

UNCLASSIFIED

AD NUMBER: AD0891385

LIMITATION CHANGES

TO:

Approved for public release; distribution is unlimited.

FROM:

Distribution authorized to U.S. Government agencies only;  
Test and Evaluation; 09 Feb 1972. Other requests for this document must  
be referred to AFIT/SLGR, Wright-Patterson AFB, OH, 45433.

AUTHORITY

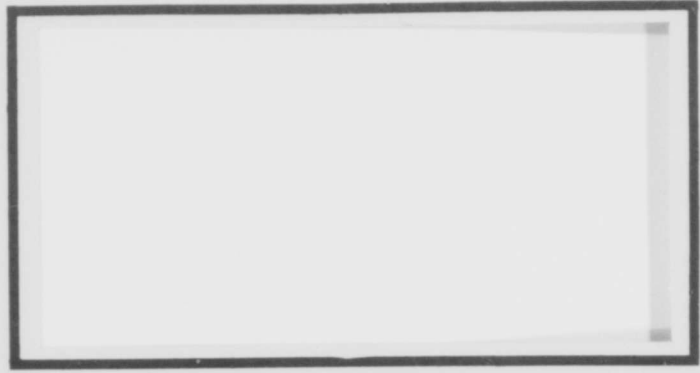
ST-A AFIT LTR, 18 MAR 1974

62

AD 891385



AD No. \_\_\_\_\_  
DDC FILE COPY



UNITED STATES AIR FORCE  
 AIR UNIVERSITY  
 AIR FORCE INSTITUTE OF TECHNOLOGY  
 Wright-Patterson Air Force Base, Ohio

DDC 13  
 RECEIVED  
 FEB 9 1972  
 RECEIVED  
 C

69



ACCESSION for	
CPST	WHITE SECTION <input type="checkbox"/>
OSC	DWF SECTION <input checked="" type="checkbox"/>
UNANNOUNCED	<input type="checkbox"/>
JUSTIFICATION	
BY	
DISTRIBUTION/AVAILABILITY CODES	
NET	AVAIL. OR SPECIAL

B

UNITED STATES INVOLVEMENT IN  
CODEVELOPMENT: AN ANALYSIS OF THE  
US/FRG V/STOL FIGHTER AIRCRAFT PROJECT  
AND NATO SEASPARROW PROJECT

Captain Melvin T. Baas

SLSR-61-71B

Distribution limited to U.S. Gov't. agencies only;  
Test and Evaluation; 9 - FEB 1972 Other requests  
for this document must be referred to

*AFIT/SLGR,  
Wright - Patterson AFB, Ohio 45433*

DDC  
RECEIVED  
FEB 9 1972  
C

SLSR-61-71B

**UNITED STATES INVOLVEMENT IN CODEVELOPMENT:  
AN ANALYSIS OF THE US/FRG V/STOL FIGHTER AIRCRAFT PROJECT  
AND NATO SEASPARROW PROJECT**

**A 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 Logistics Management**

**By**

**Melvin T. Baas, B.S.  
Captain, USAF**

**August 1971**

~~This document is subject to special export controls and each transmission to foreign governments must be made only upon prior approval of the Director, Systems and Logistics, Air Force Institute of Technology, Wright-Patterson AFB, Ohio 45433.~~

This thesis, written by

Captain Melvin T. Baas

Has been approved by the undersigned on behalf of the faculty  
of the School of Systems and Logistics in partial fulfillment  
of the requirements for the degree of

MASTER OF SCIENCE IN LOGISTICS MANAGEMENT

Date: 12 August 1971

*Leslie M. Norton*  
Research Chairman

## ACKNOWLEDGMENTS

I would like to express my appreciation for the substantial assistance received from numerous individuals associated with international logistics within the Department of Defense and the military services, without whose cooperation the research effort would have been significantly more difficult.

I am indebted to Mr. Julius Singer for his cooperation in making available to me the official records of the US/FRG V STOL SPO. Mr. W. Pritchard's responsiveness in furnishing information on the NATO SEASPARROW project is also deserving of special mention.

Special acknowledgment is extended to Doctor Leslie M. Norton, my thesis chairman, for his professional and exacting standards in guiding the efforts of this research study.

TABLE OF CONTENTS

	Page
ACKNOWLEDGMENTS . . . . .	v
LIST OF FIGURES . . . . .	ix
CHAPTER	
I. INTRODUCTION . . . . .	1
Problem	
Problem Statement	
Background	
Scope	
Objectives	
Research Questions	
The Procedure	
Methodology for Data Analysis	
II. ANALYSIS OF US/FRG V/STOL PROJECT. . . . .	14
Project Synopsis	
Statement of Objectives	
Project Accomplishments	
Project Failures	
Summary	
III. ANALYSIS OF SEASPARROW PROJECT . . . . .	36
Project Synopsis	
Statement of Objectives	
Project Evaluation	
Summary	
IV. CONCLUSIONS AND RECOMMENDATIONS. . . . .	47
Conclusions	
Answers to the Research Questions	
Recommendations	
BIBLIOGRAPHY . . . . .	55
BIOGRAPHICAL SKETCH OF THE AUTHOR . . . . .	61

## LIST OF FIGURES

Figure	Page
1. Types of Foreign Aid	4
2. US/FRG V/STOL & US/UK Lift Engine Organizational Structure and Relationship.	19

## CHAPTER I

### INTRODUCTION

#### Problem

Problem Statement. The nations of the Free World can be expected to spend a minimum of \$200 billion in procurement of modern defensive weapons during the 1970-1985 time period.<sup>1</sup> Any duplicative effort in research and development among the free nations would appear to be an unnecessary waste of scarce resources. The United States has been the dominant supplier of weapon systems to the Free World, primarily through its grant aid and military sales program. During the early 1960s our technologically developed Allies insisted upon coproducing many United States developed weapon systems. A trend began to appear in the late 1960s whereby nations of the Free World began codeveloping certain weapon systems. The United States has participated in four major programs and subsequently concluded its participation, prior to the production phase, in

---

<sup>1</sup>James Hessman, "A Booming European Defense Industry Tools Up for the Next Decade," Armed Forces Journal, 107:14, July 25, 1970. (Mr. Hessman, Senior Editor of the Journal, reported that European industrial officials estimate that amount to be spent for military, missiles, and space satellites alone.)

three of these.<sup>1</sup>

The problem is that codevelopment programs, with United States participation, have failed to produce defense weapon systems for the United States and its Allies.

Background. The United States, particularly since WWII, has recognized a need for a strong free-world defense posture. Therefore, the United States has pledged itself to cooperate with its Allies to the greatest degree possible in the development of defense equipment, where such cooperation is in the overall best interest of the United States. (47:1)<sup>2</sup>

Codevelopment (synonymous with cooperative development is defined as, "an international sharing of research and development (R&D) costs." (7:2) Successful codevelopment programs are usually expected to culminate in coproduction programs. Coproduction is defined as, "two or more prime contractors in two or more nations who produce a weapon system for their common defense." (10:5)

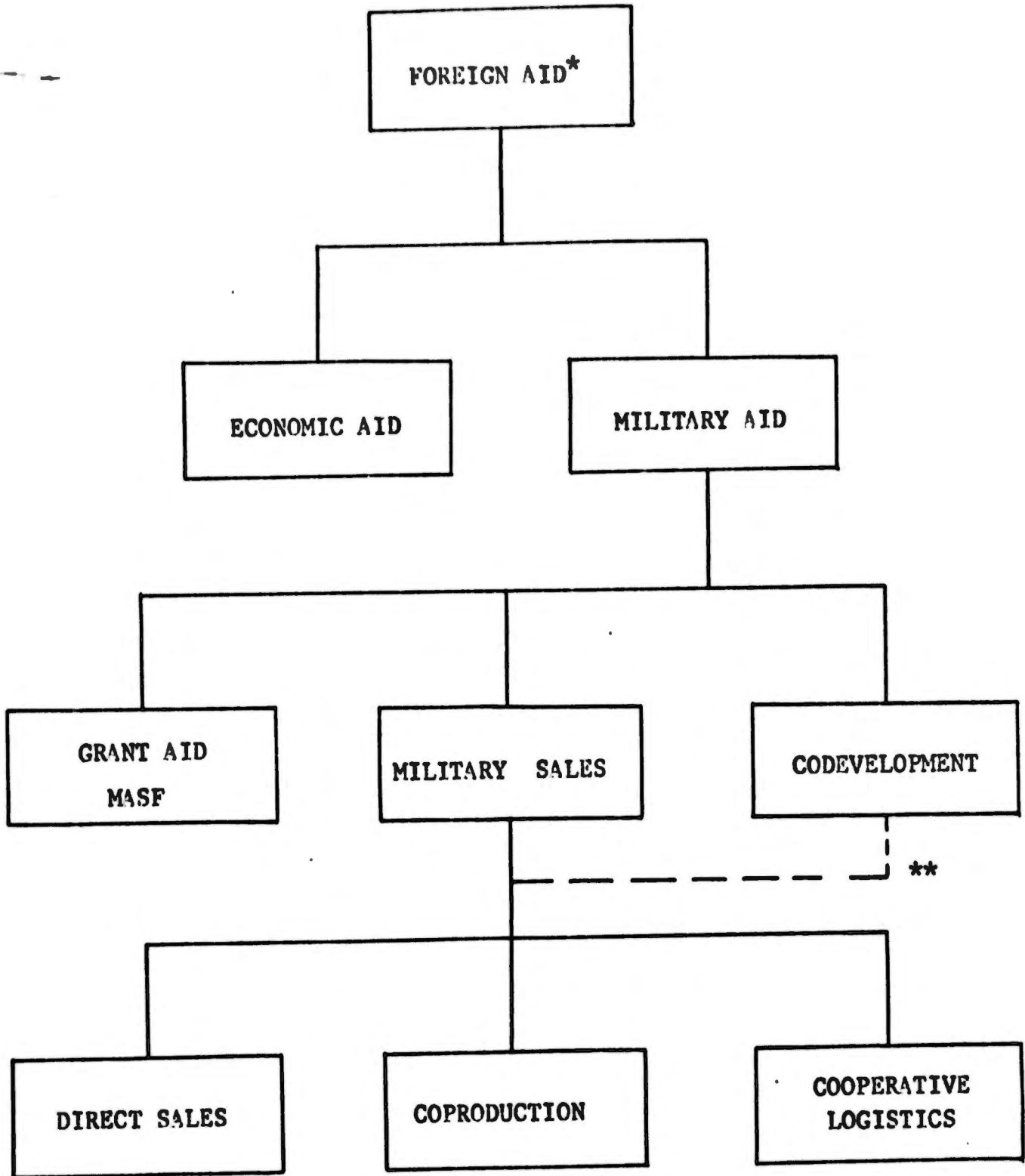
Codevelopment is considered to be one aspect of the United States foreign aid program. (20:4-7) Foreign aid

---

<sup>1</sup>The four programs are: Main Battle Tank (MBT-70), Project Mallard, US/FRG V/STOL Fighter Aircraft, and NATO SEASPARROW. Only the SEASPARROW project is still current, and it is in the Engineering Development phase.

<sup>2</sup>The numbers in parentheses refer to the Bibliography. The first number indicates the source and the second indicates the pages.

consists of both economic aid and military assistance as shown in Figure 1. Military assistance can be accomplished through Grand Aid or Military Assistance Service Funded (MASF), Military Sales, and Codevelopment. Military Sales can take on the form of direct sales to a country, coproduction with a country, and/or cooperative logistic support for a country. Codevelopment may eventually lead to any one of the three forms of Military Sales. Foreign aid has taken on various shapes and forms during the past three decades. Out of necessity it has conformed to the needs of the participants and their environment. Foreign aid, as it is known today, began with the destroyer-base agreement with Great Britain in 1940 and the "Lend-Lease" Bill of 1941. With this agreement the United States received rights to establish bases in British Territories in exchange for 50 destroyers. Under the Truman Doctrine foreign aid was expanded to provide assistance to Greece and Turkey in 1947. In 1948 the Marshall Plan was inaugurated to assist Western Europe in its post-war recovery. The military portion of the foreign aid program received its impetus when the United States ratified the NATO Treaty and enacted the Mutual Defense Assistance Act of 1949. The Mutual Security Acts of 1951 and 1954 further refined the administration of the assistances programs to assure that the proper utilization of military aid was achieved. The Foreign



\*This chart illustrates the various types of Foreign Aid not the organizational structure designate to implement the programs.

\*\*Codevelopment may result in a type of Military Sales.

Figure 1. Types of Foreign Aid

Assistance Act of 1961 reflected the decreasing need for grant aid and the increase in the sale of military weapons. Concurrently, nations of the Free World were desirous of coproducing the less sophisticated weapon systems. Consequently, the United States has to date entered into agreements with foreign nations for over \$3.5 billion in coproduction programs.<sup>1</sup> They include such programs as the F-104G aircraft, M-113 armored personnel carrier, CH53 helicopter, and MK 44 torpedo.

At the same time certain nations were also advocating participation in codevelopment programs. The Federal Republic of Germany (FRG) was quite interested in participating in the development phase of various weapon systems. In 1963 FRG entered into agreement with the United States to develop a Main Battle Tank (MBT-70) for the 1970s. (11:10) After experiencing numerous delays, rapidly rising costs, and a shift in defense priorities, the program was abandoned as a joint venture in 1969. (39:10)

Late in 1964 the U.S. and FRG established a working group to study the feasibility of combining separate Vertical/Short Take-off and Landing (V/STOL) fighter aircraft projects into a codevelopment project. The study group recommended that the program be undertaken jointly and consist of three distinct

---

<sup>1</sup>This information was obtained from DOD personnel.

phases of work, namely, the Conceptual, Prototype Definition, and the Acquisition phase. At the conclusion of each phase a new joint agreement was needed to proceed into the next phase. The program had progressed through the Prototype Definition phase when it was jointly decided to terminate it. (6:12-16)

The United States, Canada, Australia, and Great Britain agreed in 1967 to jointly develop a secure tactical communication system for the 1975-1985 time frame. (13:13-17) This project, called Mallard, completed the Concept Formulation phase by mid 1969 and was expected to complete its Contract Definition phase by mid 1971. This program was cancelled as a joint venture in November 1970. (37:20)

Only the NATO SEASPARROW project with Norway, Denmark, Italy, Netherlands, and the United States as participants, was in being as of July 1971. (32:20) The NATO SEASPARROW project is a multilateral cooperative development program to produce a second-generation point defense anti-air missile weapon system. The Memorandum of Understanding was signed in June 1968 resulting in a six-month Contract Definition phase. This phase was followed by a three-year Engineering Development phase which will produce three test models required to validate the system before it enters the Production phase in 1972. (32:31)

A number of research studies concerning the foreign military sales program have concluded that although coproduction is the market of today, codevelopment programs are the market of the future. A thesis by Captains Catledge and Knudsen addressed the problem that the United States Foreign Military Sales program is inconsistent with the trends toward coproduction and codevelopment. (7:2) They concluded, "...codevelopment, or international collaboration in weapons development, represents the path which the participants in tomorrow's arms market will follow." (7:181) A related study by Colonel R. G. Collins, USAF, concluded that it is probable that the 1970s will see joint aircraft weapons production increase dramatically through consortia efforts solely among the nations of Western Europe. (10:45)

#### Scope

##### Limitations:

1. This thesis considered two codevelopment programs which involved the United States. They were the US/FRG V/STOL Fighter Aircraft project and the NATO SEASPARROW project. Although references to the MBT-70 program and Project Mallard were made throughout the paper, no detailed analyses of these programs were attempted. This paper excluded the Foreign Military Sales and coproduction programs.

2. The codevelopment programs were examined under the policies and objectives in being during the duration of each respective program.

3. A detailed analysis of the political decisions surrounding each codevelopment venture was not included in this study.

#### Assumptions:

1. It was assumed that there were common "evaluation points" in past programs that could be applied to current and future codevelopment programs. "Evaluation points" included balance of payments, interchangeability of equipment, scientific and technological status, and alliance relationships.

2. It was assumed that the V/STOL and SEA-SPARROW projects were representative examples of codevelopment programs.

#### Objectives

The objective of this thesis was to examine a past and a current codevelopment program to determine if codevelopment programs are capable of attaining the goals of the Military Assistance program. A corollary objective was to identify any common underlying problem that the United States must overcome before codevelopment can actually become a viable part of the future Foreign Military Assistance Program.

## Research Questions

The premise was that the United States was not prepared to harmonize its objective with that of other nations on a mutual basis in the area of codevelopment projects prior to their reaching the production phase. The following research questions were used to address the investigation of this premise:

1. Did codevelopment projects increase the scientific and technical resources of the United States and its Allies?
2. Was the maximum practicable degree of interchangeability of defense equipment between the United States and its Allies attained by codevelopment projects?
3. Did codevelopment enhance cooperation in research and development enabling the best equipment to be available to the United States and its Allies?
4. Were closer military ties among the Alliances developed as a result of codevelopment programs?
5. Did codevelopment programs have a positive effect on reducing the United States balance of payments deficit?
6. Did codevelopment projects fail when they did not produce a mutually used defense weapon?

## The Procedure

Nature and Source of Data. Data was collected from both primary and secondary sources. The nature of the primary

data was the original documents that stated the policies and objectives of codevelopment projects at their conception. Additional internal data in the form of periodic summaries and final reports were gathered. Secondary data were gathered to supplement the data gleaned from official files or records. The secondary data was accumulated mainly from sources external to the project office and obtained through library investigation of codevelopment. An enumeration of the main sources of data follows.

Authority for conducting cooperative development is contained in the Foreign Assistance Act of 1961, as amended each year (Public Law 90-137). (43:2958) Within the framework of this public law the Department of Defense (DOD) has issued directives stating DOD's purpose as regards codevelopment of defense equipment. These directives also specify the policy of DOD along with the overall objectives of codevelopment. DOD Directive 3100.3 pertains to "Cooperation with Allies in Research and Development of Defense Equipment." (47) The DOD policy as stated in this directive was formulated into question format and used as my research questions. Closely associated with this directive is DOD Directive 3100.4, entitled, "Harmonization of Qualitative Requirements of Defense Equipment of U.S. and Allies." (48) The policy pertaining to the exchange of weapon development data is stated in DOD Instruction

2015.4 entitled, "Mutual Weapons Development Data Exchange Program (MWDDEP) and Defense Development Exchange Program (DDEP)." (46)

Prior to the start of an international development program, the countries involved signed a Memorandum of Understanding. This document expresses, in broad terms, the mutual intentions of the participating countries. Subsequent to this agreement additional Memorandums of Understanding or International Agreements are signed in which the specific objectives, scope, and responsibilities of the participating countries are stated.

The US/FRG V/STOL project was governed by two Memorandums of Understanding, dated August 1, 1963 and February 5, 1965. (49:13.2-4) Additionally, an International Agreement on Cooperative Research and Development for V/STOL aircraft was signed by the United States and Federal Republic of Germany on November 14, 1964. (49:13.2-4) When the V/STOL project terminated in early 1968 all the records of the project were categorized and filed in the Records Staging branch of the Aeronautical System Division (ASD), Wright-Patterson AFB. The custodian of these records, Mr. Julius Singer, made these files available to me. Mr. Singer was the Assistant Director of the US/FRG V/STOL project.

The NATO SEASPARROW project is managed under the guidance specified by the Memorandum of Understanding signed by the

participating countries in June 1968. (32:32) An unpublished report entitled, "Genesis of a Cooperative Development Program - The Founding of NATO SEASPARROW," provided a historical summary of the project from its beginning. (17) An article written by the first Project Manager of SEASPARROW, Capt. Charles D. Allen, Jr., provided additional insight into the goals of the project. (3:144-147) Much of the secondary data on codevelopment was collected from research reports by the Industrial College of the Armed Forces (28) and Rand Corporation. (19)

Data Collection Techniques. The principle method of collecting data was through an extensive examination of the written records of the V/STOL and SEASPARROW projects. A library search produced additional data and information which were written by knowledgeable individuals in the fields of codevelopment projects, international economics and defense technology. A synthesis of various aspects of codevelopment projects was obtained from structured and unstructured interviews with DOD personnel. The interviews included individuals who managed the projects (54) (57) as well as the codevelopment monitors in OASD(I&L). (55) (56)

#### Methodology for Data Analysis

Chapter II was an analysis of the US/FRG V/STOL fighter aircraft project. A synopsis of the project preceded an

enumeration of the objectives of this codevelopment project. These objectives, examined phase by phase, were then used as a guide to evaluating the project's accomplishments and failures. The general analysis which followed was structured to facilitate answering the six research questions. In analyzing the data an attempt was made to measure the degree to which the data answered each specific question. Since much of the data was qualitative in nature, the weight applied to it was a value judgement of the author.

Chapter III was an analysis of the NATO SEASPARROW project. The data was classified in a manner similar to the data on the V/STOL project. An exception was necessary when evaluating the accomplishments of the project, since the project is still current. The author attempted to evaluate the project based on its actual record to date. Using its past record as a guide, the future accomplishments of the program were projected.

Chapter IV contained a conclusion and my recommendations. The conclusion addressed the original premise and answered the six research questions. The paper was concluded with some specific and general recommendations for future attempts at codevelopment.

## CHAPTER II

### ANALYSIS OF US/FRG V/STOL PROJECT

#### Project Synopsis

On August 1, 1963 the United States' Secretary of Defense and the Federal Republic of Germany's Minister of Defense signed an agreement entitled "Memorandum of Understanding Applicable to the United States-Federal Republic of Germany Cooperative Research and Development." (49:1-2) This agreement established the basis upon which the two countries could later enter into codevelopment ventures. It stated that the principle objective for the US/FRG cooperative research and development program was:

To best utilize the scientific and technical resources of the two countries in meeting common defense interests ....To standardize, as much as possible, or make interchangeable the systems and equipment used for the defense of the two countries. (49:13-15)

The memorandum established a standing organizational structure for the planning and coordinating of all cooperative efforts. A steering committee was charged with the responsibility of establishing broad policy and procedural guidance, to include provisions for long range planning. This committee was composed of three officials from each country. Representing the United States were the Deputy Director, Defense

Research and Engineering; the Assistant Director, International Programs; and a Military Officer. FRG's three members were the Ministerial Director of the Federal Military Directorate (Division T) and two additional FRG representatives from that division. It was agreed that the Steering Committee would delegate responsibility for conducting technical negotiations to their respective research and development groups. These groups would be headed by a Senior National Representative.

The Secretary of Defense and Minister of Defense further agreed on November 14, 1964 to a US/FRG Cooperative Research and Development Program for a V/STOL aircraft. (49:1-2) This agreement established a joint US/FRG V/STOL working group to study the feasibility of combining separate V/STOL development projects into a codevelopment project. This working group recommended that the USAF Advance Development Objective (ADO-12) program, a V/STOL aircraft design study, and the Heavy/STOL Fighter program of Germany could be combined into a codevelopment program to be undertaken by the two countries. They also recommended that the program consist of three distinct phases of work requiring joint government approval of each successive phase. The three phases were the Conceptual Phase, Prototype Definition Phase, and the Acquisition Phase.

Another Memorandum of Understanding was signed on February 5, 1965 which authorized each country to issue

Requests for Proposals (RFP) for the design study (Conceptual Phase). In addition, it established a Joint Study Management Group made up of defense officials from both countries. Identical Statements of Work were submitted to two German and eighteen US aircraft manufacturers by the study group. Separate source selection procedures were conducted by each government. On October 1, 1965 contracts were issued to four US contractors and two German contractors for a six month design study competition. The contract for this study was funded separately by each country but jointly managed by the Joint Study Management Group to ensure commonality of objectives and results. Independent source selection activities in the United States and Federal Republic of Germany culminated in the selection on November 30, 1966 of Republic Aviation Division of Fairchild-Hiller Corporation and Entwicklungsring Sued Gmbh (EWR) as sole contractors for the Prototype Definition and Acquisition Phase.

The Joint Study Management Group made specific recommendations to the US/FRG System Program Office (SPO) located in the United States. The US would provide the director and the division chiefs, while FRG would fill the assistant positions. Second, the contractors would form one corporate entity to better facilitate program management and responsibility. Third, the program would be equally funded by each government.

Fourth, the committee established that English would be the official language for the program and the US system of weights and measurements would be used. (49:1-2, 3)

On April 12, 1967 the German Study Group and the US project personnel were combined into a single group known as the US/FRG V/STOL Tactical Fighter SPO. Also in April 1967, EWR and Fairchild-Hiller formed a legal entity known as the EWR Fairchild International (EFJ) with headquarters in Germany. The ultimate weapon system was to be a V/STOL tactical fighter aircraft with the following capabilities:

(1) All-weather, low-level, high-speed penetration, for delivery of either nuclear or non-nuclear ordnance.

(2) Air to ground strikes in support of ground combat operations.

(3) All-weather, low-level, high-speed penetration reconnaissance and/or strike reconnaissance.

(4) Air-to-air combat of a self-defensive nature. (49:1-4)

The engines for the fighter aircraft were not included in the US/FRG V/STOL project, but were to be provided under separate contracts. The United States and the United Kingdom had signed a Memorandum of Understanding on October 20, 1965, for the development of a direct lift engine for V/STOL aircraft. The United States had contracted with the Allison Division of General Motors while the United Kingdom contracted with Rolls

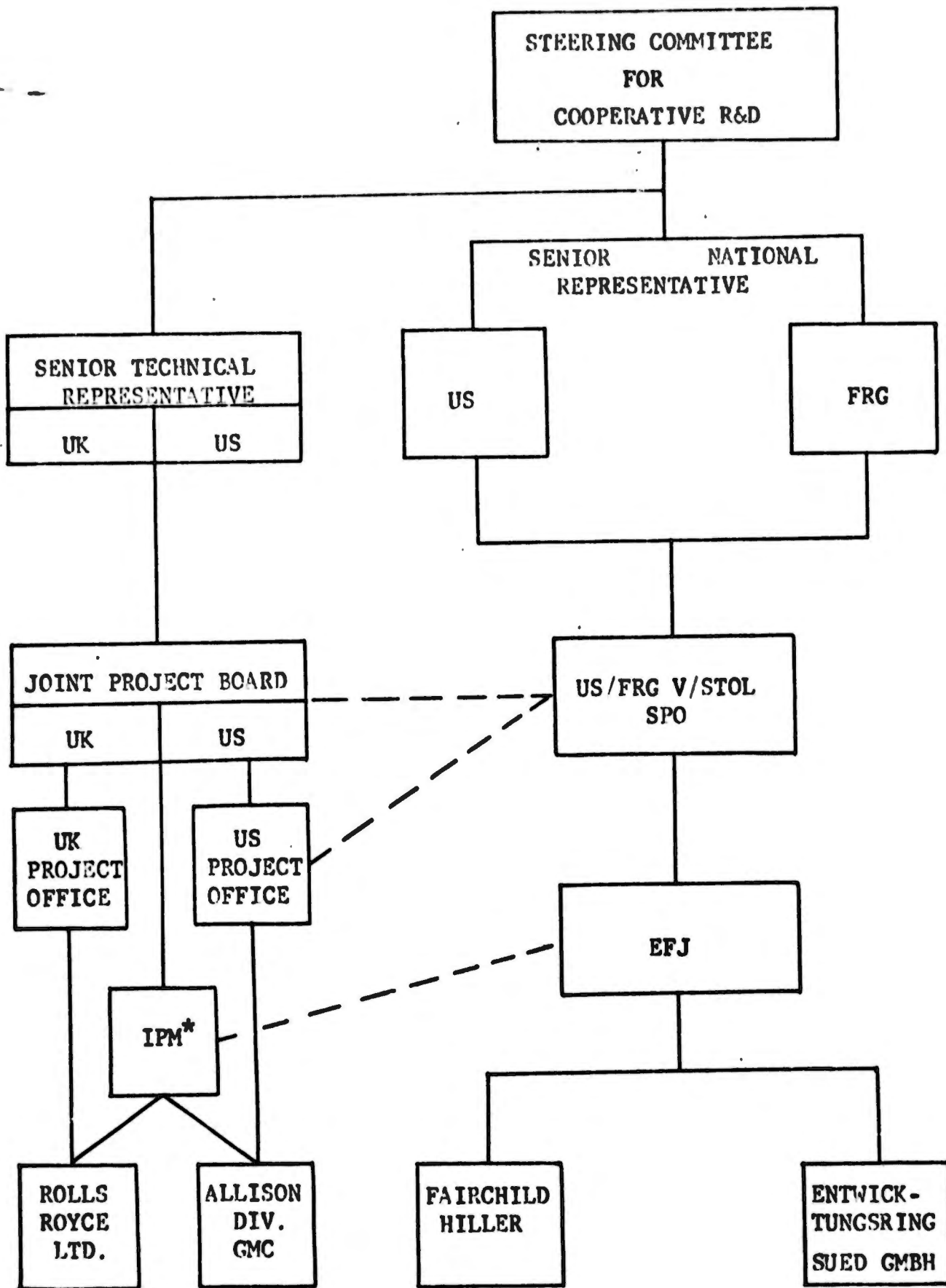
Royce Limited. Through a joint Project Board and an Industrial Program Manager (Figure 2), the lift engine project provided support to the US/FRG V/STOL project. EFJ was working with two additional US contractors that were competing for the right to build the cruise engine. Pratt-Whitney and General Electric were the two US companies in competition to develop the vector-thrust cruise engine for the US/FRG V/STOL project. (12:25)

The contractor, EFJ, had submitted the final reports of the Prototype Definition phase by December 1967. The SPO was in the process of validating the effort when the decision was made by the US/FRG Steering Committee not to enter the Prototype Acquisition phase. The reasons given for terminating the project were that the U.S. Air Force had not established an operational requirement for the aircraft and also increasing monetary constraints were limiting Research and Development projects. (6:12) This decision was made on January 29, 1969 and resulted in the disbanding of the SPO and program by June 1968. (24:1)

#### Statement of Objectives

The ultimate goal of the joint US/FRG V/STOL project was to conduct a realistic operational evaluation of the potential application of a V/STOL tactical fighter aircraft. (49:1-3)

Both countries realized that operating tactics, support systems,



\* Industrial Program Manager

Figure 2. US/FRG V-STOL & US/UK Lift Engine Organizational Structure and Relationship

and the performance envelope of V/STOL aircraft are quite different from those of conventional aircraft. Robin Ransome, a flight test representative on the DOD team which evaluated the FRG/V/STOL aircraft in 1964, wrote in Armed Forces Management that:

...insufficient flying hours have been accomplished on second generation aircraft to support an adequate definition of mission requirements and necessary aircraft characteristics needed to satisfy those requirements. ...there is little data on long-term system characteristics and reliability. (38:89)

Such concepts as the extent of field maintenance, supply, and command and control must be analyzed in depth before the precise military worth of a V/STOL fighter aircraft could be fully determined. The United States and the Federal Republic of Germany felt that to obtain valid data, it was necessary to actually evaluate a prototype aircraft with operational capabilities under simulated combat conditions. Therefore, the stated objectives of the program were:

(1) To develop a sound basis for future decisions regarding the acquisition of an operational V/STOL tactical fighter weapon system.

(2) To advance the technology and promote the exchange of technical and tactical information between the United States and the Federal Republic of Germany. (49:1-3, 4)

These objectives were of necessity quite broad and general in nature. To provide more definitive guidance to the management

team and the contractors these objectives were more specifically stated as they applied to each phase. The objectives directing the Design Study phase were:

(1) Determine if a single configuration of a V/STOL tactical fighter aircraft can satisfy the objectives of the United States and Federal Republic of Germany concerning future V/STOL developments.

(2) Obtain additional information on the operational, supportability, cost effectiveness, etc., aspects of V/STOL fighter aircraft.

(3) Select a U.S. and a FRG contractor to participate as members of a single industrial team to conduct the contractor definition effort and the development, production and test of the prototype aircraft. (36:13)

The specific objectives of the Prototype Definition Phase were to:

(1) Fully define the jointly approved V/STOL fighter prototype design in terms of general system and performance specifications and inter-system/intra-system interfaces.

(2) Develop a detailed plan for contractor distribution of work and responsibility in development of the prototype system; which involves taking best advantage of each country's industrial capacity, but at the same time satisfies the individual secondary objectives of each country such as economic, technology advancement, data exchange, etc.

(3) Further refine cost and schedule estimates for production engineering, facilities, support, data, hardware and test, both flight and component.

(4) Identify risk areas, personnel and training requirements, and evaluate further trade-offs. (36:14)

The objectives of the Acquisition phase which included the building and testing of twelve prototype aircraft were to:

(1) Implement and further define the design requirements and plans for development of the prototype system.

(2) Further identify in detail the logistic, personnel, and training requirements appropriate to the peculiarities of this program.

(3) Verify the specifications and requirements through preliminary and detail design reviews and categorical testing.

(4) Produce and test the twelve prototype V/STOL fighter aircraft to satisfy the program objectives.

(5) Evaluate and/or resolve existing V/STOL technical characteristic uncertainties such as "suck-down" effect and temperature and acoustic environment problems.

(6) Provide a basis for a decision to procure a V/STOL tactical fighter weapon system for the operational inventory.  
(36:15)

### Project Accomplishments

Since the project was planned in three distinct phases, it is appropriate to evaluate its accomplishments from this perspective.

Design Study Phase. Upon completion of the Design Study phase the joint US/FRG evaluation group endorsed a single configuration of V/STOL fighter aircraft on which each country was willing to continue development. This willingness was evidenced by the signing of the US/FRG Project Agreement for the Definition phase. (23:1) Determination of a single configuration was not an easy task. There were four U.S. contractors as well as two German contractors who had submitted proposals during the Design Study phase. The evaluation group was tasked to take the best design characteristics from any or all the proposals submitted and form the single configuration that they felt was needed. (57) Once this configuration was decided upon, the joint evaluation group had to determine which contractor was best able to build the aircraft to that configuration. Both countries held their own separate source selection proceedings with the understanding that their selectee must be able to work with any one of the contractors from the other country. The selection of Entwicklungsring Sued Gmbh and Fairchild-Hiller to form the industrial team was an accomplishment of this design phase.

The Joint Evaluation Group also addressed the subject of supportability of a V/STOL fighter. Their findings were summarized by the commander of Aeronautical Systems Division (AFSC), Major General Terhune, in an interview for Data magazine. He stated:

...in our US/FRG advanced V/STOL fighter design study substantial investigation of these factors (supportability) was made against several potential operational concepts. We believe these logistic and maintenance problems can be satisfactorily resolved with relatively minor adjustment to current procedures coupled with design features in the aircraft that gave it greater self-sufficiency than many of our current aircraft. (26:31)

It is apparent that the study group investigated the cost-effectiveness aspects of V/STOL. In the same article General Terhune commented that, "unit costs as well as the operating cost, of V/STOL aircraft will be higher." The justification he gave for the higher costs was that, "they are more than balanced, however, by the speed of response inherent in an aircraft not dependent upon a fixed landing site." (26:42) The author was unable to determine if a quantitative cost analysis was accomplished to substantiate this justification. Nevertheless, the objective of obtaining information on these concepts was at least partially met.

Another accomplishment of this phase was the agreement between the representative of each country to have unlimited rights to all data generated and submitted to the Joint Study

Group as a result of the design study contracts. (36:30)

This was one of the primary objectives underlying the desirability of international codevelopment.

Prototype Definition Phase. The evaluation report of the definition phase by the SPO indicated that the contractor satisfactorily accomplished the objective of defining general system design and performance specifications. (50:I-5) This objective should be considered only partially satisfied because as the report stated, "the contractor's Definition Phase final report revealed some omissions and treatments in less depth than was expected." (50:I-12) A more thorough discussion of this subject will be left to the section covering project failures.

EWR/Fairchild International had developed a detailed and acceptable plan for contractor production of the prototype aircraft. The plan called for the assembly of seven (7) aircraft in the U.S. and five (5) in Germany. (50:I-10) This type of split is not unreasonable in the light of the fact that one of the main reasons the Federal Republic of Germany desired a codevelopment program was to take advantage of our expertise in production and assembly of aircraft. This arrangement was designed to satisfy the objective of "taking advantage of each country's industrial capacity." Although there was an uneven split in the aircraft assembling, the plan

still called for a 50/50 split of funds from each country. FRG would be compensated by receiving a larger share of work in another portion of the Acquisition phase.

The cancellation of the program before the beginning of the Acquisition phase left its objective of producing and testing prototype V/STOL fighter aircraft unattainable. Instead of having the Acquisition phase provide a decision basis for future production of an operational V/STOL, the Definition phase accomplished this objective by not being able to justify its existence to the Steering Committee.

#### General Project Accomplishments

Technology Advance. One objective that was stated as a program objective but not explicitly stated in one of the phases was the goal of advancing the technology of both countries. Some aviation analysts have contended that the entire program was a probing by each country into the technological resources of each other. The editors of Flight International magazine stated that, "it has been widely felt--and often said-- that AVS (US/FRG V/STOL) was really nothing more than a technical exercise, albeit one from which the two main countries (and a number of others, including Britain) stood to gain a lot of valuable expertise." (27:262) The article also advances the idea the United States obtained a significant amount of theoretical knowledge particularly in the area of

mixed lift and cruise powerplants. They point out that, "the technological gem of the aircraft, however, was to be the system of swing-out lift engines." (27:263)

Exchange of V/STOL Data. Another accomplishment of the program was its promotion of the exchange of V/STOL technical data between the United States and the Federal Republic of Germany. When the program terminated both countries agreed to a semi-annual conference where researchers from AFSC's V/STOL Technology Branch would exchange data with their contemporaries in the German Air Force. (9)

Complemented Engine Research. Lt. Colonel Hite, writing in the Air University Review notes that the British had made a breakthrough in turbojet engine design with their vector thrust Pegasus. (25:91) This Pegasus engine had its beginning in 1957 when the U.S., through its Mutual Weapons Development Program, assisted Britain's Siddeley Corporation with funds for its development. (42:1936) An unofficial estimate by the editors of American Aviation magazine put the U.S. contribution, through 1964, at \$26 million or 56 percent of the total development cost. (52:32) It appears to this author that the United States, desiring to keep their engine research progressing, also needed a potential airframe to use it in. The V/STOL aircraft program provided the United States with a potential application for its engine research and, therefore, a justification

for its continual existence.

Weapon System Management. The United States government and its aviation industry had developed sophisticated management and production practices that have been proven in past weapon systems acquisition processes. The German participants were introduced to the U.S.'s advanced management concepts, our broad production base, and our knowledge in systems development.

### Project Failures

Since the program failed to produce a V/STOL fighter aircraft, it is readily obvious that this objective was not met. It is also important to review the program by each phase and pinpoint specific deficiencies leading to that failure.

Design Study Phase. Contributing in part to the aforementioned failure was an apparent lack of defining an operational role for the V/STOL fighter aircraft early in the project. General Terhune alluded to the idea that the study had investigated several potential operational concepts. (26:31) Yet DOD or Air Force officials did not define a specific operational role which required a V/STOL fighter.

Prototype Definition Phase. It should be noted that the SPO's evaluation was based on the contractors initial proposal. Many deficiencies of the proposal would have been resolved through negotiations between the SPO and the contractor to

insure the necessary quality needed by the Acquisition Phase contract. (50:I-4) Nevertheless, these problems were known as well by the decision-makers on the US/FRG Steering Committee and, therefore, could have influenced their decision on continuation of the program.

Engineering Design. Within the engineering and technical sphere two areas, reliability and maintainability, required additional analysis. The SPO felt that the reliability specifications in such tasks as subcontractor requirements and subsystem prediction were not clearly defined and related to total program objectives. (50:II-6) As to maintainability, the SPO felt that the required procedure for transforming system maintainability requirements into subsystem design requirements was not followed. The position the evaluation report held was that there would have to be considerable re-orientation of the plan early in the Acquisition phase to be responsive to the requirements of reliability and maintainability. (50:II-7) Maintainability and reliability are two very important factors for this type of airplane. Its modus operandi is that it would operate from dispersed and unprepared sites requiring a high degree of self-sufficiency. This self-sufficiency would be lost if maintainability and reliability were not capable of reducing the need for extensive ground-based logistic support.

Cost Estimating. The definition phase incurred difficulties in an attempt to further refine cost estimates for the follow-on Acquisition phase. The contractor appeared unwilling to propose any type of contract which resulted in his sharing the cost risk. (50:I-11) He proposed a cost-plus-incentive-fee (CPIF) and fixed price incentive (FPI) with successive targets. In both cases renegotiation of target cost would occur after most of the cost had incurred, thereby making it a low risk contract. The SPO was of the opinion that the contractor's cost proposal of \$448.8 million was underestimated by \$60.3 million. (50:I-12) The evaluation team indicated the two influential factors in the contractor's cost estimate was the use of F-104G historical data as a baseline and an inappropriate learning curve. The F-104G aircraft was basically a production-line aircraft built by a European Consortium under U.S. licenses. The V/STOL program required extensive R&D and, therefore, introduced more unknowns. An 85 percent learning curve was used by the contractors while the SPO felt that a 93 percent learning curve was more realistic for a complex weapon system. (50:I-13)

#### General Problems

Interchangeable Equipment. One of the intents of the program was to increase the amount of interchangeable defense equipment available to the two countries. It is rather

obvious that we were unable to standardize a V/STOL fighter aircraft. Further investigation into evaluation reports and historical summaries of the program failed to reveal any "spin-off" items that were standardized between the countries.<sup>1</sup> The reason for the lack of interchangeable equipment is that the project did not advance beyond the paper studies phase.

Balance of Payments. A requirement of all codevelopment programs is that consideration be given to its effect upon our international balance of payments. (47:3) The author was unable to trace what percent of the approximate \$6 million that went into the project was spent in the United States and how much was spent in the Federal Republic of Germany. The international industrial organization that was established, with offices in Germany, was actually a legal entity used to manage and process the individual work of both countries. The biggest share of the design study and research was conducted within the companies' home offices, rather than at the international office. The most noticeable effect the program would have on our balance of payments would be during the Acquisition phase or in subsequent production contracts resulting from the program. Pentagon officials envisioned a

---

<sup>1</sup>A "spin-off" item being any unanticipated product derived from a research or development effort.

potential of \$16 billion of sales resulting from a successful project. (29:32) As to the Acquisition phase, all indications were that the U.S. would receive between 50 percent and 60 percent of the work. This reasoning is logical when viewed in relation to the political climate at the time. The U.S. was insisting on Germany offsetting the cost of having U.S. troops in Germany with purchase agreements from the U.S.

(18:18) Although the program had a potential for reducing the balance of payments its actual effect can only be considered negligible.

"Not Invented Here" Syndrome. A contributing factor to the demise of the US/FRG V/STOL fighter aircraft is what is now referred to as the "not invented here" syndrome. (22:22) The European aerospace industry was voicing this opinion in 1966 when this project was in the formulation stage. Admitting that they couldn't compete with U.S. industry in production capability, the European industries actively sought out those special fields wherein the U.S. had expressed little interest. This accounts for the large amount of development work the Europeans had accomplished in vertical take-off and landing aircraft in the previous years. (53:47) European manufacturers were expressing dismay with the U.S. for not taking advantage of this know-how through purchases or license agreements but rather learning what Europe had already learned. (53:47)

This "not invented here" attitude has changed considerably recently. In the FY1971 budget DOD had requested \$96 million for 18 Harrier V/STOL fighter aircraft to be built by McDonnell-Douglas under license from Great Britain's Hawker-Siddeley Aviation Company. (35:16) Congress approved the request for 18 aircraft but insisted that they be built entirely in England for \$64 million. (35:16)

Financial Difficulties. During this same time DOD was incurring rising costs in connection with the war in S.E. Asia. This was forcing DOD to curtail the high risk research projects. FRG was experiencing acute financial problems itself which were compounded by a mild recession. (18:18) Their Federal Defense ministry's budget was feeling this strain and forcing them to restrict their research expense in favor of paying operating expenses and buying U.S. military equipment.

Lack of an Operational Mission. Throughout both the Design phase and Prototype Definition phase there was evidence that the Air Force had not defined an operational mission for the V/STOL fighter aircraft. (15:25) This lack of definition contributed to the complexity of the aircraft which the industrial-government team was attempting to design. The engineers had to design an aircraft that might possibly be used in interdiction, close air support, and reconnaissance roles. The concept of dispersal with minimal support increased

the need for a complex aircraft. This complexity in turn decreased the reliability and maintainability which increase the quantity required or else increase the necessary logistic support. These alternatives were both expensive and defeating to the original concept of concealment and mobility.

### Summary

The program cannot be considered a total failure because of its inability to obtain a V/STOL fighter aircraft for either government. Part of its objective was to advance technology and promote the exchange of data. The U.S. advanced its technology through scientific investigation of V/STOL concepts as applied to fighter aircraft while Germany received valuable knowledge in jet engine technology. The exchange of V/STOL data was promoted through the arrangement of semi-annual conferences between the two countries. The Federal Republic of Germany obtained valuable insight into the systems approach for development of complex weapon systems.

The difficulties of the program can be classified as financial and technical. The cost of the proposed program was highly uncertain with the industry and SPO differing as to the amount. The U.S.'s defense budget was being stretched in order to support the war in S.E. Asia. This caused our R&D efforts to be curtailed. FRG was also forced to reduce R&D funds so as to assist in paying for U.S. troops stationed

in her country. The project was not helping to reduce our balance of payments deficit, therefore, it was highly vulnerable to cancellation.

The technical difficulties stem from the USAF inability to define an operational mission for a V/STOL fighter aircraft. The anticipated problems in reliability and maintainability were a result of the complexity of the aircrafts design. The strong feeling within the U.S. and particularly the Defense Department towards procuring only weapon systems designed in the U.S., contributed to the cancellation of the codevelopment project.

## CHAPTER III

### ANALYSIS OF NATO SEASPARROW PROJECT

#### Project Synopsis

The NATO SEASPARROW project is a codevelopment program designed to produce a second-generation point defense anti-air missile weapon system. The SEASPARROW will serve as a surface ship self-defense missile weapon system for the Navies of Denmark, Italy, Netherlands, Norway, and United States.

NATO had experienced considerable difficulty in establishing cooperative development programs within the NATO organization. In 1966, the Conference of National Armament Directors modified the procedures so that the only prerequisite for cooperative projects was that there be a mutual agreement between the participating countries as to the management, cost-sharing, and end-products of the program. (17) During the same year the United States proposed the cooperative development of a surface ship self-defense missile weapon system built around the SPARROW air-to-air missile. Seven countries expressed an interest with Italy, France, Norway, along with the U.S. having representation on a planning group under the auspices of NATO's Naval Armaments Group. Federal Republic of Germany, Denmark, and the Netherlands participated as observers only.

At the first meeting of the planning group, held in February 1967, a preliminary agreement was reached on the system configuration, a cost sharing formula and a management approach. By April of 1967 the United States, Italy, and Norway indicated that they were ready to make national commitments to participate in the program. Three countries, FRG, Netherlands, and France had decided to drop out, while Denmark remained on as an observer. The countries also agreed that the Raytheon Corporation of the U.S., would be the most suitable prime weapon system contractor.

At the third meeting of the Planning Group, in September 1967, the Raytheon Corporation introduced their tentative cost estimates for the project. This estimate permitted the countries to more realistically plan their SEASPARROW force structure. In addition a draft of the program management plan and the Memorandum of Understanding was submitted for review. The fourth and final meeting of the Planning Group was in Brussels during January 1968. This meeting concluded with complete agreement on virtually all facets of the program and the recommendation that it proceed into funded development as soon as two or more nations signed the Memorandum of Understanding.

The memorandum was finally signed by the U.S. on June 7, 1968, followed by Norway, Denmark, and Italy all within a

month's time. During this month the NATO SEASPARROW project office was activated in Washington, D.C. This approval by the participating countries permitted the Contract Definition phase contract with Raytheon to be signed on June 25, 1968. (17:6)

The Contract Definition phase was a six-month detailed study conducted by Raytheon. It permitted them to refine the specifications of the missile system, which was a necessary step before submitting a responsive proposal for engineering development. After a thorough review of the proposal by the participating countries, Raytheon was awarded a \$23 million contract in September 1969 for a three-year Engineering Development program. The first two years of this phase would be devoted to producing three test models and their necessary support equipment. (41:16) The third year would be devoted to various testing programs and the resulting engineering changes.

The Engineering Development phase has progressed so well that factory testing of the missile system began in July 1971. (54) This testing will continue till July 1972 when one of the models will be fitted into a test ship and subjected to extensive sea tests to determine if it meets all performance requirements. (3:145) The initial production phase is scheduled to begin in November 1972 and last for two years.

Plans call for a complete production data package to be made available to the participating countries at that time. This will allow them to contract for follow-on production in their own country. At present the project office is working on plans to maintain a central management organization to assist in configuration control during follow-on production. (54)

The Netherlands became the fifth country to join the NATO SEASPARROW project when the other countries unanimously agreed to her joining. (41:16) Since the Netherlands entered the program after Engineering Development began she is unable to do development work in her country because of the lead time required for letting contracts. Nevertheless, she will still share in the development costs.

Program Management. Early in the planning stage the countries agreed that overall control of the program would be vested in a NATO SEASPARROW Steering Committee. Each participating country had one member on the board of directors. Decisions would be by majority vote, except for those decisions which cause major changes in the system design, schedule or cost. In those cases a unanimous vote would be required. A single line of authority exists from the Steering Committee through the project manager to the prime contractor. The prime contractor is in turn responsible for the subcontractors being located within the various participating countries. The

research and development. The third objective was to achieve financial gain through pooled efforts for the four<sup>1</sup> nations-- Denmark, Italy, Norway, and the United States. (3:144-145)

### Project Evaluation

Although the program is still in the Engineering Development phase it has already made significant contribution to the desirability of international codevelopment.

Codevelopment Under NATO. The NATO SEASPARROW is the first cooperative development program under the present NATO rules to actually reach the point of spending funds through a common organization. (3:144) Prior to 1966 a codevelopment attempt under NATO had to proceed through a maze of NATO committees before it could begin. (51:v) This allowed all NATO countries, whether or not they were financially participating in the program, to have a voice in how the weapon system should be developed. Consequently, the time involved in making decisions on a program made the method prohibitive. In addition, countries who didn't intend to purchase the end product had an undue amount of influence in development of the weapon system. This had forced codevelopment programs to be scraped in favor of coproduction programs. Under coproduction

---

<sup>1</sup>The Netherlands became the fifth member but she did not join until the spring of 1970.

the countries sought NATO auspices for their programs only after they make the arrangement to coproduce a weapon system which one of the countries had previously developed. The SEASPARROW project was in effect then, a test case for the validity of the revised procedures within NATO's Conference of National Armament Directors. The fact that a SEASPARROW missile has been built and is presently undergoing testing, is visible proof that this method of codevelopment works.

System Configuration. Significant factors in the success the program has enjoyed to date is the early identification of the system configuration, procedures for cost sharing, and its method of managing the program. The use of the United States Sparrow III air-to-air missile as a starting point for development provided the necessary impetus, early in the program, for concentration on a specific configuration. The selection of Raytheon early in the program to be prime contractor aided the configuration selection process. Raytheon was selected since the Sparrow III was their original design and also because of their past experience in coproduction of the NATO Hawk missile. (17:8)

Cost Sharing. The early agreement as to cost sharing and allocation of work among the countries encouraged them to proceed with detailed planning and early commitments to the program. When a country was unable to make a commitment

it participated as an observer and only those with financial interest make decisions. It also discouraged countries from delaying their procurements to avoid paying their share of the development cost. (3:146)

Project Management. The method of managing the program corrected many of the problem areas evident in past attempts at codevelopment. The only committee responsible for decision making would be the NATO SEASPARROW Standing Committee. The vote of each country represented on the committee was in proportion to the financial share provided by that country to the cooperative project. (30) This eliminated a past problem of undue influence of project decisions by countries not intending to share the cost or use the weapon system. The selection of a single project manager and single prime contractor simplified the usually complex task of coordination of work between the participants.

Contractor Participation. In selection of subcontractors within the participating countries, the program drew upon the particular expertise of each country. Norway, having developed a computer-operated fire control system for another weapon system, is developing the radar pedestals and fire control digital computers. Denmark is developing and building the radar microwave receiver, while Italy is modifying previously developed monitoring system for use as the firing officer's

display equipment. (54) Use of the particular scientific resources of each country assists in minimizing the R&D costs to each country.

Interchangeable Equipment. Another accomplishment of the project is an increase in interchangeable equipment between weapon systems and among our Allies. In particular, the SEASPARROW missile launchers are now planned for use in other missile systems. (54) A difficulty in past codevelopment programs has been the mutual acceptance of common tolerance standards for the measurement of equipment. The United States has used what engineers refer to as a "wide tolerance" while the European countries normally work with a "close tolerance" concept. This difference has hindered the interchangeability of equipment between the United States and its Allies. Mr. H. Pritchard, the Engineering Manager within the project office, stated that the participating countries have all accepted the use of the wide tolerance in this project. (54) This indicates a positive step in the direction of producing more standardized equipment between the United States and its Allies.

Military Alliance. An objective of all international codevelopment programs is to increase, or at least maintain, the strength of our military ties with our Allies. Attesting to this increased relationship is the addition of the

Netherlands to the project in the spring of 1970. Further, other countries have expressed a desire to join the program but the details concerning their inclusion have not been finalized. This willingness on the part of our Allies to join an in-being codevelopment project indicates a desire on their part to strengthen their military ties with the United States through standardization of defense equipment.

Financial Arrangements. When the Engineering Development phase began, Raytheon had subcontracted work in each participating country in proportion to their financial support of the program. The only change in that proportion to date, is where unexpected costs have arisen. According to the SEASPARROW project office, the countries are all within the plus or minus 25 percent constraint. (54) This constraint results in no effect to the international balance of payments between the countries. Monies that each government furnish in support of the project are repayed to industrial contractors within their own country.

### Summary

The SEASPARROW project has accomplished many of its original objectives as well as some of the goals of international codevelopment. It is giving NATO an excellent model for the management of international codevelopment. The establishment of a single project office with a single channel of authority

and responsibility has contributed to its present success. A single prime contractor with authority and responsibility for subcontracting the work among the participating countries has resulted in the knowledge of each country being utilized. Interchangeability of defense equipment has increased because of the use of the missile launchers in other missile systems. The acceptance of the "wide tolerances" in equipment measurement has aided interchangeability. The project has had a net effect of zero on the United States balance of payments since the country's share of the work is equal to the financial support they provide. This codevelopment project shows signs of strengthening the military alliances between the participating countries.

## CHAPTER IV

### CONCLUSIONS AND RECOMMENDATIONS

#### Conclusions

The United States has not been completely willing to harmonize its objectives with those of our Allies as pertains to codevelopment projects. The United States has been willing to exchange scientific knowledge with participants in codevelopment. The United States has used codevelopment also as a method of enhancing continued cooperation in research and development of defense equipment. In the past, United States has stopped short of providing our defense establishment with weapon systems wholly or partially developed and produced outside the United States. The Defense Department and the Military Departments in particular, had developed a "not invented here" syndrome that has precluded the procurement of foreign made weapon systems. This syndrome appears to be diminishing somewhat after the cancelation of the US/FRG V/STOL project as evidenced by our present commitment to the NATO SEASPARROW project and the purchase of the Harrier aircraft for the Marine Corps.

Research Questions Answered. The following answers to the research questions serve to substantiate this conclusion.

1. Did codevelopment projects increase the scientific and technical resources of the United States and its Allies?

Codevelopment projects do increase the scientific and technical resources of the United States and its Allies. In the case of the US/FRG V/STOL project, the United States obtained basic research data on a V/STOL concept which made use of a complex combination of lift and cruise powerplants. The Federal Republic of Germany military-industrial team obtained first-hand knowledge of the U.S.'s advanced systems management concepts and an insight into our methods of production. The NATO SEASPARROW project further amplifies this claim. The United States by making available its Sparrow III missile as a basis for development of a ship-based missile system increased the technical knowledge of the other participating countries. Norway's knowledge in computer guidance systems and Italy's development of telemetry equipment provided additional scientific knowledge to the United States.

2. Was the maximum practicable degree of interchangeability of defense equipment between the United States and its Allies attained by codevelopment projects?

Codevelopment projects have enjoyed only limited success in obtaining interchangeable defense equipment for

the United States and its Allies. The US/FRG V/STOL project never left the paper definition stage and, therefore, did not contribute to the standardization of defense equipment among our Allies. The SEASPARROW project provides co-development with a small measure of success in this area. Adaptation of the missile launcher to other missile systems indicates that interchangeability is possible. This program offers high hope for an increase in defense weapon standardization after production of the missile system begins.

3. Did codevelopment enhance cooperation in research and development enabling the best equipment to be available to the United States and its Allies?

Codevelopment has enhanced cooperation in research and development. The US/FRG V/STOL project opened up new avenues of communication for engineers and scientists engaged in basic research in V/STOL aircraft technology. Should either country decide to build a V/STOL fighter aircraft the fact that there has been an interchange of knowledge will preclude wasteful "discovery" of known scientific and technical data. SEASPARROW has cultivated a general willingness on the part of participating nations to exchange data, especially when it leads to the obtaining of the best defense equipment. The SEASPARROW missile system is recognized as a major improvement in performance over existing ship based self-defense systems.

This indicates that the benefits are not just one-way but that codevelopment can also assist the United States in obtaining the best defense equipment.

4. Were closer military ties among the Alliances developed as a result of codevelopment programs?

There is no evidence of a deterioration of our relationship between the United States and its Allies because of canceled codevelopment programs. At the same time, it is difficult to attribute a portion of our existing alliance strength to specific codevelopment programs. Nevertheless, when our Allies join an in-being codevelopment program to obtain common military equipment, it indicates a strengthening of military relationships.

5. Did codevelopment programs have a positive effect on reducing the United States balance of payments deficit?

Codevelopment programs do not have a positive effect on reducing the United States balance of payments deficit. Our technologically advanced Allies are insisting on receiving a share in the development of weapon systems which will be used by their country. These countries have their own balance of payment problems as well as a desire to establish their own industrial capability in producing weapon systems. The result is a share in the development work equal to their financial support of codevelopment projects. This produces

a net difference of zero upon the international balance of payment ledger.

6. Did codevelopment projects fail when they did not produce a mutually used defense weapon?

Codevelopment projects cannot be considered a complete failure when they fail to produce a mutually usable defense weapon system. If the sole purpose of the project were only to obtain a weapon system, it most assuredly would be considered a failure. This is not the case, however; such intangible benefits as mutual exchange of scientific and technical research data is a consideration. Broadening of each countries technological base is also a factor in evaluating the merits of a codevelopment project. Both an exchange of data and advancement of the technological base have resulted from the US/FRG V/STOL fighter aircraft codevelopment project. The SEASPARROW project shows strong evidence of being able to produce a mutually usable weapon system. It has already achieved an increase in interchangeability of equipment between weapon systems.

### Recommendations

Throughout the review of both the US/FRG V/STOL project and NATO SEASPARROW project, specific policies and procedures became evident as to the future direction our codevelopment projects should take. The following are my specific recommendations:

Balance of Payments Constraint. Codevelopment projects should be released from the restriction of giving priority to projects that assure a substantial amount of foreign funds spent in the U.S. for R&D. The countries that seek codevelopment projects are desirous of developing their own technological base as well as providing first-line defense equipment. Codevelopment projects should not be viewed as competing directly with our Foreign Military Sales program. Our Allies alternative to codevelopment with the United States is codevelopment with other countries rather than purchases from the United States. Our goal for codevelopment should be a zero impact on the balance of payments. This would allow the scarce defense dollars to be spent where it is the most cost-effective.

Selection of Codevelopment Projects. The prospective partners in codevelopment projects should select programs where each country has already ascertained an operational need or mission. It should be recognized that the decision process is necessarily longer when two nations are involved. Therefore, a positive early commitment is needed to weather the long acquisition process. Projects that have multi-purposes or are extremely complexed should be avoided. This does not mean that only systems presently within the state-of-the-art should be considered for codevelopment. Rather, that the system configuration should be structured for a specific

purpose early in the program thereby minimizing the number of changes in the planning cycle. Projects whose primary purpose is to provide scientific and technical data through basic research should be differentiated from those with an end product as their goal.

Project Management. Selection of participants in a project should be determined by their willingness to commit themselves to an expenditure of funds. Only those countries with a financial commitment should be allowed to participate in the determination of the ultimate weapon system. When the financial commitment is not equal among the partners, the work distribution should be divided in proportion to each countries commitment.

The use of committees for overall responsibility is a necessity in international projects even though it tends to slow down the decision-making process. The requirement for unanimous consent in these committees should be avoided or restricted to only the most fundamental decisions. A more workable method is to weigh the votes in proportion to the countries participation in the project.

The use of a single project manager and project office has a distinct advantage. This permits most of the relatively minor decisions to be resolved within the project office rather than accumulating these problems in the top management

committees. Participation within the project office should again reflect their share in the codevelopment venture.

Industry Participation. Use of one prime contractor with various subcontractors provides the most nearly ideal industrial arrangement for multi-nation codevelopment projects. This permits the contractors to resolve the industrial problems at their own level and within the sphere of business procedures. When only two nations are involved and the work is divided evenly, the situation demands an international corporation that is capable of contracting as a legal entity.

Foreign Weapon Systems. The Department of Defense and especially the various military departments should recognize the advancement foreign technology has made in the past few years. The military department should actively seek out codevelopment arrangements with countries having more advanced systems than are presently available in the United States. This will also require the Armed Service Procurement Regulations to change its current procurement policies.

## BIBLIOGRAPHY

1. "A Last Look at Military Assistance," Armed Forces Management, 13:155-59, April 1967.
2. Abrino, Lieutenant Colonel Francis E., USA, "Coproduction for Security," Ordnance, 48:646-48, May-June, 1964.
3. Allen, Charles D., Captain USN, "NATO SEASPARROW", U.S. Navy Institute Proceedings, 95:144-147, July, 1969.
4. Baldwin, George B. "Brain Drain or Overflow," Foreign Affairs, 48:358-372, January 1970.
5. "British Aircraft Coproduction with Germany?" Armed Forces Management, 14:58, April 1968.
6. "Cancellation of U.S./German V/STOL Fighter Won't Hinder Important Lift/Cruise Engine," Aerospace Technology, 21:12-16, February 12, 1968.
7. Catledge, M. B., Knudsen, L. F., "Foreign Military Sales: United States Involvement in Coproduction and Trends toward Codevelopment." (Wright-Patterson AFB: AFIT School of Systems and Logistics, Masters Thesis (SLSR-20-69), August 1969).
8. Cheney, Robert A., "The Exchange of Defense Technology," Washington, D.C.: Industrial College of the Armed Forces, Report N70-29, March 9, 1970.
9. Colglough, Richard. Deputy Director V/STOL Technology Division, Flight Dynamics Laboratory (AFSC). Personal Interview, November 3, 1970.
10. Collines, Richard G. "An Evaluation of the Joint Production of Combat Aircraft in Western Europe: With Impact on the U.S. Military Sales Program." Washington, D.C.: Industrial College of the Armed Forces (Report N70-37), January 31, 1970.
11. Dalvin, Welborn G., Major General, USA. "Lessons Learned: Joint International Program Management for the US/FRG Main Battle Tank." Rock Island, Illinois: U.S. Army Management Engineering Training Agency, September 1966.

12. "DOD Cancels U.S./FRG Program," Armed Forces Management, 14:25, March 1968.
13. Feyereisen, Paul A., Major General, USA. "The Mallard Program," Signal, 23:13-17, November 1968.
14. "First Harriers Delivered to Marines," Armed Forces Journal, 108:17, January 18, 1971.
15. "Forward Area V/STOL Problems Studied," Aviation Week & Space Technology, 89:17-19, July 1, 1968.
16. Fowler, Charles A. "Defense R&D: Characteristics, Problems, and Trends," Armed Forces Journal, 107:24-28, July 25, 1970.
17. "Genesis of a Cooperative Development Program - The Founding of NATO SEASPARROW." Unpublished report on file with the Military Sales Branch, Naval Material Command, Washington, D.C., January 1969.
18. "Germany to Offset 75% of U.S. Troop Costs," Aviation Week & Space Technology, 88:18, June 17, 1968.
19. Hall, G. R. and Johnson, R. E. "Aircraft Coproduction and Procurement Strategy." The Rand Corporation Report 450-PR. Santa Monica, California: The Rand Corporation, May 1967.
20. Heintzelman, Warren C. "The Administration and Operation of the U.S. Military Assistance Sales Program." Washington, D.C.: Industrial College of the Armed Forces (Report M65-71), March 15, 1965. (Most of the historical background leading to codevelopment was extracted from this thesis.)
21. Hessman, James. "A Booming European Defense Industry Tools up for the Next Decade," Armed Forces Journal, 107:14-28, July 25, 1970.
22. Hessman, James and Cossaboom, Bruce. "BoP, NATO, Harrier, and a Cure for the NIH Syndrome," Armed Forces Journal, 107:22, October 5, 1970.
23. Historical Report of the US/FRG V STOL Tactical Fighter System Program Office (January 1-June 30, 1967). Deputy/Systems Management, Aeronautical Systems Division, Air Force Systems Command, Wright-Patterson AFB, Ohio, June 30, 1967.

24. Historical Report of the US/FRG V/STOL Tactical Fighter Systems Program Office (January 1-June 30, 1968). Deputy/Systems Management, Aeronautical System Division, Air Force Systems Command, Wright-Patterson AFB, Ohio, June 30, 1968.
25. Hite, Kenneth F. "Why the VTOL Fighter?" Air University Review, 19:86-92, July-August 1968.
26. "Increase Funding & Technical Effort Vital to Future of V/STOL," An Interview with Major General Charles H. Terhune. Data, 11:31-43, October 1966.
27. "Killed by Complexity? The demise of AVS (The West German/American Advanced Vertical Strike Aircraft)," Flight International, 93:262-263, February 22, 1968.
28. Kraft, Herbert H. "The Impact of the U.S. Balance of Payments Problem on the Department of Defense," Washington, D.C.: Industrial College of the Armed Forces (Report M70-92), January 1970.
29. Lucas, Hugh. "Military V/STOL Programs Face a Sharp Cost Axe," American Aviation, 30:16-38, March 1967.
30. Memorandum of Understanding for International Development of the NATO SEASPARROW Missile System. Memorandum on file in the NATO SEASPARROW Surface Missile System Project Office, Washington, D.C. Section IV, June 1968.
31. NATO Facts and Figures, NATO Information Service, Brussels, Belgium, 1969.
32. "NATO SEASPARROW Program," Air Force and Space Digest, 53:31, November 1970.
33. Nelson, Richard R. "The Technology Gap: Analysis and Appraisal," The Rand Corporation Paper P-3694-1 Santa Monica, California: The Rand Corporation, December 1967.
34. Palumbo, M. Domenic. "Western European Co-Production of Weapons of United States Origin, An Analysis of," Washington, D.C.: Industrial College of the Armed Forces, (Report M66-120), March 1966.

35. "Pegasus Jets for Marine Harrier Assured Despite Rolls-Royce Troubles," Armed Forces Journal, 108:17, January 18, 1971.
36. Preliminary Management Plan--United States/Federal Republic of Germany V/STOL Tactical Fighter (Draft), V/STOL Strike-Recce System Program Office, Deputy for Systems Management, Aeronautical System Division, Air Force Systems Command, Wright-Patterson AFB, Ohio, March 15, 1966, (C).
37. "Project Mallard Cancelled," Army Times, November 13, 1970.
38. Ransome, Robin K. "Lack of Definition Clouds V/STOL Future," Armed Forces Management, 14:88-89, February 1968.
39. Sheridan, Stan R. "US/FRG Main Battle Tank-A Case for Joint Development?" Washington, D.C.: Industrial College of the Armed Forces (Report M70-153), March 31, 1970.
40. Stevens, Robert W. "Wishful Thinking on the Balance of Payments," Harvard Business Review, 44:6-30, 194-200, December 1966.
41. "The Netherlands Joins NATO SEASPARROW Missile Program," Defense Industrial Bulletin, 6:16, August 1970.
42. "Tripartite Evaluation of VTOL Operations," Interavia, 20:1936-1938, December 1965.
43. U.S. Code Foreign Assistance Act of 1967 (Public Law 90-137) St. Paul, Minn.: West Publishing Co., 11:2957-2977, December 11, 1967.
44. U.S. Department of the Air Force. Foreign Military Sales, AFM 400-3. Washington, D.C.: July 5, 1968.
45. U.S. Department of Defense. International Coproduction Projects and Agreements Between the United States and other Countries or International Organizations, DOD Directive 2000.9, Washington, D.C.: March 26, 1968.

46. U.S. Department of Defense. Mutual Weapons Development Data Exchange Program (MWDEP) and Defense Development Exchange Program (DDEP). DOD Instruction 2015.4, Washington, D.C.: August 15, 1963.
47. U.S. Department of Defense. Cooperation With Allies in Research and Development of Defense Equipment. DOD Directive 3100.3, Washington, D.C.: September 27, 1963.
48. U.S. Department of Defense. Harmonization of Qualitative Requirements of Defense Equipment of U.S. and Allies, DOD Directive 3100.4, Washington, D.C.: September 27, 1963.
49. US/FRG Advanced V/STOL Tactical Fighter-Preliminary Technical Development Plan, Deputy/Systems Management, Aeronautical System Division, Air Force Systems Command, Wright-Patterson AFB, Ohio, October 1966.
50. US/FRG V/STOL Tactical Fighter Program--Definition Phase Evaluation Report, Deputy/Systems Management, Aeronautical System Division, Air Force Systems Command, Wright-Patterson AFB, Ohio, Volume I, April 1968.
51. Vandervanter, E. Jr. Coordinated Weapons Production in NATO: A Study of Alliances Processes, Research Memo RM-4169-PR, The Rand Corporation, Santa Monica, California: November 1964.
52. "V/STOL: A Special Report," American Aviation, 28:16-41, March 1965.
53. "V/STOL, Europe's Proof of U.S. Disinterest," Armed Forces Management, 12:47, June 1966.
54. Washington, D.C. Interview with Mr. W. Pritchard, ILS Engineering Manager, NATO SEASPARROW Project Office, July 13, 1971.
55. Washington, D.C. Personal interview with Mr. McLaren, Assistant for International Coproduction, Military Sales Branch, OASD/I&L, December 21, 1969.

56. Washington, D.C. Personal interview with Mr. Sam Marshall, Military Sales Branch, Naval Material Command, December 22, 1969.
57. Wright-Patterson AFB, Ohio. Personal Interview with Mr. Julius Singer, Assistant Director AGM 86 SPO, Deputy for RECON/STRIKE/ELECT Warfare, Aeronautical Systems Division. (Mr. Singer was the Assistant Director of the US/FRG V/STOL SPO) June 8, 1971.

## BIOGRAPHICAL SKETCH OF THE AUTHOR

Captain Melvin T. Baas is a native of [REDACTED]. After enlisting in the Air Force in 1962, he entered the aviation cadet program for navigator training at James Connally AFB, Texas. Upon graduation in 1963, Captain Baas received his navigator wings and was commissioned into the Air Force. He was assigned to the 437 Military Airlift Wing, Charleston AFB, South Carolina. He received his Bachelor of General Studies degree from the University of Nebraska at Omaha in June 1968, after completing one year of study under the Air Force's Bootstrap program. In 1970 he entered the School of Systems and Logistics. His next assignment will be as a navigator with the 360th Tactical Electronic Warfare Squadron, Tan Son Nhut Air Field, South Vietnam.

UNCLASSIFIED

Security Classification

## DOCUMENT CONTROL DATA - R &amp; D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author) Air Force Institute of Technology, School of Systems and Logistics		2a. REPORT SECURITY CLASSIFICATION	
		2b. GROUP	
3. REPORT TITLE UNITED STATES INVOLVEMENT IN CODEVELOPMENT: AN ANALYSIS OF THE US/FRG V/STOL FIGHTER AIRCRAFT PROJECT AND NATO SEASPARROW PROJECT.			
4. DESCRIPTIVE NOTES (Type of report and inclusive dates) Thesis			
5. AUTHOR(S) (First name, middle initial, last name)  Melvin T. Baas (Capt USAF)			
6. REPORT DATE 18 August 1971		7a. TOTAL NO. OF PAGES 71	7b. NO. OF REFS
8a. CONTRACT OR GRANT NO.		9a. ORIGINATOR'S REPORT NUMBER(S)  SLSR-61-71B	
b. PROJECT NO.		9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)	
c.			
d.			
10. DISTRIBUTION STATEMENT This document is subject to special export controls and each transmittal to foreign governments or foreign nationals may be made only with prior approval of the Air Force Institute of Technology, School of Systems and Logistics, Wright-Patterson AFB, Ohio 45433.			
11. SUPPLEMENTARY NOTES		12. SPONSORING MILITARY ACTIVITY	
13. ABSTRACT  This study examined a past and a current international codevelopment program to determine if codevelopment projects are capable of attaining the goals of the Military Assistance program. Since the United States has not produced any major defense weapon system through codevelopment projects, this study attempts to identify any common underlying problems that the United States must overcome. The objectives of the two programs were used as guides to examining each program's accomplishments and failures. These results were evaluated against the five stated goals of the Department of Defense as pertains to international codevelopment projects.  <u>KEY WORDS:</u>  International Codevelopment NATO SEASPARROW Project US/FRG V/STOL Project Cooperative Development			

DD FORM 1473  
1 NOV 65

UNCLASSIFIED

Security Classification