterrent factor. The economy of the United States possesses a latent capability to supplement current forces in response to

strategic threats and, as such, serves as a critical element of America's deterrent strategy (19:28). Also, a healthy economy provides the revenues to purchase the weapons for defense. The security of the United States has been funded for many years with less than seven percent of the gross national product (19:28). Yet, the relationship works two ways. Not only does the overall economy of the United States serve the defense industrial base and national security, but the defense industrial base also aids the overall economy. In 1985, the Department of Defense spent nearly \$165 billion within the industries comprising the defense industrial base. This represented 4.1 percent of the U.S. gross national product, and 21 percent of the manufacturing gross national product (19:v). Consequently:

...the Department of Defense is cognizant of its formative influence on the larger manufacturing economy. Through its impact on the employment of scientists, engineers, and factory workers, its research and development expenditures (particularly in advanced manufacturing technologies), and its role in fostering capital investment, the Department's influence on innovation and manufacturing far exceeds its relatively small share of expenditures in our national income accounts. (19:28)

The overall industrial base of the United States and the defense industrial base are therefore intertwined--each one's fortune dependent upon the health of the other. The strength of the overall industrial base impacts the defense industry, serves as a deterrent, and produces the revenues necessary to pay for U.S. defense. The health of the defense industrial base affects that of all industry and

accounts for a significant element in the United States' economy.

The Military History of the Defense Industrial Base.

History has recorded the contribution which industry has made to the defense of this country. Titles such as the "Arsenal of Democracy" were born out of the industrial mobilization achieved during World War II. In fact, many experts agree that the primary reason for the U.S. victory in the Second World War was the ability of America to bring its vast industrial base to bear on the enemy (97:11). Enumeration of the hardware produced by the United States during World War II is evidence of this industrial strength. The U.S. manufactured over 88,000 tanks, 900,000 trucks and motorized weapons carriers, 310,000 aircraft, and 27 aircraft carriers (103:8). Though this is but a partial listing of the country's output during World War II, it is an impressive record of the industrial support for America's fighting forces. Although a full mobilization did not occur during the Korean War or the Vietnam conflict, the defense industrial base continued to support these efforts. In the Korean War, the industrial base allowed for an expansion of the war effort without a resulting impact on the American consumer. Thus, the idea of the "guns and butter" approach to limited warfare was born (107:13-17).

These lessons from the past on the military value of the defense industrial base, as well as the previously

discussed economic realities, underscore the importance of this segment of the U.S. industrial base. Perhaps if the health of the defense industrial base were not so vitally important, the recent deterioration would not be as alarming.

Deterioration of the U.S. Defense Industrial Base.

Concern over the capability of the defense industrial base began in the post-Vietnam era. In 1976, the first warning was issued by the Defense Science Board Task Force on Industrial Readiness. The Task Force concluded:

...the United States is presently deficient in the extent to which the defense industrial base is postured to provide material support to the forces in response to the full spectrum of potential conflict situations upon which our national security plans are based.

(103:9)

In 1980, a Congressional Board was convened to investigate the subject. Known more commonly as the "Ichord Report" after the board's chairman, the report The Ailing Defense Industrial Base: Unready for Crisis was issued 31 December 1980 by the Defense Industry Panel of the House Armed Services Committee. The "Ichord Report" found the U.S. defense industrial base to be in a state of deterioration, with little improvement in sight. Several findings were documented in the report:

1. An unbalanced industrial base, where excess production capacity at the prime level is not matched at the subcontractor level.
2. An inability to surge production of the necessary material for national emergencies.

3. A significant increase in lead times for military equipment.
4. A shortage of skilled manpower.
5. A lack of capital investment by defense industries. (103:11)

Since the release of the "Ichord Report" the state of the defense industrial base has been the subject of much study. Good news has been hard to come by. Dr. Jacques Gansler, a recognized defense expert and former Assistant Secretary of Defense, stated:

The overall picture is not bright. [Deterioration of the defense industrial base] is a combination of a weak market, heavy debt, inability to borrow, excess capacity, low profit on sales, perceived high-risk, lack of capital investment, low productivity, and rising prices. (43:89)

Another study found:

...a large amount of industrial restructuring [is] going on in the "arsenal of democracy" and rightly observes that America's traditional industrial base has already rusted away, moved off-shore, or is being eroded by structural changes in the economy and strong foreign competition. (34:viii)

Little improvement in the condition of the defense industrial base has been documented since the findings of the "Ichord Report". To the contrary, numerous studies have continued to find deep-seated problems in this vital sector of U.S. industry.

In August 1988, the General Accounting Office completed a study of defense-critical industries. Such industries were defined as "those in which the majority of DOD's budget is spent, directly or indirectly, as well as industries that

the military services consider vital to defense production" (44:14). The study concluded that, although they enjoyed average or above-average profitability, defense critical industries:

- did worse than overall manufacturers in terms of adding to productivity capacity, with only 41 percent of defense-critical industries matching or exceeding the overall manufacturing average growth in productive capacity;

- had 75 percent with worse-than-average growth in real shipments.

- had 62 percent with lower-than-average capital expenditures in 1980, which continued in 1985 when 72 percent had lower-than-average capital expenditures;

- had 47 percent with below-average productivity growth (17 industries actually had declining productivity).  
(44:15)

These findings echo what numerous studies have continued to claim since the late 1970's--the defense industrial base has followed a dangerous course of decline.

Contraction of the Subtiers. One may wonder how industries involved in defense production can compete in light of the findings by the GAO. In fact, sectors of the defense industrial base have experienced severe contractions. "The number of firms doing defense work--especially at the critical supplier and subcontractor level--has been declining for decades" (2:1). Figure 3 illustrates this shrinkage in some selected sectors of the defense subtiers.

<u>PRODUCT</u>	<u>NUMBER OF SUPPLIERS</u>	<u>PRODUCT</u>	<u>NUMBER OF SUPPLIERS</u>
AIRBORNE RADARS	2	TITANIUM SHEETING	3
AIRCRAFT ENGINES	2	TITANIUM WING SKINS	2
LANDING GEAR	3	TITANIUM EXTRUSIONS	1
AIR NAVIGATION SYSTEMS	2	SPECIAL BALL BEARINGS	1
INFRARED SYSTEMS	2	NEEDLE BEARINGS	2
MISSILE/DRONE ENGINES	2	MILSPEC CONNECTORS	3
GUN MOUNTS	2	RADOMES	2
DOPLER NAVIGATION SYS.	2	IMAGE CONVERTER TUBES	1
ALUMINUM TUBING	2	SPECIALTY LENSES	2
		OPTIC COATINGS	1

Figure 3. Decline in the "Lower Tiers"  
(2:14)

Contraction in the subtier of the defense industry becomes even more ominous since it has been found that 50 to 85 percent of the total expenditures of the Defense Department actually are for purchase of material and components by the prime contractors from the subtiers (19:vi). Causes of this shrinking in the defense industrial base are many. An assessment of the defense industrial base by the Air Force Association cites such factors as foreign penetration of U.S. markets, movement by firms out of the defense arena to commercial markets, defense budget fluctuations, and reduced investment by companies in both capital improvements and research (2:14-16).

International Programs and the Defense Industrial Base.

The concern for the defense sector of American industry has been a major cause of the debate over the wisdom of entering into international armament programs. The already unhealthy defense industrial base, coupled with the findings of foreign sourcing and competition in the U.S. defense market, places suspicion on joint programs as to their role, if any, in this deteriorating sector of our industry. The follow-on concern, then, is that even if international programs do not directly cause deterioration in the defense industrial base, they might exacerbate existing industrial frailties.

International armament programs, by their very nature, involve foreign firms and therefore may introduce foreign dependency into a weapon system or create a foreign competitor in the defense market.

The potential effects of offsets on the U.S. defense industry and national economy are obvious: for every component part purchased overseas there is one less sale for any possible U.S. manufacturers, resulting in a substantial flow of dollars out of the country, further increasing the trade deficit and introducing more foreign dependency into U.S. mobilization plans. Subcontracting firms bear the brunt of such agreements.

(2:19)

Testimony to the Senate Armed Services Committee on this idea offered the following view on international programs:

If you have a situation in which you are required to get the components offshore, you are either going to look for those offshore subcontractors or you are going to create them by transfer of technical data so they can produce the product. So essentially, General Electric, Westinghouse, Boeing, General Dynamics and any of the other large contractors still gets the

contract. The one who does not get the contract or does not get the benefit of it is the subcontractor who would have been the United States in the past and is now going to be Dutch or German or French or Japanese. That is the essence of offsets. (104:234)

Thus, it is the concepts of foreign competition, foreign sourcing, and the fragile subcontractor base that are being focused upon in the debate over international programs and their impact on the defense industrial base. This is an important point. The previous discussion on the defense industrial base and its health was rather expansive. The deterioration in the defense industrial base can be attributed to numerous factors such as low capital investment, faltering productivity, shortage of skilled manpower, and insufficient research and development investment, to name a few. Such factors are broad and deep-rooted. Whether these issues are indeed causes of the decline or merely symptoms of deeper problems is even open to debate. However, although the health of the defense industrial base is very important, this research can only focus on those elements involved in the international program arena. These issues are much more limited in scope.

Foreign Competition. Foreign competition is becoming a recurring theme in this research. The issue was presented in the previous section, and will be further researched in the ensuing Trade and Competition section of this literature review. As stated above, international programs have the potential to create foreign competitors

(whether any such foreign competitors are successful in the market is another issue). In the immediate context of the defense industrial base, competitors that successfully dislodge American firms would naturally harm the industry. Such market penetration steals revenues from the American firm, affects efficient production rates, reduces funds available for capital investment and research and development, and could even completely shut the American firm out of the volatile defense market (104:277).

In many cases, foreign sources have penetrated the market and either driven out American firms or replaced recently departed ones. A recent report by the U.S. Senate claims:

The defense industrial base, for a variety of reasons, is losing the ability to respond to challenges from foreign industry and is rapidly losing its ability to respond to defense needs. To a growing extent, our defense needs are being filled by offshore sources. This is especially true for second and third tier industries. The ability of U.S. industry to support defense needs as well as compete in the world economy is one of the most crucial questions before the country. (106:12-13)

This proliferation of foreign sources in the U.S. defense marketplace has produced several critical concerns for the United States. The Department of Defense identifies these in its Bolstering Defense Industrial Competitiveness report:

1. The loss of U.S. technology leadership.
2. The implications of foreign ownership of American manufacturing facilities.

3. The loss of supremacy in manufacturing technologies.
4. The threat of foreign dependency. (19:29-32)

Reliance on Foreign Sources. Successful foreign competition can be damaging to the U.S. defense industrial base, and may consequently establish a foreign source which could impact national security. A study for the Joint Logistics Commanders analyzed the impact on several specific weapon systems if foreign sources were suddenly cut-off. This study determined that for the Sparrow missile, M-1 tank, OH-58D helicopter, sonobuoys, F/A-18 and F-16, the impact would be a drop to zero production for periods ranging from 6 to 14 months (108:iii). Such dependence places U.S. national security at risk in the event that foreign supplies are cut-off for either economic or political reasons. This potential impact on U.S. national security is the basis of foreign sourcing fears.

Foreign Source/Dependence/Vulnerability. However, attributing the weakness of the defense industrial base to foreign competition, or national security threats to foreign sources, may be too simple (and politically expedient). First, it needs to be recognized that there is a difference between a foreign source, a foreign dependence, and a foreign vulnerability. Martin Libicki et al, in their study on the U.S. industrial base, developed important distinctions among these three levels:

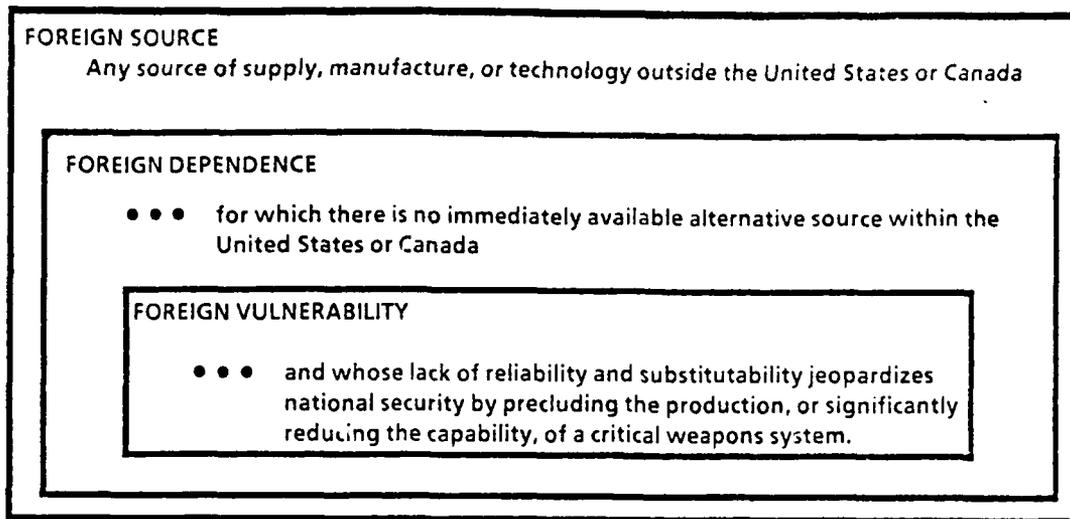


Figure 4. Foreign Source/Dependence/Vulnerability  
(59:4)

The Libicki study explains that:

...not everything that is sourced abroad, nor indeed all foreign dependencies, represent vulnerabilities. This observation is absolutely critical to properly understanding foreign vulnerabilities and developing policies to deal with identified vulnerabilities. The key to successfully dealing with vulnerability is not identifying and eliminating foreign sources, or even all foreign dependencies, but identifying and eliminating those dependencies that are indeed vulnerabilities.  
(59:5)

Therefore, foreign sourcing and foreign vulnerability are not necessarily one and the same. Vulnerabilities are a subset of the overall concept. Foreign sourcing represents certain trade-offs. While dependence on overseas sources warrants concern, benefits can also be realized from such arrangements. What the United States must strive for is a balance between the risks associated with foreign sources, and the benefits which can be achieved through the free

world's scientific and industrial base (59:9). Joseph Muckerman and James Miskel address this idea:

While there is a critical mass of domestic production that needs to be maintained for national security purposes, it is uneconomic in peacetime to rely entirely upon U.S. industry when foreign sources may produce certain systems or components at a lower cost. Buying from higher cost producers reduces the number of units that can be purchased with a given amount of funds and shifts resources away from research and technological innovation. . . . The point here is that it would be inadvisable economically, politically, and possibly militarily for the United States to try to become fully self-sufficient in defense production. Autarky is simply not an achievable or desirable policy in a global economy. (70:38)

The reality of a global economy is central to such positions. Recognizing its existence, along with the concomitant comparative advantages amongst trading partners, is basic to understanding the foreign source debate. Likewise, the U.S. has the options of a "Buy American" policy, a free trading policy, or something in-between. Acknowledgement that a foreign sourcing may not represent a foreign vulnerability, as well as recognizing the potential benefits of utilizing foreign sources, tempers the often-heard outcries over foreigners in the U.S. defense market. In addition, it has been proposed that international armament programs promote interdependence, rather than simply a possible foreign dependence for the United States.

Ultimately, interdependence among nations may prove more advantageous to the United States than dependence on others. As the United States gets more deeply involved in reciprocal buy/sell relationships with its allies (particularly those with whom we have formal alliance ties), the risk inherent in relying on foreign suppliers is mitigated by mutual and interlocking military and economic dependence. Ties and

interdependence are the political basis of alliance cohesion. This is qualitatively different from a situation in which the United States buys high-technology products in the international marketplace, and is at the mercy of the policies (or whims) of other nations. (104:106)

Perhaps the traditional view of international programs needs to be readdressed as to its effects on foreign sourcing versus interdependence.

Recent Studies. A great deal of work has been conducted on the study of international programs and their effect on the defense industrial base. Joel Johnson, Vice President of the American League for Exports and Security Assistance, testified to Congress that:

...in spite of hearings over three years on this subject, and several major government studies, there still does not seem to be any concrete evidence, or even anecdotal cases, which links offsets to a decline in any specific industry. (55:8)

However, he also cautioned that simply gathering data on the topic is a monumental task. In addition to the many prime contractors in the defense industrial base, there also exist thousands of subcontractors. Johnson offered the example of a modern-day jet fighter which is estimated to comprise "at least 5,300 domestic and 55 foreign subcontractors and vendors involved in the production of the aircraft"--and that this did not include roughly 50 percent of the equipment provided by the government in its own contracts and subcontracts (55:8).

In his study of offsets, Vawter concluded that offsets are increasing foreign competition at the subcontractor

level; that this competition may be contributing to the erosion of the U.S. subcontractor base; and that the current burden is on the subtier but may affect the primes in the long term. However, Vawter also cautioned that such evaluation of subcontractors is difficult, and that one cannot equate business lost with business which may have been lost except for offsets (108:23-24).

Nevertheless, some studies have been successful in reaching certain conclusions. These findings tend to dispute the blanket statements that international programs harm the defense industrial base.

A major issue in defense trade is the impact of offsets on subcontractors. The 1985 DPA 309 database showed that 21 percent of offset obligations were for subcontractor production. Of this, nearly half was done in Canada. Other nations, e.g. Israel, that are involved in significant amounts of subcontractor work are either allies or friends with whom the U.S. shares security and foreign policy interests. Foreign sourcing as a result of offset arrangements should be considered in light of RSI and other foreign policy goals, and its effects contrasted with what would have [been] obtained had the export sale not been made. Furthermore, it is important to bear in mind that diversification of defense production can in some cases create competition, which can lower prices and increase quality, allowing U.S. taxpayers to pay less for defense and broadening the West's defense and industrial base. (74:37-38)

Another common assertion is that offsets cost the U.S. jobs through the transfer of work overseas. The 1988 Office of Management and Budget study on offsets found that:

...those who expect great domestic employment gains from the elimination of offsets would be greatly disappointed. By the same token, the countries that insist on offsets because of their presumed positive role in job creation will be equally disappointed; if,

that is, they expect the offsets to generate new additions to their overall employment. (74:53)

The OMB study found that the effects of offsets on total U.S. employment is minor, if not actually positive. However, such offsets are inefficient for both the U.S. and the foreign country demanding such arrangements. Employment tends to be shifted away from industries in which each country possesses a comparative advantage towards industries which the offset arrangement is seeking to promote (74:58-59).

In addition, as discussed previously in the international cooperative program section of this literature review, offsets are not a large element in the defense industry. The Aerospace Industry Association asserts that although offset-related sales are a component of the revenues of U.S. defense firms, "they are not the principal determinant of the health of the U.S. defense base. U.S. Government purchases play the most important role in maintaining a vital defense industrial base" (60:62).

In summary, the defense industrial base has deteriorated, and concern over its health and viability is warranted. The defense industrial base is an essential element of the economy as a whole and has proven its importance to the national security of this country throughout U.S. history. This apprehension over the defense industrial base has also focused attention on the international armament program. Foreign competition,

foreign sourcing and the subcontractor base are major elements of this concern. Measurement of any such impacts is difficult. However, the condemnation of international ventures for their impact on the defense industrial base is premature. Although increased foreign competition may be a result of some offset programs, there is no clear evidence that international programs are significantly disrupting the subtiers of the defense industry. Foreign sourcing may not translate into a foreign vulnerability, and the benefits available through the global economy must be incorporated into the equation. The international program/defense industrial base issue therefore becomes an exercise in cost benefit analysis. Because, although international ventures may not be devoid of harms, the causes of the current industrial base woes are much more expansive and deep-rooted than any impacts associated with international ventures.

The U.S. Aerospace Industry. Before concluding this section of the literature review, it would be valuable to this study to address any findings on the sector of the defense industry involved in the ensuing case analysis--the aerospace industry. The aerospace industry in many ways reflects the previous discussion of the defense industry as a whole. This component of the defense industrial base is the largest sector of the defense industry, and is also a leading sector of the U.S. economy (74:38). Perhaps no other product, defense or commercial, "embodies as much

refinement in such a wide range of advanced technologies from such areas as composite materials, advanced metallurgy, fiber optics, computers, semiconductors, and adhesives" as an aerospace product (30:65). The return on investment to the U.S. economy with aerospace endeavors is considerable. A Department of Transportation study found that the spillovers from the aerospace industry to the commercial economy in the form of technology were vast (30:65). In addition:

Work on military programs often provides a manufacturer with the experience and technology to develop commercial products. Once a nation's aircraft industry matures, mutually beneficial technological interchange between military and commercial sectors usually results. (30:64-65).

Aerospace is also a significant employer in the United States. In 1982, it accounted for 6.2 percent of all manufacturing employment in the U.S., with only 3.6 percent of U.S. manufacturing sales (30:64). These employees are a highly skilled element of the workforce, accounting for 18.6 percent of U.S. scientists and engineers in 1982 (30:64). Consequently, the previous assertions made about the importance of the defense industry to the overall economy, as well as to national security, are especially true for the aerospace industry.

Unfortunately, another parallel between the characteristics of the defense industry and the aerospace sector also holds true. The aerospace industry has not been spared from the deterioration found in the defense

industrial base. Gansler determined that in the period from 1968 to 1975 the number of active aerospace industry subcontractors decreased from more than 6,000 to less than 4,000 (43:129). In 1982, Air Force Systems Command studied the loss of critical aerospace subcontractors and component suppliers and discovered that the number of such firms had decreased by more than forty percent in the past fifteen years (2:15). Labor productivity in the aerospace industry has declined. It has declined since 1971, and now lags that of several industrialized nations (73:47).

The commercial aerospace industry is vitally important to the defense industrial base as well as that portion devoted to military projects. Vawter states that:

The civil aviation industry, because it supports a large aerospace industrial base that is readily convertible to military production, is critical to national defense. Because of the high value of its products and its positive trade balance, it is similarly important to the economy. (108:41)

However, the commercial market has seen harder times also. The U.S. commercial airframe manufacturers have experienced a loss of marketshare due to the emergence of such foreign competitors as Airbus.

From a national perspective, the erosion in U.S. [aerospace] industry's market position results in major economic disruptions in the U.S. The 20% reduction in market share that has already occurred translates into the loss of 255,000 jobs and the following annual financial impacts: a \$4.5 billion reduction in tax and social security revenues; an increase of \$400 million in unemployment benefit payments; and the loss of \$2 billion in trade balance contribution. (9:21)

In many ways, commercial aerospace is a delicate and risky business. Several economic realities characterize the industry. For example, the industry demands extremely large initial development investments and long development times; the learning curve is a significant factor; long production runs are required to recover costs; and the market can only sustain a few producers on a profitable basis (9:10).

High launch costs and significant uncertainties lead to a high level of risk facing manufacturers contemplating new aircraft or engine products. Unsurprisingly, many projects and companies have not been successful. For example, only six of the nineteen jet aircraft programs prior to 1982 had sold over 500 units by that time and one industry analyst estimates that only two of twenty jet aircraft programs initiated have clearly made money. (30:60).

Clearly, the commercial aerospace industry is as vital a component of the defense industrial base as that devoted to military aircraft. Yet, this sector has also seen troubles, and is by nature a delicate and risky business.

As with the defense industry as a whole, international armament programs have also been a concern with regards to the aerospace industry. The Aerospace Industry Association states that

Military co-production programs, which were largely foreign policy decisions, had economic repercussions which were often not fully appreciated. These programs helped develop strong competitors for U.S. manufacturers and, because they led European producers to develop specialized skills in the development and production of parts and components, may have contributed most significantly to competition for U.S. subcontractors--the second and third tier levels of the U.S. aerospace industrial base. (60:45)

However, analysis by the OMB indicates that the aerospace industry is quite healthy, despite assertions to the contrary.

If the defense industrial base effects that may be attributed to offsets were significant, one would expect to see lagging competitiveness in this sector. In fact, at a time when other economic sectors are experiencing large trade deficits, aerospace exports have remained highly competitive and have continued to show large, growing trade surpluses. The aerospace trade balance registered a surplus of \$12.6 billion in 1985, \$12.8 billion in 1986, and \$16.0 billion in 1987.  
(74:38)

The interdependence advantages of international ventures also appear to be establishing themselves in the aerospace industry. The Aerospace Industry Association labels this as a "win-win" situation where the growing number of advanced aerospace manufacturers in foreign countries yields a multitude of contractor/subcontractor arrangements. Consequently, when a U.S. aircraft is sold, foreign subcontractors benefit, and when a foreign aircraft is sold the U.S. subcontractors benefit (74:38).

The U.S. aerospace industry, both military and commercial, is vital to the well-being of the economy and national security. Some deterioration has occurred in this sector of the defense industrial base, just as it has in other areas. While international programs may have spawned foreign competitors in the marketplace, the aerospace industry has apparently weathered such competition much better than other sectors.

Summary. This discussion of the U.S. defense industrial base provides a greater understanding of the issues involved in this national problem. It should certainly promote better analysis of sweeping statements that international armament programs harm the industrial base. The problems in the U.S. industrial base are real. However, any discussion of the role of international programs in the defense industrial base must be limited to the relevant issues.

Several elements can now be added to the developing framework for international armament programs.

Potential Advantages:

o Economic/Industrial

- Employs the global economy and the associated advantages.
- Promotes interdependence and the associated advantages.
- The benefits of competition may be realized.
- Use of an offset may win a sale that may otherwise have been lost.
- Little net impact on employment has been found in past offset arrangements.

Potential Disadvantages:

o Military/National Security

- Foreign sourcing could lead to a foreign vulnerability.
- Successful foreign competition could impact national security through the loss of defense-critical industries.

o Economic/Industrial

-Foreign competition again finds a place in the framework. In addition to previously documented threats, successful foreign competitors threaten further contractions in the subtier, loss of technology, the threat of foreign ownership of U.S. firms, and a loss of manufacturing leadership.

Technology Transfer

Like the defense industrial base, technology transfer is yet another issue in the international armament program concept. The previous section discussed the value of technology to the economy and national security. This idea cannot be overstated. The Defense Department asserts:

There is a substantial body of evidence that technological leadership is irrevocably tied to manufacturing capacity and leadership. The revenues generated by successful manufacturing are essential to achieving and maintaining the levels of research and development required for technological leadership. Without technological leadership, the Department of Defense cannot count on industry's ability to produce affordable, high-quality, state-of-the-art weapon systems. (19:30)

The United States depends on technology to counter the Soviet numerical superiority in a host of weapon systems. Economically, technology is the key to competitiveness. High technology industries have been responsible for our economic success over the last quarter of a century, and today high-tech exports exceed imports by \$31 billion in an era of rising trade deficits (80:Vol 2,306-307). And, as discussed earlier, future economic success rests on continued technological advancement.

However, many see international programs as a direct threat to the U.S. technological base. The previous section on international programs addressed the fact that many international arrangements require technology transfer as part of the deal. This practice developed after World War II as an aid to our allies. However, in today's setting, critics see this practice as a "give-away" to foreign industries.

In the past, the United States did this in order to help its allies' military industries develop more quickly, thus contributing more to the common defense. In recent years, however, as foreign industries become more able to compete on an equal footing with U.S. firms, questions have been raised about the wisdom of giving the nation's best technology to its commercial rivals and, also, risking its loss to the Soviet Union.

(2:20)

Clyde V. Prestowitz, former Commerce Department negotiator and now a leading critic of international ventures, testified to the Senate Armed Services Committee:

I think that the offset agreements that we have negotiated with our allies have been deleterious to our defense effort. I think that they have resulted in a massive transfer of technology to our allies who, in many cases, are our chief economic competitors. Let me say that we use this term "ally", but in some cases the people to whom we transfer technology have no defense responsibilities toward us, and in some cases, the effect of these policies is to undermine in the long term our defense capability. (104:271)

Critics of international armament programs view technology transfer as a major plank in their case against such agreements. The perceived threat of foreign partners as future commercial competitors is the main point of this argument.

Technology Transfer Examples. Many cases are available to illustrate the technology transfer aspect of international armament programs. As with the previously discussed sale to Turkey of F-16s, technology transfer is a major component of joint ventures. A 1980 U.S.-Canadian agreement for the purchase of F-18s caused a political furor in the United States. This arrangement

...provided offsets designed to enhance specific Canadian technology shortfalls in selected industries. These offsets included providing the technology, and research and development facilities for manufacturing jet engines, fiber optics, composite materials and metals processing. (99:8)

In a similar deal with Australia for 75 F/A-18s, not only is such technology as titanium hot-forming, carbon composites manufacturing, metal plating, and titanium commercial milling to be transferred, but also actual facilities. U.S. companies are to help build production facilities in Australia that are to remain in place after completion of the contract (99:8). The F-16 coproduction program with the European Participating Group provides a unique opportunity to view the effect of technology transfer. The Office of Management and Budget found that certain European industries involved with the F-16 have since utilized the skilled labor, invested capital, and transferred technology to expand their markets. Examples of such new competitors to U.S. industry are

-DAF in the Netherlands, which now competes for new landing gear contracts with the U.S.-based Menasco Corporation.

-Norsk Farvarslekiologi of Norway, which has entered the commercial maritime gyrocompass market based on the F-16 experience. (74:68)

Such examples of increased commercial competition as a result of technology transferred through an international armament program are the heart of the critics' argument.

In summary:

When technology, essential to the economic or military well-being of one country, is transferred and results in the economic or military development of the receiving country, the donor country can be weakened. The degree to which this occurs is a function of the value or relative scarcity of that technology as a capital resource. This transfer then is contrary to pure economic evolution which would cause the U.S., when it has a comparative advantage, to prefer to export the product. Such actions can cause change in the economies of both countries. The donor country becomes the loser because it has transferred one of its factor endowments for which it had an economic comparative advantage. (71:4)

Technology Compromise. In addition to the concern over the potential rise of commercial competitors from technology transfer, critics also warn of the potential for transferred U.S. technology falling into Soviet hands. The flagship case for this argument is the Toshiba and Kongsberg Vabenfabrik incident, in which milling machines and computer-controlled systems containing technologies originally developed in the U.S. were sold to the Soviet Union by Toshiba of Japan. These technologies were considered militarily sensitive by the United States for their ability to produce super-quiet submarine propellers (2:20). This argument may be well-founded. A 1985 report entitled Soviet Acquisition of Militarily Significant

Western Technology--An Update stated that, according to the Soviet's own assessment, over 5,000 of their military research projects benefit each year from technical documents and hardware obtained from the West (64:8-1).

Technology Protection. The President's Commission on Industrial Competitiveness determined that "since technological innovation requires large investments of both time and money, the protection of our intellectual property is another task we should place on our competitive agenda" (80:21). The Commission also felt that in the international trade arena, the U.S. must create safeguards against the misappropriation of intellectual property for commercial purposes, especially by the newly industrialized countries (80:22). However, in the international armament programs arena, the United States already has in place "a complex system of reviewing any technology transfer from a national security perspective" (55:11). The primary policy governing the process of technology transfer in the Department of Defense is DoD Directive 2040.2, "International Transfer of Technology, Goods, Services and Munitions" (64:8-2). This directive establishes technology transfer policy in strong terms. A portion is reprinted here:

It shall be DoD policy to treat defense-related technology as a valuable, limited national security resource, to be husbanded and invested in pursuit of national security objectives. Consistent with this policy and in recognition of the importance of international trade to a strong U.S. defense industrial base, the Department of Defense shall apply export controls in a way that minimally interferes with the

conduct of legitimate trade and scientific endeavor. Accordingly, DoD Components shall:

- o Manage transfers of technology, goods, services, and munitions consistent with U.S. foreign policy and national security objectives.
- o Control the export of technology, goods, services, and munitions that contribute to the military potential of any country or combination of countries that could prove detrimental to U.S. security interests.
- o Limit the transfer to any country or international organization of advanced design and manufacturing know-how regarding technology, goods, services, and munitions to those transfers that support specific national security or foreign policy objectives.
- o Facilitate the sharing of military technology only with allies and other nations that cooperate effectively in safeguarding technology, goods, services, and munitions from transfer to nations whose interests are inimical to the United States.
- o Give special attention to rapidly emerging and changing technologies to protect against the possibility that military useful technology might be conveyed to potential adversaries before adequate safeguards can be implemented.
- o Seek, through improved international cooperation, to strengthen foreign procedures for protecting sensitive and defense-related technology.
- o Strive, before transferring valuable defense-related technology, to ensure that such technology is shared reciprocally. (64:8-2,3)

Additionally, DoD Directive 2010.6 dictates that:

Commercial implications of technology transfers proposed in support of a collaborative project should be considered when weighing the costs and benefits of that project. These considerations should include an estimate of how the commercial applications of the technology transfer might affect U.S. commercial competitiveness in future international markets.

(24:12)

Consequently, for international armament programs, the DoD is governed by these regulations as well as the Arms Export Control Act and the International Traffic in Arms Regulation. Export licenses must be approved by the Department of State and reviewed by Congress. The entire process is a complex one, prompting one study to conclude that because of the numerous agencies involved, and variety of laws and regulations, "there is a great controversy among agencies and within the Congress as to how best to assure that transfer of technology does not constitute a threat to U.S. security" (55:11).

#### Technology Transfer Issues

Availability of Technology. There do, however, exist several theories on technology transfer which do not typically receive as much attention as the arguments of the critics, yet deserve consideration. For example, the Aerospace Industry Association suggests that:

Excessive efforts to limit technology transfer for civilian applications will likely prove futile in view of the number of technology capable competitors in the market and the fact that U.S. technology is embodied in aircraft flown throughout the world. (60:74)

The Department of Transportation agrees with this idea that the U.S. does not have a sole proprietorship on aerospace technology, especially commercial technology.

Modern commercial aircraft and turbine engines are among the most complex manufactured products, yet much of the technology in the most recent generation of products seems familiar. Some of the planes sold today are derivatives of planes designed twenty years ago. This raises the question of whether aircraft is really a high technology industry and whether gaining access

to current technology is a significant barrier to improving a company's competitiveness. (30:40)

Most product design technology in the aircraft industry is not proprietary. . . . Little aerospace technology is patented, some innovations being unpatentable and others hard to protect. . . . Much technology incorporated in aircraft is developed in supplier industries. . . . These technologies are available to all aircraft manufacturers, with the result that no airframe company has an overwhelming technological advantage. (30:41-42)

This argument is certainly worthy of consideration, especially in light of the fears that the transfer of military technology could result in the establishment of a commercial competitor. This is a common accusation, particularly of international military aircraft programs. In its comments on a General Accounting Office study on military cooperative programs and their effects on commercial applications, the Commerce Department suggested:

The report would benefit from differentiation between the transfer of technology and management know-how. In this era of rapid communication, breakthroughs in pure technology become known around the world with very little delay. Technical papers presented at meetings of scientific societies and industry associations frequently provide the vehicle; commercial joint ventures serve similarly. (46:46)

Therefore, the idea that technology is not so difficult to obtain is interesting. In the aerospace industry, a number of foreign competitors exist in both the commercial and military aircraft markets. American aircraft are sold and flown throughout the world. Even the most modern commercial aircraft do not necessarily possess technology that is not

obtainable through several means. Technology flows easily throughout the aerospace community.

Technological Suicide? The aerospace contractors themselves will argue that in military cooperative programs, they have little control over the transfer of military technology abroad since this is dictated by government-to-government MOUs. However, in their agreements with foreign firms, U.S. contractors insist that they carefully protect technology necessary to maintain their competitive positions. Vawter found that "the indication is that industry is exercising great restraint and, in its opinion, is not giving away the store" (108:42). In addition, they suggest that since major collaborative projects may last a decade or more, that any technology that is shared cannot compare to the value of new technology embarked upon in the meantime (60:52). Therefore, the challenge is for companies to transfer technology that still has a value, but that will not threaten the firm's ability to compete in the future. The best way to ensure that is for the company to always have new and better technologies under development (55:7).

Value of Technology. Another idea for consideration is, as the Commerce Department previously suggested, that perhaps technology is not as important a factor as other expertise may be. It has been suggested that in today's global economy, human resource management

may be the key to competitive advantage. Two conditions are offered in support of this idea:

1. Industrial technology, as previously discussed, is readily transferrable; and
2. Social, cultural and political values and norms, mobilized within a society to establish a particular workplace orientation, are not normally transferrable.  
(73:22)

The result is that human management may be a more important competitive advantage than capital technology or market know-how.

Technology transfer may also be of limited value to the receiver. There is much to be said for the process and continuity of developing technology rather than simply obtaining the perfected technology. The Department of Transportation found that:

In aircraft production, however, the technology transfer enables the firm to move down its existing experience curve, but not to match the experience of the firm providing the technology. The greater number of prior models developed by the established firm permits that firm to have its entire experience curve lower than that of the new entrant, and perhaps to have a steeper slope as well. That downward shift reflects the value of the corporate assets of design and production experience acquired on previous planes.  
(30:105)

The established firm's previous experience, as well as progress on new projects, should prove to be a distinct competitive advantage over the firm receiving transferred technology.

This pursuit of the next-generation of technology is important. The office of the United States Trade

Representative believes that this pursuit is where the strength of the U.S. economy lies. "Technology cannot be effectively hoarded in today's competitive world. We should sell yesterday's technology where possible to gain funds to invest in tomorrow's" (46:40). This idea is taken further with the suggestion that the sale of technology may even suppress the purchaser's domestic technology.

Pioneers of technological change, including the U.S., benefit when their technology becomes the world standard--even if they "give it away." It is simply incorrect to analyze technology transfers in monetary terms, because financial returns are seldom the primary consideration. What is most important is the protection of one's technological leadership. In this light, technological transfers benefit the exporters of technology because they forestall the emergence of alternative, and possibly superior, technologies. Competitors are transformed into functional subsidiaries. (76:19)

Yet another idea involves the value of particular technologies. It has been suggested that possession of one transferred technology may not be as far-reaching as once believed. This is because the traditional view of technology evolution may not hold in today's environment. The traditional American view has been that of a "straight-line" evolution: basic research leads to applied research which leads to technological development and then a new product. Instead, the process may have evolved into a complex blending of skills which has been described as "technological fusion". "The line of innovation has curled into many circles. No longer does control of access to one bit of technology necessarily check the progress of others"

(100:17). The example used to illustrate this concept is Japan's microchip industry. This industry gained preeminence after fusing the different technologies of camera makers (for printing circuits), crystallographers (for pure silicon wafers), and builders (for dust-free rooms) (100:17). Consequently, a variety of technologies may be necessary to advance one particular technology.

Responsibilities in Technology Transfer. A particularly strong school of thought advocates the idea that the onus is on the partner who is transferring technology in the international collaboration to ensure that the arrangement is in his best interests. Yves L. Doz conducted a five year study of 15 strategic alliances around the world and found several reasons to support this tenet. Most prominent, Doz suggests:

Whether collaboration leads to competitive surrender or revitalization depends foremost on what employees believe the purpose of the alliance to be. It is self-evident: to learn, one must want to learn. Western companies won't realize the full benefits of competitive collaboration until they overcome an arrogance born of decades of leadership. In short, Western companies must be more receptive. (32:138)

The collaboration must be a two-way street, with both parties gaining from the arrangement. This requires that the partner who is leading and transferring technology must take an active and vigorous role in gaining from his partner. For the deal to be successful, each must contribute something distinctive, and the other must ensure that this contribution is received. "The challenge is to

share enough skills to create advantage vis-a-vis companies outside the alliance while preventing a wholesale transfer of skills to the partner" (32:136). This is not an easy task. The transfer of technology must be selective, with sufficient safeguards to prevent the indiscreet and wholesale loss of technology. In addition, the partner that is transferring the technology must pursue and capture the contribution that the other partner brought to the arrangement in exchange for the technology--whatever this may be. Doz found that the most successful collaborations follow a "simple but powerful" set of principles:

- o Collaboration is competition in a different form. Successful companies never forget that their new partners may be out to disarm them. They enter alliances with clear strategic objectives, and they also understand their partner's objectives will affect their success.
- o Harmony is not the most important measure of success. Indeed, occasional conflict may be the best evidence of mutually beneficial collaboration. Few alliances remain win-win undertakings forever. A partner may be content even as it unknowingly surrenders core skills.
- o Cooperation has limits. Companies must defend against competitive compromise. A strategic alliance is a constantly evolving bargain whose real terms go beyond the legal agreement or the aims of top management. What information gets traded is determined day to day, often by engineers and operating managers. Successful companies inform employees at all levels about what skills and technologies are off-limits to the partner and monitor what the partner requests and receives.
- o Learning from partners is paramount. Successful companies view each alliance as a window on their partners' broad capabilities. They use the alliance to build skills in areas outside the formal agreement and systematically diffuse new knowledge throughout their organizations. (32:134)

These principles have application to international armament agreements. Success is the responsibility of each partner, and if the commitment to gaining and learning is one-sided, then competitive compromise can be the only outcome.

The arrogant attitude of the West which Doz referenced may also affect the selection of technology to pursue from partners of the United States. Perhaps because American technology has usually led the world, a myopic view of what U.S. partners can contribute has developed. The partner to the U.S. in an international program may not possess many of the technological skills of the United States, but that certainly does not mean that the partner does not have something valuable to contribute. Process technology is an excellent example. Many U.S. partners in collaborative projects, Germany and Japan for example, possess excellent process technology. Such technology could be a valuable exchange for U.S. technology.

Perhaps the most glaring deficiency in America's technological capabilities has been our failure to devote enough attention to manufacturing or "process" technology. It does us little good to design state-of-the-art products, if within a short time our foreign competitors can manufacture them more cheaply. (80:20)

This is merely an example. The point is that any U.S. partners should be able to bring something to the table from which the United States could benefit.

Summary. This section has been devoted to technology, its transfer in international collaborations, and the

implications of this practice. It would be hard to find someone to argue with the position that technology is an extremely valuable commodity to the United States. It has been invaluable in the past, and holds the success for the future. The Defense Science Board went as far as suggesting that the pursuit of technology superiority be a national policy, much as was the lunar exploration program of the 1960's:

Simply stated, our goal should be to achieve and maintain a clear superiority in advanced civil and defense technologies as a basic element of our strategy for our future. In the past, we have shied away from the term "technological superiority" for fear of offending our friends and perhaps inciting our adversaries. Perhaps, in the process, we have only confused ourselves and our own sense of purpose. We feel that it is time to state unambiguously a goal which can create the climate for increased investment in advanced research and development and technical education which can underpin the revival of our clear leadership and which, as a result, will alleviate most concerns about increased industrial collaboration with our allies. (25:69)

In this light, technology transfer must be an effectively managed aspect of international programs, and not a liability of the concept.

Additions to the international program framework include:

Potential Advantages:

o Military/National Security

-The sale of "old" technology can finance the search for the next-generation of technologies.

-A "two-way street" can be pursued which would utilize developed technologies of our allies in U.S. weapon systems. Not only may excellent

technologies be employed, but also valuable R&D resources conserved.

o Economic/Industrial

-Technology transfer is not an easy issue. Potential threats may be overstated, and the transfer of technology may actually be beneficial. Considerations include the availability of the technology elsewhere, the idea that technology is not the sole ingredient for success, that development of technology is more valuable than its purchase, the benefits of U.S. technology becoming the "world standard", that control of technology transferred is possible, and that the transfer of technology may actually suppress the development of other technologies which may prove better.

-The "two-way street" may benefit the commercial industries also.

Potential Disadvantages:

o Military/National Security

-The impact of any loss of U.S. technological leadership on the ability to field effective weapon systems.

-Compromise of technology to the Soviets by the country the technology was transferred to (e.g. Toshiba incident).

o Economic/Industrial

-Any advantage provided to economic competitors through the technology transferred--both commercially and in the defense markets.

Trade and Competition

No other issues in recent years have focused the spotlight on international armament programs as have the imbalances which the United States is now experiencing with its trade partners. Intimately involved with the trade

issue is the concern for America's competitiveness in the world market. This section shall explore these two issues.

The United States has advocated and profited from the traditional concept of a world economy open to trade and governed by the forces of the market. U.S. policy is based on the premise that competition guides the efficient allocation of resources, and that the result will be quality products at low prices, diffusion of technology, low inflationary pressure, and increased productivity and income (20:19). However, recent history has witnessed growing trade imbalances for the United States. The preeminent study of U.S. industry and its position in the world market is Global Competition--The New Reality by the President's Commission on Industrial Competitiveness. This report supported the previously discussed concept of a global economy. The U.S. is operating in an economic environment that is dramatically different from the 1950's. A growing international economy that is becoming more and more interdependent is now the norm. As evidence, "Almost 20 percent of U.S. production is exported and over 70 percent of U.S. goods must compete with foreign products in the domestic market" (108:vi-vii). Today U.S. industry is faced with competitors from throughout the globe that are increasingly more capable. This competition in world trade has resulted in the United States maintaining a negative

trade balance since 1975, as compared to a positive trade balance for the entire 20th century prior to 1971 (108:vii).

Global Competitors. Countries such as Korea, Brazil, and other traditionally less developed nations have gained formidable industrial capacity in recent years. Although the top ten newly industrialized countries account for just 15 percent of world trade, the rise of Japan from 1950 to 1980 should be a cautionary lesson. In 1980 the U.S. exported \$26.1 billion more to the newly industrialized nations than it imported. By 1986, this had changed to the U.S. importing \$27.9 billion more than it exported (31:79). The Pacific Rim has undergone an impressive strengthening of its industries. The mastering of manufacturing technology by Japan and other Asian nations has allowed these countries to enter types of industries which the U.S. has traditionally controlled, such as steel, automobiles, televisions, and machinery (80:Vol 2,19). In addition:

...foreign companies have succeeded in closing the technology gap with the United States in high technology industries, such as semiconductors and telecommunications, and have used sometimes superior manufacturing ability to gain world class status. Thus, the traditional pattern by which the United States led industries through technological dominance has been broken. Moreover, competitive success in many industries today is as much a matter of mastering the most advanced manufacturing processes as it is in pioneering new products. (80:Vol 2,19)

Europe is another competitor to the United States that is not all that new. Europe has traditionally been a strong competitor and trading partner with the United States. Yet,

the future may witness a Europe that is even more formidable. The European Commission has embarked upon a plan that calls for the completion of an internal European free market by 1992 (31:80). This ambitious plan calls for the elimination of obstacles to the flow of goods, services and people. If successful, the European manufacturers could gain in at least three ways. The more integrated capital markets will reduce the cost of capital. Economies of scale could develop, and European goods could become cheaper from the reduction of internal trade costs (31:80). Prospects of an even more competitive European market has industry and government officials worried. Not only may European goods be even more competitive in the U.S. market, but U.S. companies may also find it difficult to compete in the European home market.

U.S. Competitiveness. Not all of the blame for U.S. trade woes can be attributed to the actions of new and old competitors. The United States in many ways has not helped its case. For example, productivity growth in the U.S. has not been exemplary. From 1960 to 1983, the average productivity growth in the United States has only been 1.2 percent--less than the growth of all its major trading partners. Japan experienced a 5.9 percent growth, Korea 5.2 percent, and West Germany 3.4 percent (108:vii). The U.S. manufacturing base has continued to shrink. The primary reason for this contraction is the deterioration of the

manufacturing trade deficit. An assessment of U.S. manufacturing competitiveness is discouraging. Since 1979, the United States has improved relative to Canada, but is falling behind France, and had a productivity growth just 50 to 60 percent of Japan, Italy, and the United Kingdom (69:43).

The President's Commission on Industrial Competitiveness defined the idea of competitiveness as:

. . . the degree to which a nation can, under free and fair market conditions, produce goods and services that meet the test of international markets while simultaneously maintaining or expanding the real incomes of its citizens. (80:6)

The commission went on to identify four key indices of national competitiveness in which the U.S. is faltering. These gauges found insufficient productivity growth compared to U.S. competitors, stagnating growth in real wages, inadequate real returns on manufacturing assets, lackluster trade performance in manufactured goods, and eroding world market shares in many industrial sectors critical to future economic development (80:Vol 2,16). These findings and those preceding them on productivity and the trade deficit should prove to be a sobering testimony to America's competitiveness and trade problems. However,

Only through a competitive America can we sustain economic growth, assure our national security, maintain our leadership position in world affairs and our technological preeminence, and provide greater opportunities for the generations to follow. (80:45)

Defense Trade. Defense industries have experienced the same difficulties as the overall U.S. economy. Japan, Taiwan, Hong Kong, Singapore, and Korea--as well as Western Europe--are directly competing with industries critical to the defense of the United States (19:29). The U.S. share of the international defense market has continued to decline, and, in addition to the Pacific Rim and traditional Western European competitors, Israel, Brazil, Italy, and Spain have also increased their market share (55:5). In addition to direct competition, the declining U.S. defense budgets and numerous DoD cost-cutting policies have also weakened defense industries (83:30). C.D. Vollmer, Staff Vice President of General Dynamics' Defense Initiatives Organization, states:

...in today's era of competition, U.S. industry is less able to compete. No longer does American industry have technological superiority across the board. Foreign companies are closing the gap and replacing less competitive American firms. (83:30)

Such competition and U.S. weakness is reflected in the defense trade figures. The Aerospace Industry Association reports that:

The U.S. share of the world defense market declined from approximately 43 percent in FY 1983 to an estimated 20 percent in 1986; in 1976, U.S. market share was 49 percent. The decline in U.S. market share is attributable to factors which include the U.S. self-imposed, domestic political and technological transfers constraints; increased foreign competition including increased cooperative arrangements for arms production, including offset; and the development of indigenous arms production capability in a growing number of countries. (60:66)

With NATO alone, once a defense market monopolized by U.S. firms, the Commerce Department reports that the defense trade balance is approaching parity (60:62).

The Importance of Defense Trade. Defense exports are important to the U.S. defense industrial base. Although it has been previously stated that the majority of the responsibility for the health of the defense industry lies with the Department of Defense, the defense industrial base is not solely dependent on DoD.

The strength of the base is primarily a function of the economic viability of the companies which make up the base. Their viability depends on their competitiveness in the commercial market as well as on their relationship to DoD. (12:2)

Consequently, defense exports, as well as any commercial products they produce, supplement the revenues earned by defense contractors. One study found "...a significant difference between those industries that manufacture defense goods and those that do not in the area of exports" (8:vi). This study found that defense industries which exported were more competitive than industries that do not export at all (8:vi). In addition, sales of defense equipment through exports provide contractors with funds to increase research and development in basic and applied technology (60:64). And through exports a larger production base is possible than with DoD-only sales (60:64). An additional consideration involves the political realities of defense exports:

The U.S. Government has carefully orchestrated arms export policy to advance U.S. political and defense interests abroad. If U.S. defense contractors lose a substantial share of exports to other arms makers and if they are shut out--politically or on the basis of cost--from participation in foreign defense markets, the U.S. could correspondingly lose influence. It may not be able to generate the sales to Third World nations that have contributed to its ties with many of these strategic countries. (60:67)

Therefore, defense exports serve the U.S. and the defense industry in a variety of ways.

Aerospace Trade. The subject of the ensuing case analysis, the aerospace industry, is a particularly active player in world trade. Trade in aerospace is closely monitored in the U.S. because of its important contribution to the trade balance, and as a measure of the competitiveness of this industry so valued for its technological and national security contributions (60:15). Table 1 records the U.S. and aerospace balance of trades from 1973 through 1987.

As depicted by Table 1, the aerospace trade balance has continued to be a bright spot in the overall trade picture of the United States. Aerospace exports have continued to grow throughout this period; however, so have the aerospace imports. Imports grew over 10 times in the 1973 to 1987 period, while exports grew only 4.65 times their 1973 level. This hints at the current situation which is summarized by the Aerospace Industries Association:

U.S. market dominance has been increasingly challenged since [1960]. In 1970, the U.S. share of free world aerospace production was 79 percent; by 1975, it had

Table 1. Total U.S. and Aerospace Balance of Trade, Calendar Years 1973-1987

(74:46)

(\$ in millions)

Year	<u>Total U.S.</u>	<u>Aerospace</u>	<u>Aerospace</u>	
	<u>Trade Balance</u>	<u>Trade Balance</u>	<u>Exports</u>	<u>Imports</u>
1973	1,222	4,360	5,142	782
1974	(2,996)	6,350	7,095	745
1975	9,630	7,045	7,792	747
1976	(7,786)	7,267	7,843	576
1977	(28,970)	6,850	7,581	731
1978	(33,741)	9,058	10,001	943
1979	(30,272)	10,123	11,747	1,624
1980	(27,336)	11,952	15,506	3,554
1981	(30,051)	13,134	17,634	4,500
1982	(35,182)	11,035	15,603	4,568
1983	(60,710)	12,619	16,065	3,446
1984	(110,932)	10,082	15,081	4,917
1985	(136,627)	12,592	18,724	6,132
1986	(162,281)	12,802	20,704	7,902
1987	(171,200)	16,019	23,924	7,905

dropped to 66 percent. The European Economic Community industries accounted for about 30 percent, with the remainder distributed among other countries. U.S. market share declined gradually through the late seventies to 60 percent in 1980 and then rose again through the early eighties as U.S. defense spending in aerospace reached record levels. By 1984, U.S. share of the free world domestic market was 69 percent--a significant increase over its 1980 level yet still nearly 10 percent below even its 1970 market share of nearly 80 percent. (60:20-21)

Consequently, although the U.S. aerospace industry has continued to grow and compete in the world market, it does not enjoy the dominance it once exercised. This deterioration of the position of the U.S. aerospace industry in the world market affects more than the economics of the individual firms. This condition, because of the previously discussed role aerospace plays in the U.S., is also a

detriment to the American economy and U.S. national security objectives (9:18).

U.S. aerospace exports involve a complete range of products, both commercial and military. The following tables and figures present data on the composition of both U.S. exports and imports.

Table 2. Composition of U.S. Exports  
(60:18)

(Millions of Dollars)							
	1965	1970	1975	1980	1985	1986	1987
Total	<u>1,474</u>	<u>3,400</u>	<u>7,821</u>	<u>15,506</u>	<u>18,724</u>	<u>20,704</u>	<u>24,719</u>
Total Civil	835	2,508	5,351	13,239	12,919	14,833	16,709
Complete Aircraft	<u>476</u>	<u>1,530</u>	<u>3,230</u>	<u>8,256</u>	<u>6,694</u>	<u>7,365</u>	<u>7,284</u>
Transports	<u>352</u>	<u>1,295</u>	<u>2,424</u>	<u>6,727</u>	<u>5,518</u>	<u>6,276</u>	<u>6,087</u>
General Aviation	69	114	312	739	191	243	272
Helicopters	16	28	105	299	210	277	242
Other	39	94	389	491	775	569	683
Aircraft Engines	56	116	231	556	923	987	1,175
Aircraft and Engine Parts	303	862	1,890	4,427	5,302	6,481	8,250
<hr/>							
Total Military	637	892	2,471	2,267	5,805	5,871	8,010
Complete Aircraft	304	467	1,306	949	2,011	2,479	3,633
Aircraft Engines	25	46	94	63	146	111	210
Aircraft and Engine Parts	303	271	771	506	2,823	2,624	3,376
Guided Missiles, Etc.	6	108	299	749	825	657	791

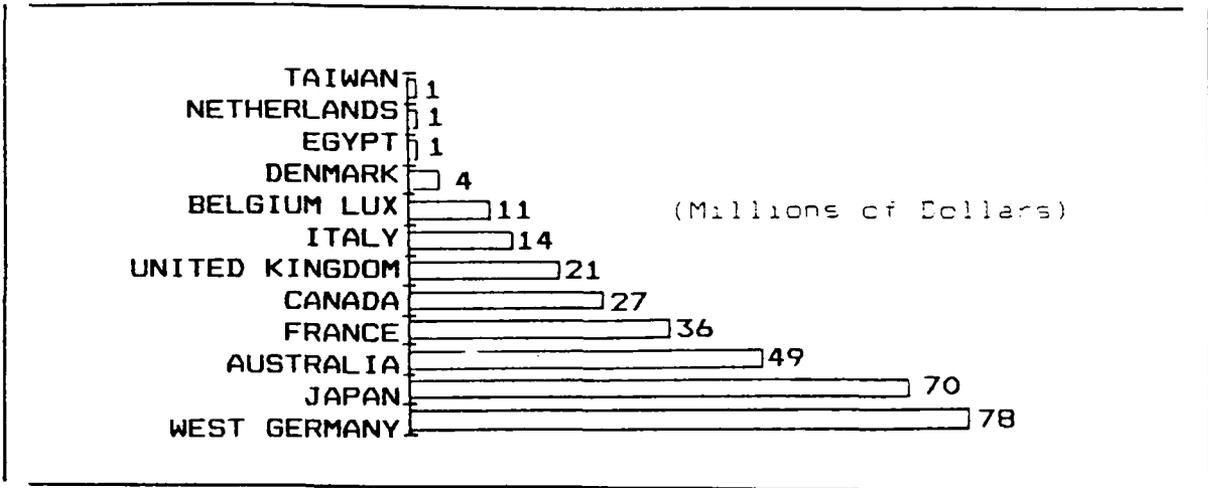


Figure 5. U.S. Civil Aerospace Exports, by Country, 1965  
(60:19)

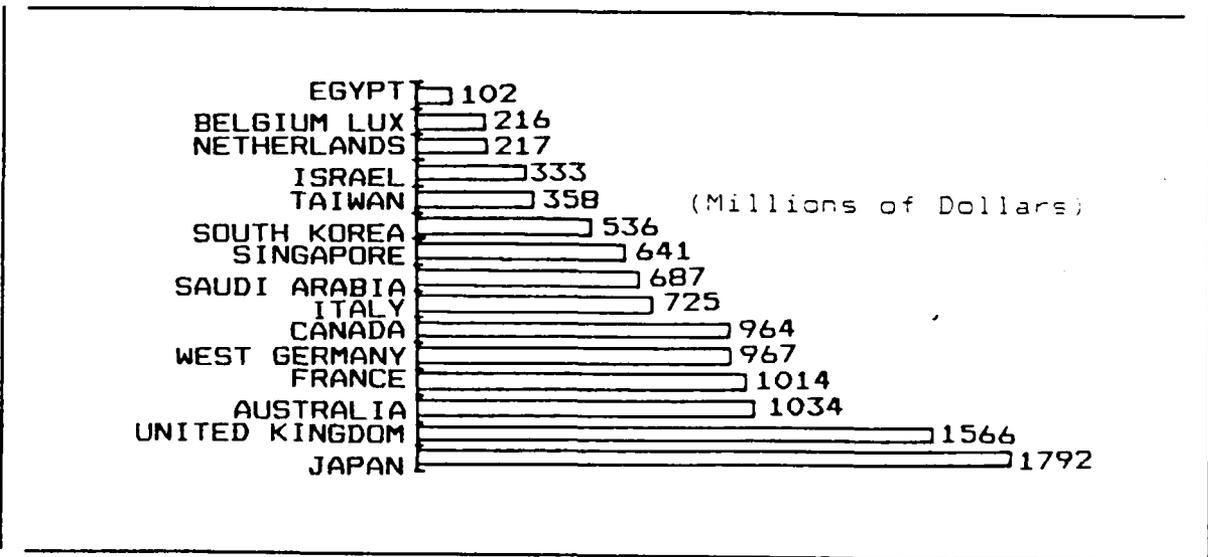


Figure 6. U.S. Civil Aerospace Exports, by Country, 1985  
(60:19)

Table 3. Composition of U.S. Imports  
(60:20)

(Millions of Dollars)						
	1965	1970	1975	1980	1985	1986
<b>Total</b>	<b>158</b>	<b>308</b>	<b>747</b>	<b>3,554</b>	<b>6,132</b>	<b>7,902</b>
<b>Total Civil</b>				<b>3,228</b>	<b>4,984</b>	<b>6,398</b>
Complete Aircraft*	<u>73</u>	<u>48</u>	<u>192</u>	<u>1,316</u>	<u>1,502</u>	<u>2,050</u>
Transports				285	599	742
General Aviation				496	673	1,053
Helicopters				54	45	63
Other				481	185	192
Aircraft Engines*	20	33	229	731	1,019	1,133
Aircraft and Engine Parts	65	226	325	1,181	2,463	3,215
<b>Total Military</b>				<b>325</b>	<b>1,148</b>	<b>1,504</b>
Complete Aircraft				4	20	35
Aircraft Engines				29	217	286
Aircraft and Engine Parts				292	911	1,183

\*separate data for civil and military products not available for 1965, 1970, and 1975

NOTE: Detail on 1987 imports not available.

a Details may not add to total because of rounding.

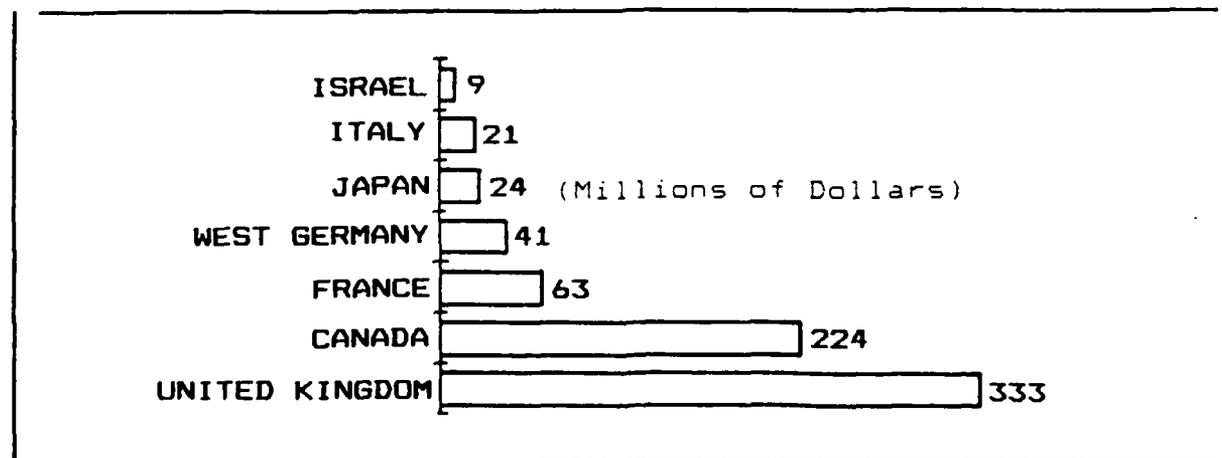


Figure 7. U.S. Aerospace Imports, by Country, 1975  
(60:22)

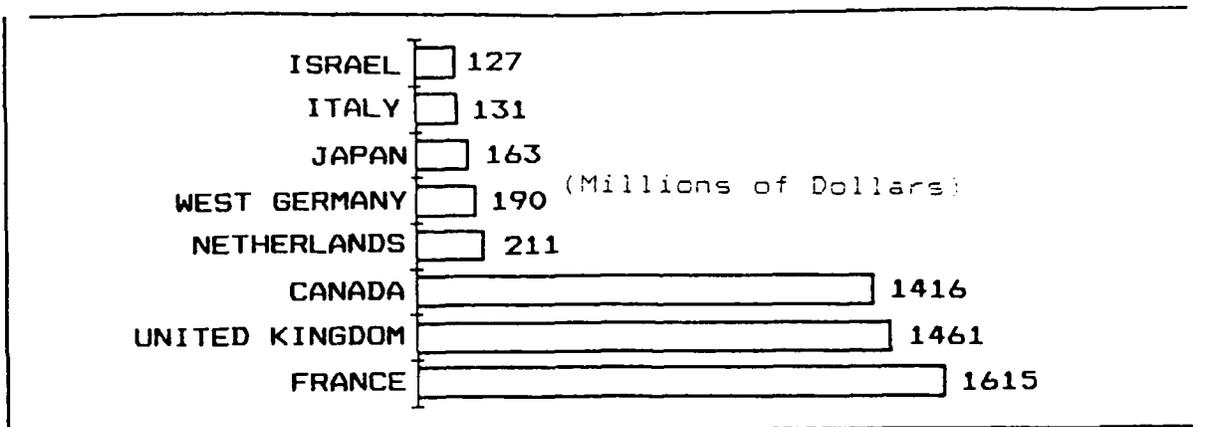


Figure 8. U.S. Aerospace Imports, by Country, 1985  
(60:22)

As Table 2 and Figures 5 and 6 indicate, the commercial aerospace market has historically provided the bulk of U.S. aerospace exports and is dependent on the world marketplace. Sales to non-U.S. airlines have represented 55 percent of total commercial sales to date, and are projected to account for 60 percent of the total during the next ten years (9:5; 60:49). Therefore, the commercial aerospace market is an integral component of U.S. aerospace sales, and can be expected to continue to be in the future. The import market in the U.S., as depicted in Table 3 and Figures 7 and 8, is relatively small and dominated by the parts market.

The data also indicates that the military export business has historically not comprised as large a portion of the U.S. aerospace export business. Nevertheless, it has been an important element of the overall sales, especially for those companies primarily devoted to defense work. However, the future of military export sales may not be as

bright as that of commercial exports. One estimate is that only 8,700 new fighters may be bought by the year 2010, and most of these will be relatively cheap, low-performance versions of advanced trainers. This source further estimates that, because of increased competition and dedicated national purchases, the resulting uncommitted market will be no more than 1,200 aircraft by 2010 (6:114).

Trade and International Armament Programs. Trade and international programs have become closely associated. Some possible explanations for this relationship include the growing practice of international ventures, today's focus on trade issues, and the fact that many international projects involve the very countries the U.S. is battling in the commercial markets. The Under Secretary for Export Administration, Department of Commerce, Dr. Paul Freedenberg, spoke for many who share a concern over the relationship when he testified to the Senate Armed Services Committee that:

Offsets in defense trade are another area of Commerce Department concern with respect to the defense base. Offsets, required by the purchasing government as compensation for the purchase of U.S. military equipment, are a key factor in defense trade which may have a detrimental impact on our nation. Offset requirements by our allies have continued to increase in recent years, even though their economic standings have improved dramatically. Our studies prepared under section 309 of the Defense Production Act have highlighted the fact that more than 75 percent of our offset obligations are to our industrialized allies, such as Canada, Japan and European NATO countries, which include countries with which we have major trade deficits. (104:199)

Although this testimony may seem repetitive of previously discussed issues, the difference is in the strong linking of the international program to trade. No longer is the international program a uniquely Department of Defense or State Department concern. The trade wars and U.S. casualties in those battles have forced the international program into a larger arena.

The Boeing AWACS sale to both France and Britain is an excellent example of an international armament program becoming a major trade concern. This sale of America's premier surveillance aircraft produced quite a controversy. Both the purchasers in this case are advanced in their aerospace industries, and very active competitors in the world aerospace market. Britain manufactures a complete array of aerospace products, and currently exports about 60 percent of its aerospace output (74:82). The British aerospace industry enjoys an overall trade surplus which reached \$3 billion in 1986 (74:82). The British firms participating in the AWACS program are among the United Kingdom's most sophisticated and competitive aerospace firms, and the AWACS offsets are comprised mostly of subcontracting, teaming, technology development, and purchasing (74:82).

Likewise, France possesses an aerospace industry that is one of the largest and most sophisticated in the world. In both civil and military wares, the French aerospace

industry produces a wide range of world-class aerospace products (74:87). The French aerospace industry has historically relied heavily on aerospace exports. Approximately 60 percent of total French sales are exported versus less than 20 percent for U.S. aerospace output (74:87).

The Boeing AWACS sale to France and Britain was accomplished with a 130 percent offset. The following depicts some specifics of the sale:

	<u>Units</u>	<u>Value of Sale*</u>	<u>Value of Offsets*</u>
U.K.	7	1,133	1,474
France	4	705	915

\*millions

(74:76)

This 1987 sale had accomplished, by 30 June 1988, \$529 million in offsets for Britain (74:81). Consequently, the sale of sophisticated hardware to advanced aerospace competitors such as Britain and France, coupled with a lucrative 130 percent offset, produced outrage in many Americans. The Office of Management and Budget even conceded that:

The details of the AWACS offset agreements indicate some potential concerns for the competitiveness of some U.S. subcontractors. Foreign systems manufacturers might benefit not only from the additional sales emanating from the offsets, but also from the formation of new market patterns, some of which may be lasting, and from the "learning experience" derived from working within the American aerospace marketplace. If offset arrangements afford foreign firms wider market positions as a result of

these offsets, U.S. firms could find it more difficult to compete against them.

Another important consideration is the impact that the numerous advanced aerospace technologies associated with major systems development have on related subcomponent industries...[i.e. forgings and castings]. Other industries which may experience long term adverse impacts either directly or indirectly from offsets include the investment casting, precision bearing, microwave tube, machine tools, fasteners, and electronic component industries. These relatively small industries have followed the major aircraft and aircraft engine companies into the global aerospace markets, forming foreign subsidiaries or licensing technologies in foreign countries, in some cases because of offsets. The aerospace portions of these subcomponent industries perform much of the research and development, employ a major share of the scientists and engineers, and introduce a disproportionate share of the technology that underwrites much of these sector's technical advances and competitive capabilities. Thus, offsets in these sectors can have long term competitive consequences for firms in these industries. (74:90-91)

U.S. trade difficulties coupled with an international program involving advanced competitors forced a new orientation on the AWACS sale. This program stepped out of its traditional realm as a concern of the State and Defense Departments into the broader and more volatile arena of U.S. international trade.

Another concern embodied in arrangements like the AWACS sale is the aid which the foreign governments provide their industries. Dennis M. Biety, Counsel for Pneumo Abex Corporation, testified to the Senate that:

Ultimately it is not the fact that these companies are competing which we find onerous; it is the fact that in a typical offset or coproduction transaction, the foreign license is subsidized to a great extent by his own government, the governments pick up technology transfer fees, they supply tooling, they pay for training, they put up factories in some instances, and

they ultimately buy the products of their own domestic manufacturers at ever-increasing prices. (104:274)

Consequently, international sales such as the AWACS to Britain and France exemplify the potential threats which such offsets may pose to the competitiveness of U.S. defense industries. They may open new markets to foreign industry, impact U.S. subcontractors, and allow foreign governments to "subsidize" their own industries--all possibly leading to an increased competitive posture for the foreign firms. It is in such sales agreements that we see the conflict between foreign policy and military considerations and trade and competitiveness issues.

The Offset as a Sales Feature. Very important to this issue is the recognition of the offset as a reality in the marketplace. Demands for offsets are increasing in the defense trade. So called "off-the-shelf" purchases of U.S. military equipment are uncommon in today's market. Political considerations in the purchasing country often preclude the straight purchase of American military goods. On the other hand, few nations have the technological capability or can afford a strict domestic development program for the needed hardware. The international collaborative arrangement provides an attractive compromise, and therefore the U.S. will find it more and more difficult to make sales in the world defense market without offsets (60:51).

Because of the concern over the impact to the U.S. of offsets, Congress and others have called for the abolishment of the practice in U.S. sales. However, the experts believe that, no matter their consequences, they are "a genie that will be impossible to get back in the bottle" (2:20). The difficulty in the United States dropping out of offsets is that offsets have now become as competitive a factor as the merits of the military goods sold. In the competitive world defense market that now exists, if one seller is willing to make offset concessions, all offerors will have to in order to remain in the competition. The only way out of this situation is if the United States offers a clearly superior or unique product that eliminates the competition. This is a difficult position to attain in today's market of increasing competitors, and contesting national priorities in the purchasing countries (55:5). Thus, a United States position of eliminating offsets would only serve to eliminate the U.S. from the competitive marketplace. The offset, therefore, has become a factor in the competitiveness of a country in the world market. This is a unique twist on the issue. Much attention has been placed on the potential impact which an offset may hold for future U.S. competitiveness. However, there also needs to be an acceptance that the offset may hold the key to U.S. competitiveness in the immediate sale.

## Opportunities of International Programs.

A Method for Regaining Competitiveness? So much attention is focused on the potential harms of international armament programs that perhaps not enough attention is placed on the possible benefits. In this era of increasing competition in both the overall global economy as well as the defense trade, armaments cooperation may be one of our best avenues to remain competitive. This is a unique view. While many blame the international program for deteriorating U.S. competitiveness, others regard it as the only hope the U.S. has to regain its competitive posture. It is difficult for any country, let alone any corporation, to outspend its global rivals. Collaboration provides a way to reduce needless duplication of research and development efforts among friends and allies. The United States is no longer developing world-class technology in every field. Yet, world-class technology is the key to achieving superiority, or at least parity, with its rivals:

We must utilize world class technology developed by our allies and redirect our own resources from uncompetitive technologies to our world class technologies. Armaments cooperation also promotes commonality and interoperability, enabling us to conduct more efficient combined operations. It improves incentives for our allies to invest in force-modernization and burden-sharing. And it achieves urgently needed economies of scale throughout the life cycles of our weapon systems. (18:70)

International collaboration can be a low-cost strategy for achieving these ends.

Opening New Markets. Another advantage of international armament programs is that they can lead to an increased access to international markets. The Aerospace Industries Association claims that international ventures provide the opportunity to surmount formal and informal protectionist trade barriers. And, a product which is created by two or more collaborating countries loses the "foreign" label in those marketplaces (60:47). With the defense markets that exist outside of the United States, such ventures may be the route to marketability.

Emergence of Economic Deterrence. International ventures and the resulting trade relationships can strengthen military objectives beyond the often-repeated advantages of interoperability and RSI. Economic strength and trade can become a deterrent strategy. Libicki et al suggest:

...deterrence is enhanced as U.S. economic power is augmented by that of Japan and Western Europe. That is, from the Soviet perspective, if the United States operates within, and its firms are intimately tied to, an economic network that includes the democratic and capitalist countries of East Asia and Western Europe while the Soviet Union operates principally within an economic network that includes its allies, Western strength is clearly superior to Soviet strength and deterrence is enhanced. (59:112)

Therefore, international armament programs may very well promote advantages that often get lost in the debate. These advantages offer an argument counter to those leveled against international armament programs. International collaboration may increase U.S. competitiveness in the

global market, open new markets, and strengthen international trade relationships which may in themselves be a deterrent factor.

A New Approach. The growing friction between trade and national security interests has prompted calls for the U.S. to take a fresh approach to the coordination of national policies. The Cuomo Commission, established by New York Governor Mario Cuomo, addressed such policy conflicts and concluded that the U.S. must acknowledge a "new realism."

Our policy must be based not on classical or Keynesian theory but on a "new realism" that recognizes America's relatively diminished global position, understands the way an open world economy affects domestic policy, and develops a practical perspective on the institutions of production. The first tenet of the New Realism is to acknowledge the interdependence of the global economy. This new interdependence means that the United States must coordinate its fiscal and trade policies in order to achieve desired rates of growth and global balance. The second tenet of the New Realism is to recognize the importance of policies to help production. (91:38)

Deputy Secretary of State Whitehead addressed this globalization of the world economy:

The globalization of our daily lives is evident everywhere--from the products we buy and use to the attention paid to exchange rate movements in the morning newspaper. Globalization is not simply a matter of increased trade; we see it also in the worldwide markets for currency and credit, in the pattern of production, and in the flow of information and technology. (74:2)

Many other countries seem to have heeded such calls to a much greater extent than the United States. In contrast to U.S. trading partners, most of whom have set trade and industrial competitiveness as a national policy, the United

States has no coherent policy promoting trade. Some see this as an important cause of U.S. industry's competitive decline (108:viii). The President's Commission on Industrial Competitiveness found:

U.S. trade and international economic policies have not yet assumed equal stature with other U.S. policies. In part, this is symptomatic of fragmented and duplicative U.S. trade and investment policy mechanisms. Decisions are split between at least 25 executive branch agencies and 19 congressional subcommittees. Many governmental agencies--the Department of State, Justice, Treasury, and Defense among them--make policies that strongly influence our international trade position. Often they fail to consider the ramifications of their decisions on our ability to compete in world markets. (80:38-39)

Economic and trade strength are increasingly recognized as an element of national security. Further, there is also a growing recognition that trade policies may affect the health of the source of our defense--industry.

It must be noted that a free or liberal trade policy is a means to an end and not an end in itself. It is an excellent method for "waging peace", but it should not be implemented so as to cripple this nation's ability to wage war, if the need arises. (20:34)

Other governments have taken a much more active role in monitoring and promoting their industries. The growing strengths of Japan and other Asian nations may be attributed in part to the development-oriented strategies of these countries (80:Vol 2,17-19).

These strategies have actively promoted the development of key industrial sectors and have forsaken passive attention to a nation's shift in industrial composition. The governments of these nations have collaborated heavily with industries to promote growth and foster the creation of competitive advantages for local firms. These development strategies have worked well in Asia, and the level of government support given

to foreign competitors has become a vital consideration for U.S. firms. (80:Vol 2,17-19)

Consequently, support is growing for the U.S. Government to take a similar role in this country. The President's Commission on Industrial Competitiveness concluded that if the U.S. is to effectively compete in the global economy, it must:

1. Articulate and enforce trade policy in a coordinated way;
2. Reduce domestic obstacles to U.S. trade competitiveness;
3. Balance foreign policy and national security and export controls with the need to compete in world markets;
4. Expand U.S. exports; and,
5. Strengthen the international trading system.

(80:38)

This commission went as far as suggesting that a Department of Trade be established to act as "one voice" on trade issues, and also balance and coordinate such issues with domestic and foreign policy issues (80:42).

The implications for international armament programs should be obvious. Such programs are now a part of the trade discussion. International collaborations bring together a blend of economic, trade, security, and foreign policy issues. However, such issues are outside the traditional domain of the State and Defense Departments and are now handled by various executive and Congressional

organizations. Therefore, a coherent policy is difficult to achieve in such a bureaucracy.

Summary. This section of the literature review has introduced the trade aspect of international programs, and added to the discussion of U.S. competitiveness. Both topics combine to introduce a new aspect to the environment in which the international armament programs operate. The rise of the global economy, complete with revitalized foreign industries, has changed the traditional view of U.S. trade. The formidable capabilities of the competitors to U.S. trading, along with the United States' lagging competitiveness, has produced the trade imbalances which the U.S. now experiences. These trade imbalances, the increasing growth of international ventures, and the strength of the countries involved in U.S. cooperative programs have served to force the international armament program out of its traditional arena and into the broader trade debate ongoing in this country.

The following factors can be added to the international armament program framework:

Potential Advantages:

o Military/National Security

-Defense trade serves to support U.S. defense industries. Such revenues aid their strength, provide R&D funds, support a larger production base, and serve U.S. security policies.

-Economic and trade strength may prove to be an important deterrent to aggression.

o Economic/Industrial

- Any support of the defense industrial base through international defense trade is also beneficial to the industrial base as a whole.
- International programs may prove to be an avenue to increased competitiveness.
- International programs may open new markets to U.S. industry.
- Defense trade helps the U.S. balance of payments.

Potential Disadvantages:

o Economic/Industrial

- The role which many foreign governments assume in international ventures may provide subsidization which aggravates the foreign competition problem.
- Trade issues have taken on new significance in the international program environment. Any deleterious effects which an international arrangement may have on an already imbalanced trade relationship now takes on an even greater significance.

Chapter Summary

The purpose of this rather expansive literature review was to comprehensively analyze the environment in which international armament programs now operate. To this end, the areas of international programs, the defense industrial base, technology transfer, and trade and competitiveness were addressed. The result of this research has been the delineation of the international program environment as well as the development of an initial framework for the evaluation, negotiation, and management of international armament programs. Therefore, two main purposes have been

served. First, the proper orientation has been achieved for the following case analysis. Second, the ultimate goal of this research, a framework for viewing international programs, has been furthered.

## IV. Case Analysis

### Introduction

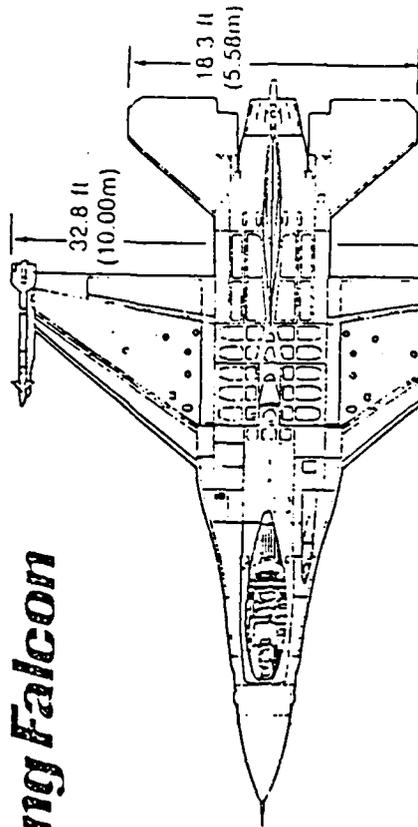
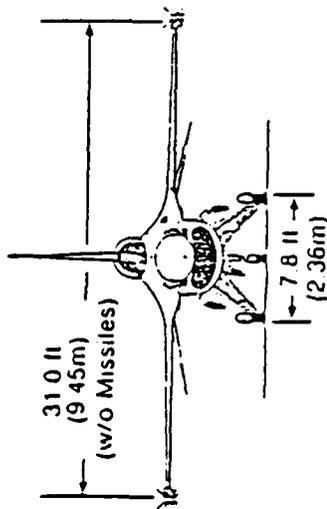
A strident debate has arisen over the joint program between the U.S. and Japan to develop the next-generation fighter aircraft for the Japanese Air Self-Defense Forces. This aircraft, dubbed the FSX (Fighter Support-Experimental, also abbreviated as FS-X), would be a derivative of America's F-16 fighter (see Figure 9). The Departments of Defense and State have aligned in favor of this cooperative program. However, certain members of Congress, as well as the Department of Commerce, have loudly criticized the program and are maneuvering to prevent its approval. The focus of the debate centers on issues such as the health of the defense industrial base, protection of technology, trade balances and international security relationships. This scrutiny of the program suggests more than just the fate of 130 aircraft for Japan. Of greater significance is the implication such review holds for the future of U.S. international cooperative programs.

### Japan

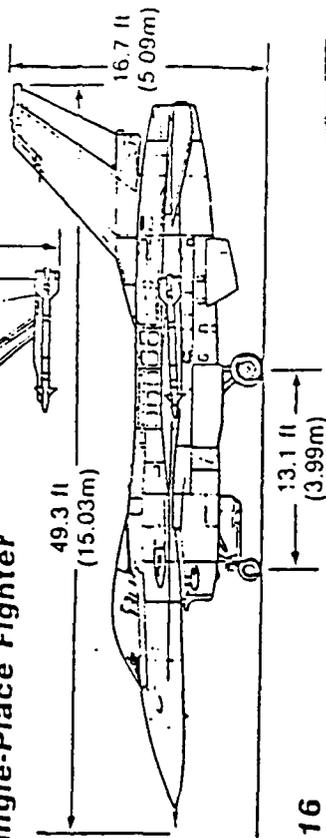
Because Japan is the other key player in the FSX case analysis, it is important to explore some relevant background on Japan. This section will provide such information. In addition, this focus on Japan will permit the reader to apply the framework which has been developed

# F-16

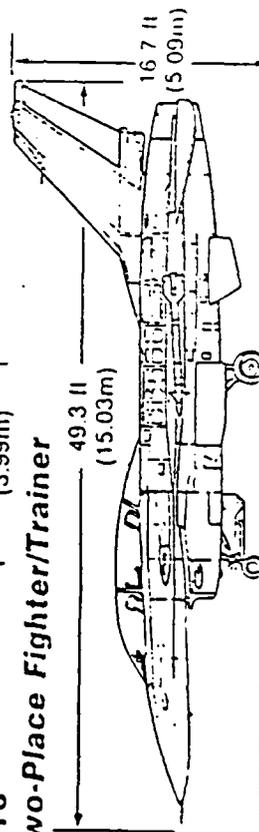
## Fighting Falcon



**F-16**  
Single-Place Fighter



**F-16**  
Two-Place Fighter/Trainer



Characteristics	Blk 15	Blk 40
Wing Area	300 sq ft	300 sq ft
Aspect Ratio	3.0	3.0
Leading Edge Sweep	40°	40°
Weights:		
Empty (F100-PW-220 Engine)	16,292 lb	18,380 lb
Empty (F110-GE-100 Engine)	N/A	19,162 lb
Internal Fuel	6,846 lb	6,846 lb
Max TOGW	37,500 lb	42,300 lb
Design Load Factor	9g	9g
Service Life	8,000 hr	8,000 hr
Engine Thrust:		
(F100-PW-220)	23,770 lb	23,770 lb
(F110-GE-100)	N/A	28,984 lb

Characteristics	Blk 15	Blk 40
Wing Area	300 sq ft	300 sq ft
Aspect Ratio	3.0	3.0
Leading Edge Sweep	40°	40°
Weights:		
Empty (F100-PW-220 Engine)	16,904 lb	18,504 lb
Empty (F110-GE-100 Engine)	N/A	19,295 lb
Internal Fuel	5,659 lb	5,659 lb

AM19023

Figure 9. F-16 Fighting Falcon (47)

thus far. Many of the issues previously identified will be relevant to this look at Japan.

The U.S.-Japanese Security Relationship. An appropriate place to begin is with the unique security relationship which exists between the United States and Japan. The Treaty of Mutual Cooperation and Security was signed by the two countries in 1960 (22:27). This treaty continues to provide the foundation for the security arrangement which exists between the U.S. and Japan. For the Japanese, such a relationship constitutes "a basis of Japan's defense and an indispensable element of its security" (22:26). Further,

in order to maintain its own peace and independence, Japan must establish an unassailable defense posture competent to prevent any conceivable situation, ranging from all-out warfare involving the use of conventional arms to military coercion and intimidation. But since it is impossible for Japan to set up such a defense posture on its own, it depends on the security arrangements with the United States for the defense capabilities which it lacks, such as deterrent power against nuclear threats and counterattack capability against large-scale invasion with conventional weapons.  
(22:26)

William Clark, Jr., Deputy Assistant Secretary of State for East Asian and Pacific Affairs, explained that the current agreement between the U.S. and Japan on defense roles and missions "gives the United States responsibility for nuclear deterrence and offensive operations in the region while Japan is to defend its territory, airspace, and selected sealines of communication out to 1,000 miles" (29:2).

For the United States, the security agreement serves broad strategic interests. "Most of our 60,000-man force in Japan has a dual mission. They are there not simply to defend Japan but to maintain peace and stability elsewhere in the Far East" (29:2). A Department of State briefing paper states that from bases in Japan, 7th Fleet ships ensure security throughout the Pacific and as far away as the Persian Gulf. The 3rd Marine Amphibious Force is on Okinawa to respond rapidly to contingencies in Asia (27:1). Towards the support of these forces, Japan contributes over \$2.5 billion per year. This contribution accounts for approximately forty percent of the costs to maintain U.S. forces in Japan. Not only does this support significantly defray the costs of maintaining these dual-mission troops, but it amounts to the most generous host nation support agreement the U.S. has anywhere in the world (29:2; 27:1).

Japanese Defense Buildup. The 1980's have witnessed an increased focus on defense in Japan. Several factors have spurred this attention. In East Asia, the Soviets have continued to build a formidable military presence. In the early 1960's, the Soviets had a mere 15 divisions in the Far East. Today the Soviets maintain 53 divisions, over 80 modern naval components, nearly 2,500 attack and air defense aircraft, and some 170 SS-20 ballistic missiles in the region (57:130-131). This sabre-rattling has heightened Japanese

defense awareness. In addition to the Soviet presence, U.S. pressure on Japan to increase its contribution for its own defense has also promoted security concerns (57:131).

Consequently,

In the course of those seven years [1979-1986], the trend of public opinion has shifted greatly. Every public opinion poll in the first half of the 1980s shows the annual progress in the defense consciousness of the Japanese people. This is shown in the increasingly affirmative answers to the maintenance of the U.S.-Japan Security Treaty and reinforcement of Japanese defense capabilities....Although there still exists a deep-rooted postwar pacifist sentiment, it can be safely assumed that the change of defense consciousness in the Japanese people is irreversible.  
(75:57)

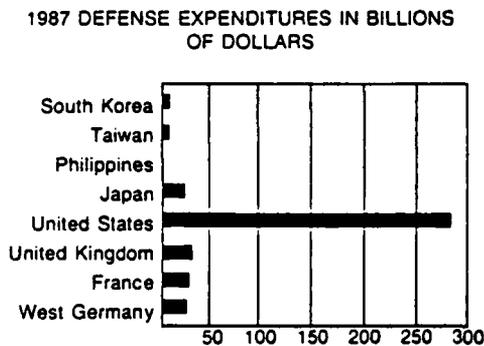
Japan has accordingly continued to bolster its defense spending in the 1980s. Measured in dollars, defense spending in Japan is now higher than that of any other nation except the United States and Russia--on the order of \$40 billion (53:63). Growth in the Japanese defense budget has been large and continuous. The latest Japanese Defense Budget was approved in February of 1989 and it marked the third consecutive year that Japan has maintained a growth rate of nearly six percent in military spending (51:22), compared to the NATO goal of only three percent per year (27:1). Figure 10 summarizes.

The Japanese Defense Industry. The Japanese defense industry has likewise grown. However, unlike the United States, Japan does not possess a dedicated industrial base devoted primarily to defense production. Japan's major defense industries are among the largest firms in the world,

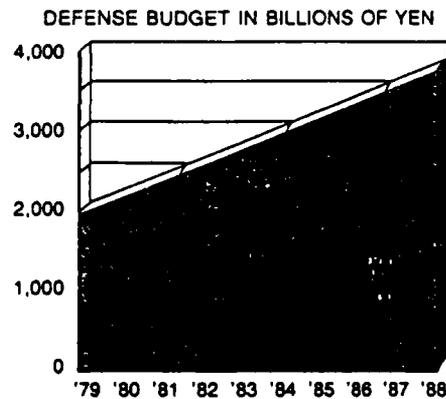
THE FORCES	
NAVY:	54 large surface warships (36 destroyers, 18 frigates), 15 submarines, eight amphibious landing ships, 84 land-based aircraft, 70 helicopters.
Personnel:	45,000
ARMY:	1,150 tanks, 385 helicopters, 590 other armored vehicles.
Personnel:	156,000
AIR FORCE:	389 combat aircraft
Personnel:	45,000



#### WHAT OTHERS SPEND



#### THE COST



NOTE: Because the dollar-yen exchange rate has fluctuated wildly in recent years, figures in yen are used above. The comparable dollar values, in billions, are: 1979—\$9.7; 1980—\$9.9; 1981—\$10.4; 1982—\$11.2; 1983—\$11.7; 1984—\$12.3; 1985—\$13.1; 1986—\$19.8; 1987—\$24.6; 1988—\$29.7.

SOURCES: Center for Defense Information, International Institute for Strategic Studies, Jane's, Arms Control and Disarmament Agency.

Figure 10. Japan: The Scope of the Nation's Defense  
(47)

and defense work is only a portion of their overall business (64:5-3). Although defense work has grown for these industries, even for a major Japanese defense contractor like Kawasaki Heavy Industries, defense work accounts only for 30 percent of its revenues (82:7). Analysts expect missiles and aerospace to drive the development of the Japanese defense industry into the 1990s (68:55). The Patriot missile system, "Star Wars" research, and the FSX fighter are all ongoing projects in the defense industries of Japan.

The Japanese defense industry is developing in a supportive environment. Since 1962, Japan has produced well over 80 percent of its defense materials and equipment (25:59). From this industrial base, Japan has embarked upon the more ambitious missile and aircraft projects. Additional support is provided by its national drive for technological innovation, vast economic resources, governmental commitment, and public support (25:59). In addition, the Defense Science Board found that Japan's long term objective is to "achieve maximum feasible self-sufficiency for defense procurement" (25:25). Consequently, Japan is committed to, and has the industrial potential, to build a formidable defense industrial base.

Reasons for the Growth. Rationale for the growth in the Japanese defense industries goes beyond the goals of self-sufficiency and U.S. pressure. Japan also views the

development of its defense industry as advantageous to its economy as a whole. Economic strength is viewed in Japan as a vital component of its national security. Defense industries, such as aerospace, are among the high value-added industrial technologies which can only strengthen Japan (84:24). These industries can therefore be spurred by government controlled defense spending and counterbalance declining Japanese industries such as shipbuilding and petrochemical plant construction (84:9). Recognition of such additional motives in Japan's support and growth of its defense industries prompted the Office of the United States Trade Representative, Aerospace Trade Policy, to comment on the GAO's study of military coproduction:

...I'd hope somehow that we could avoid giving Japan "credit" for increased defense spending to the extent that their spending is more for industrial development purposes than for national defense.  
(46:39)

Therefore, Japan's military spending in the defense sector promotes defense industries which have great value to the overall economy in their high value-added nature and as a replacement for other lagging sectors.

Defense Exports. One issue should now be addressed, and that is the idea of Japan exporting weapons. Many are concerned over Japan's potential as an arms exporter. Citing Japan's vast industrial potential, commitment to a self-sufficient defense industry, and limited domestic military needs (which make economies of

scale in weapons production difficult to achieve) these individuals consider arms exports by the Japanese as a likely prospect (46:5). Japan's current policy prohibits the export of weapons to other countries (46:5). Still,

Though exports of arms are officially banned, the United States Arms Control and Disarmament Agency thinks that Japan's weapons exports have been running in the tens of millions of dollars since at least 1972, peaking at around \$320 million in 1983. Mr. Reinhard Drifte and Mr Kazuo Tomiyama have tracked separately over the years exports ranging from Oki Electric's sale to the Chinese navy of radar for destroyers, to Kawasaki Heavy Industries' sale of anti-submarine helicopters to Sweden, Burma and Saudi Arabia.

(68:54-55)

Others claim that Japan remains committed to its policy prohibiting weapons exports, despite economic pressures inherent in weapons production for small countries, and the allure of the lucrative world arms market. These individuals refer to a belief that the Japanese people remain strongly pacifistic. Their abhorrence for war and aggression is believed to be the controlling doctrine behind the ban on weapons export (63:10). Whether Japan is now, or will ever, export weapons is still a matter of conjecture.

Japanese Aerospace. The aerospace industry is of particular importance to Japan. The Japanese Ministry of International Trade and Industry (MITI) established aviation and space as one of the "technology leading industries" for Japan in the 1980s and beyond, and stated that aerospace would "form the basis for long-term economic progress" (25:107). Economic analysts claim that the Japanese

aerospace industry will be one of the country's key industries in the 1990s (53:63). Also, according to analysis by Booz, Allen & Hamilton, the aerospace industry is strategically important to Japan's future. Japan is planning to establish a world-class aerospace industry based on high technology, high quality, and shorter development times. The FSX combat aircraft, a propfan aircraft, and the International Aero Engines (IAE) Consortium are offered as evidence of this expansion (52:7).

History. Post World War II aircraft manufacturing in Japan began in 1952 when Japan's Air Self Defense Force was established and the aircraft industry of Japan was allowed to resume operations with the repair and overhaul of U.S. military aircraft. The licensed production of the U.S. F-86 and T-33 followed in 1955. What has ensued has been a few domestic designs like the Fuji T-1 trainer, the Kawasaki YS-11 domestic transport, PS-1 and US-1 flying boats, and the Mitsubishi F-1/T-2 domestic fighter/trainer. However, the majority of aircraft production in Japan has been licensed production from the United States. In addition to the F-86 and T-33, Japan has produced the Lockheed F-104, McDonnell F-4, Lockheed P-3C, and the McDonnell F-15 under license. Mitsubishi and Kawasaki have also served as subcontractors on commercial programs such as the DC-10, 747, 767, MD-80, and others (82:2). What should be immediately evident, especially in the context of this

study, is the role which licensed production has played in the Japanese aerospace industry. The General Accounting Office found that

Japan recognizes that the development of some advanced weapons systems requires a high level of technology, a long period of time, and very large investments. On the other hand, purchasing finished items denies Japan the opportunity to use defense production as a means of expanding its high-technology industrial base and becoming more self-sufficient in military supplies and equipment. Thus, Japan has clearly indicated its preference to rely, to the maximum extent feasible, on coproduction and to import finished items as only a last resort. Through coproduction, Japan sees an opportunity to

- obtain advanced technology and know-how,
- enhance its high technology base, and
- develop and maintain a viable defense industry which increases its military self-sufficiency.

(46:4)

Therefore, licensed coproduction has provided Japan a unique avenue to pursue several objectives.

Technology Transfer. Coproduction has served the Japanese defense industry well in the area of technology transfer. This is a particularly inflammatory subject for many Americans. The Japanese desire for advanced U.S. technology is not limited to the Japanese Defense Agency (JDA), but rather a goal of most Japanese industries. The International Trade Commission has estimated that inadequate protection of U.S. technology cost American firms \$24 billion in lost sales during 1986--and that the Japanese, "the magpies of the technological world," were high on the list of culprits (102:57). The Defense Systems Management College maintains that:

Throughout Japan's defense industries, the investment in facilities, tooling, and test equipment would support far greater production levels than any yet achieved or projected. The national policy of indigenous production at any cost can only be justified on the basis of the technology transfer involved, mainly from the U.S., and the maintenance of surplus capacity for potential mobilization purposes. (64:5-4)

The aforementioned aircraft coproduction arrangements figure prominently in such technology transfer. The Japanese licensed production of the F-15 is an excellent example. The coproduction of America's air superiority fighter "added to Japan's experience and technological capability in aircraft production" (46:20). The Japanese used this program to the greatest extent possible. Under the MOU for the program, certain technologies were not releasable for U.S. national security reasons. Yet, since the signing of the MOU in 1978, Japan has requested and successfully negotiated the release of much of this technology (46:20). This is just one example of Japan's vigorous pursuit and collection of U.S. technology. The case of Japan is therefore an excellent subject for application of the previous section in the literature review on technology transfer.

Some have called for "shutting off" U.S. technology to Japan. This could very well hurt the Japanese. Japan's technological trade deficit is narrowing, but it still pays out 3.3 times as much for licenses, patents, and royalties as it receives from the sale of its domestic technology

(102:57). However, such control has been attempted in the past, only to find that such actions backfire.

In the early 1980s America stopped selling many high technology wares to Russia, hoping to prevent the Russians from building a pipeline to bring Siberian natural gas to Europe. The embargo cost American firms millions in lost orders. The pipeline was completed more or less on schedule. What technology was not available elsewhere, the Russians redeveloped for themselves. (102:57)

An alternate strategy may be for the U.S. to become as good a borrower of Japanese technology as the Japanese are of American know-how. The Japanese and Americans have an agreement (signed in 1983) that allows Japan to transfer military technology to the U.S., and only the U.S., based on the mutual security arrangement (25:28). The Defense Science Board determined that, although few Japanese military technologies exist that would prove beneficial, there do exist numerous dual-use technologies (applicable to both commercial and defense products) that could be of great benefit to the U.S. (25:42). However, successful pursuit of these technologies may very well require a change in the mindset of the United States.

A large part of America's problem in this regard seems to be due to its apparent inability to match Japan as a quick and effective user of external technology. As Brooks (1983) has warned, "the United States, so long accustomed to leading the world, may have lost the art of creative imitation.... (62:1167)

The U.S. would have to actively pursue Japanese technology, as the Japanese now do with U.S. technology. For example, Japanese scientists and engineers know a great

deal about U.S. technology while their U.S. counterparts know very little about Japanese accomplishments (25:60). The United States will have to substantially change its approach towards Japan if it truly wants to garner Japanese technology.

Consequently, in the technology transfer arena, the United States is presented with a unique opportunity in the presence of Japan. The potential of technology transfer from Japan to the U.S. is an encouraging prospect. In Japan, the U.S. faces a formidable economic competitor as well as a military partner. The technology transfer aspects of international armament programs should not be ignored. Likewise, the technology transfer potential from Japan to the U.S. should be recognized. The challenge for the United States is to re-route a "one-way street" of technology flow into a "two-way" road. It was this reasoning that drove the Defense Science Board to conclude that

despite the possibility of eventual competition from Japanese industry on defense exports, it would be in the overall best interests of the United States to increase technological cooperation in defense with Japan if it can be achieved on a truly bilateral basis. (25:65)

The Task Force feels strongly that the most important actions to enable technological cooperation with Japan would be those that strengthen our national technological base and preserve our technological leadership. U.S. industry will then have the ability and confidence to cooperate on technology with Japanese industry, to the benefit of both countries. (25:76)

Japan and Commercial Aerospace. A major concern over this transfer of technology in U.S.-Japanese aerospace collaborations is the potential application of the technology to commercial ventures. The General Accounting Office studied the effects of military coproduction on Japan's civilian aerospace industry and claimed:

According to industry and agency representatives, some of the advanced technology transferred through military programs has commercial applications. For example, composites, avionic instrumentation, and propulsion technologies transferred through the F-15 program can be applied to civil aircraft production. . . . Furthermore, much of the same tooling and machining technologies are used to produce civil and military aircraft. (46:15)

Further,

The licensed production of U.S. military aircraft supports a competitive civil aircraft industry by enhancing its production and technology base. Performance requirements differ for military and civilian aircraft, but an official of Japan's MITI, Aircraft and Ordnance Division states that "...the development and manufacturing technologies are closely related and technological spinoffs can be mutually anticipated." (46:11)

The claim, therefore, is that the coproduction arrangements with Japan have transferred technology that will send them further down the road towards direct competition in the world commercial aircraft market.

Others contend, however, that such claims are overstated. A Department of Transportation study looked at technology transfer in the Boeing 767 program in which Japan was a subcontractor. The study conceded that it is tempting to depict the transfer of individual technologies under this

contract as extremely beneficial to the Japanese. The study stated though that "To do so, however, is to underestimate the technology level of the Japanese industry by this date" (30:129). The report continued that the ability of the Japanese aerospace industries was quite advanced and that the individual technologies were easily duplicated by the Japanese. However, even the Japanese admitted that the real expertise was with Boeing because they had the previous development and long term production experience with the technologies (30:129).

In addition to the advanced current state of Japanese technology, their industry also maintains other advantages not related to technology transfer. Japan may already be well on its way towards developing the military-industrial infrastructure so critical to commercial aerospace success. The combination of increased defense procurement with the current Japanese strength in dual-use technology may allow Japan to combine "spin-off" and "spin-on" technologies for both military and commercial use at the same time (84:7).

Also,

the specific requirements of the next generation [aircraft] make virtues of the distinctive technological, organizational and managerial characteristics of Japanese industry. Technologically, Japan is on the leading edge in advanced materials, microelectronics, and other relevant areas, a potential advantage that the "spin-on" strategy deliberately exploits. Organizationally, since much of the new technology originates in other industries, Japanese aerospace's tighter intersectorial links should assist its identification and transfer. Managerially, Japanese firms have thirty years of experience with

interfirm cooperation, while it is a brave new world for their American counterparts. (30:7-8)

Such factors demand as much credit for any Japanese success in commercial aerospace as the transfer of technology from U.S. coproduction arrangements.

However, there have been some drawbacks to the Japanese formula. A factor which hinders Japanese aerospace's pursuit of a world-class industry is a result of the very success of the application of coproduction. The primary customer of the Japanese aerospace industry is the Japanese Defense Agency (JDA), which has historically accounted for no less than 80 percent of the aerospace industry's production (98:6; 30:111). This near monopsony (one buyer) for Japan's aerospace industry ties the fortunes of the industry to the JDA, which clearly favors coproduction.

At all points in the post-war period, however, the JDA has not been willing to sacrifice its desire for proven technology and technology at the highest level of sophistication. As long as these "consumer preferences" are of paramount importance to the JDA, it will be very difficult for Japanese firms to persuade their main and very demanding customer that the development, as opposed to the production of the aircraft, should take place in Japan. (30:111)

Consequently, although most countries are interested in licensed production because it gives them access to U.S. technology, Japanese aerospace industries now also recognize that this method denies its design engineers the experience of development--and it has been almost 20 years since Japan designed its last successful high performance aircraft, the Mitsubishi F-1/T-2 (82:5). The JDA has also insisted that

any development or production be shared among several firms. This demand is a result of the JDA's desire to avoid creating any domestic monopoly in aerospace. Therefore,

With this division of the military aircraft pie, the ability of the single firm to develop a large scale, stable production or design volume was rather limited by the JDA policy of wide distribution of both design and production work. (30:113)

The policies of the JDA towards coproduction and workshare among industry has hindered the Japanese aerospace industry to some degree in its pursuit of a world class capability.

There also exist some unique conditions in the commercial aerospace field which Japan will have to contend with if it pursues the market. The Department of Transportation outlined these forces:

- Economies of experience count more than economies of scale and economies of experience cannot be purchased as readily as economies of scale.
- New state of the art technologies are not commonly available for purchase on the open market nor are they readily transferrable.
- International and domestic Japanese markets for aircraft are open, unprotected and unprotectable from foreign competition, even in the short run.
- Japanese aircraft demand in both commercial and military sectors requires a substantial deviation from conventionally successful Japanese government industrial policy. Only the best products will do, and the best products come from abroad.

(30:7-8)

Japan may not be able, therefore, to apply its traditional approaches to the commercial aerospace market and achieve the success it has in other industries. The other half of the equation is the actions of the present

competitors in the commercial aerospace market. Japan's success in commercial aerospace may well depend on the health and vitality of the traditional suppliers as much as its own actions. The General Accounting Office incorporated this idea into its study on the effects of military coproduction:

The likelihood of Japan succeeding in its goal to develop an internationally competitive aircraft industry is, of course, a matter of judgement. We have no reason to doubt they could succeed. We have revised the report to acknowledge that the degree of success depends as much on the ability of the United States to maintain the vitality of its industry as on Japanese actions. (46:25)

In the post-war era, the Japanese aerospace industry has developed advanced capabilities. The role which U.S. military coproduction programs have played in this growth should not be underestimated. However, there are other factors involved in whether Japan achieves success in commercial aerospace. It should be remembered that with over thirty-five years of effort, the Japanese have yet to carve out a role in the industry which is commensurate with the overall prominence of Japan in the global economy, suggesting that other market forces may be at work besides technology transfer (30:163-164).

U.S.-Japanese Trade. U.S. trade with Japan is the most obvious example of trade issues focusing attention on other national concerns such as international armament programs. The Japanese philosophy on trade can be traced back to 18th century and the ideas of Honda Rimei, who provided the axiom

"Foreign trade is a war in which each party seeks to extract wealth from the other" (37:4). Japan's success in the international marketplace has been phenomenal. To this end, Japanese productivity growth has been five times that of the U.S. since 1960 (80:11), and Japan's industrial production increased by 147 percent from 1967 through 1983, as compared to the U.S. increase of 56 percent (25:23). The National Research Council determined in 1986 that Japan led the United States in 8 of the 11 key technologies of advanced processing (108:iv). Many more statistics could be offered, but the point should be clear--Japan has developed into a formidable economic competitor in the global economy. Trade figures bear this out. In the period between 1960 and 1980, the U.S. trade deficit with Japan in high technology products increased almost seven-fold from \$500 million to \$3.22 billion (80:Vol 2,308). The overall trade balance has become just as uneven. In just the period from 1980 to 1985, U.S. imports from Japan increased from \$33 billion to \$72 billion, but U.S. exports to Japan only rose from \$21 billion to \$23 billion (37:4). Figure 11 reflects the current state of Japanese accounts. Such trade imbalances draw attention to joint ventures between the two countries. The discussion of issues in the literature review on trade and competitiveness are therefore quite relevant to the situation between Japan and the United States.

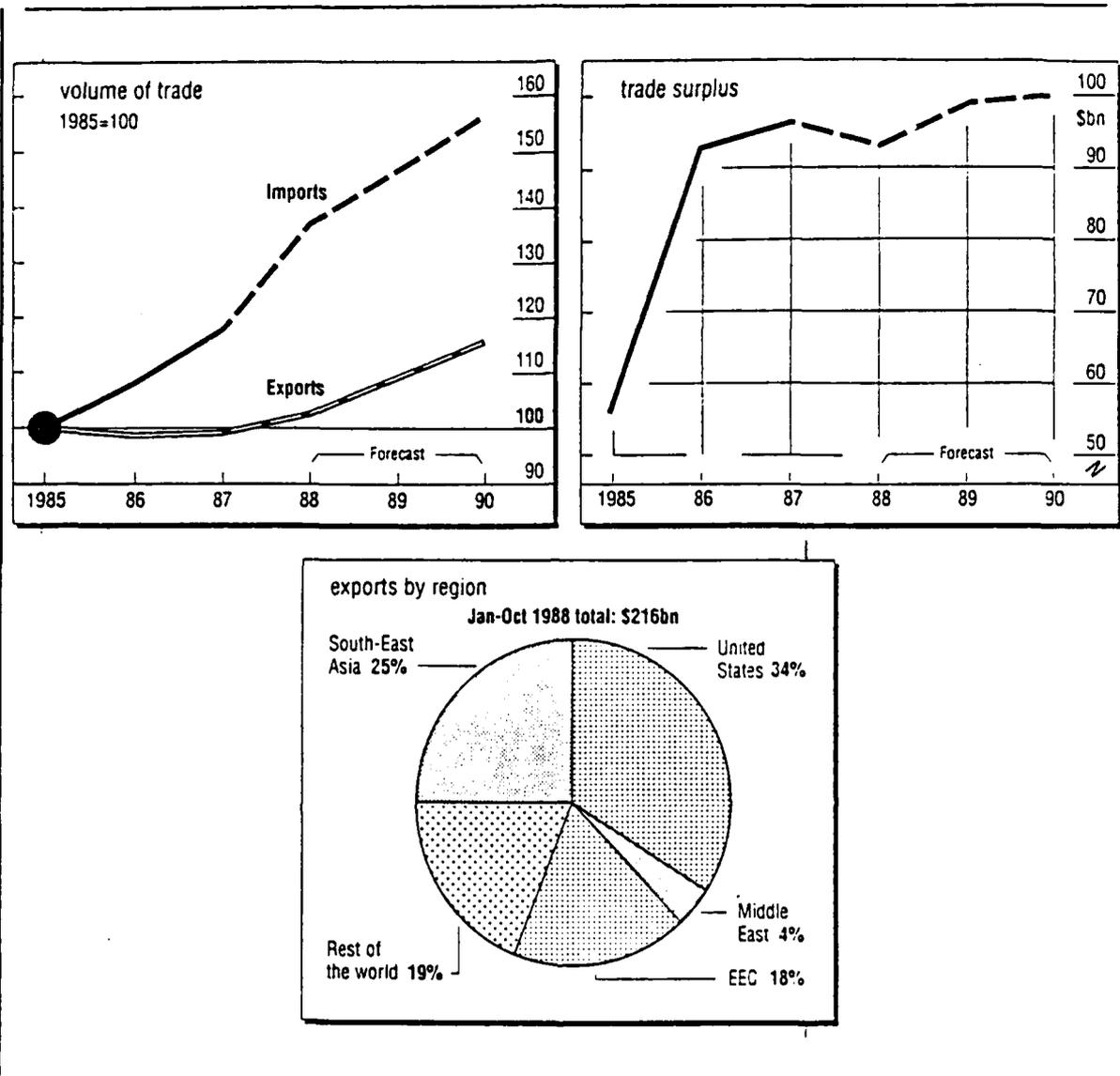


Figure 11. Japanese Trade Figures  
(101:58)

Japanese Government Planning. Many government and industry officials in the U.S. favor an increased role for the United States Government in trade and industrial policy. The model these advocates cite is Japan's Ministry of International Trade and Industry.

The Ministry of International Trade and Industry (MITI) is probably the most well-known (in the U.S.) and all-pervasive entity in the Japanese bureaucracy. Its basic function is that of controlling and guiding Japan's industrial policy, and it is equipped with a powerful set of tools with which to do its job. Among its responsibilities are determining the structure of the industrial sector, guiding industrial production and development, directing trade and commercial relations, ensuring adequate raw materials and energy supplies, and managing specific sectors such as small business, patents, and technology transfer. . . . In short, MITI dominates Japan's industrial and trade sectors, and seeks to mold them, as appropriate, to satisfy the needs of the economy. (37:7-8)

MITI has committed to high technology and the commercial success that can be achieved through it. In cooperation with Japanese industry, MITI has developed a technology strategy for the twenty-first century that calls for Japan to be the world leader in areas such as robotics, artificial intelligence, new materials, biotechnology, and aerospace (82:5).

Japan sees its high-technology industries as the key to future growth and prosperity. Other industries rely on them. They stimulate foreign commerce, the profits from which help to pay enormous energy costs. Also, as it becomes more difficult to compete against South Korea, Singapore, Taiwan, and Hong Kong in products at the middle to lower levels of technology, the pressure increases on the Japanese to invest more heavily at the high end. (72:221)

Japan's MITI therefore applies a widespread control over the Japanese economy, with a distinct focus on the high technology industries of the future.

Interim Summary. The preceding information provides important background on Japan. The U.S.-Japanese security relationship, Japan's defense industries, the Japanese

aerospace industry, technology transfer, trade and MITI were all addressed. Consequently, a foundation has been laid for the following case analysis of the FSX fighter aircraft arrangement.

### FSX History

Direction for the FSX program is rooted in Japan's Mid-Term Defense Program (MTDP) adopted in 1985. It states that the FSX "will be selected among three options; first, domestic development; second, conversion of fighters in the inventory; third, introduction of foreign aircraft" (110:27). However, the conversion of existing fighters in Japan's inventory was dismissed rather early. Because of plans to modify many of the Japanese aircraft for other roles such as reconnaissance, too few eligible fighters would be left to fill a support fighter role. Consequently, the early options for the FSX narrowed to domestic development in Japan or purchase of existing foreign aircraft.

Of these remaining two options, serious debate was directed towards the appropriate path for the FSX. Richard J. Samuel and Benjamin C. Whipple of the Massachusetts Institute of Technology chronicled the debate in Japan:

Private industry, the JDA's [Japanese Defense Agency] Technical Research and Development Institute (TRDI) and Air Staff Office, and MITI's Aircraft and Ordinance Office, were the most active proponents of domestic development, while MITI's Trade Bureau and JDA Budget officials were opposed. Finance and Foreign Ministry officials concerned with budgets and US-Japanese relations were reported to be cautious or opposed. The

other ministries were united in opposition and were joined by Japan's perennial opposition parties.

(84:15)

These same sources reported that the depth of the original opposition to domestic development of the FSX would have dictated that Japan purchase a foreign aircraft to fill the role. However, a Service Life Extension Program for the aging F-1's (the plane which the FSX is to replace) provided proponents of domestic development with a strategic delay that was to alter the debate over domestic development versus foreign purchase. Essentially, the active life of the F-1 was extended by at least four years, and

Due to the life extensions of the F-1's, replacement of them will begin four years later than originally planned [from the late '80's to the 1990's]. This delay will leave enough time to develop [the] FSX.

(110:32)

When the FSX debate resumed in Japan in 1985, proponents were able to address the issue from a much stronger position. Five developments in the interlude strengthened the domestic development argument:

- 1) Ambitious military aircraft programs were conducted in the 1980's which nurtured the capabilities of the Japanese aerospace industry. Consequently, proponents were able to argue that Japanese industry was ready to produce an indigenous fighter--an argument which was not convincing prior to these aircraft programs.
- 2) The role of the FSX expanded to fulfill several missions, thereby boosting the economics of the program.
- 3) The later deployment of the FSX produced the argument that foreign candidates would be technologically obsolete.

- 4) Industry and government in Japan embraced the idea of promoting dual use technology.
- 5) The need to redirect heavy industry in Japan, as well as disenchantment with international cooperative programs vis-a-vis the faltering 7J7 and IAE programs, strengthened the domestic development cause. (84:20-21)

The result was that "when the FSX decision was finally made, domestic opposition to domestic development had largely withered away, and only US pressure, amplified by the Toshiba incident, remained a significant obstacle" (84:21).

U.S. Pressure. U.S. companies such as General Dynamics and McDonnell Douglas had been vigorously marketing their off-the-shelf fighters to Japan for years. In November of 1985 Japan issued a questionnaire to these companies for Foreign Military Sales and license data on the F-16 and F-18 aircraft (15; 79). This inquiry was supported by Japanese opponents to domestic development of the FSX. However, as documented above, the domestic development argument in Japan had been strengthened, and this coincided with the emergence of official U.S. pressure to "buy American."

The Defense Security Assistance Agency (DSAA), along with DoD and State Department representatives, embarked upon earnest negotiations in 1985 with the Japanese for a U.S. role in the FSX program. The U.S. "pushed a straight, off-the-shelf purchase of U.S. aircraft as hard as you could push it," stated a DSAA official involved in the negotiations (15). However, this option was never a credible one in the opinion of those involved:

An "off-the-shelf" purchase of a US fighter was never a realistic possibility. Since 1955, under a policy endorsed by every Administration since Eisenhower, Japan has license-produced US military aircraft. General Dynamics, maker of the F-16, tried 12 years without success to sell F-16s to the Japanese Defense Agency. (26)

With the removal of a Japanese purchase of U.S. aircraft as an option for the FSX, U.S. efforts turned towards dissuading the Japanese from embarking on an indigenous development route. The U.S. case against Japanese domestic development centered on the following arguments:

- 1) Japanese indigenous development of the FSX would not be cost effective. Starting "from scratch" would consume valuable resources.
- 2) The final product of such development would, in the U.S. opinion, be inferior to existing U.S. aircraft and be fielded too late.
- 3) Domestic development would not embrace the defense cooperation principles developed through the history of the U.S.-Japanese security relationship.
- 4) An all-Japanese aircraft would not be interoperable with U.S. forces.
- 5) American industry would have been excluded from the project, further aggravating a growing trade deficit with Japan. (26)

This pressure from the United States culminated with the discussions in early 1987 between then-Secretary of Defense Weinberger and Japanese Defense Agency Director General Kurihara. It was at this point, after long and intense negotiations, that the two governments agreed to a modified U.S. fighter for the FSX role rather than an indigenous Japanese aircraft.

In October 1987, Director-General Kurihara Yuko of the Japanese Defense Agency announced that Japan would forego domestic development of the FS-X and instead spend \$6 billion procuring a "lightly modified" American aircraft. (84:21)

### FSX Negotiations

The Japanese subsequently chose the General Dynamics F-16C as the basis for the FSX. Additionally, Mitsubishi Heavy Industries was selected as the prime contractor with General Dynamics, Fuji Heavy Industries and Kawasaki Heavy Industries serving as subcontractors. The formal Memorandum of Understanding for the FSX was signed 29 November 1988 by Japanese Defense Agency Bureau of Equipment head Masaji Yamamoto and DSAA Director Lt. Gen. Charles Brown. The MOU broadly outlined the FSX agreement, establishing that Japan would completely fund the program, that FSX technology would flow back to the U.S., and that the Japanese Defense Agency would chart the development of the FSX in close consultation with the U.S. However, specific technology transfer issues and the U.S. workshare were left for later negotiations.

These two issues, specific technology transfer and the workshare, proved to be the focus of intense negotiations following the signing of the MOU. Much of the disagreement focused on the FSX wings. These were to be developed utilizing Japanese composite technology. Mitsubishi was willing to transfer the technology, but insisted the wings be built in Japan. However, the U.S. felt that for effective transfer of the technology, that General Dynamics

would have to construct full wings in its U.S. facilities (94:9). In addition, the MOU merely stated that total U.S. workshare of the FSX would be between 35 and 45 percent, which was the compromise reached in June of 1988 by Secretary of Defense Carlucci and Director General of the Japanese Defense Agency Tsutomu Kawara (112:B-2). U.S. negotiators were intent on "nailing down" the specific work share, and ensuring that it was a quality contribution. By mid-January of 1989 these issues were resolved. The two sides agreed that the wings of two of the seven prototype aircraft would be built in the United States. In addition, negotiators settled on a forty percent workshare for the United States, based on a task-based division of the development work, thereby ensuring that the American share is composed of quality work (96:45).

The License and Technical Assistance Agreement (LTAA) between General Dynamics and Mitsubishi was signed on 12 January 1989. This agreement formalized and established the relationship between the two companies on the FSX program. The next step was for the Bush Administration to notify Congress of its intent to approve a commercial manufacturing license for Japan, in accordance with section 36 of the Arms Export Control Act. Congress would be allowed to review the export license application for the F-16 data to be transferred to Japan. This notification was expected by 31 January 1989. However, notification was suspended due to an

intensifying debate over the proposed joint venture with Japan.

### The FSX Debate

Opponents' View. Although Congressional opposition to the FSX agreement had been mounting, it was the interagency differences within the Administration that forced the postponement of the formal Congressional notification. The Departments of State and Defense are staunch advocates of the program. The Commerce Department and U.S. Trade Representative officials lined up in opposition to the deal. Protests from these officials put the notification of Congress on hold pending interagency review to resolve Administration differences.

Technology Transfer. The criticisms of the FSX program are substantial in number. Many of the opponents believe that the U.S. is not "getting enough out of the deal" and simply "giving our technology away".

Critics quickly charged that Japan was getting off cheap. The deal calls for General Dynamics to get only about \$440 million worth of work on the FSX, though development of the F-16 cost U.S. taxpayers \$5 billion. "We're getting less than 10 cents on the dollar," says one Congressional critic. (1:34)

Such a technology "giveaway" is at the heart of the Commerce Department's concerns. Commerce officials fear a complete release of data to Japan ranging from the development aircraft, the YF-16, all the way through the proposed next-generation F-16, the Agile Falcon (11). Clyde

V. Prestowitz, former acting Assistant Secretary of Commerce for International Economic Policy, takes this sentiment even further:

In addition, because GD [General Dynamics] is a competitor in the Air Force's latest development program (the advanced tactical fighter) and knowledge is fluid within the company, it is likely that some technology from the ATF program will also be transferred. (81:D-4)

In addition to the pure technical data that can be transferred, critics warn of the transfer of systems integration capability. Design and production of an advanced fighter requires advanced systems integration skills. Japanese capability has lagged behind in the integration skills considered vital for most advanced technology projects.

Opponents are also wary of the value of Japanese technology which the U.S. could obtain under the technology flowback provisions of the MOU. Of particular interest to the U.S. is the composite wing and phased array radar which Japan proposes to employ on the FSX. However, many believe the Japanese have overestimated their capabilities in these areas, and that the U.S. will not realize any useful technology from Japan (56; 66). Industry experts believe that American firms lead the world in composite technology, and that the gallium arsenide chip at the heart of the phased array radar is incapable of being produced economically at this point in time. Critics also point to the 1983 and 1985 technology transfer agreements with Japan

as an avenue to purchase such technology from Japan if it does reach fruition, and at less cost in terms of our technology being "given" to Japan.

Interoperability and Mutual Defense. FSX

opponents quickly attack the interoperability capabilities of the aircraft. Prestowitz claims that the FSX will be stripped, redesigned and modified to the point that it will be virtually a new airplane (81:D-4). The agreement calls for Japan to develop the radar, avionics, fire-control system and armaments. Therefore, critics claim, interoperability with U.S. forces is not a realistic goal with the FSX.

The interoperability argument will usually lead FSX opponents quickly into a critique of Japan's defense intentions. Critics contend that the FSX is a glaring example that Japan did not have defense considerations in mind when the deal was negotiated. The argument is quickly developed that if the laws of comparative advantage were followed, Japan would buy F-16s from the U.S. Opponents cite the F-16 to be the premier fighter in the world, that it is available now, and that it is priced at bargain rates. For Japan to embark on developing the FSX to fill a role for which the F-16 is more than adequate is simply a waste of resources. These are the same resources which Japan could utilize to shore-up other weaknesses in its defense. Instead, this burden is shifted to the United States.

Consequently, these opponents ask who is more concerned with the defense of Japan--Japan or the United States? (38; 56; 66)

U.S.-Japanese Trade. The state of the trade deficit with Japan is also a common plank in opponents' positions. The Journal of Commerce addressed this argument:

The FSX project stands in blatant contradiction to Japan's commitments to increase imports from the United States. Were its foreign trade roughly in balance, Japan's desire to build its own airplanes would be difficult to decry. But with Japan enjoying a \$55 billion trade surplus with the United States last year--a surplus that is not declining--the situation is entirely different.

Instead of spending an estimated \$42.2 million to import each airplane from an American factory--a step which could knock \$6 billion or more off Japan's trade surplus over the next decade--the Japanese government plans to keep almost all of its spending at home...

(85:32)

U.S. Planning. Several Congressional opponents are particularly upset that the Commerce Department was not consulted on the FSX. The 1989 Defense Authorization Bill contained an amendment which required that the Defense Department consult the Commerce Department before signing any MOUs. Although Commerce officials were briefed on the FSX MOU, Commerce was not intimately involved in the negotiations as some in Congress had envisioned. In a letter sent to President Bush on 1 February 1989, twelve senators expressed their concern that the long-term effects of the FSX deal on the health and competitiveness of the U.S. aerospace industry were not being considered. They

cited the exclusion of the Commerce Department and the U.S. Trade Representative from the FSX negotiations as a reason for this concern (17:1).

Japan and Commercial Aerospace. Looming over all opponents' arguments is the specter of a Japanese aerospace industry challenging that of the United States. This is a prevalent concern in Congress, as well as in the Department of Commerce:

[Commerce Secretary] Mossbacher's concern, shared in Congress, is that Japan will use the project as a springboard for an indigenous civilian and military aerospace industry that eventually would compete head-on with the U.S. (67:16)

This fear of competition from the Japanese industrial juggernaut extends to all sectors of the aerospace industry--military, civilian, and secondary parts. This argument is supported not only by Japanese prowess in other industries, but also by the statements of Japan itself:

For over 30 years, Japan's Ministry of International Trade and Industry...has targeted development of a domestic aircraft industry. (81:D-4)

The Japanese government has tagged aerospace as one of the country's key industries for the 1990's. (39:72)

Though Japan's policy forbids the export of weapons, there have been calls to revise this stance. Prime Minister Noboru Takeshita has said on several occasions that Japan should have military power "commensurate" with its economic strength. (33:62)

Many of Japan's industrial strategies support such statements. Experts have estimated that Japan spent three times the cost to produce F-15s through coproduction rather than a straight purchase (104:228). The FSX will cost much

more to develop than a purchase of F-16s. Yet, "the Japanese justify that as the cost of education" (39:72).

Opponents warn that the Japanese policy not to export weapons is just that--a policy, and one that could be reversed for economic gain.

It would be wise for U.S. planners to further expect that not too many years down the road we could expect to see versions of Japanese combat aircraft that could be competitive on the foreign military sales market, if Japan should someday lift its ban on arms exports.  
(41:206)

If Japan holds firm on its arms export policy, opponents to the FSX still fear the aid which the program may offer to Japanese civil aviation aspirations. A 1982 GAO report on the effects which Japanese F-15 coproduction had on Japanese civil aviation industry is a prime source for these fears. This report concluded that Japan uses international cooperative arrangements to further its goal of a world-class civil aerospace industry. In addition, U.S. military coproduction programs, such as the F-15, contribute to this goal by "enhancing its aircraft production and technology base with proven U.S. aircraft research and development and production know-how" (46:iii). Supporters of this argument also quote the report's finding that a good portion of military aircraft technology is transferable to civil aircraft production. In their view, the FSX poses an even greater threat than that of the F-15 coproduction. Benefits are already being realized in Japan:

Already, development of technology for the FSX has been used to advance such areas as metallurgical forming and bonding techniques, non-metallic materials processing and manufacturing, advanced electronics systems and optical data transmission. (13:47)

Dr. Freedenberg, in testimony to the Senate Armed Services Committee, summarized:

I think from studies that have been done in the past, for example, the study of the F-15 back in 1982, it is clear that the Japanese see [the FSX] as a long-term development program for their own industry. I do not know that we have looked at it from the point of view of the long-term health of our defense industrial base to the degree that they have. (104:223)

Such are the arguments which opponents to the FSX are offering up to the debate.

#### Proponents' View

Technology Transfer. Supporters of the agreement have fully developed their positions as well. These proponents of the FSX are quick to rebut the "technology giveaway" argument. To claim that the U.S. is injudiciously transferring any and all technology to the Japanese is to ignore reality, according to those involved with the program. General Dynamics cannot release any of the technical data on the FSX without approval from the U.S. government. This approval is only granted after review by foreign disclosure personnel who are adhering to stringent U.S. technology transfer guidelines. In fact, many defense companies have complained that the process is too stringent. Further, Japan would be the 15th country to participate in the F-16 program, and the 9th to actually coproduce the

aircraft (47) (See Figure 12). FSX supporters continue their case by focusing on that data which is eligible for transfer. This transferable data is much more constrained than what critics have suggested. First, only technology data applicable to the FSX configuration is subject to release (47). Second, transfer of technology falls into the categories of engine technology, avionics, integration and airframe. The FSX engines used during the development of the aircraft will be purchased from either Pratt & Whitney or General Electric (61:1). The MOU did not address the production phase of the program. Therefore, DOD has informed both Pratt & Whitney and General Electric that no arrangements for coproduction of an FSX engine can be made without the permission of the U.S. government. Neither company is "authorized to discuss, forecast, or release data related to license production workshare, releasability, or technology transfer at this time" (111). The production FSX engine will be discussed only if and when the Japanese are prepared to negotiate the production MOU. As for the avionics, most of the systems proposed for the FSX are to be developed by the Japanese without U.S. assistance (77). The integration technology is an area of sensitive software technology and processes. Therefore, "the US Government has advised Japan that certain processes associated with integration must be undertaken either entirely by Japan or entirely by the United States, and that there will be no



# WORLDWIDE INVENTORY OF F-16 A/B/C/D AIRCRAFT

	A	B	C	D	TOTAL
USAF	597	109	556	77	1339
BELGIUM	90	19	0	0	109
DENMARK	44	14	0	0	58
NORWAY	54	11	0	0	65
THE NETHERLANDS	124	33	0	0	157
ISRAEL	58	6	51	24	139
EGYPT	33	7	34	6	80
PAKISTAN	27	11	0	0	38
VENEZUELA	18	6	0	0	24
KOREA	0	0	30	6	36
TURKEY	0	0	17	6	23
SINGAPORE	4	4	0	0	8
THAILAND	8	4	0	0	12
INDONESIA	0	0	0	0	0
BAHRAIN	0	0	0	0	0
GREECE	0	0	3	5	8
US NAVY	0	0	22	4	26
<b>TOTAL</b>	<b>1057</b>	<b>224</b>	<b>713</b>	<b>128</b>	<b>2122</b>

\* EXCLUDED ATTRITED AIRCRAFT  
 Figure 12. Worldwide Inventory of F-16 A/B/C/D Aircraft  
 (47)

sharing of information with respect to certain areas of integration" (78). These assertions narrow the eligible technology to that of the airframe.

Internal DoD papers explain that the airframe technology to be transferred under the FSX plan is old, "roughly equivalent to the F-15 airframe technology which Japan has had for about 10 years." (49:3)

Consequently, proponents of the FSX assert that the technology eligible for transfer is a rather small subset of the complete F-16 data package, and that which will be transferred is not cutting-edge technology. In reply to Clyde Prestowitz's comments, Secretary of Defense Carlucci stated,

Mr. Prestowitz says that the United States has invested \$5 to \$7 billion in developing and refining the F-16. That number bears no relation to this project, as it includes an array of technologies that will not be transferred to Japan under this agreement. He also failed to mention that the F-16 has been coproduced to varying extents, in eight other countries since 1979, and in its present form does not represent leading-edge U.S. technology. There will be absolutely no U.S. advanced tactical fighter (so-called ATF) technology involved in building the FSX. (16:A-19)

Japan and Commercial Aerospace. As for the technology which is transferred to Japan, FSX proponents do not believe that it is particularly valuable to Japanese efforts other than the FSX. In fact, many believe it to be a less educational method of developing the FSX than Japanese industry pursuing indigenous development. They cite the Japanese aerospace industry lacking continuity in aerospace projects. Also, being given directions for building an airplane does not instill the knowledge that

autonomous development from "scratch" would. Proponents give great credence to Japan's policy forbidding military exports. If Japan were to change this policy, officials cite several significant barriers:

- 1) The Japanese defense market is so small as to prevent economies of scale from being achieved at home.
- 2) The overall foreign military sales market in the world is shrinking.
- 3) Third party sales of F-16 technology is subject to U.S. approval by the MOU. (54)

FSX supporters do not believe the program threatens the competitive posture of the U.S. civil aviation industry.

The U.S. Air Force maintains that experience in developing a fighter is not substantially transferable to a civil aerospace industry. General Dynamics believes that under FSX, Japan is denied expertise in design technologies which are most critical for a civil aerospace industry. In addition, it is arguable that if Japan intended to develop such an industry, FSX is an inefficient approach, and investment in civilian research and development would be the more productive route. (28:1)

These supporters point to coproduction of the F-4, F-15, and P-3, as well as civilian licensed coproduction of the Boeing 757 and 7J7, as projects undertaken by the Japanese aerospace industry. Yet, according to these advocates, the fears of a dominant Japanese civilian aircraft industry have yet to materialize.

U.S. Benefits. Advocates of the FSX submit a lengthy list of benefits accruing from the accord. The most obvious is the financial benefit for U.S. industry. Estimates for the U.S. share of the development work range

from \$420 to \$500 million. General Dynamics estimates that participation by U.S. industry represents 2,700 man-years of jobs that are either sustained or created during the development phase (77). DOD further projects that

the total direct and indirect economic activity created by the FS-X development in the United States, based on the current budgetary estimate, could be as high as \$900 million. (78)

Although the production MOU has not been negotiated, DOD and General Dynamics have estimated the economic impact to the U.S. if production is undertaken and the U.S. workshare remains at the development level of forty percent. Production could yield 58,800 man-years of jobs for the U.S. and generation of \$2.5 to \$3.2 billion of direct and indirect economic activity (77).

Proponents also look towards the Japanese technology which the U.S. could gain from the program. Well-publicized technologies of interest to the U.S. are the co-cured wings, phased array radar, and high-speed canopy. Supporters point out, however, that there are numerous, though less publicized, technologies of equal interest to the U.S. (technologies which would directly advance the F-16 state-of-the-art). Critics seem relatively uninformed regarding these technologies, which include advanced Japanese avionics with standardized interfaces, redesigned aft fuselage using Japanese composite and advanced metals technologies, Japanese radar absorbent material technology, and

advancements in process technology and quality control, long recognized Japanese strengths (47).

Security Relationship. Proponents see a great benefit to the defense relationship between the U.S. and Japan. "It is in the best interests of the United States that Japan possess the best defense possible" (54). The FSX is believed to further this goal. With the third largest defense expenditures in the world and growth of these expenditures at approximately double that of NATO, the Japanese Self-Defense forces maintain a formidable presence in the Pacific:

No one familiar with these and other realities could regard Japan as a militarily insignificant client state to which America can dictate its wishes. Japan remains a strong friend and ally that has done more in recent years to improve its own defense capability than any other U.S. ally, and it continues to chart substantial progress for the future. It is within this framework that the FS-X program must be viewed. (16:A-19)

Future Cooperation. Proponents also look at the future implications of the agreement. They envision joint programs between the U.S. and Japan that could greatly benefit both nations. Combining the skills of the two greatest economic powers on earth is an exciting prospect.

From the U.S. point of view, shrinking domestic defense budgets mean less money for the expensive process of developing new weapon systems. And Japan could contribute by jointly developing those weapons or by providing technology to improve existing ones. (94:9)

Takaaki Yamada, general manager of the FSX prime contractor Mitsubishi Heavy Industries, views the agreement in terms of future cooperation, not competition:

We are not talking about sending small planes to America the way Japanese industry sent small cars, he says. Instead, the skills MHI picks up will be very useful for Japan-U.S. joint development of aircraft and for civil aircraft ventures, too. (40:1)

However, proponents fear that if the U.S. reneges on the FSX deal, future agreements would be difficult to pursue.

Realism. Advocates of the FSX strongly urge critics to focus on the realities surrounding the deal. They will be the first to state that a straight purchase of F-16s by Japan would have been preferable. However, this avenue was never a real possibility. The alternative to the FSX deal was indigenous development of the fighter by Japan. These proponents will argue that it is reasonable for Japan to have wanted to pursue domestic development.

The Swedes are building their own plane, so are the French, the Indians and others. Don't we expect the Japanese to want to do the same? (67:17)

In addition, advocates insist that the agreement must be looked at in the context of the realities of the international defense market:

...any restriction on the availability of prime contractors to use offsets and coproduction [for the FSX] will be absolutely useless. The Japanese already have a manufacturing capability in many subsystems which has developed as a consequence of earlier aircraft programs, and it is conceivable that, given a national dedication to a design effort, they could design their own aircraft. Perhaps more likely, if U.S. suppliers were out of the picture, there are a number of other countries and companies which would be glad to fill the vacuum. (104:275)

Consequently, the proponents of the FSX believe the U.S. negotiated hard and received a favorable deal. The

Senate Armed Services Committee stated in April of 1988 that it "regarded codevelopment and coproduction [of the FSX] as the next best alternative" to a straight sale of F-16s. This same committee stated that U.S. negotiators should ensure that the U.S. receive a favorable workshare in the agreement, and that Japanese technology developed under the FSX "flows back expeditiously and without charge" (105). Proponents believe the negotiators of the agreement fulfilled these requirements and provided the United States a fair and beneficial agreement with Japan.

#### Resolution

The FSX agreement was negotiated by the Reagan administration, but President Bush's cabinet was tasked with implementing the accord. Concurrent with the change in administrations was the raising of voices in the debate over the FSX:

Problems occurred only when the new US Administration came in. Objections were raised by the secretary of commerce (Robert Mossbacher), the special trade representative (Carla Hills), as well as those on the far right in Congress (Jesse Helms) and the Democratic left (choose one of several) who have been gunning for Japan for some time. The pot was artfully stirred by some with knowledge of Japan (including Clyde Prestowitz, a former US government official) and warmed up by some prominent US publications. (65:23)

Not only were new voices in the debate being heard from the recently formed Bush cabinet, but the debate was also refueled by a growing interest, and fear, of Japan. The death of Emperor Hirohito, the burgeoning trade deficit, and

the political scandal within Japanese Prime Minister Takeshita's cabinet all drew attention to our Pacific ally. In fact, a Washington Post/ABC News Poll conducted in the spring of 1989 discovered that 44 percent of Americans believed that the economic power of Japan posed a greater threat to U.S. national security than the Soviet military (7:46).

A Divided Cabinet. Consequently, resolution of the FSX dispute landed squarely in the lap of President Bush. With his cabinet split over the deal, President Bush found himself sorting out the arguments offered for and against the agreement. The Pentagon and National Security staff supported the FSX, while the economic agencies of the government lined-up in opposition (5:D-1). Leading the opposition within the cabinet was Secretary of Commerce Robert Mossbacher, who advocated a greater role for his department in the FSX and future MOUs. Mossbacher proposed that "As we lessen the apparent risk of actual warfare . . . we find that we are moving from battleships to the trade aspects of our international relationships. U.S. policy has changed." (5:D-7). Several news accounts characterized this clash of views on the FSX as a "donnybrook" between the Pentagon and the Commerce Department. In this battle within the FSX war, Mossbacher claimed a victory. Not only did the Defense Department agree to share power with Commerce in approving future weapon deals, but Commerce also won a role

in monitoring the technology flows under the FSX (3:D-1). However, this agreement occurred without the President's decision on the FSX program.

The still divided Bush cabinet took the issue directly to its boss on a 14 March 1989 meeting of the National Security Council. From this debate before the President, three major issues were offered for the President's consideration:

1. Inclusion of source codes in the FSX agreement. Such source codes are likened to the blueprints for software. The concern centered upon the source codes for the fire control and flight control systems.
2. Clarification of the technology which the U.S. would receive from Japan.
3. A guarantee of U.S. share in the production phase of the aircraft.

(4:A-16)

President Bush consequently decided on going forward with the FSX, contingent upon "clarification" of these issues with Japan (93:28).

Renewed Negotiations. What followed was a reopening of discussions with Japan on the FSX agreement. Japan sent a delegation to Washington on 22 March 1989 in an effort to dissuade the President from changing the agreement. Kichiro Tazawa, Director General of the Defense Agency, called on the U.S. to "respect what has been agreed to in the memorandum of understanding" (48:E-1). However, Washington stood their ground on the areas of protecting U.S. technology, delineating what Japanese technology would be

transferred to the U.S., and demanding a 40 percent U.S. workshare in any subsequent production (92:1). As the discussions with Japan dragged on, Japanese sources were increasingly quoted as to their displeasure with Washington's reopening of a "done deal." Japanese officials were quoted as saying that such discussions would "leave a very serious scar in the minds of people who should be cooperating with each other" (109:1). The Japanese delegation left Washington on 29 March 1989 without an agreement. However, Japan did award an \$81 million contract to Mitsubishi Heavy Industries on 30 March 1989 for the FSX development (95:4).

As discussions between the U.S. and Japan continued, several developments added high drama to the talks. Japan was forced to negotiate from a position in which Prime Minister Takeshita had announced his resignation due to the recruiting scandal his government had incurred. Some in Congress accused Mitsubishi of being involved with the sale of chemical warfare equipment to Libya. Such factors figured with the already present trade friction to demand that both sides reach a politically palatable agreement. The press also reported rumors that the Japanese had reopened discussions with France and Israel to explore replacing the U.S. in the FSX deal (21:4). And the United Auto Workers and International Association of Machinists and

Aerospace Workers joined the fray in demanding the agreement be scrapped (90:3).

The United States and Japan were able to finally reach agreement on the FSX however. On 28 April 1989, President Bush announced that the two governments were able to reach an agreement "that will allow us to proceed with joint development of the FSX fighter aircraft" (90:3). The "new" agreement included:

1. A 40 percent U.S. workshare in both the development and production phases.
2. Control of the F-16 source codes to allow access to only those necessary to complete the project.  
(90:3)

The administration performed the required notification of Congress on 1 May 1989, and Congress had 30 days to review the agreement.

Congressional Battles. Congressional opponents were already geared up for a battle, with resolutions in both the Senate and House introduced to derail the FSX (88:3). The Senate was the first to vote on a resolution blocking the FSX, and on 16 May 1989 this resolution was defeated by a 52-47 margin. This was a much closer vote than was expected, and reflected a growing opposition within Congress to the sale. In order to block the FSX, resolutions in both the House and Senate had to be passed, and by at least a two-thirds margin to override any Presidential veto. This was never seen as very likely to occur, even by the opponents (87:3). With the Senate vote on the resolution of

disapproval eliminating any chances of blocking the sale, Congressional opponents switched strategies and attempted to affect the conditions of the agreement. Senator Byrd of West Virginia introduced legislation which sought to impose the following conditions on the FSX deal:

1. Require each transfer of technology to Japan be subject to Congressional disapproval.
2. Require the U.S. to obtain 40% of the production work, including spares.
3. Prohibit the transfer of critical engine technology to Japan.
4. Prohibit the transfer of any FSX technology by Japan to any third country.
5. Require a review of the implementation of the MOU by the General Accounting Office every six months.

(47; 66)

The Byrd Resolution passed the Senate on 16 May 1989 by an overwhelming 72-27 vote (66). Similar legislation was adopted by the House on 7 June 1989 by a 262-155 vote, which would not be enough to override a Presidential veto (66). However, the stage was set. Unable to block the FSX program, the Congress passed legislation to affect the terms and conditions of the program. When the deadline for this research arrived, the battle over the FSX was not yet finished. Congress still had not submitted the Byrd resolution, or its House counterpart, to the White House. Whether President Bush vetoes the resolutions, whether Congress is able to override any vetoes, and the affect of any such actions on Japanese relations was still a matter of

conjecture. However, the FSX case had long ago served its purpose for this study. The debate over the FSX and the accompanying substantive issues were the focus of the case analysis. This debate had not changed. The FSX program itself, however, had developed into a broader political battle between the Executive and Legislative branches of the U.S. government. The final outcome of this fight, though important to the FSX and future U.S.-Japanese ventures, is not a critical factor in this study. It is the issues of the debate, and not necessarily the outcome, that are important to this effort.

## V. Findings and Conclusions

### Introduction

This final chapter will present the findings and conclusions of the research. The previous analysis will be synthesized into a framework of knowledge which can be applied to the evaluation, negotiation and management of future international armament programs.

### Importance of this Research

The stated objective of this research was to comprehensively assimilate the existing research on international programs, incorporate the findings of the recent FSX case, and develop a framework of knowledge for future use. Such analysis is important for a variety of reasons. International armament programs are growing in size and importance. The potential such programs hold for the sharing of risks, for reducing the United States' defense burden, and for increasing cooperation amongst the Allied nations is great. Conversely, the risks such programs likewise hold for the U.S. in regards to increased global competition, loss of domestically developed technology, and trade imbalances are also significant. Therefore, the need for expert decision making and management of international armament programs is paramount. This research provides those involved in international programs a tool for use in those difficult evaluations of

U.S. participation in a program, negotiation of the terms and conditions of the program, and subsequent management of the effort. In light of the myriad of issues involved in international programs and the cost-benefit analysis required in this arena, any tool which aids in such decision-making should prove valuable.

#### International Armament Program "Realities"

The preceding research suggests that the first step towards the evaluation and negotiation of a proposed international venture is an understanding of the joint venture--not the specifics of the particular program, but rather the general nature of international programs as a whole. Research has identified themes common to all cooperative programs. Among these characteristics are technology exchange, shared investment and risk, and shared access to new or expanding markets. It is the "nature of the beast" that international armament programs possess risks for both partners. Consequently, concern in the United States over the role joint ventures may play in increasing foreign competition, transferring technology, and impacting the defense industrial base are not so unwarranted. However, criticism of international programs for possessing such risks is unwarranted. After all, criticizing a vehicle like a joint program for its inherent risks could be likened to condemning the stock market for the risks it holds of losing money. The proper approach

would be to recognize the stock market's risks, manage those risks as best possible, and to not invest if the risks are unacceptable. It can be argued that a similar approach should be used with a joint venture.

Another "reality" of the international armament program involves the motivations each party has to join the effort. The research found that international armament programs evolved over the post World War II years from grant-aid "gifts" of military hardware through licensed production, coproduction, and now even codevelopment. Such programs arose out of the belief that bolstering the defense of Europe and Japan as well as their industrial bases and economies was in the best interest of the United States. Today, the United States professes to participate in international ventures for similar national security purposes. Current joint ventures are entered to

- boost the Allied defense posture
- project U.S. power
- promote interoperability
- support U.S. defense production and efficiency
- promote RSI, and
- ease the economic strain of costly weapon systems.

These are the reasons which the U.S. offers as justification for its participation in international armament programs. It should not be surprising that the foreign partner has its own reasons for entering into the joint venture with the United States. However, what many in the U.S. have difficulty accepting is that the foreign partner's reasons may not be the same as those of the United States. The

evidence suggests that many foreign partners place economic considerations ahead of traditional security concerns, and that it is such economic goals that motivate the foreign government to enter international ventures with the United States. For example, the analysis suggests foreign goals include:

- the desire for self-sufficiency
- improving the balance of trade with the U.S.
- increasing domestic employment
- gaining high technology
- promoting certain domestic industries
- gaining entrance to new markets.

Realization and acceptance of this differing motivation for the foreign partner's involvement in the joint program is essential to U.S. efforts in evaluating and negotiating future international ventures.

The final "realities" of the international armament program involve the role such programs play in today's defense markets. The analysis depicts international programs as a necessary element in today's competitions for defense sales. Foreign countries are demanding such arrangements and for the U.S. to not participate would only serve to remove U.S. firms from the competition. However, the international armament program contributes only a marginal income to U.S. defense firms. The health of the U.S. defense industrial base is dependent primarily upon U.S. Government purchases.

Consequently, these "realities" of the international armament program are a first step towards the thorough and

responsible evaluation, negotiation and management of international joint ventures. The very nature of international programs is comprised of risks. Identification and management of these risks is the appropriate method for dealing with U.S. involvement in the international arena. Next, identification of the reasons the United States wishes to enter a joint arrangement is generally not difficult. Analysis of the foreign partner's reasons for participation may require more effort. However, such analysis is critical to understanding the motivations of the future partner. Such understanding can then be used to effectively evaluate, negotiate and manage an international armament program with the United States' best interests in mind. And finally, international ventures are a reality in today's defense marketplace. To refuse to participate would only exclude the U.S. from effective competition. However, the role of the international program must not be drawn out of proportion--it is the purchases of the U.S. Government which dictate the health of the U.S. defense industrial base.

#### The International Armament Program "Environment"

Shifting focus from the "realities" of the international armament program, the next step is to evaluate the "environment" in which a future international program may operate. This "environment" is obviously open to change. However, certain factors now exist which will

likely persist into the near future. For example, the research documented a deep-seated deterioration of the U.S. defense industrial base which cannot be quickly reversed. The importance of the defense base to the United States was also well documented. Not only does it serve to produce the necessary weapons of war, but it also acts as a deterrent and aids the overall economy. Likewise, a healthy civilian economy can be a deterrent as well as the source of revenue to pay for defense. Therefore, the health of the U.S. defense and commercial industrial base is a pertinent element in the "environment" in which international programs operate. As the research details, however, the focus on the defense industrial base in regards to the international program may be narrowed to the areas of foreign competition, foreign vulnerability, and the fragile U.S. subcontractor base.

Technology transfer is another issue operating in the international armament program environment. The importance of technology leadership was well documented in this research. For both military and commercial purposes, the U.S. is dependent on state-of-the-art technology. The fact that technology transfer is typically an integral element of international programs makes the issue a significant element of the "environment."

A changed economic order in the world is also operating in the international program "environment." Trade

imbalances and a loss of competitiveness are currently afflicting the United States. The new economic order in the world is witness to a growing global economy. Increased interdependence and a growth in the number of formidable competitors to the U.S. is an outgrowth of these changes. Such competition comes from not only the Pacific Rim but also Europe and many newly industrialized countries. The United States no longer dominates the world economy.

Trade has become closely linked to the international armament program. Once the sole domain of the Departments of Defense and State, the joint venture is now also the territory of the Department of Commerce, the U.S. Trade Representative and Congress. Once international programs were only debated among Defense and State officials based on political and military concerns. Now such programs raise trade issues as well and instigate spirited battles among various interests groups in Washington.

Political concerns are also an element of the international program's "environment." Perhaps the most volatile and difficult to analyze of the environmental elements, such political concerns take on numerous forms. Domestically, defense budgets, interservice rivalries, and "pork barreling" may all affect the future of an international venture. International politics also affect the cooperative program. For example, joint ventures with NATO seem to be more amenable to Congress and the U.S.

public than programs with Japan and other Pacific Rim countries. In fact, Congress has consistently advocated the NATO joint venture. The U.S. relationship with Israel is always a factor in international programs with other Middle Eastern countries. The perceived lessening of tensions with the USSR is also a factor in the current international program "environment." These are just a few examples, but the concept of politics operating in the international armament program "environment" is real.

The "environment" of the international joint venture is a dynamic, complex arena. However, analysis of such conditions is critical to the goal of effective evaluation, negotiation, and management of the international program. Such ventures do not operate in a vacuum. The complete and accurate analysis of the environment in which the international program is operating is critical.

#### The International Armament Program Framework

After the "realities" and "environment" of the international armament program are analyzed, it is appropriate to apply the framework which has been developed in this research to the individual program. The framework begun in the previous chapters is now further developed and presented as Table 4.

Table 4. International Armament Program Framework

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1. MILITARY/NATIONAL SECURITY CONSIDERATIONS

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A. The impact of the new system on the military capabilities of the foreign partner(s).

Comments: Analysis of the gain the partner(s) will receive in their war-fighting capability due to the system's presence in their inventory.

References: pages 22; 104-106; 124-126; 126-133; 142

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B. The impact of the system on U.S. military capabilities.

Comments: Analysis of the value the system may have to the United States' war-fighting capability.

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C. The stability of the alliance and the ties the foreign partner(s) had or may have to U.S. foes.

Comments: Evaluation of the relative strength of the partners' loyalty and commitment to the alliance; the influence and threat of past, present or future relationships the foreign partner(s) had or may have with countries hostile to the U.S.; the overall future of the alliance.

References: pages 104-106; 126-127

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D. The impact of the system on the military balances between the U.S., the foreign partner(s), and any foes of the nations involved in the joint program.

Comments: Analysis of the effects the system will have on the overall military balances between the participants and their foes.

References: pages 22; 104-106; 124-125; 126-127; 132-133; 142

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**E. The affect such a program has on the alliance between the U.S. and its foreign partners.**

Comments: Evaluation of the effects which the program will have on U.S. relationships; whether the program will harm any relationships; whether the program may establish or strengthen any relationships.

References: pages 104-106; 124-125; 126-127; 132-133; 142

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**F. The affect such a program has on the military alliances of the potential foes of the partners.**

Comments: Analysis of the reactions of the foes of the partners; the strengthening or weakening of hostile alliances due to the program; the potential for retaliatory measures.

References: pages 104-106

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**G. The impact of the arrangement on common objectives, strategies, and goals.**

Comments: Determination of how the program either supports or detracts from the goals of any alliances or common objectives.

References: pages 23; 104-106; 124-125; 126-127; 132-133; 142

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**H. The ability of the foreign partner(s) to control and protect classified and sensitive data. The impact to the U.S. of a loss of the technology to hostile countries.**

Comments: Analysis of whether the system contains classified or sensitive data; whether the foreign partner(s) should be provided such data; whether they can and will protect such data; and the impact on the U.S. of the loss of such data.

References: pages 60; 63-64; 131

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## **2. TECHNOLOGY TRANSFER CONSIDERATIONS**

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**A. The availability of the system's technology elsewhere.**

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Comments: Evaluation of whether the technology of the system can be obtained from sources other than the United States; the availability of the technology in the world market; includes comparison to similar or substitutable technologies.

References: pages 66-68; 136-138

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**B. Analysis of the true value of the system's technology.**

Comments: Careful and comprehensive analysis should be undertaken to determine the real value of the technology. Mediating factors such as the need for management expertise in the subject technology; the advantages of having originally developed the technology; and the benefit that the transfer of U.S. technology may have of suppressing the development of foreign technology which may prove better are all elements which may influence the real value of the technology.

References: pages 68-71; 139-140

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**C. The value of the technology, both from the U.S. and from the foreign partner(s), to commercial ventures.**

Comments: Analysis of the role the technologies involved in the system play, or could play, in commercial ventures. Such consideration applies to both the foreign partner(s)' use of U.S. technology as well as the United States' use of foreign technology.

References: pages 60-63; 70; 76-80; 94-95; 112-114; 114-120; 131-133; 134-136; 134-142

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**D. The impact of foreign sourcing/dependency/vulnerability and or foreign ownership on the U.S.**

Comments: Evaluation of the prospects and impacts of these concepts on the United States.

Reference: pages 45-51; 76-80; 90-91

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**E. The probability and impact of a foreign competitor entering the system's industry or component industry.**

Comments: Analysis of the potential for the foreign partner(s) to penetrate the markets of U.S. industries as a result of their participation in the joint program.

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References: pages 21; 26-28; 43-48; 51-54; 57; 60-63; 76-80; 116-120; 134-136; 139-140

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F. The potential for foreign competition to drive out a domestic source for the system or component. The impact of such a loss.

Comments: Evaluation of the probability of foreign competition, as a result of the program, damaging either commercial and/or defense industries in the United States.

References: pages 43-48; 51-54; 57; 76-80; 90-91; 134-136; 139-140

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G. The ability of the foreign partner(s) to absorb the system's technology.

Comments: Analysis of if, and to what extent, the foreign partner(s) is capable of effectively learning and using the system's various technologies.

Reference: pages 60-63; 68-71; 112-113; 136-139

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H. The value and availability of the foreign partner(s)' technology for U.S. use.

Comments: Identification and evaluation of the foreign technology which could prove useful for U.S. commercial and defense needs. Evaluation of the United States' ability to garner such technology from the foreign partner(s).

References: pages 71-73; 94-95; 111-115; 131-132; 141-142

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I. The threat the foreign partner(s) pose to U.S. technological leadership.

Comments: Analysis of the foreign partner(s) ability to impede the U.S. pursuit of technology. Evaluation of the impact to the U.S., both militarily and commercially, of a loss of leadership in a technology as a result of the program.

References: pages 36-37; 60; 131

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**J. The presence or future availability of superior technology for the United States.**

Comments: Analysis of the current and future state of U.S. technology to determine if superior technology is or will be available to replace that which will be transferred during the program.

References: pages 68; 70

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**3. ECONOMIC/INDUSTRIAL CONSIDERATIONS**

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**A. Financial support the program would provide for the development of new technology.**

Comments: Evaluation of the financial benefits that would accrue to the U.S. as a result of the program. Analysis of the reinvestment in the U.S. industries as a result of the financial benefits.

References: pages 68; 70; 140-141

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**B. The resources conserved through the sharing of risk and finances in the program.**

Comments: Analysis of the economic and programmatic benefits resulting from the sharing of risks and resources in the program.

References: pages 23-24; 94-95

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**C. The impact of the program on the health of the U.S. defense industries involved.**

Comments: Comprehensive analysis of the industries likely to be affected by the program. Particular attention should be placed on the evaluation of likely foreign competition, the health of the prime and subtier industries involved in the program, and the interaction of the two.

References: pages 21; 26-28; 35-44; 51-54; 57; 76-80; 90-91; 1116-120; 140-141

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**D. The impact of the program on the cost and efficiency of the U.S. production of the system.**

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Comments: Evaluation of the gains the U.S. would receive as a result of supplementing U.S. production of a system with the foreign production of the same system. Areas such as cost and production time may benefit, i.e. the European production of the F-16 and any associated benefits for U.S. production of the F-16.  
References: page 22

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**E. The impact of the program on U.S. employment.**

Comments: Analysis as to whether the project will result in a gain or loss of U.S. jobs.  
References: pages 52-53; 140-141

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**F. The impact of the program on market access to both the U.S. and its foreign partners.**

Comments: Determination of whether the program will result in new markets opening for either the U.S. or its partner(s).  
References: pages 21; 26-28; 95

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**G. The impact of competition on the price and availability of the system and/or its components.**

Comments: Evaluation of the potential for foreign competition, as a result of the program, affecting the price and/or availability of either the system or its components.  
References: pages 59; 90-91

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**H. The impact of the program on U.S. trade.**

Comments: A wide and complex issue, this consideration involves such factors as the program's effects on U.S. economic and trade strength; the deterrence value of a strong economy; trade impacts on the U.S. industries involved; and the state of the trade relationships between the U.S. and the foreign partners.  
References: pages 80-92; 95-96; 109; 120-122; 133-136; 142-143

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I. The impact of the program on the U.S. balance of payments.

Comments: Analysis as to the affects the program will have on the state of the balance of payments between the U.S. and the foreign partners.

References: pages 120-122; 133; 140-141

J. The interaction of the program with the concept of a global economy.

Comments: Evaluation of whether the program supports the advantageous aspects of today's global economy.

References: pages 50; 95-96

K. The impact the program may have on interdependence between the U.S. and the foreign partner(s).

Comments: Analysis of the program's affects on the concept of interdependence between the partners. Determination of the possible advantages for the U.S. of such interdependence.

References: pages 50-51; 58; 142-143

Implementation of the Framework. The International Armament Program Framework can be applied to a future international venture as a reference tool during the course of the evaluation, negotiation, and management of the program. Divided into three subject areas of considerations, the framework also contains references to pages in this study where the considerations are illustrated. The references are to both the literature review and the case analysis where appropriate.

Consequently, this study presents a process by which analysis of an international program may be approached.

This process begins with the study of the "realities" surrounding the subject program. Next, the "environment" of the program is analyzed. And finally, the framework is applied to the specific program. Figure 13 illustrates this procedure.

Figure 13 depicts a series of stages in the analysis of a program which structure the appraisal. Upon proposal of a joint venture, the United States must first decide whether it should participate in the program. Such decisions can only effectively be made if the proposed program is comprehensively evaluated as to its merits, risks, and faults. If the United States decides to participate in the effort, then the next stage would be to develop a position for negotiations which would maximize the benefits of the program and protect U.S. interests. Upon completion of negotiations, the program must then be managed in a manner which implements the negotiated terms and conditions of the joint effort.

The process and framework proposed by this research can be effective in each stage of the analysis. The analysis performed at one stage of the process flows to the next stage. The idea is that though there are stages in the analytical process, the evaluation of the "realities" and "environment" and the application of the framework is appropriate in all the stages. Evaluation of U.S. participation in an international program, the negotiation

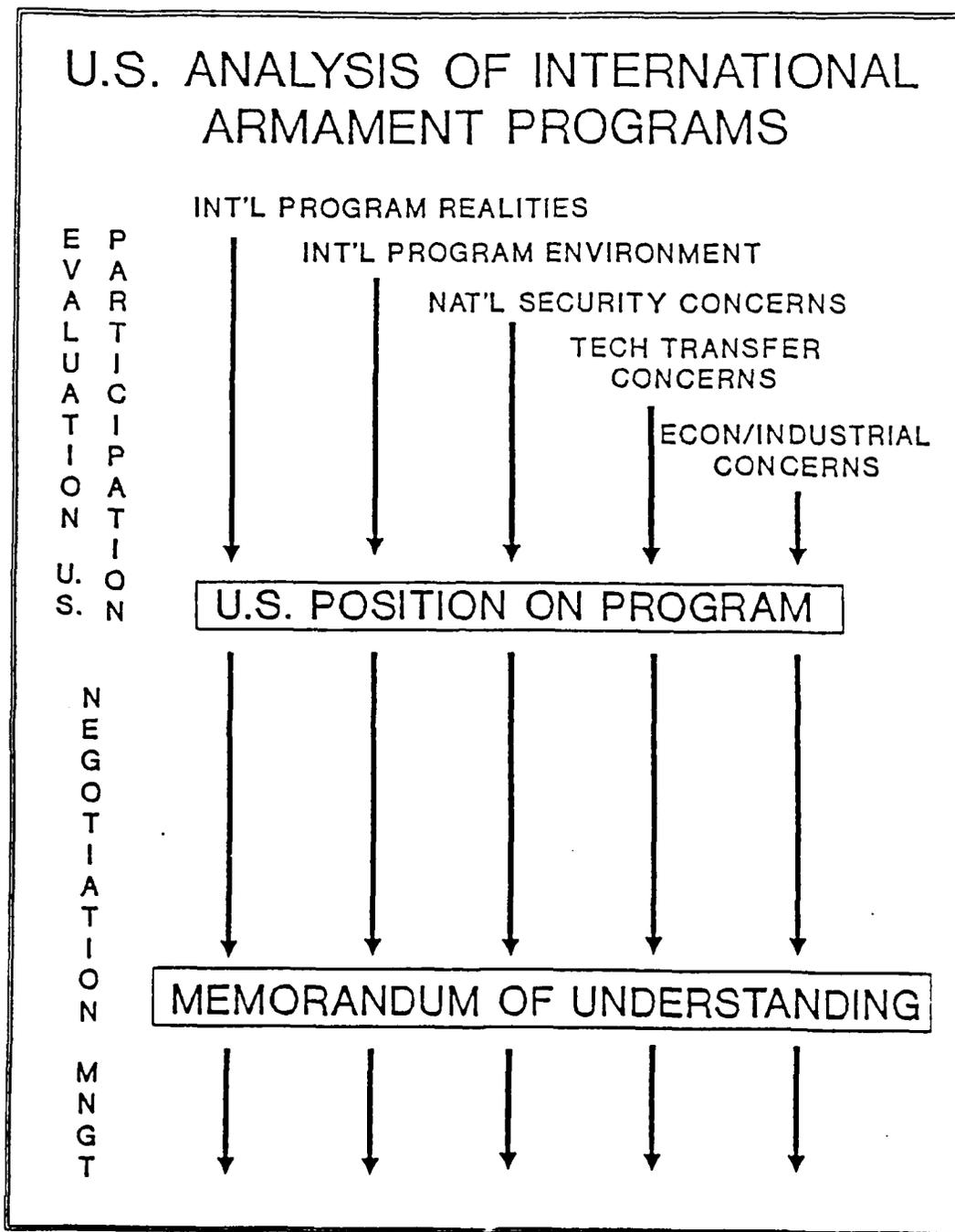


Figure 13. U.S. Analysis of International Armament Programs

of any such participation, and the management of a program may all benefit from this method of analysis.

The true value of the process and framework is in its ability to promote comprehensive and responsible analysis of a joint venture. This study does not profess to provide a "cookbook" approach to such evaluation. Even if possible, such an approach would ignore the very underpinnings of this study's proposed approach--comprehensive, flexible, open-minded analysis of each individual international arrangement. Only through such an approach will effective decisions be made and programs capably managed.

#### Application to the FSX Case

The case analysis of the U.S.-Japanese FSX program illustrated many of the research findings from the literature review. Applying the analysis process and framework to the case further substantiates these concepts.

Beginning the process with the recognition and acceptance of the "realities" of international programs, the FSX case embodies these ideas. The "reality" of the risks associated with an international program was evident in the FSX. It was the risks of the program that produced much of the criticism of the project. The proponents of the venture contend that such risks were recognized and managed. Opponents of the FSX argue otherwise. In addition, the "reality" of the motives behind each parties' participation in the FSX were also a factor in the debate. The United

States asserted that the program was based upon sound security concerns. The FSX was to bolster the defense of Japan, strengthen the security relationship between the two countries, promote interoperability of forces, and further project U.S. power in the region. Lesser motives included suppressing indigenous Japanese development of their own fighter, maintaining a presence in the Japanese defense market, the financial benefits of the agreement for U.S. firms, and the acquisition of Japanese technology. The research suggests that the Japanese motivation for the FSX program included not only boosting their defense capabilities, but also a drive toward self-sufficiency, maintaining (and further developing) a capable defense industry, and gaining U.S. technology. Finally, the "realities" that joint ventures are often a requirement in today's marketplace and yet still a small percentage of U.S. defense work were present in the FSX. Japan had been coproducing U.S. hardware for years. A straight sale of F-16s to Japan was never a realistic possibility. With other countries' aerospace industries willing to join the Japanese, the U.S. was forced to participate in a joint venture if it wanted to be involved in the FSX. However, despite the \$7 billion price tag for the 120 FSX aircraft, the project is a small element of U.S. defense work.

The "environment" of the FSX program is a complex, dynamic one. The health of the U.S. defense industrial base

was obviously a concern in the FSX debate. Technology transfer, and the Japanese penchant for gathering U.S. technology was a major plank in the opponents' positions. The economic prowess of the Japanese as well as the growing trade imbalance with the U.S. also played heavily in the FSX debate. The international climate where the perceived threat from the USSR was less a worry to the U.S. than the trade deficits impacted the FSX program. The FSX program became a political football in the United States. From the halls of Congress to the editorial pages of newspapers, the FSX was debated throughout the United States. Consequently, the environment in which the FSX operated was a significant factor in the evaluation and negotiation of the project.

The application of the framework developed during this research to the FSX program reveals that the considerations are relevant to this international program. All the concepts in the framework present themselves in some form in the FSX. Employment of the framework to the FSX facilitates a comprehensive and effective analysis of the joint venture.

### Conclusions

FSX Conclusions. Synthesizing the research findings with the developed framework produces certain conclusions about the FSX program. First, the value of the security relationship with Japan was an element of the program which was not heavily debated, yet was a major motivation for U.S. participation. To debate the FSX from a primarily economic

approach is to ignore the important security relationship the U.S. has with Japan. Perhaps the economic arguments are easier to quantify, however the strategic security relationship is no less important.

The final FSX agreement provides adequate safeguards for U.S. technology. However, this should not be confused as a statement that technology will not be transferred. The history of Japanese pursuit of U.S. technology as well as the nature of the international program assures that technology will, and indeed must, be transferred. However, the issues surrounding such transfer are complex and usually contentious.

First, to assume that technology transfer cannot be controlled--that the Japanese can merely gather whatever they wish--is a position which does not give much credit to the United States. Second, technology itself is not the sole ingredient for success in either military or commercial ventures. Other factors such as management know-how, integration, past experience and development experience figure heavily in the success of state-of-the-art systems. Third, the technology which will be transferred is either already possessed by Japan or available from other countries. The FSX is not the first cooperative effort for the Japanese. Such systems as the F-4 and F-15 are already being produced by Japan. World-class aerospace technology is no longer the sole domain of the United States. Aerospace technology, particularly commercial technology,

flows easily throughout the market and is available from numerous sources. Several countries possess advanced aerospace industries which are willing and able to join the Japanese. The same statistics that point to the power of Japan's economy should also convince the world that a country cannot prevent them from growing. It is only natural that Japan's aerospace industry should want to advance. Retarding such growth is not possible, nor desirable from a security standpoint. Finally, the FSX is merely one example of an international arrangement with an economic rival. The U.S. has participated in numerous international ventures with very capable countries. Many of these programs have been far more generous to the foreign partner.

The research identifies aerospace as a target for Japanese development. This is not a new pursuit for the Japanese, and, despite their access to the latest technology, their success has been limited. This suggests that forces other than mere technology are at work in the aerospace market. The commercial aerospace market is a difficult one to enter. Market-unique forces serve to make commercial aerospace a difficult and delicate industry. The U.S. has historically dominated the market. Therefore, Japanese success will depend on the actions of U.S. industry as much as its own efforts.

The research also embraces the idea of a bilateral exchange in the technology transfer arena. Japan offers a unique opportunity for the U.S. to gain technology from another country. Besides the heavily debated composite wings and phased array radar of the FSX, Japan possesses numerous other technologies which hold promise. However, success at technology flowback will depend heavily on the actions of the United States.

The FSX has ushered in a new era. No longer are international programs solely a Defense and State Department concern. Trade has become closely linked with such ventures. Joint programs with such economic powers as Japan, who also maintain a trade imbalance, complicates the issue.

Finally, the FSX Memorandum of Understanding was not negotiated and managed in the manner in which the research suggests. Lessons learned from past international programs as well as the statements of the U.S. Government itself advocate that any MOU be carefully negotiated and constructed since it is equivalent to a contract. The FSX, however, operated under a MOU which left important issues for later resolution and was then reviewed and debated after its signing. Such actions are a departure from doctrine, the lessons of previous experience, and prudent business practices.

General Conclusions. Growth of the foreign partner's capabilities, technology transfer, strengthening of the

Allied defense industrial base, and the value of the strategic security relationships have all been traditional underpinnings of the international cooperative program since World War II. Today's world is witnessing a growing concern and elevated importance of economic and trade issues on international armament programs. While national security concerns are no less important, the U.S. must learn to consider these new dimensions if it is to negotiate effective international agreements that meet the needs of all participating nations.

The research suggests that a new approach in the U.S. for government planning in the international program field is warranted. Admiration of Japan's MITI and the identification of shortcomings in the current U.S. system prompt calls for a revised, more comprehensive approach to the evaluation, negotiation, and management of international armament programs. This research is aimed at such efforts.

However, the evaluation and negotiation of an international program is a difficult task. Numerous issues, both pro and con, present themselves. Therefore, international programs become an exercise in cost-benefit analysis. It is human nature to avoid negative alternatives to decisions. The challenge is for the United States to evaluate, choose, and successfully negotiate the most advantageous route for an international effort. Negatives may very well exist in such an approach, however it is the

overall cost-benefit status of the program which the U.S. must maximize. In light of the fact that the analysis of the impact of an international program on the economy and industrial base of the United States is difficult and untimely, such effort at effective decision-making on the front-end of an international program makes even more sense. This study aims to affect the decision process governing the evaluation and negotiation of future international programs. Analyzing the aftermath is much more difficult and not nearly as important. Effective, thorough, and responsible evaluation and negotiation of an international program is critical.

Technology transfer is an ominous aspect of the international armament program. This research documented many aspects of the concept. However, perhaps the most important finding is that technology transfer is a manageable aspect of the program. Signing an MOU does not necessarily result in the dikes breaking and a torrent of technology automatically flowing to the foreign partner. The U.S. has had vast experience in international armament programs and has the ability to effectively protect its valuable technology. The responsibility and determinants of success rest with the United States. This is a two-edged sword. Not only does the U.S. control the release of its own technology, but it also is largely responsible for the pursuit of foreign technology. The U.S. no longer dominates

all aspects of world technology. Increasingly capable countries exist which offer the U.S. the opportunity to become as good a student as it has been a teacher. Such pursuit of foreign technology, though promising, will depend on a shift in the attitude of the U.S. as well as concerted effort to gain the technology.

This idea of technology transfer leads to the final finding of this research--competition. The debates over international programs are increasingly wrapped around the concern over foreign competition. It is easier to debate an issue such as the FSX rather than face the real concern. Fear of competition from increasingly capable foreign competitors, most who are also our allies, is entrenching the United States and likewise affecting the international program arena. Effectively competing with other economic powers is a vastly more complex issue than whether or not to codevelop a fighter with Japan. It involves education, research and development investment, capital investment, and other national issues. Offsets and international programs are too small an element to be a cause of the U.S. competitiveness woes. Technology cannot be effectively hoarded in today's world. Competitors to the U.S. will develop with or without international armament programs. The only effective recourse the United States has in today's economic markets is to become more competitive. Protectionism and entrenchment is not the answer.

Development of superior technology and an increased competitiveness in the world market is the only solution to the advances other countries have achieved. Fortunately, increased competitiveness is largely controlled by the United States' own actions or inactions. Therefore, the United States maintains one clear advantage in the struggle to regain its competitiveness--the future of U.S. trade, technology and prosperity rests in its own hands.

Appendix: Interview List

Mr. Brad Botwin	Director, Strategic Resources Division, Office of Industrial Resources Assessment. Commerce Department, Washington DC.
Capt. Andrew Buttons (USN)	Former Deputy Chief, Weapons Systems Division, Defense Security Assistance Agency, Washington DC.
Mr. Randy Ferryman	Staff, Sen. Alan J. Dixon (IL). Washington DC.
Maj. James L. Hansen (USAF)	Program Manager, Directorate of Multinational Programs, F-16 System Program Office. Wright Patterson AFB OH.
Col. Akihiko Hayashi (Japan)	Air Attache, Embassy of Japan. Washington DC.
Col. Robert C. Johnson (USA)	Industrial and International Programs. Office of the Deputy Under Secretary of Defense (Acquisition). Washington DC.
Mr. Kevin Kearns	Staff, Sen. Jesse Helms (NC). Washington DC.
Mr. Martin Libicki	Industrial College of the Air Force, National Defense University. Washington DC.
Mr. Ed McGaffigan	Staff, Sen. Jeff Bingaman (NM). Washington DC.
LCDR Torkel L. Patterson (USN)	Assistant for Japan, Office of the Assistant Secretary of Defense, International Security Affairs. Washington DC.
Mr. James A. Pierce	Office of Japan Affairs. Department of State. Washington DC.
Mr. Stuart Tomlinson	General Accounting Office. Washington DC.

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The purpose of this study was to develop a framework within which future international armament programs can be evaluated, negotiated, and managed.

International armament programs are gaining importance. Global interdependence, skyrocketing weapons costs, and increasingly capable allies make for a great opportunity to employ international programs. However, a fragile industrial base, global competition, and huge trade deficits also make international programs risky for the United States. Consequently, future international armament programs will demand expert and enlightened management. Those involved must be well-versed in the potential benefits as well as the risks of U.S. participation in international programs.

This research provides a solid foundation for the policy maker or the program manager. A comprehensive approach has been taken with the existing literature on international armament programs.) Out of this review, a developing framework was derived for the evaluation and negotiation of international armament programs. To further develop this framework, a case study of a current international program was conducted. Through analysis of the FSX agreement between the U.S. and Japan, the framework was refined to reflect issues arising out of the current economic, political, and military balances in the world.

The resulting framework provides a tool for those involved in the evaluation, negotiation, and management of future international armament programs. By encompassing the major issues involved in today's international arrangements, the framework can be used not only to educate, but also to guide. Tailored to meet a wide variety of scenarios, the framework can be applied to a future international program as an aid in the evaluation of whether the U.S. should participate in the arrangement. For those agreements the U.S. decides to enter, the framework can be applied to negotiations as a tool to help ensure U.S. interests are protected.

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