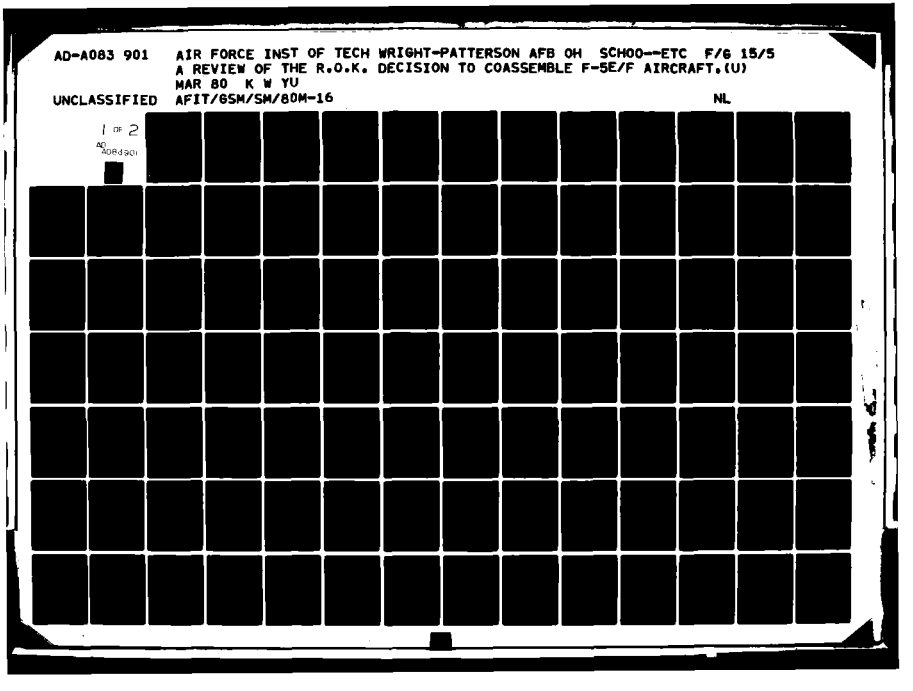
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A REVIEW OF THE R.O.K. DECISION
TO COASSEMBLE F-5E/F AIRCRAFT

THESIS

AFIT/GSM/SM/80M-16 Yu, Kun Woo
LTC ROKAF

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A REVIEW OF THE R.O.K. DECISION TO COASSEMBLE F-5E/F AIRCRAFT

THESIS

Presented to the Faculty of the School of Engineering

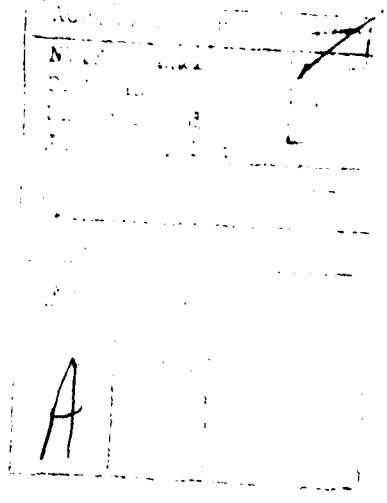
of the Air Force Institute of Technology

Air University

in Partial Fulfillment of the

Requirements for the Degree of

Master of Science



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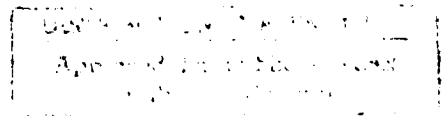
Yu, Kun Woo

LTC ROKAF



Graduate Systems Management

March 1980

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Abstract

This study reviews the proposed F-5E/F coassembly program by the ROK. The review is conducted within the context of the historical trend of US security assistance to the ROK and ROK military and economic needs and objectives. Program analysis and assessment include an evaluation for the potential of the coassembly program to fulfill ROK needs and objectives. Assessment is further augmented by a review of lessons learned by ROC and Japanese coproduction/coassembly programs with the U.S. Finally, the author identifies potential problem areas and makes recommendations for solutions.

CHAPTER I

INTRODUCTION

Background

Security assistance (S.A.) has been a major instrument of American foreign policy. In context of the Total Force Concept (13:-). U.S. S.A. has been designed to promote the security and economic well-being of allies. By encouraging friendly nations to develop an increasingly greater defense capability; the United States seeks to promote collective worldwide security and stability while at the same time relieving itself of a portion of the associated military, economic, and political burdens.

Particular emphasis for S.A. has been given to geopolitically important and sensitive areas and countries. One such country is the Republic of Korea.*

By virtue of its location, Korea holds vital economic, military, and political importance for the United States. Open Sea Lanes of Communication (SLOCs) in the Pacific are a key to the American worldwide logistics capability (4:4). SLOCs to the Indian Ocean, the eastern coast of Africa, the Red Sea, and the middle East are crucial to the U.S. projection of influence for combating Soviet begemonist intentions in Asia. The forward basing capability provided by R.O.K. therefore directly promotes U.S. worldwide flexibility for economic and military action. For that reason, continued stability and preservation

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*The Republic of Korea, South Korea, Korea, and R.O.K. will be used interchangeably throughout this thesis.

of the status quo on the Korean peninsula has been a primary goal of U.S. military and economic aid.

The most singular threat to stability on the Korean peninsula has come from the North Korean regime of Kim, Il Sung. Since the Armistice in 1953, North Korea has continued to develop an aggressive offensive military posture in order to force unification of the two Koreas under the terms of Kim, Il Sung. Examples of North Korean aggression in the post-Korean war era abound; in 1967 infiltrators from the North caused 131 South Korean deaths, on January 21, 1968 a North Korean commando unit came within 800 meters of the "Blue House" for an unsuccessful attempt on President Park's life, two days later the American intelligence ship U.S.S. Pueblo was captured by North Korean forces, on April 14, 1969, American EC-121 was shot down by North Korea, and finally on August 18, 1976 North Korean soldiers murdered two American officers and wounded four American enlisted men and four South Koreans during "the tree cutting incident" at Panmunjon (4:26). These incidents combined to shake the confidence of the R.O.K. government in its ability to respond to North Korean aggression.

The task of American security assistance has therefore been to bolster South Korean confidence as well as real military capability. In its form, the American military aid program has evolved as the R.O.K.'s military and economic abilities have progressed. In its inception security assistance consisted of Grant Aid (GA). From the end of the Korean war to 1976 the total amount of direct economic and security assistance (Grant Aid) totaled $13 billion (15:46). During that twenty-three (23) year period U.S. S.A. ensured the R.O.K.'s

ability to counter any military threat from the North while at the same time promoting economic development and stability of South Korea.* With the development of a series of a Five-Year economic development plans in 1962, Korea has managed to sustain an average annual GNP growth rate of more than 10 percent. (4:86).

The traditional G.A. program was ended by President Ford in 1976, because of Korea's impressive economic progress. Much of the assistance provided under grant aid was switched to the cash and credit program of Foreign Military Sales (FMS).*

The latest permutation in the evolution of military assistance to the R.O.K. includes coassembly or coproduction programs. "Coproduction encompasses any program wherein the United States, either directly or indirectly, enables a foreign producer to acquire substantial 'know-how' to manufacture or assemble, repair, maintain, operate..a specific weapon, communication or support system (13:-). A goal of the Korean Force Improvement Program (FIP) is to develop an indigenous defense industry through coproduction. The first such effort came in

---

*Almost as important, in American eyes, as military security for the R.O.K; was the intent to encourage Korean investment into the economy to promote long term growth. The eventual goal being complete economic and military self-sufficiency for the R.O.K.

*The terms of the credit provide that the borrower shall pay the U.S. Government's cost of borrowing, with a one-time charge of one quarter of one percent. The repayment period will not exceed the useful life of the item, with the typical repayment period being 8 to 12 years but not to exceed 12 years. Payments are made semi-annually (MASM: III.E.).

970 with the M-16 rifle. Later efforts included tactical communications equipment, the Hughes 500 helicopter, and coastal patrol and attack ships (15:51).

The current goal of Korean coproduction is to develop an advanced military aircraft industry. The F-5E/F coproduction effort negotiated by the R.O.K. is the first step toward that goal. This author is aware of the extensive economic resources that must be invested by his country in this effort. Therefore, this thesis will present the F-5E/F co-production plan, its impact on R.O.K. economic and military development, and the prognosis for its successful implementation and execution.

Statement of Justification

Coproduction of the Northrop F-5E/F aircraft by the R.O.K. is a major milestone in the evolution of U.S. S.A. to South Korea. The economic growth of Korea has continued at approximately 14 percent annually from 1975 to 1979 (4:88). It is vital that no coproduction effort results in adverse economic impacts thereby being counter-productive to the historic goals of U.S. military assistance to the R.O.K. In order to minimize the risks entailed by this initial effort, it is imperative that the United States, the Northrop Corporation, and the Korean government conduct thorough planning in order to maximize the probabilities for success. Furthermore, success is highly dependent upon a complete understanding by the R.O.K. government and corporations* of the plans developed by the Northrop staff. This entails consideration for number of variables including: fiscal strength of the R.O.K. technical capability, social and managerial structure in Korean

*R.O.K. Korean Air Line schedule to coassemble F-5E/F fuselage, and SAM SUNG industry assemble engine.

industry, and military and defense requirements.

Problem Statement

A need exists to determine whether or not the F-5E/F co-assembly decision is consistent with the goals of U.S. S.A. and the long term Korean objective of developing an aerospace industrial capability. Such a determination must consider Korean understanding of the co-assembly decision in context of the evolution of U.S. S.A. as well as R.O.K. economic and military requirements.

OBJECTIVES:

To describe the SA relationship between the US and the R.O.K.

To examine the latest decision both in perspective of long standing US-ROK relationships and by describing the program itself.

To outline a framework for assessing the program and a course of action for successful implementation.

Research Design

Primary sources of information for research include the various planning documents of the Northrop Corporation and interviews with key managers and decision makers. The planning documents provided information revealing the foundation of the F/5E/F coproduction issue, while interviews with Northrop managers provided insight of the relative issues underlying the coproduction package.

Additionally, a strong background of relative issues of aircraft coproduction with the United States, and Korean-American security assistance issues was obtained from master's thesis, research reports and Congressional reports. Key documents included: A Case History of the Co-production of the F-5E Aircraft by the United States of America and the

Republic of China, Security Assistance to South Korea: Assessment of Political, Economic, and Military Issues from 1975-1979, Aircraft Co-production and Procurement Strategy, RF-4 Co-production: United States and Federal Republic of Germany, the October 1978 Fraser Report entitled, Investigation of Korean-American Relations, and a report by Senators Hubert Humphrey and John Glenn, U.S. Troop Withdrawal from the Republic of Korea. U.S. Security Assistance policy insight was also gained by reviewing the International Security Assistance Acts pertinent to this research. This information was continuously updated by articles from periodicals and discussions with international S.A. experts.

The research effort concentrated on defining the evolution of U.S. Security Assistance to the R.O.K. the F-5E/F coproduction decision in context of this evolutionary policy, and its prospects for fulfilling the needs and espectations of the Korean government both economically and militarily.

Limitations and Assumptions

Some of the planning premises, and indeed plans themselves, are consideredcompetition sensitive by the Northrop Corporation and politically sensitive by the U.S. State Department since the MOU had not been issued at the time of this research. Therefore, instrumental to this research is the assumption that much of the sensitive information is not necessary in order to develop an accurate conception of the basic plan for implementing and executing the coproduction of the F-5E/F; and that further, that information that is essential has been uncovered in non-sensitive planning documents, interviews of knowledgeable individuals, and other research efforts and studies of the subject matter.

RESEARCH QUESTIONS:

1. How does the F-5E/F coproduction decision relate in the historical context of Security Assistance Programs between the US and R.O.K.?

2. Did the coproduction decision consider the needs and best interests of the R.O.K. military, defense industry, and economy?

3. How can current knowledge and lessons learned from previous coproduction endeavors be used for developing a R.O.K. plan of action?

4. What plan of action should the R.O.K. follow to ensure successful implementation of the program?

Plan of Presentation

Current U.S. Security Assistance is the culmination of a plan developed by the United States, with the consent of the R.O.K. over two and one half decades ago after the Korean war. In order to determine the validity of the F-5E/F corproduction decision it was necessary to develop this evolution of security assistance, to present the coproduction decision as it was made, and to analyze its impact on Korean needs, as well as its potential for successful implementation. The issues and events are organized as follows:

Chapter 2 - Presents the evolution of U.S. security assistance to South Korea from economic and grant aid to FMS and coproduction.

Chapter 3 - Outlines the F-5E/F coproduction program.

Chapter 4 - Presents an analysis of the coproduction program with heavy reliance on lessons learned during previous aircraft coproduction programs.

Chapter 5 - Addresses the research questions and provides the author's conclusions and recommendations for program success.

CHAPTER II

The Evoluation of U.S. - R.O.K. Security Assistance

Introduction

U.S. foreign policy has operated under the precept that the security and economic well-being of friendly countries is essential to the security and economic well-being of the U.S. Since the advent of the Korean War, the Republic of Korea (R.O.K.) has relied heavily on the U.S. foreign policy philosophy. The resultant military and economic assistance promoted R.O.K. military and economic development. In its broadest sense; the U.S. Security Assistance has included military security assistance, the economic support fund, peace-keeping operations, and commerical materials export. However, within the U.S. Department of Defense; Security Assistance has a somewhat more narrow composition of the Military Assistance Program (MAP), also known as Grant Aid (GA), Foreign Military Sales (FMS) Foreign Military Sales Credit (FMSC), and the International Military Education and Training (IMET) program. Still, a more specific definition of Security Assistance is provided by the Dictionary of Military and Associated Terms (16:306).

"Security Assistance is a group of programs authorized by the Foreign Assistance Act of 1961, as amended, and the Arms Export Control Act of 1976, as amended, or other related statutes by which the United States provides defense articles, military training, and other defense related services, by grant, credit or cash sales, in furtherance of national policies and objectives."

As was stated in Chapter I, this chapter will present the taxanomic elements of U.S. security assistance to the Republic of Korea. It

includes a brief description of key American government and military agencies of the security assistance structure in order to provide the reader a basic knowledge of areas of responsibility. Once the bureaucratic structure has been developed; a discussion will ensure which is designed to show the evolution of American security assistance to the R.O.K. as American foreign policy and Korean economic and military capabilities evolved. Thus, this chapter will draw upon the specific definition of security assistance presented above, as well as the broader definition previously developed by the DoD. The principle elements thereof being economic assistance, military assistance, and Foreign Military Sales.

KEY AGENCIES OF SECURITY ASSISTANCE

Due to the complex transactions involved in securing military assistance, it is essential that any buyer or potential buyer understand the great number of American agencies that play an important role in deciding the types and extent of security assistance that will be provided. It is critical for any potential FMS customer to understand that there are two virtually parallel management structures one within the Department of Defense the other within the State Department, responsible for conducting FMS programs.

The key agency of American security assistance is the Bureau of Politico-Military Affairs (BPMA), U.S. State Department. The BPMA is the central agency concerned with international logistics and has four major functions: 1) develops policy for national and international conduct of logistics actions, 2) supervises and directs the conduct of programs, 3) effects coordination with other government and DoD agencies, and 4) is responsible for liscensing actions in conjunction

with industry-to-industry sales (Hand-out of International Logistics Overview in School of Systems Logistics).

Although the State Department develops the policies governing U.S. security assistance implementation including financial management of FMS programs is the responsibility of the Secretary of Defense. The Defense Security Assistance Agency (DSAA) performs the following financial management functions; develop policy, supervise policy implementation, conduct sales negotiatons, coordinate planning for the furtherance of the Total Force Concept (TFC), perform a liason role with industry, assign sales cases, and oversee the expenditure of funds for those assigned cases.

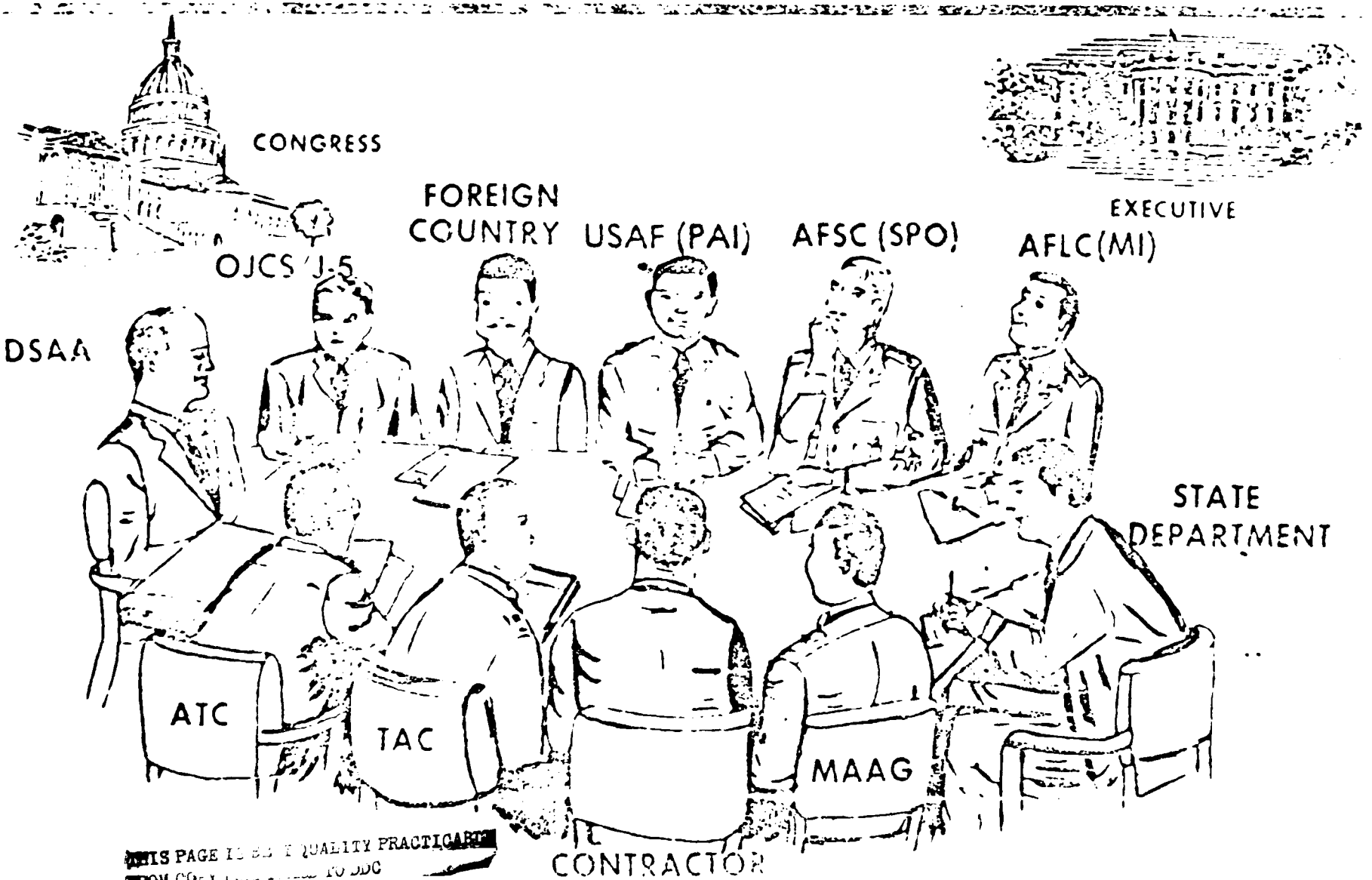
Within the DoD, there is a second tier of management at each of the service level Headquarters. Detailed implementation responsibilities rest with each respective service. The Directorate of International Programs, Hq USAF, monitors all Air Force programs through four geographical divisions (Eastern Division, Western Division, Special Programs Division, Foreign Military Training Division). The Directorate of International Programs is the "working level" of Air Force programs. Country-specific disks within each division are responsible for planning and executing tailor-made programs for each country within that division.

THE EVOLUTION OF US SECURITY ASSISTANCE TO THE ROK

At its inception in 1950, US S.A. to the R.O.K. was a matter of providing brute force to help that country stave off the attack from the North. Since that first involvement, American security assistance has been changed by U.S. legislation, R.O.K. economic and military capabilities, and the magnitude of the threat from North Korea. The economic and military evolutionary aspects will be discussed in following sections of this chapter. However, since U.S. legislation has

Figure 1

PRIMARY AGENCIES INVOLVED IN FOREIGN MILITARY BUSINESS



determined what kinds of military and economic assistance may be provided to American allies, a brief description of milestone legislation and its impact is in order;

1. The Mutual Security Assistance Act of 1954 consolidated the Marshall Plan and the 1951 Act. It also established the position of Director of Mutual Security in the Department of State to supervise overall military, economic, and technical assistance programs.

2. The Foreign Assistance Act of 1961 replaced the Mutual Security Assistance Act of 1954, as amended. Herein Congress restated its belief that the security of the U.S. is strengthened by assuring the security of other free countries. A key feature of this act is the fact that it defined the roles of the Secretaries of State and Defense in security assistance. The Secretary of State was charged with responsibility for the continuous supervision and general direction of security assistance programs. The Secretary of Defense was, on the other hand, responsible to implement the military assistance program. Although military assistance as a grant aid terminated 30 September 1977 (with the exception of programs specifically approved by Congress) this particular act is still the basis for the Economic Support Fund, the Military Assistance Program, and the International Military Education and Training Program.

3. The Foreign Military Sales Act (FMSA) of 1968 was amended and designated the Arms Export Control Act in 1976. The emphasis of this legislation was to place restrictions on the ways in which FMS and direct commercial export sales are conducted.

4. The International Security Assistance and Arms Export Control Act of 1976, as amended, places major Congressional restrictions and

controls on U.S. Arms exports. Among these restrictions are; recovery of all costs including charges for administrative services, use of plant and production equipment, non-recurring R&D, and production costs; a clause which restricts security assistance to countries violating basic human rights; and that all military equipment transactions of $25 million or more with non-NATO countries must be transacted through the U.S. government not through commercial channels. Some other important aspects of the "1976 Act" included termination of MAAGS, restriction on level of sales not to exceed 1976 level, sales that adversely affect U.S. combat readiness must be kept to an absolute minimum, and it ordered a presidential study of FMS policies. (13:-).

The trend in these acts is hardly mistakeable. The United States obviously desires to keep security assistance at the minimum levels necessary to ensure its own, and its allies national security. A second trend revealed in legislation is the desire that military sales programs neither "make" nor "lose" money. Wherein the past the U.S. has often resorted to give-away programs which natually lost money. The following three sections will discuss American economic, military, and FMS assistance as it evolved through the last four decades.

ECONOMIC ASSISTANCE

The foundation for American economic assistance to the R.O.K. was laid by the American Military Government (AMG) of 1941 to 1948. The AMG suffered from a number of maladies which made it difficult, if not impossible, to administrate an effective economic assistance program. The AMG had difficulties in dealing with the lack of trained manpower, the distribution of assets largely owned by the Japanese, and virtually non-existent transportation systems. Further complicating the AMGs task was the fact that the Japanese had developed the Korean economy to complement the Japanese economy. Therefore, there existed no workable framework for self-sufficient economy in Korea. Due to Japanese economic exploitation, low crop yields, run-a-way inflation, and countrywide starvation; ninety percent of U.S. assistance was in the form of basic necessities such as food, fertilizer, clothing and fuel.*

Reflecting on the state of affairs in its "Investigation of Korean-American Relations" the 95th Congress stated,

> "The economic depression was exacerbated by the failure of the U.S. military government to effect meaningful nationwide land reform, control the extremely high rate of inflation, or stimulate agricultural and industrial production. U.S. economic assistance took the form of relief, consisting principally of food and basic necessities."

---

*These necessities were provided primarily under Government and Relief in Occupied Areas (GARIOA). Total economic assistance from 1945-1948 alone was over $400 million.

The failure of the AMG to establish an industrial production capability at this early hour, was to be one of the great obstacles for developing a R.O.K. defense industry in later years.

In 1949 the U.S. Army began a three-year program which signaled a shift from relief and toward long run development. The program used $350 million of GARIOA funds for capital development, electrical power production, fertilizer, food, and industrial raw materials. At approximately the same time Congress had begun to take great interest in the large sums of money being invested in South Korea by the US. In actuality the concerns of Congress were twofold: 1) the great in-pouring of funds to Seoul seemed only to increase the value of the "potential prize" in the event of a communist takeover, and 2) the seeming lack of concern on the part of Seoul to comply with American human rights policies was interpreted in many circles as impertinent. (6:49).

On the other hand, South Koreans viewed American policy as disjointed and incongruent. How could the Americans propose to achieve political, economic, and military stability by proposing increased individual and political freedoms at a time when strong authoritarian rule was necessary to control large numbers of dissidents and to rally the loyal populace in preparation for possible war?

From the Korean perspective, this ambiguity of American foreign policy was again personified by the withdrawal of most American troops in 1949. The withdrawal action was followed almost immediately (Jan 1950) by a statement by then U.S. Secretary of State Dean Acheson. In his statement Mr. Acheson stated that the American defense perimeter

in Asia extended south from Japan through the Ryukyu Islands.

Conspicuously, this defense perimeter did not include the R.O.K. Students of Korean politics and history theorize that these two actions on the part of the United States may have contributed significantly toward promoting the North Korean invastion in June 1950.

The war was an economic disaster for the R.O.K. With virtually no industrial capacity, the entire "backyard" industry dedicated its' efforts to the war. Additionally, the war took an estimated 300,000 South Korean casualties, 142,000 American casualties and $54 billion American. (4:21)

The end of the Korean war was negotiated by the United States in an armistice which took effect July 27, 1953. President Rhee of South Korea was vehemently opposed to the Armistice, primarily because of his goal to march to the North and reunite Korea and its industries. The Presidents' firm resolution was to base future economic growth in Korea on the resources possessed by both the North and the South. President Rhee relented only after the United States agreed to enter into a Mutual Defense Treaty which in part promised $1 billion for reconstruction assistance (7:16).

In the post war years the United States was finally willing to conduct some long range economic planning for the R.O.K. However, as the first two attempts at such planning revealed, there was yet a great deal of uncertainty on the part of the United States as to the eventual future of the R.O.K.

The TASCA Plan was President Eisenhower's first attempt at an economic development plan for the R.O.K. The plan was named after Dr. Henry J. Tasca appointed in April 1953 as a special representative on the Korean reconstruction economic aid program. After a six week survey, the TASCA Team

submitted its report entitled, "Strengthening the Korean Economy." The TACSA report appeared to be too optimistic in its treatment of uncertainties about the future of Korean reconstruction and was glaring in its omission of economic requirements for future Korean growth and development.

In an effort begun prior to the TACSA plan, Dr. Robert R. Nathan and Associates developed the NATHAN Plan for Korean reconstruction. The NATHAN team was composed of a group of American economists, and prepared an economic study in 1954 at the request of the United Nations Korean Reconstruction Agency (UNKRA). The Nathan Plan outlined a five year period for developing economic self-sufficiency. In addition, the plan called for capital investment projects which clearly duplicated existing North Korean facilities. The recommended capital investment projects caused the United States to drop support of the plan because it was not consistent with the American policy goal of a unified Korea. The NATHAN Plan was subsequently shelved and never implemented.

Thus with no longer-range plan at hand, United States economic aid during the reconstruction period (1953-1957) totaled in excess of $1.5 billion. The Aid had accomplished reconstruction of war damaged facilities and provided a minimum industrial framework of electrical power generation, transportation and communications (4:53).

Economic development of South Korea appeared to become stagnant until Park Chung Hee was elected President in November of 1963. President Park embarked on a succession five-year economic development plans that helped the Korean economy at a GNP growth rate not matched by any other Asian nation. In order to give Park's five year plan better

chance for success, the U.S. released $28 million in military aid for FY 61. This action relieved the R.O.K. economy of having to bear this extraordinary military burden, and permitted the government to direct its full effort toward economic development. Under the capable and firm leadership of President Park the First Five Year Economic Development Plan (FFYP) posted a 9.4 GNP growth rate. (7:27).

President Park's firm leadership style was undeniably responsible for Korean success under the FFYP. However, the same leadership style was continuously under criticism from the West because of its firm stand on limited individual and political freedoms. The Congressional "Investigation of Korean-American Relations" indicates that the U.S. used,

> "...military and economic aid as leverage to induce the Korean government to adopt certain policies and undertake certain reforms (human rights). American leverage was enhanced by the R.O.K. Governments' need for good relations (with the US) as a symbol of legitimacy, both domestically and internationally."

In response to the increased criticism and pressures, President Park came to the U.S. in May 1965 to confer with President Johnson. The Presidents developed a two part plan to improve relations. The first part was for Korea to give priority to normalization of relations with Japan. The Japanese economy was healthy and looking for ways to expand. Improved Japanese relations with Korea, the two leaders reasoned, could likely result in Japanese investments there. The second part of the plan was designed to boost the American position in Vietnam by demonstrating that other non-communist nations were interested enough in South Vietnam to sacrifice lives. This part of the plan was responsible for a

commitment of a force level in Vietnam of about 50,000 troops from 1966 to 1973 by the R.O.K. In return President Johnson promised $1.5 billion economic assistance to the R.O.K. over five years. (7:26).

During these last years of the Vietnam war period Korean-American relations prospered. The Agency for International Development (AID) estimated that Korean foreign exchange earnings from 1966 to 1972 totaled $925 million. (7:177). AID officials attributed the significant Korean economic growth to the expanded business opportunities presented as a result of being involved in a war effort.

The AID organization was perhaps the most successful organization, in the early 1960's, for promoting R.O.K. economic stability. According to the Fraser Committee Report, "The primary role in U.S. economic assistance was played by AID which provided grants, loans, technical assistance, and advice. AID worked within the long-term U.S. strategy of having Korea support the cost of its own defense. AID's principle function was to administer a set of programs designed to develop Korea to the point of self-sufficiency (7:158). AID was more successful in obtaining Korean support than other forms of American economic aid. This was due primarily to the fact that AID was perceived by President Park and other R.O.K. officials as a fiscal and monetary advisory agency which did not pre-conditionalize nor withhold its assistance in order to attain R.O.K. political compliance on sensitive issues.

In his drive for Korean self-sufficiency and independence from foreign influence, President Park encouraged foreign investment in Korean industry as well as savings in the private sector. These were the main ingredients of his Second Five Year Plan (SFYP), 1967-1971. The SFYP became the first in a series of economic improvement plans which extended into 1981,

also alternatively identified as the Third and Fourth Five Year Plans. Although it was receiving significantly less economic aid from the U.S. after the SFYP, the Korean economy continued its gradual growth into the early 1970s. This continued growth was based primarily on the AID encouraged textile export industry. Ironically enough, as Korea arrived on the international export scene, its prime customer, the United States, was experiencing high unemployment rates under President Nixon. Characteristically, the United States negotiated export quotas with the R.O.K. Compensatory measures for Korea included $100 million in developmental loans and increased PL 480 (Food for Peace) loan guarantees to $275 million over a five year period beginning in 1971 (7:194). There is no doubt among economists that the U.S. trade restrictions dealt a great blow to the developing Korean economy. The US embassy estimated that Korea's worldwide exports had been reduced by $400 million in 1976 as a result of further overseas trade restrictions. (7:203). It seems perhaps a brutal series of blows to deal to an economy one has spent nearly thirty years in developing, but for the part of the United States; the author, if he may be permitted a romantic hypothesis, surmises these events as the sign for the arrival and maturity of the Korean economy. Obviously, if greater nations are forced into protecting their own economies from lesser economies of other nations, then the economies of those other nations must at least in part be competitive. Therefore, the necessity for import restrictions by the U.S. is perhaps testimony for the success of American economic aid and Korean ingenuity and sacrifice toward developing an economically self-sufficient nation.

MILITARY ASSISTANCE

The previous section discussed American economic assistance to the Republic of Korea. This section discusses the adjunct, indeed practically the synonym, for economic assistance which is military assistance under grant aid. Although there is no distinctive grant aid period designated vice a FMS period; it is generally noted, with respect to Korea, that Foreign Military Sales increased sharply in 1974 with the growth of the R.O.K. economy.* However, by the end of 1976 all grant aid to the R.O.K. was phased out of FMS.

The reader will recall our earlier definition of grant aid; the furnishing of military equipment, supplies, services, and training, with the understanding of no repayment obligation on the part of the R.O.K. American grant aid to Korea flourished during and after the Korean War under the spirit of the Mutual Defense Treaty, enacted in 1953, in which both parties vowed to..."maintain and develop appropriate means to deter armed attack and will take suitable measures.."

Most of the suitable measures derived by both the U.S. and Korea included economic aid, which was practically synonomous with military aid until the 1960s. Since the economic aspects of American assistance were completely discussed in the previous section, our discussion of grant aid will concentrate on the post-1960 time period.

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*As the R.O.K. economy grew stronger in the early 1970's, the U.S. encouraged the R.O.K. to assume increasing shares of the Korean defense burden. In 1973 R.O.K. FMS purchases totaled $25.58 mil; in 1974 the figure was at $144.88 mil. (FMS Facts 1 Dec 78).

In its entire history, U.S. military assistance to Korea has been tied to political and economic issues. The American policy of developing the Korean military capability was implemented directly through the Military Assistance Program (MAP), and indirectly through economic aid (PL 480) and political debate over human rights issues.*

The MAP consisted of grants which Korea used to obtain military equipment, supplies, and services from the U.S. in addition to the sale of U.S. surplus defense articles at one-third of their acquisition costs. The sale of the surplus defense articles was often financed by U.S. loans to the R.O.K. The Table 1 shows the extent of grants and loans for military assistance for the years 1971-1981. To provide a complete perspective with respect to the increased demands on the Korean economy to support defense development, the table also presents the percentage of the R.O.K. GNP dedicated to defense development. The GNP investment is presented in terms of U.S. dollars to demonstrate the increasing expenditure on defense in familiar values.

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*Political issues, such as the Korean human rights issue, served primarily to restrict the military and economic assistance provided by the US.

Table 1

US Military Assistance and R.O.K. Investment*

In Defense Spending (In Millions of Dollars; fiscal year)

	71	72	73	74	75	76	77	78	79	80	81
Grants	541.2	515.2	338.8	100.6	82.6	59.4	5.5*	800	0	0	0
Loans	15.0	17.0	24.2	56.7	59.0	126.0	286.5	275	275	275	275
% of GNP	4.4	4.9	3.1	4.0	4.7	5.1	6.2	6.5	5.6		
$(U.S.)	387	442	461	734	914	1,525	2,005	2,586	3,219		

*This sudden increase in grant aid is the compensation derived in terms of military equipment for the Phase II withdrawal of American troops.

The trend of decreasing grant aid and increasing loan financiing, down in the table, actually began in the mid-60s. The US began, in that time period, to encourage the R.O.K. to increase its own military budget. In fact, the US attempted to suspend the MAP program in the mid 1960s. However that decision was suspended due to the ROKs dedication of 15,000 fighting troops to support the predominately American war effort in Vietnam. In the post-Vietnam period American grant aid began a rapid reduction, based primarily on the American perception of the increased economic strength

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* MAP assistance from 1953 to 1971 totaled more than $3 billion while the sale of surplus defense articles amounted to about $200 million from 1946 to 1971 (7:173).

of Korea. American economists generally agreed that a R.O.K. investment of less than 8-10 percent of GNP was possible without endangering the impressive growth rate of the Korean economy.

Korean officials did not share the opinion of the American economists. The R.O.K. noted that American economic grants (PL 480) provided goods for resale in the Korean market place. Revenue from the resale provided two-thirds of the R.O.K. defense dollar into the early 1960s.* In spite of strong R.O.K. objections, U.S. political pressures prevailed and Korea reluctantly accepted the new American thrust toward Foreign Military Sales (FMS) on a credit basis. As a result, PL 480 and other U.S. commodity assistance was reduced from $176 million in 1961 to $20 million in 1969. The grant portion of PL 480 was finally ended in 1971. (7:162). However, to avoid confusion, it should be noted that PL 480 continued to be closely associated to R.O.K. military and economic development after 1971. Firstly because Title II of PL 480 remained in effect. Title II provided long term (10-40 years), low interest loans for commodity assistance. Secondly, the 1971 Kennedy Agreement provided Title I grant commodity assistance quid pro quo for textile import restrictions instituted against the R.O.K. by the U.S. (15:48).

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*In 1960 the resale of PL 480 commodities provided enough revenue to support 96 percent of the R.O.K. defense budget.

Table 2

Funds Provided Under all Economic Assistance Programs 1961 - 1969

(In Millions of Dollars)

	1961	1962	1963	1964	1965	1966	1967	1968	1969
Supporting Assistance	175	93	82	75	71	60	45	30	20
Development loans	3	23	28	29	49	80	61	30	20
Public Law 480	44	59	90	81	73	55	73	75	186
Technical Assistance	11	11	5	3	3	5	9	6	5
Total	261	207	230	208	191	252	178	180	220

Source; Investigation of Korean-American relation P-163

In retrospect, American grant aid to the R.O.K. was instrumental toward the development of a self-sufficient economy. Although ambiguous policy statements and policial issues resulted in delays to the Five Year Plans and MOD plans the significance and success of the American assistance is undeniable.* Once the R.O.K. economy achieved relative self sufficiency in the 1960's, the emphasis in the 1970's was placed on the development of a defense industry to form the cornerstone for Korean self-defense. The necessities and considerations for the development of a R.O.K. defense industry will be addressed in the succeeding and final section of this chapter.

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*The $1.5 billion MOD plan was originally scheduled for completion in 1975. However, Congress intervened on the basis of human rights violations by the R.O.K. and reduced the administration's request for FY 1975 from $238 million to $145 million. Subsequently the MOD plan was not completed until 1977.

FMS ENVIRONMENTS

The R.O.K.'s arms trading program has been, and is most dependent upon the United States as a source of both weapon systems and military doctrine. American weapon sales, grants, and military support in general have formed the baseline for Korean military doctrine and tactics. A prime example of this was provided by the forward defense concept near the DMZ as developed by Generals Stillwell and Hollingsworth in 1974. Another example is the R.O.K.'s and United Nation Command's (UNC) reliance on American nuclear weapons as a deterrent to North Korea. It is anticipated that an American nuclear threat on the Korean Penninsula will be maintained for quite some time into the future to compensate for the perceived qualitative inferiority of the South Korean military arsenal.

FMS sales to the R.O.K. will be the primary method for increasing the quality and quantity of weapons in the R.O.K. arsenal. The previous section briefly mentioned the U.S. initiated trend of decreasing grant aid and, conversely, increasing FMS sales to the R.O.K.G. From 1966-1978 total FMS sales to the R.O.K. reached $4.4 billion (11:-).

Beginning in the mid 1970s the increasing use of FMS became particularly evident. These trends are illustrated by the following table.

The reader will note that during the 1955-1968 time period, when Korea was emphasizing economic development, FMS sales agreed to were less than one-onehundredth of the dollar value of FMS agreements entered into from 1968-1978. It can be seen that once Korean economic growth

Table 3

FMS Sales Include Commercial ($ Millions)

	FY1955-FY1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	FY1955-FY1978
FMS Agreement	1,799	3,093	---	393	8,760	1,594	100,260	214,284	616,459	656,088	390,265	1,992,995
FMS Deliveries	1,713	716	1,904	408	371	2,378	13,318	70,893	161,384	178,847	414,336	264,268
Commercial Sales	0	0	0	69	685	187	1,090	3,550	19,909	77,169	66,668	169,327
Economic Grant Aid		121,000	76,600	47,000	21,000	17,200	12,100	9,500	2,900	500	0	

Source: FMS Facts Published DSAA Dec 1978.

occurred during the mid-1970's the dollars expended on FMS increased dramatically while at the same time economic and grant aid assistance from the U.S. decreased abruptly. Korea's increased participation in FMS as well as the type of weapon systems purchased have over the years contributed greatly toward what is now called the Total Force Concept.

The contribution of Korean FMS purchases toward the TFC is vividly demonstrated by the following list of examples of missile and aircraft purchases (11:-).

TABLE 4
Major Weapon Acquisition

Weapon System	Quantity/Total $ Value (mil)	Delivery
General Dynamics F-16	180 max./NA	Approx. 1980
McDonnell Douglas F-4D	18/$46.5	
McDonnell Douglas F-4E	37/$215	1976-1977
Northrop F-5A	70/NA	1965-1971
Northrop F-5E	30/$77.4	1975-1977
Bell UH-1B	20/$1.1	1977
Bell UH-1H Huey Cobra	48/$36.7	(Proposed) 1977
Improved Hawk, NIM-23B	152/$16.0	1974-1975
TOW, MGM-71	600/N/A	1976
SS Harpoon, AGM-48	120/$80.4	1978-1979

Source: DMS Market Pg 3-11

The table is by no means intended to be an exhaustive list of Korean aircraft and missile FMS purchases. However, in conjunction with the table on the previous page it serves to underscore the extensive commitment of the R.O.K. to the TFC and the revised American philosophy toward military assistance in the middle and late 1970s.

Indeed with the support provided by American aid and FMS credits, the R.O.K. has made monumental progress toward economic solvency and military strength. In realistic terms, however, a long road lies before the R.O.K. before FMS acquisitions and indigenous military production will provide the force strength needed to deter the threat posed by North Korea.

THREAT AND FORCE COMPARISON

North Korea has been in a constant state of military escalation since the division of the Korean Peninsula at the 38th Parallel by the United States and the Soviet Union in 1945. North Korea is known to have completed preparations for invasion of the R.O.K. and appears to be awaiting only an opportune time to initiate the attack.

Public statements by the radical North Korean President, Kim Il Sung, have served as testimony to the aggressive aims of the North. Shortly after the fall of Saigon in the Spring of 1976 Kim visited Peking and boosted,..."(W)e are all prepared for war... what we will lose in a war will be the truce line, and what we will gain will be the unification of the fatherland."

The most frightening aspect of this boisterous Kim Il Sung for South Korea is the fact that he has supported his threats with purposeful and effective military planning and action. In their Masters Thesis on U.S. Security Assistance to South Korea: Assessment of Political, Economic, and Military Issues from 1975 to 1979, Captains Bolles and Perkins cite proof of the offensive nature of North Korean forces (4:122).

1. The North Korean production and import of offensive weapons such as tanks, armored personnel carriers, and mobile artillery.

2. North Korean storage of 30 to 90 days of supplies would allow the DPRK to endure for a short period without Soviet or PRC aid.

3. North Korean divisions along the DMZ are in a constant state of readiness and can attack with no additional preparations.

4. Forward hardened airfields and large bunkers to house long-range artillery have been built along the DMZ.

5. Three North Korean tunnels under the DMZ have a capacity for passage of 3,000 - 5,000 troops per hour. Additional tunnels have not been discovered, but are believed to exist.

The extent of activity on the part of the North Korean "war machinery" is dramatized by the enumeration of principle military advantages of the North. These advantages as listed below were presented by U.S. Senators Humphrey and Glenn in their report to the Senate entitled, U.S. Troop Withdrawal from the R.O.K.

NORTH KOREAN MILITARY ADVANTAGES

1. more ground combat divisions
2. greater ground firepower
3. more armored vehicles
4. superior naval forces
5. more air assets
6. better air defense system
7. greater logistics capability
8. greater military defense industry
9. capability of launching a surprise attack
10. ability to concentrate attacking forces
11. extremely short distance from Seoul
12. more commando-type forces
13. closer proximity of major allies

The most feared of the North Korean capabilities is that of launching a surprise attack. U.S. commanders in Korea have little confidence in the ability of the Combined Forces Command to detect a North Korean surprise attack for two reasons. First, even though the activity of North Korean forces is centered along the DMZ, security precautions are so extreme that very limited information can be obtained by the allied forces with present equipment and facilities. Secord, as just mentioned, the physical assets available for intelligence gathering in Korea are not effective enough to penetrate the North Korean security net. The combined effects of extremely effective security measures, superior ground, naval and air forces pose an ominous threat to South Korean survival.

The following tables provide a detailed comparison of North and South Korean ground, naval, and air forces composition. The depth and breadth of North Korean forces clearly establishes the military advantages enjoyed by the North.

The Ground Forces Composition table clearly indicates the North Korean firepower advantage in numbers of tanks and self-propelled artillery.

TABLE 5

Ground Forces Composition[1]

North Korea	South Korea
600,000 troops[2]	580,000 troops
40 infantry divisions[2]	19 infantry divisions
12 infantry brigades	7 tank battalions
2 tank divisions	1 mechanized division
5 tank regiments	1 marine division
3 motorized infantry divisions	2 marine armored divisions
3 reconnaissance brigades	2 air defense brigades
3 antiaircraft artillery brigades	30 artillery battalions
10 antiaircraft artillery regiments	5 special forces brigades
5 airborne battalions	2 SAM brigades with HAWK and Nike Hercules
3 SSM regiments	1 SSM battalion with Honest John
20 artillery regiments	880 tanks
2,600 tanks[2]	

[1]North Korea also has a strong paramilitary force consisting of 40,000 security forces and border guards, and civilian militia of 1-2 million with small arms. South Korea has 1.1 million reserves and approximately 1 million personnel in the Homeland Defense Reserve Force for rear-area security.

[2]Statistics for these categories reflect Army and CIA revised estimates released in January 1979 (1:2).

Source: The Military Equation in Northeast Asia, p. 38; and Air Force Magazine, December 1978, "The Military Balance 78/79," p. 102.

TABLE 6

Naval Forces Composition

North Korea	South Korea[1]
27,000 troops	32,000 troops
15 submarines	9 frigates
3 frigates	9 destroyers
21 large patrol craft	10 coastal escorts
18 fast patrol boats with Styx SSM	23 coastal patrol craft (10 large)
100 motor gun boats	8 fast patrol boats with Standard SSM
157 motor torpedo boars	5 fast patrol boats without guided missiles
90 landing craft	11 coastal minesweepers
	22 landing craft

[1]The ROK also has 25,000 naval reservists.

Source: Air Force Magazine, December 1978, "The Military Balance, 78/79," p. 102.

As in ground force composition, the North enjoys superiority of naval forces. Particularly significant are the numbers of submarines, fast patrol boats, motor torpedo boats and landing craft. The motor torpedo boats of the North could provide fast and effective support of an amphibious North Korean attack behind the "forward defense" developed by Generals Stillwell and Hollingsworth.*

*The forward defense concept will be discussed in more detail later in this Chapter.

TABLE 7

Air Forces Composition

North Korea	South Korea[1]
45,000 troops	30,000 troops
655 combat aircraft	276 combat aircraft
3 light bomber squadrons with 85 IL-28s	15 fighter-bomber squadrons (37 F-4D/E, 35 F-5A, 126 F-5E, and 48 F-86F)
13 fighter ground attack squadrons (20 SU-7, 320 MIG-15/-17	1 reconnaissance squadron with 10 RF-5As
10 interceptor squadrons (120 MIG-21, 110 MIG-19)	1 antisubmarine warfare squadron with 20 S-2Fs
250 transports	1 search and rescue squadron
60 helicopters	34 transports
110 trainers	103 trainers
antiaircraft atoll air-to-air missiles	54 helicopters
3 SAM brigades with 250 SA-2 missiles	sidewinder and Sparrow air-to-air missiles

[1]The ROK also has 55,000 air force reservists.

Source: Air Force Magazine, December 1978, "The Military Balance 78/79," p. 102.

The composition of North Korean Air Forces again demonstrates at least numerical if not also qualitative superiority. The North possess more than a two-to-one advantage in fighter aircraft, anti-aircraft artillery pieces and missile launchers as well as an extensive radar net with an early warning capability. Another considerable threat is presented by the 250 transports of North Korea as 220 of them are AN-2 guerilla paratroop aircraft. Again, in conjunction with the naval amphibious attack, paratroops could be used by the North to initiate a flanking action against the forward defense forces of the Combined Forces Command (CFC). A successful maneuver of that nature almost certainly assures the fall of Seoul before American and Korean forces could react in defense.

It was the sudden realization in mid-1979 by the U.S. of the actual and surprising imbalance of forces on the Korean Peninsula that caused President Jimmy Carter to suspend his troop withdrawalplan. On June 21, 1979 Defense Secretary Harold Brown publicly stated, "there clearly is a larger North Korean force than had been thought a couple of years ago." Secretary Brown was merely acknowledging intelligence assessments which upgraded the threat to the R.O.K. Armed Services and Intelligence Committee testimony revealed that North Korea has an army of approximately 600,000 troops - not the 450,000 as had been previously believed. In addition, infantry and tank strength assessments were revised upward (17:-).

In January of 1978, Senators Humphrey and Glenn had already recognized that, "(t)he military balance has shifted from rough parity in 1970 to a definite advantage for the North in 1977. The principal advantages

for the North today lie in ground weapons (tanks, artillery, mortars), quantity of fighter aircraft and quantity of naval combat vessels." In addition, Humphrey and Glenn foresaw the danagers of the South Korean inferiority. "If surprise were attained, South Korean defenses would be in serious jeopardy and the possibilities of breakthrough to Seoul would be increased."

The Senators recognized, as do all military strategists, that the most significant military disadvantage of the R.O.K. is North Korea's excellent prospect for achieving success in a surprise attack attempt against Seoul. Approximately one-fourth of the R.O.K. population is concentrated in Seoul some 50 kilometers south of the DMZ. American Army Generals Stillwell and Hollingsworth recognized this weakness in 1974. The two Generals decided a perimeter defense of Seoul was impractical and frutile against the North Korean capability. Therefore, Generals Stillwell and Hollingsworth developed the "forward defense concept." The forward defense concept is designed to defeat a North Korean attack before it reaches Seoul. The concept has several important consequences.

"It has accentuated the need for strong, indepth reinforced defensive positions, massive firepower, mobility, excellent communications, tactical air support, better air defense, and substantial warning time before an attack (15:39).

Presently, many of the ingredients necessary to make the forward defense concept work are provided by American forces. With respect to an eventual turnover of the forward defense to the R.O.K., most American military officials feel that there are five essential ingredients which at the present time cannot be transferred to the R.O.K.:

1. Intelligence capability for improved warning time
2. massive firepower to support the forward defense concept
3. physiological deterrent of nuclear weapons
4. U.S. 2nd infantry role as a "tripwire" for American involvement in the event of North Korean attack
5. U.S. truce keeping role

However, the rapid development of the Korean economy and military could very well permit Korean assumption of those responsibilities within the short term future. There appears to be just one exception, the deterrent value of nuclear weapons. In view of the American nuclear non-proiliferation policy, and past actions by the United States to halt South Korean attempts at developing a nuclear weapon capability; it is extremely likely that American armed forces must continue to supply this vital ingredient for the forward defense concept.

R.O.K. NEEDS AND ITS FORCE IMPROVEMENT PLAN

Because of the termination of U.S. grant aid in 1976 the R.O.K. was forced to formulate its own five year Force Improvement Program (FIP).* The FIP calls for a $5 billion investment by the R.O.K. from 1976 to 1980. This thesis cannot include an indepth presentation of R.O.K. military needs nor the detailed contents of the FIP due to the sensitive and classified nature of most of that information. Therefore, this discussion will deal with the overall concepts of the R.O.K. defense industry and the difficulties facing the R.O.K. as it deals with the need of making rapid military improvements while still attempting to maintain economic growth.

The R.O.K. has come to the stark realization that American public and political pressures exert tremendous influence on U.S. foreign policy decisions. In the realization, therefore, that U.S. aid is by no means guaranteed to help meet future crises, the R.O.K. has embarked on an ambitious military force improvement program. To finance this effort all Koreans have been asked to make sacrifices. On January 18, 1980 President Choi requested that R.O.K. citizens practice frugality and cooperation as the R.O.K. makes its economic commitments to develop an effective counter-threat to North Korea.

However, a single burning question remains in the minds of R.O.K. government and military officials. Which aspect of military power or capability should be developed first, and how much? The U.S. I Corps Commander has stated that the R.O.K. should concentrate on obtaining

greater numbers of anti-armor weapons, tanks, artillery, hardened communications and command and control facilities (15:43). Senior U.S. observers, however, feel that these requirements are unlikely to be met by 1981, which is the date set by President Carter for re-evaluation of the troop withdrawal program. Other defensive improvements required include better forward defense positions, early mine field implantment, improved road nets, more comprehensive logistics capability, better intelligence capability, better air/land battle coordination, and enhanced battlefield flexibility on the part of the R.O.K. general staff (15:43).

The five year FIP (1976-1980) was designed to remedy these observed shortcomings. The R.O.K. dedicated $5.5 billion to the FIP. In addition $3.5 billion was provided to meet R.O.K. military needs through the foreign exchange market through 1985. However, American advisors calculate that mearly $8 billion would be required to satisfy Koreas military needs through the foreign exchange. From the Korean standpoint, the amount of investment is not nearly so critical as the need to avoid any delays in implementing necessary programs. Perhaps the most critically important of the necessary programs is that of developing an effective defense industry in the near future.

ROK DEFENSE INDUSTRY

The United States had discouraged development of Korean defense industries up into the late 1960s because of concern for South Korea sacrificing its economic growth in order to develop the capability to attack North Korea (7:74). In the early 1970s, the U.S. began

to encourage limited R.O.K. defense production. There appeared to be two primary reasons for the American change of philosophy. First, political pressure in America was building to reduce the U.S. ground troop commitment. Second, the four Five Year Plans of the R.O.K. had succeeded in developing a strong and growing economy. Both developments, from the American point of view, seemed to indicate that assumption of a greater portion of the defense burden by the R.O.K. was in order (4:113).

President Park vigorously launched the R.O.K. into the defense industry with the purpose of catching-up to North Korean defense production. Both President Park and the Korean people saw this as an opportunity to reduce the possibility of the Korean Peninsula ever again being used as a battlefield for major powers (15:51).

For its part, the Carter Administration held similar hopes of avoiding future involvement on the Korean Peninsula. One aspect of the Carter Administration's encouragement included the prompting of South Korea to increase the share of GNP investment for defense purposes. The following table summarizes and compares both South and North Korea expenditures for defense. The reader should take note of the significantly higher dollar level of South Korean expenditures while the percent of GNP expended is nearly one-half that of North Korea. This statistic vividly demonstrates the economic success of the R.O.K.

President Carter further encouraged the R.O.K. to develop managerial and quality assurance in its industry by promoting the sale of technical assistance, production equipment and manufacturing licenses. The U.S. Department of State has noted an increasing trend since 1978 of Korean

TABLE 8

Comparisons of Defense Expenditure 1976-1979

		R.O.K.	North Korea
Total Defense Expenditure	1976	1,500	n,a
	1977	2,033	1,000
	1978	2,586	1,200
	1979	3,219	1,231
$ Per Head	1976	42	NA
	1977	58	60
	1978	70	70
	1979	85	70
% of GNP	1976	5.1	N/A
	1977	6.2	11.2
	1978	6.5	10.5
	1979	5.6	11.4

Source (Air Force Magazine Dec 1979, P-133, (4:114)

purchases of technical data packages for the production of defense systems

The increased purchase of technical data packages by the R.O.K. should promote more efficient management and production of future military hardware, as well as improve programs begun prior to 1978.

The list below summarizes some of the milestones of coproduction efforts between the U.S. and the R.O.K.

1. 1969, M-16 rifle production (Colt Mfg. Co.): This program was the first instance of major licensing coopration to establish a U.S. defense industrial plant in the R.O.K. State Department pressure was brought to bear on Colt executives who resisted the move for fear of potential leaks through industrial espionage.

2. 1972, Air Defense Missiles (Gold Star Precision Industries): The JUSMAG-K provided assistance to develop depot maintenance capabilities for the HAWK and Nike Hercules missile system. The program saved the R.O.K. several million dollars over life cycle costs due to decreased labor costs, reduced transportation costs, and utilization of locally produced repair parts. This program led to the first Korean produced surface-to-surface missile, a modifed Nike Hercules, in 1978 (7:100)

3. Tanks and other military vehicles: The R.O.K. is rebuilding tanks and manufacturing spare parts for the M-47 and M-48 tanks which are no longer in production in the U.S. Heavy trucks and jeeps are also manufactured as spin-offs from the expanding R.O.K. civilian automobile industry.

4. 1973, Artillery and Infantry weapons (Watervliet Arsenal): The R.O.K. is producing 155mm and 105mm howitzers, M-72 rocket launchers, 4.1 in mortars, 81mm and 60mm mortars.

5. 1976, Helicopters (Hughes Helicopter Corp): In June 1976 the R.O.K. entered into a $50 million coproduction agreement for the military version of the 500 MD light helicopter equipped with TOW missiles.

6. Patrol boats (hyanda and Tacama): The R.O.K. builds its own high speed coastal patrol boats.

7. 1979, F5E/F (Northrop Corp): In the fall of 1979 the U.S. Congress studied Letter of Offer for coproduction of approximately

68 F5E/F fighter aircraft.

The Letter of Offer for coproduction of the F5E/F aircraft is perhaps the most significant development in U.S. - R.O.K. FMS to date. This effort requires close attention and judicious analysis in order to ensure its success. Chapter 3 will be devoted in its entirety to the analysis of the proposed F5E/F coproduction.

CHAPTER SUMMARY

No country save Vietnam has received more extensive support from the United States than the R.O.K. The commitment of American forces in a deterrent role has enabled the R.O.K. to implement economic development programs that have resulted in an astonishing GNP growth rate of approximately 10 percent per annum.

The grant aid program influenced extensively the development of R.O.K. military doctrine, tactics, training, and education. The development of the Korean economy and the Total Force Concept developed by the United States brought about the end of grant aid in 1976. The Total Force Concept emphasized strength through partnership with American allies. As a result the R.O.K. was forced into assuming a greater share of its own defense burden. Although this concept is more burdensome for Korea, Korean officials must understand that the R.O.K. is but one piece in the international defense puzzle; and that the United States does not possess unlimited resources for maintaining the defenses of the world's free nations. Therefore, the U.S. has taken steps to:

1. transition all security assistance into FMS,
2. encourage maximum industry-to-industry participation in co-production programs,

3. recover all costs (without making a profit) of conducting FMS and security assistance programs, and
4. avoid becoming an arms merchant for the free-world if at all possible.

The initial burden to the R.O.K. of this changing American philosophy has been great in economic terms. However, the R.O.K. has already begun to realize such benefits as decreased life cycle costs of systems produced at home, a stronger export market, and increased international prestige.

CHAPTER III

DESCRIPTION OF THE F-5E/F COASSEMBLY PROGRAM

Background and Environment

Chapter 2 explained the evolution of U.S. policy for military weapons sales/transfers to the Republic of Korea. The R.O.K. experienced a great deal of frustration and confusion with respect to the direction to take for implementing its Force Improvement Program (FIP). However, in the early 1970s Korea came to accept the change in the American philosophy of military assistance and resigned itself to increased investment for military development.

In May 1975 the R.O.K Government (R.O.K.G.) made the decision to begin developing an indigenous aircraft industry. The nucleus of this industry was designed to consist of helicopter and fighter aircraft co-assembly/co-production programs. The U.S. contenders were the Bell Helicopter Company (206B Jet Ranger) and Hughes Helicopter (500MD Defender). Both aircraft are light weight (1400 and 1200 pounds respectively), multi-purpose helicopters capable of carrying payloads equal to their own weights.

In February 1976 Hughes Helicopter and Korean Airlines (KAL) signed a contract for KAL coassembly of the Hughes 500MD helicopter equipped for the TOW missile system. The project was funded entirely on an industry-to-industry basis with the exception of some gun components, which were purchased through FMS. The Hughes 500MD coassembly program is proving to be highly successful and provides three essential commodities for the R.O.K.G.:

1. a practical military weapon,

2. technical and managerial skills needed to develop an indigenous aircraft industry, and

3. a product for third country sales.

All three commodity outputs serve to promote Korean economic and military self-sufficiency.

As a result of programs such as the Hughes 500MD, the scope of Korea's aviation industry is expanding reapidly.* Therefore, co-assembly/co-production of a high performance aircraft has been determined by the R.O.K. to be the next logical step for expansion and refinement of its aircraft industry. In pursuit of this goal in June 1976 the R.O.K. Ministry of National Defense (MND) sought U.S. government approval for a co-assembly program of the General Dynamics F-16 lightweight fighter. Approval/disapproval was delayed because the R.O.K. failed to adequately define the proposed scope of Korean participation in the co-assembly program. In March 1977 the R.O.K.G. submitted a new, this time, direct procurement request (not a request for a co-assembly program). Indications are that the request will receive U.S. Secretary of Defense approval, however, review of the request is ongoing with no final disposition available as of this writing.

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*The Hanjin Group, of which KAL is a subsidiary has formed the Korean Institute of Aeronautics to collect data and develop technology for Korea's aviation industry. KAL will be in charge of the Institute. In addition to this duty, KAL has been tasked with the responsibility for development of an airframe industry in Korea. At the same time, Samsung Precision Industry has been given the responsibility for development (an) aircraft engine manufacturing capability for the nation (22:2)."

In addition to the F-16 the R.O.K.G. has sought co-assembly programs for other advanced American fighter aircraft; most noteably the A-7, A-10, and F-5.

The A-7 and A-10 have been eliminated by the R.O.K. upon further analysis of R.O.K.A.F. requirements. Although a need exists for close air support and ground attack aircraft, a more urgent need exists for a more advanced air superiority fighter capability. for that reason the R.O.K. pursued F-5 coassembly possibilities. (22:3).

Co-assembly of the F-5 appeared to be a logical step in view of the R.O.K.A.F. need and the F-4 depot maintenance capability developed by the R.O.K. Korea has acquired extensive depot level repair capabilities for the F-4 aircraft at its Kim Hae and Taegu facilities. Testimony to this is the fact that Korea was awarded a contract by the United States to conduct depot repairs for all U.S. F-4 fighters in the Southeast Asia. However, the major stumbling blocks to F-5 co-assembly appeared to be the extensive investment required by the R.O.K. to produce this advanced and complex weapon system coupled with President Carter's reluctance to promote Korean production of an aircraft which might encourage introduction of more advanced fighter aircraft by the Soviet Union in North Korea. (23:14).

President Carter enunciated his revised arms export policy in his Presidential Decision Memorandum (PDM) number 13. Wherein he declared that the United States would not be responsible for introducing advanced weapons technology into any region of the world. PDM-13 therefore became

the stumbling block for any Korean coproduction/coassembly attempt. Then in mid-1979, the Directorate of International Program (PAI) of USAF recommended to President Carter that the R.O.K. be permitted F-5E/F co-assembly because (14:-):

1. The R.O.K. has been a long standing and supportive ally of the U.S. since the Korean war,

2. The time has come to promote Korean economic development by releasing more advanced technology,

3. The supportability of the F-5 would be improved by Korean co-assembly, and

4. F-5 coassembly by the R.O.K. would have negligible impact on the American economy since selling the aircraft in kit form employs the same number of people and produces practically the same amount of revenue as would full-scale assembly of the aircraft.

In October 1979 President Carter concurred with DOD and approved R.O.K. coassembly of the F-5E/F. The program consists of a combination of FMS and direct commercial programs. It must be noted at this point that the R.O.K. considers the F-5E/F program a compromise for its part because of the limited contribution of the F-5E/F to deal with the expected future threat of the North Korean Air Force. For example; Pentagon sources revealed that 60-100 North Korean pilots may be receiving flight training in Libya in the Soviet built MIG-23. The MIG-23 is generally accepted as a superior aircraft to even the F-4D/E, and therefore much superior to the F-5E/F (4:112). However, this subject will be a matter for the analysis of the F-5E/F coassembly program to be presented in Chapter 4.

PROGRAM DOCUMENTATION

The Memorandum of Understanding (MOU), often referred to as an "umbrella agreement," is one of the most difficult government-to-government agreements to complete. The MOU is furthermore a critical document in any FMS case in that it bounds the scope of the program. (13:-). Generally included in the MOU are the rights and obligations of the two governments, scope of the program, cost and financial terms, security, authority for the settlement of disputes, protection of proprietary rights, documentation, and other provisions. Despite the fact that at this writing there has been no official MOU agreement reached, a discussion of major sections is in order.*

PROGRAM IMPLEMENTATION: U.S. AND R.O.K. RESPONSIBILITIES

Although in general the U.S. encourages American companies to enter into direct industry-to-industry agreements with foreign governments, in the case of the F-5E/F coassembly program the U.S. elected to use an intergovernment agreement. However, only one-fifth or one-sixth of the dollar value of the program will be FMS with the remainder contracted directly between the R.O.K. and Northrop. The FMS portion will include primarily GFE (5-Fs), SE, non-recurring R&D and spare parts. The industry direct

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* The draft copy of the MOU was forwarded to the R.O.K.G. in early February 1980 (22:-).

portion consists primarily of Northrop management and operations responsibility. The U.S. government retains total control of the FMS program as well as the industry direct portion by reserving approval authority over the Northrop/R.O.K. contract.

U.S.G. responsibilities for the coassembly case will be to provide GFE, spare parts, Aerospace Ground Equipment, Support Equipment, special equipment for quality assurance and inspection, and some non-recurring R&D. While the primary U.S.G. responsibility will be to provide hardware, the Northrop Company will provide management, operation and performance monitoring of the aircraft coassembly. The responsibility of the R.O.K.G. will most likely be that of the typical FMS coassembly customer; to finance at its own expense all in-country construction, labor, capital investment items, raw materials and operating costs (3:38).*

During the negotiation process the R.O.K. is expected to press for Northrop responsibility to also provide production liscensing agreements, production tooling, technical data and assistance, company furnished equipment, training for R.O.K. technicians and managers, and other necessary goods and services. On the part of Northrop, the company is expected to seek and obtain Korean agreement that all components for coassembly be purchased from U.S. company sources unless otherwise agreed to by the U.S.G. and R.O.K.G. Both governments will agree to exemption of all equipments, machinery, tools, materials, and other parts from customs duties.

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*R.O.K.G. responsibilities may be shared by KAL if the R.O.K. accomplishes its desire, to contract the sale between Northrop Corp. and KAL (R.O.K.A.F. Source)

SCOPE

The scope of the program at this time will be for the coassembly of 68 F-5E and F-5F aircraft (total). It will include fabrication or assembly of certain portions of the nose section, tail section, and wing leading edge for 36 F55Es and 32 F-5Fs.

TRANSFERS TO THIRD PARTIES

The U.S. will in all likelihood exercise its standard policy of requiring the R.O.K. to obtain written permission before Korea would be able to sell, transfer title, or otherwise make available to any person, organization, or other government the F-5E/F aircaft, spare parts, or production equipment that was purchased, furnished, or coassembled/produced (3:40). This policy is designed to protect not only the control of the USG over the proliferation of American weapons but also the American companies entering into foreign sales agreements and foreign governments who may desire to enter into industry-to-industry or government-to-industry agreements in the future.

TECHNOLOGICAL ADVANCEMENT DISCLAIMERS

The technological advancement disclaimer is used by the USG to indicate U.S. non-support or approval for the establishment of an independent, modern aircraft production capability in the R.O.K. If exercised, this clause would directly conflict with the Korean long-term objective of developing and advanced aerospace industry. This potential area of conflict will be presented and analyzed in detail in Chapter 4.

R.O.K. - NORTHROP CONTRACT

It is not clear at this point in time whether the R.O.K. MND or KAL will be Northrop's counterpart. However, contract negotiations are expected to begin in August 1980 (22:3). Northrop will negotiate with its Korean counterpart about issues such as; liscense agreements, technical assistance, packaging and crating, preservation, marking, responsibilities for employees, and provisions to protect Northrop's rights. Another contingency to be included in the contract will be the extent of responsibility of Northrop in the event of late GFE deliveries by USAF and the resolution process for disputes arising from this contingency.

R.O.K. - Northrop contract content and MOU content, will for all intents and purposes provide the foundation for the F-5E/F coassembly program. The program itself will be presented next.

THE F-5E/F PROGRAM

President Carter approved the sale and coassembly program on October 16, 1979 (22:4). The program which consists of 36 F-5Es and 32 F-5Fs was coordinated approved by Congress in December 1979. The U.S. Memorandum of Understanding was scheduled for release by the U.S. State Department in January 1980, with negotiations anticipated to begin by end of month April or May 1980. Figure 2 illustrates the progression of the F-5E/F coassembly sales agreement. (22:5).

Figure 2 - F-5E/F COASSEMBLY PROGRAM PROGRESSION

Late 1978:	ROK requested F-5 coproduction.
Jan 1979:	Northrop proposal for 68 F-5 coassembled aircraft to ROK.
2 Aug 1979:	MND officially request LOA for coassembly of F-5.
16 Oct 1979:	Presidential approval granted. SECDEF directs preparation of LOA for FMS portion of program.
Nov 1979:	ROK draft MOU forwarded to SECDEF, HQ USAF, and American Embassy in Seoul. ROK MND requests comparative data for FMS vs DCP.
Dec 1979:	Congressional approval of sale. Draft MOU anticipated for release sometime after 7 Jan 1980.
CURRENT STATUS: (as of 14 Feb 80)	Awaiting release of draft MOU. MOU negotiations expected to begin within one month after release of draft MOU.
Expected Outcome:	MAR MOU Signed by MND Signed by DSAA

The Northrop proposal for the coassembly effort proposed five stages for implementation versus the originally anticipated seven stages. The reasons for changing to a five stage program are two-fold:

1. The 1979 R.O.K. industry survey conducted by Northrop revealed significant progress since Northrop's 1974 survey. In 1974 Northrop found Korea incapable of entering into a aircraft coassembly program for an estimated 40-60 fighter aircraft. In 1979, however, a tremendous improvement was noted in facilities, technology, and quality of personnel. This improvement, in the determination of Northrop planners, eliminated the need for the more gradual and drawn-out seven stage program. (20:-).

2. It is the desire of the R.O.K., the U.S. government, and the Northrop Corporation to keep R.O.K. costs to the minimum. Elimination of the two stages is expected to save the R.O.K. six to seven million dollars from the cost of the program. (20:-).

The five stage process spans from July 1982 until June 1986. KAL and Samsung Precision Industries will progress from the final assembly operations of stage one to the fabrication of forward fuselage and detailed parts in stage five. The R.O.K. has already developed the capability to perform most of the stage one through stage four tasks in connection with its F-4 depot maintenance and the production of the Hughes 500 MD (20:-). Northrop planning documents reflect the following schedule of tasks and events for each of the five stages:

Stage I: Activities in this stage will be restricted to a total of five F-5F two seat trainers. The major tasks for KAL will be final

assembly and support for flight operations of the aircraft. Final assembly includes major parts of the aircraft such as the nose section, center and aft fuselage compartments, the wing, nose landing gear, canopy, armament launcher rail, etc. Additionally, the R.O.K. expects to join aircraft sections, prepare the aircraft for flight, append loose items, and conduct testing and delivery functions (3:56). It is also possible that stage I will include the coproduction of the fuel drop tank for the aircraft.

Stage II: Twenty-seven F-5F ship sets will be shipped to the R.O.K. between January 1982 and August 1985. Stage II will include systems installation and major assembly tasks on an increasing work level in order to expand facilities, acquire more equipment, and increase the work force. Systems installations will include electrical wiring and component parts, air conditioning, ducting, control system mechanisms, and hydraulic lines in the fuselage shells. Installations to the wing will include the main landing gear, ailerons, control system mechanism, and access panels (3:57). This stage will be most instrumental for developing F-5 installation techniques.

Stage III: Stage III will consist of delivery of four F-5E aircraft in 1983 for combined Stage I and Stage II work.

Stage IV: Three F-5E aircraft will be delivered in the latter part of 1983. The R.O.K. will perform Stage III work plus structural assembly of the forward fuselage. Work in this stage includes gun bay assembly, side panel installation, nose undercarriage installation, aft bulkhead and floor structure assembly.

Stage V: The final stage will begin in 1984 and will consist of the delivery of 29 F5E aircraft through June 1986. Stage V includes Stage III and IV level work plus the fabrication of forward fuselage detail parts for the 29 final aircraft. Parts included are the wing leading edge extension, bonded rudder, and the nose gear.

In general the five stages begin with a relatively low level of effort to establish rudimentary procedures and know-how, and culminate in the fabrication of some forward fuselage structures by the R.O.K. Tables 9 and 10 provide a useful summary of the five stages, major tasks, and timeframe for delivery by type of aircraft. In addition to the stages for implementing the F-5E/F coassembly program major emphasis is placed on engineering, quality control, and the payment schedule. These issues will significantly determine the degree of success achieved by the five stage process and will be discussed next.

ENGINEERING AND MANUFACTURING

Critical to the program will be R.O.K.A.F. ability to incorporate mission or environment peculiar engineering changes and to acquire manufacturing technical data to support R.O.K. requirements for tools, parts, and assemblies required for coproduction. Northrop has retained design responsibility for this coassembly program. Line item 010 of the LOO provides that the contractor (Northrop) incorporate non-recurring common engineering changes. This clause protects the R.O.K.A.F. from design and manufacturing defects discovered. In addition, the R.O.K.A.F. enjoys some prospect for being able to incorporate some peculiar engineering changes should they be required. However, the USAF must provide its concurrence in such instances (21:7).

Northrop will also furnish technical data required to produce other tools, parts, and assemblies required for coproduction. Although R.O.K. manufacturing engineering will consist primarily of developing detailed plans for fabrication, installation, and assembly of detail parts; it is essential that technical data be provided in order that the R.O.K. will not be forced into the reverse engineerng mode of the early seventies. As Senators Humphrey and Glenn have pointed out, the reverse engineering concept employed by Korea has significantly hampered the development of effective quality control procedures in R.O.K. industry (15:51).

QUALITY CONTROL PLAN

From the standpoint of developing an effective industrial military capability in the R.O.K. the most important objective of the F-5E/F co-assembly program will be to develop an effective quality assurance program for advanced aircraft systems production. The R.O.K. will invest in excess of one million dollars in quality control equipment, training, and facilities in this program.

Northrop will collocate a coproduction quality control manager to coordinate the total quality control effort between Northrop and the R.O.K. In addition, the one million dollar package will include evaluation, approval, and monitorship of the contractor quality assurance program by the Air Force Plant Representative's Office (AFPRO). The AFPRO will perform inspections of fabrication and assembly operations at the contractor's facility. He will in general assure that the contractor is in compliance with the planning, procedures review, procedures evaluation, product verification inspection, and corrective action requirements of MIL-STD 29858.

TABLE 9 ROK ASSEMBLY STAGES

F-5F	I	O FINAL ASSEMBLY OPERATIONS O FLIGHT OPERATIONS
	II	O STAGE I PLUS SYSTEMS INSTALLATIONS AND MAJOR ASSEMBLY
F-5E	III	O COMBINED STAGE I AND STAGE II WORK AS NOTED ABOVE
	IV	O STAGE III WORK AS ABOVE PLUS STRUCTURAL ASSEMBLY OF FORWARD FUSELAGE
	V	O STAGE III AND IV PLUS FABRICATION OF FORWARD FUSELAGE DETAILS AND OTHER SELECTED ITEMS

SOURCE: NORTHROP BRIEFING - 8 JAN 1980

TABLE 10 COASSEMBLY SCHEDULE

IN-COUNTRY DELIVERIES

	1982 1 2 3 4	1983 1 2 3 4	1984 1 2 3 4	1985 1 2 3 4	1986 1 2 3 4
STAGE I (F-5F)	2 2	1			
STAGE II (F-5F)		1 2 1 3	3 3 3 3	3 3 2	
YEARLY TOTALS (F-5F)	4	8	12	8	
STAGE III (F-5E)		1 1 2			
STAGE IV (F-5E)		1 2			
STAGE V (F-5E)			3 3 3 3	3 3 3 3	3 2
YEARLY TOTALS (F-5E)		7	12	12	5

SOURCE: NORTHROP BRIEFING - 8 JAN 1980

As mentioned previously, the U.S. is very concerned for a minimal cost program for the R.O.K. A poor quality control program will eventually impact both life cycle costs of the program as well as the schedule for completion which in turn translates to increased costs. Therefore, the roles of the R.O.K., Northrop, and AFPRO quality assurance personnel cannot be over-emphasized for this program.

PROGRAM COST AND PAYMENT SCHEDULE Since the MOU has not been released as of this writing a firm figure for the American asking price of the F-5E/F program is not available at this time. Informed sources estimate the total program will cost between 500 and 600 million dollars (14:-). It has been established that $108 million of the program will be in the form of FMS, with the rest being conducted industry to industry. Table II provides a cost breakdown for the FMS portion and Table I2 illustrates the FMS payment schedule.

With respect to program cost, the R.O.K. is primarily interested in being assured of paying a fair price and receiving and equitable schedule for payment. It is difficult to determine the current market price of an F-5E/F since recent buyers have been foreign countries and each has tailored the content (spares training, base construction) of its program to its own particular needs. The most recent USAF buy of F5s was in 1977 for its "Aggressor Squadron." In FY 1977 the USAF paid approximately $4.1 million per aircraft. Today analysts estimate the cost to be closer to $6 or $7 million, with some guessing close to $8 million (2:-)

Table II IMS Portion of Cost

Item		Quantity	Unit Cost	Total Cost
1.	GFE (F-5E)	36	0.204M	7.344M
2.	GFE (F-5F)	32	0.209M	6.688M
3.	F-5E R&D (Non-Recurring)	36	0.120M	4.320M
4.	F-5F R&D (Non-Recurring)	36	0.249M	7.968M
5.	Quality Assurance for F-5E	36	0.016M	0.576M
6.	Quality Assurance for F-5F	32	0.016M	0.512M
7.	Audit for F-5E	36	0.012M	0.432M
8.	Audit for F-5F	32	0.012M	0.384M
9.	GFE Spares	1	N/A	1.100M
10.	Engineering Change	N/A	N/A	5.008M
11.	Peculiar Support Equip	1	N/A	0.300M
12.	Standard Support Equip	1	N/A	19.764M
13.	Non-Standard Support Equip	1	N/A	5.565M
14.	Production Line Support Equip	1	N/A	1.072M
15.	a. Spare Part for Support	1	N/A	2.7PM
	b. Aircraft standard spare	1	N/A	25.89PM
16.	Aircraft Non standard	1	N/A	13.450M
17.	Case Mgt, Hq USAF	1	N/A	0.050M
18.	Case Mgt, AFSC	N/A	N/A	0.600M
19.	Case Mgt AFLC	N/A	N/A	0.273M
20.	PCSH cost			905,730
21.	Administrative			3,502,640
22.	Asset Use			258,780
23.	Transportation			2,380,000

Source: Letter of Offer, page 1 thru 5.

Table 12 - FMS PAYMENT SCHEDULE

PAYMENT DATE	AMOUNT ($ MILLIONS)
Initial Deposit	2.9
15 September 1980	5.4
15 December 1980	9.0
15 March 1981	18.9
15 June 1981	16.3
15 September 1981	15.3
15 December 1981	11.2
15 March 1982	7.4
15 June 1982	5.5
15 September 1982	4.1
15 December 1982	2.8
15 March 1983	1.5
15 June 1983	.9
15 September 1983	.6
15 December 1983	.8
15 March 1984	1.1
15 June 1984	1.8
15 September 1984	1.8
15 December 1984	1.2
15 March 1985	.3
	108.8

Source: Letter of Offer - Page --A-7

Therefore, if the proposed price of the F-5E/F program is $600 million then the cost per aircraft to the R.O.K. would be approximately $8.8 million. There is presently some apprehension on the part of the R.O.K.G. for the prospective per unit cost of the aircraft. However, it is not possible to project the impact of the package cost on the proposed program until such costs are known. Suffice it to say that the R.O.K. is in need of a program of a reasonable cost with a payment schedule that will not endanger other military spending and economic stability.

PROGRAM MANAGEMENT

Not only are financial considerations critical for a successful coassembly program, so also are the managers and management structure to be identified and developed. The U.S. and Northrop have developed many FMS and industrial sales programs. However, for the R.O.K. this will be the initial attempt at coassembly of a fighter aircraft. The U.S. has existing organizations for weapons acquisition which interface in FMS programs. In stark contrast, the R.O.K. has just recently begun to develop an aero industry Research and Development with the establishment in May 1978 of the Korean Institute of Aeronautical Technology (KIAT). (19:11).

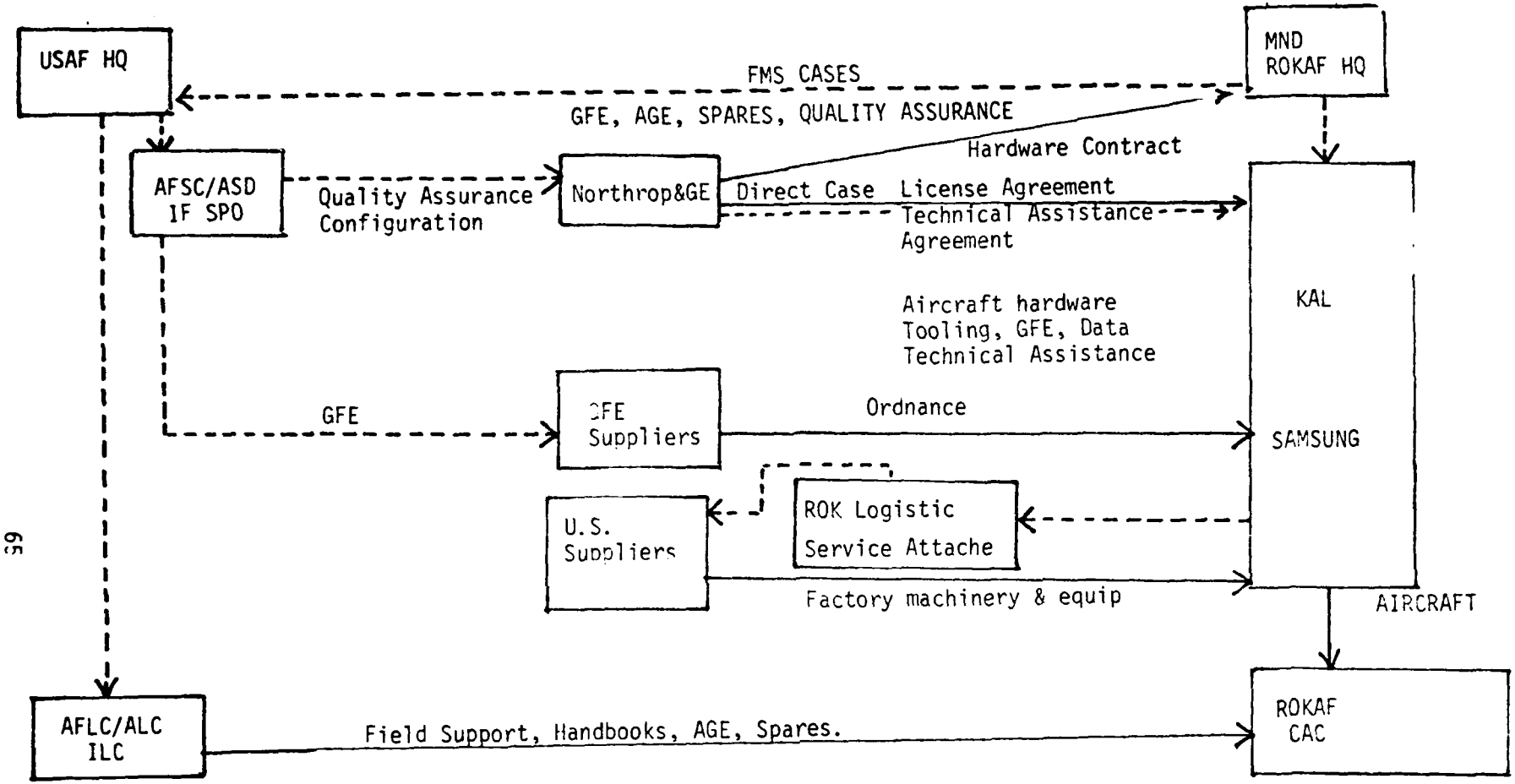
Additionally, most of the MND and R.O.K.A.F. organizations have no counterparts for American agencies such as the Air Force Systems Command (AFSC) consisting of Staff and Systems Program Offices (SPO), and AFLC including the International Logistics Center (ILC). The R.O.K. has not yet adopted program management or matrix management organizations for the acquisition of military systems.

The challenge to Korean Government, Air Force and Aeroindustry efforts will be to coordinate with U.S. government, Air Force, and aeroindustry efforts. This coassembly program will involve larger and a greater number of R.O.K.A.F. organizations than any previous coassembly or coproduction effort. Figure 3 shows the organizations that will be tasked to provide a quality acquisition program for the R.O.K.A.F. Combat Air Command. To effectively accomplish this purpose the R.O.K.A.F. must organize new offices to provide the interface of activities shown in Figure 3.

As the program manager, the Northrop Corporation is responsible for quality assurance and configuration control of the coassembly aircraft. Additionally, USAF commands have been delegated responsibility and authority to act as overall managers of the program at DOD direction.

The USAF Aeronautical Systems Division (ASD) of the Air Force Systems Command is the primary organization to interface with Northrop on program matters. Within ASD the International Fighter System Program Office (IFSPO) and the AFPRO are key participating agencies. The IFSPO is responsible for the initial planning efforts for all facets of acquisition including site activation and spares and training planning. The primary function of the AFPRO remains, as mentioned previously, to perform quality assurance surveillance for compliance with contractural requirements.

A second major Air Force Command required to support the F-5E/F co-assembly program is the Air Force Logistics Command (AFLC). Within AFLC, key agencies are the International Logistics Center (ILC) and the Air Logistics Center (ALC). The ILC coordinates and supports the ALCs for providing follow-on support for goods and services. In this program the



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Goods and services

Contract or agreement

Figure 3 Overall Organization Relationships (3-72).

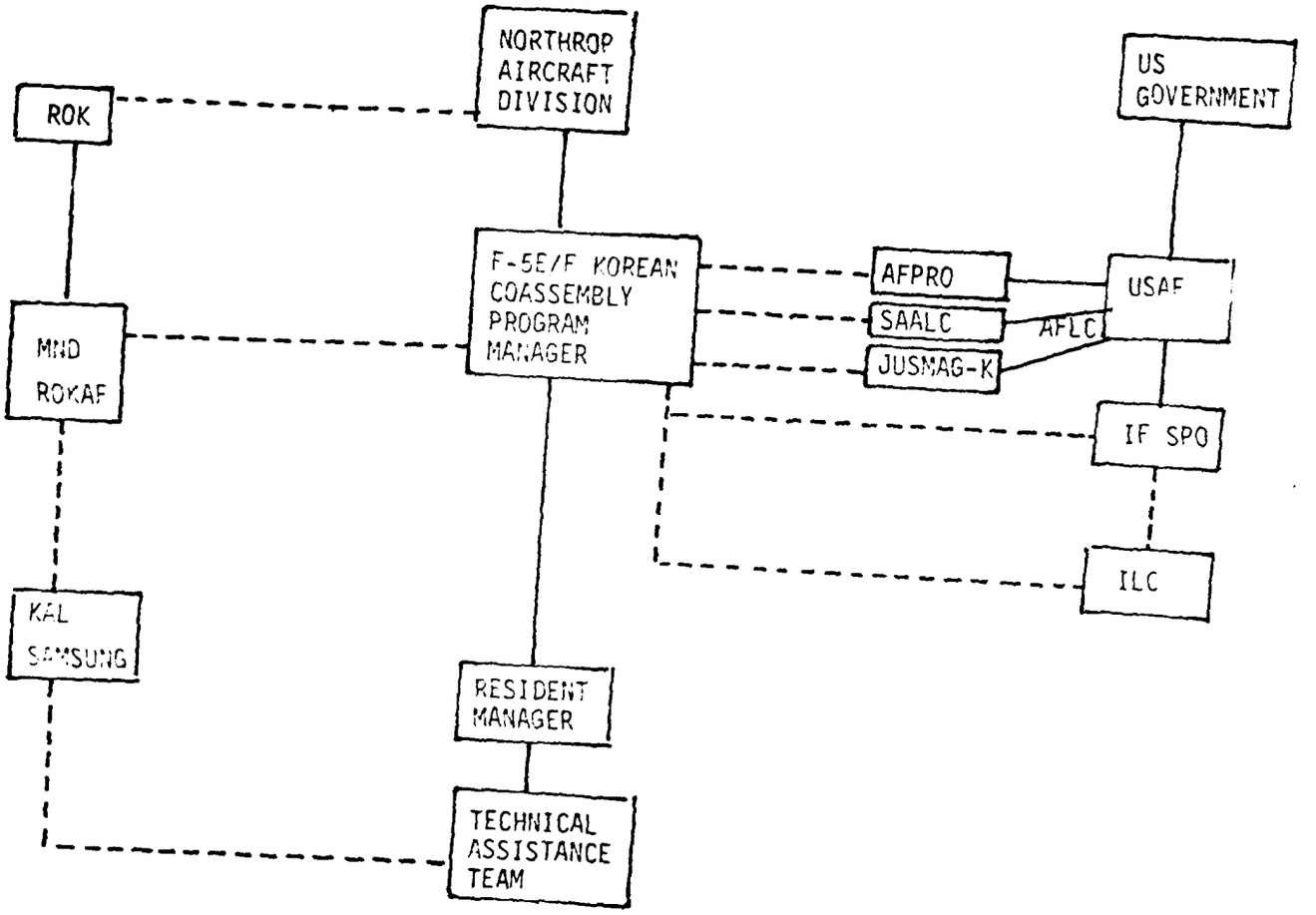


Figure 4. Northrop's Interface Relationship (3-79)

primary ALC providing support will be San Antonio ALC (SA-ALC). SA-ALC will manage the program insuring complete Support Equipment (SE) and spares support for the R.O.K.

Once all coordination and order processing has been effected spares, SE, field support, handbooks, etc. are forwarded to R.O.K.A.F. CAC. The only exception in this case being engine parts and spares which are sent to Samsung Industries for assembly and installation.

The entire process described above is directed and implemented by the Northrop Program Manager. Figure 4 provides a view of the lines of authority and communication within which the Program Manager will integrate the coassembly program.

SUMMARY

The R.O.K. has experienced success in the relatively simple coproduction efforts with the Hughes 500 MD. The next logical step is to develop an advanced fighter aircraft production capability. The F-5E/F coassembly program is designed, on the part of the R.O.K. to accomplish that in part.

Although a final MOU has not yet been signed and a contract with Northrop has not yet been negotiated, the program has been developed in preliminary form to such a degree that it provides a realistic skeleton for analysis. The entire sale will probably consist of 68 F/5E/F ship sets at a preliminary cost estimate of $500 - $600 million. Implementation will be in 5 steps beginning in July 1982 with simple assembly of F-5F trainers, to June 1986 with production and fabrication of some forward fuselage parts.

Overall program management has been assigned to the Air Force while day-to-day program management will be accomplished by Northrop. In view

of the fact that this is the R.O.K.'s initial attempt at complex fighter aircraft coassembly there will be two management responsibilities of critical importance for successful program completion:

1. Quality assurance procedures must be effectively implemented and enforced.

2. Organizational interfaces between and amongst the R.O.K., Northrop, and USAF agencies; including ASD and the IFSPO, and AFLC and the ILC and the ALCs.

The following chapter will analyze the program and structure presented herein by clearly developing some of the implied questions raised here and their potential for contributing to, or detracting from, successful program implementation and completion.

CHAPTER IV

PROGRAM ASSESSMENT

The analysis herein is based on the prognosis for the coassembly program to meet or promote the realization of R.O.K. military and economic objectives. Integral to this assessment will be the development of criteria for success and expected problem areas for program implementation. As a final means for evaluating the F-5E/F coassembly program, coassembly programs by Japan and the ROC will be used to gain insights of coassembly program issues and problems.

ROK OBJECTIVES

ROK objectives with respect to the F-5E/F coassembly program are interrelated. There appear to be three major objectives: 1) to provide additional deterrent effect against North Korea 2) promote economic and military self-sufficiency and, 3) provide a means for transition from a labor intensive export economy toward a precision technology export industry.

It is not as clear at this point how much contribution F-5E/F coassembly can make toward R.O.K. military and economic self-sufficiency. However, that is another primary objective of the R.O.K.G. with respect to the coassembly program. An aggressive and viable aircraft industry would provide military as well as comparable civilian economic development. The ultimate goal of the Korean aero industry is to design and develop a Korean aircraft by the late 1980s. A four-phase plan has been developed to achieve that capability (2-7).

1. Train technicians for aircraft maintenance.

2. assemble aircraft under liscense agreements with other countries,

3. develop domestic production of aircraft components, and

4. develop and produce a Korean aircraft either independently or jointly with another nation.

R.O.K. realization of the four phase plan will depend greatly on the technology transfer effected by the coassembly program and is closely related to the final R.O.K. objective. The final benefit of aircraft coassembly the R.O.K. desires to gain is that of transforming its labor intensive export economy into a technology or precision export industry by late 1980. Korea will have to make significant advances in metal forming, milling, and electronic component production in order to achieve this final objective (re-ChapterII).

CRITERIA FOR SUCCESS

The South Korean objectives just presented now permit the formulation of criteria by which to judge the success of the proposed F-5E/F co-assembly program. R.O.K. and US officials would be well advised to analyze program potential against the criteria prior to finalizing program scope and content.

1. Level of technology transfer: The level of technology transfer permitted by the USG and the Northrop Corporation is an absolutely essential determinant for dictating the rate and complexity of Korean technological advancement in the aircraft industry. This is an area perceived by the author as requiring extensive negotiation. A R.O.K.A.F. survey team interviewed ROC officials with respect to Taiwan's F-5E co-production program. The survey team learned that the Northrop Corporation

was not deeply intent to provide the ROC extensive technological information. However, the level of technology transfer will be based on not only the Northrop's contract and U.S.G. policy, but also R.O.K.'s program accomplishing capability with thorough planning and coordination.

2. Spillover to Civilian Economy: This criterion is a function of the level of technology transfer. The more extensive the transfer of advanced technology the more valuable the spillover effect will be to R.O.K. industry. A potential side effect of the spillover effect will most certainly include national morale. Improved and new consumer products are concrete and real things which people can see and touch. The effect is an immediate perception of increased living standards, increased morale, and increased support for the government. National support in R.O.K. has historically been a key element for the unified stand against North Korea.

3. Quality Assurance Procedures: The reader is reminded of the findings of Senators Humphrey and Glenn presented in Chapter II. The Senators found that a major stumbling block in Korean industry is the lack of adequate procedures and knowledge [15-5]. No degree of advanced technology will compensate for poor or non existent quality control procedures. Conversely, the more advanced the technology the more important becomes quality assurance. Any fighter aircraft, no matter how advanced the design, that is not reliable will not successfully deter North Korea. Nor will technological spillover uplift civilian industry and morale when the product is unreliable. For these reasons quality assurance development must also be used to evaluate the success of the F-5E/F program.

4. US - R.O.K. Security Relationship: This final criterion is proposed under the assumption that any effort entered into by two or more parties is beneficial if all parties involved benefit. The F-5E/F coassembly program should promote American security needs on the international level. A strong Korean Air Force and viable aircraft industry is bound to contribute positively to the Total Force Concept developed by the U.S. In addition, a successful program will promote the development of a militarily independent South Korea. Economic and military burdens would be decreased for the US, while the R.O.K. would acquire increasingly greater control of its military and economic destiny.

The author has not proposed, nor does he intend to do so, that these criteria for success are all inclusive. The intent was to provide some key elements for consideration by the USG, Northrop and the R.O.K.G. for implementing the coassembly program and in the end judging its worth to the US and the R.O.K.

TECHNOLOGY TRANSFER

Technology transfer is in actuality a form of security assistance in itself. Because of the US Arms export policy and the Carter administration's controls (Chap. II), the U.S.G. may stipulate that"..... modern aircraft production technology is not included in this coassembly program (3-40)". In view of this, the extent of technology transfer may be limited to the same extent as that provided to the Republic of China (ROC) in the 1975-1977 coassembly program of 140 F-5E aircraft. The R.O.K.G. conducted a survey of the Taiwan

coassembly program in January 1980. A key outcome of that investigation revealed that a great hindrance to technology transfer in that case (ROC opinion) was the presence of an unqualified Northrop technical assistance team and quality control residents (18-).

The Northrop technical assistance team and quality control residents will determine to a great degree the benefits realized from the relatively limited technology transfer anticipated by the R.O.K. In the industry-to-industry technical agreement, Northrop will provide all of the technical processes for parts fabrication, engineering specifications, special materials to be used, assembly line procedures, etc. The R.O.K. will most likely rely on the Northrop team to provide three types of technology;(12-50)

1. system specific technology - that information acquired by a firm in the design and manufacture of a specific item,

2. firm-specific technology - the non general knowledge possessed by a firm that cannot be attributed to experience with any specific item, and

3. general technology - that common store of learning used within the industry or profession.(12-50).

In the opinion of the R.O.K.G. Northrop could possibly provide a great deal of general and firm specific technology in the early stages of the F-5E/F coassembly program because the R.O.K. possesses only a rudimentary aircraft industry. The concern for the R.O.K. is however, that Northrop may be interested in protecting much of its technology for competitive reasons as well as for compliance with the Carter Administration's position of avoiding introduction of advanced technology in the region. In the end, Northrop's willingness to sell aerospace technology to the R.O.K. will be

determined by whether or not the technology is packaged in such a manner that the U.S.G. will approve its sale and the financial inducements proposed by the R.O.K. (2-).

The process of technology transfer and its cost are also dependent on the type of technology involved and the form of its embodiment. General technology will be more costly to transfer than firm-specific knowledge; and firm-specific knowledge will most likely be more expensive than system-specific knowledge, because the latter is often protected by patent rights, or emboided in designs, drawings, toolings and other physical forms (12-50). The license payments and royalties involved in the R.O.K. - Northrop contract are particularly significant because Northrop's willingness to transfer technology will depend on the extent to which the knowledge is vested with the attributes of the property.

ECONOMIC SPILLOVER AND R.O.K. AERO-INDUSTRY

Military technology in itself is valuable to improve the ability of a country to cope with an actual or perceived threat. However, the true value to the development of a country is the application of military derived technology in the civilian industrial sector. This phenomenon is called the technology spillover effect. The R.O.K. looks forward to the spillover effect for advancing industrial techniques and capabilities.

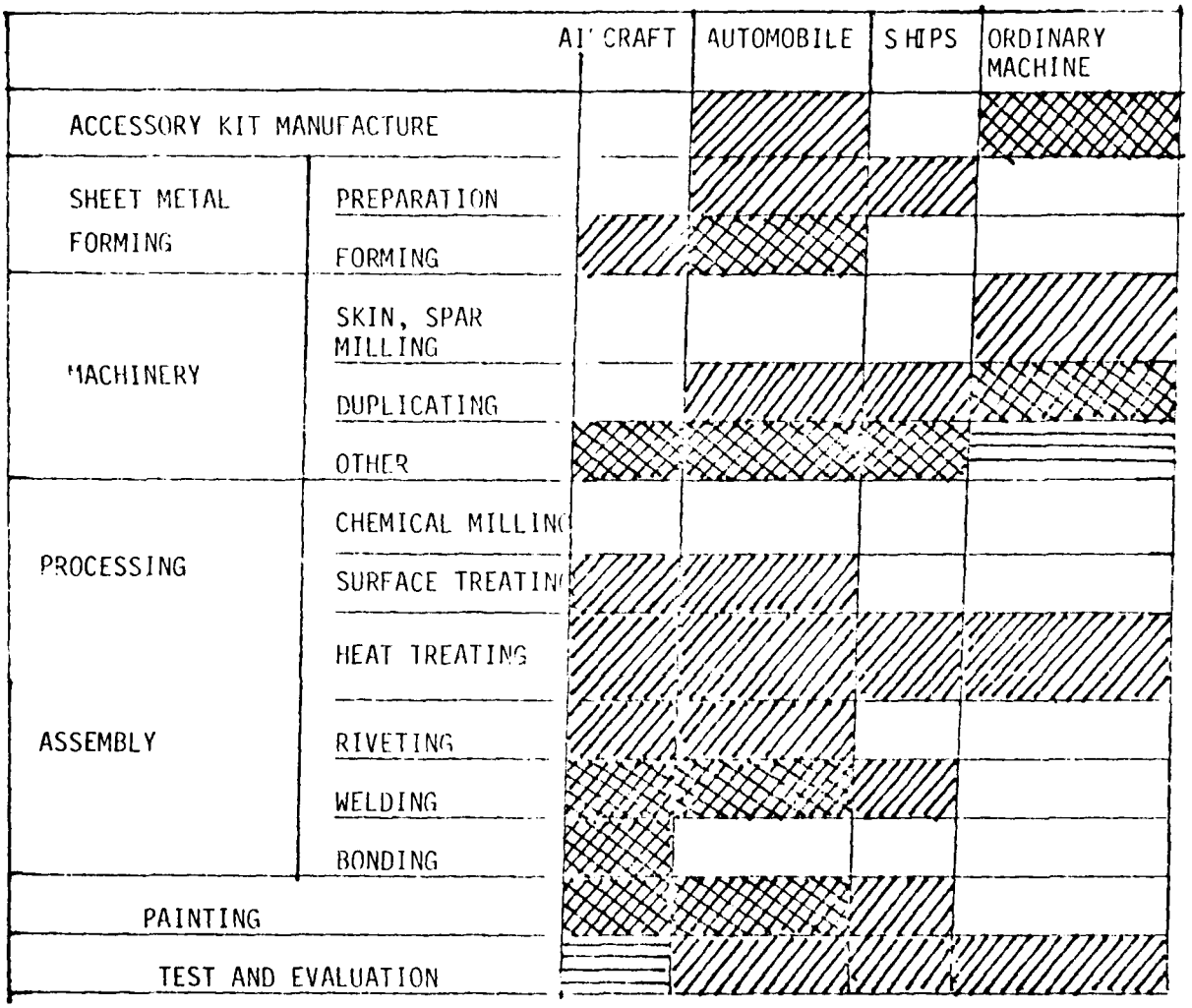
In order to take full advantage of any technology spillover the R.O.K. must recognize the present abilities and future goals of the R.O.K. aero-industry. A KIAT survey, the Northrop industrial survey of the R.O.K.. and R.O.K.A.F. officials have taken stock of the Korean aero-industry and are in agreement of its capability for technological advancement.

The overall ability for manufacturing a Fighter aircraft fuselage is extremely limited with helicopter fuselage assembly and related maintenance. The following table shows that industry sheet metal forming and machining

technology are inadequate to manufacture a fighter aircraft made from metals such as aluminum and titanium alloys which may require chemical milling and duplicating processes (19-155).

KIAT experts agree that Korea could develop an in-country fuselage manufacturing capability within four or five years after completion of the F-5E/F coassembly program if full assembly technology is made available to the R.O.K. during the program (19-160). The second table presents a prioritized schedule for developing the in country fuselage and wing manufacturing capability proposed by the KIAI. The schedule interestingly enough parallels closely the 5 stages of coassembly developed by Northrop. With the assumption of that Northrop planning is realistic, it would also appear that KIAI expectations are realistic and that the R.O.K. could indeed attain a fuselage and wing manufacturing ability by 1990.

Figure 5 CURRENT CAPABILITY FOR FUSELAGE MFG. TECHNOLOGY



Legend.

large scale application of equipment available

partial application of equipment available

possible application of equipment available

no capability

Source: Korean aircraft industry development program - Nov 1979 Korean Institute of Aeronautical technology.

Figure 6 FUSELAGE AND WING MANUFACTURING: DEVELOPMENT PRIORITIES

SECTION \ PRIORITY		PRIORITY 1	PRIORITY 2	PRIORITY 3	PRIORITY 4
FUSE-LAGE	FORWARD	SIDE PANEL NOSE UNDER CARRIAGE DOORS	FLOOR STRUCTURE LOWER STRUCTURE	NOISE PIECE CANOPY WIND SCREEN	
	CENTER		PANEL ASS'Y FLOOR ASS'Y BULKHEAD	FLOOR ASSY AIR DUCT	LANDING GEAR HINGE STRUCTURE KEEL BRAKE, SLAP SUPPORT
	AFT		PANEL ASS'Y	GAS DUCT	TAIL FILM STABILIZER
WING	SURFACE AND RIB			A:RELM SPOILER RIB SURFACE	SANDWITCH STRUCTURE INTEGRAL STRUCTURE
	SPAR			FRONT AND REAR SPAR	

SOURCE: KIAT study Report: 167

In addition to developing airframe and wing technology, Korea has proposed for itself a schedule for engine technology development. The following table shows a prioritized schedule for manufacturing jet engine components in three stages. The schedule has a goal of in-country jet engine production within 6-8 years after implementation. Once again, this is purely dependent upon the extent of engine manufacturing knowledge that GE is willing to sell to the R.O.K.

Figure 7 SCHEDULE FOR JET ENGINE MANUFACTURING

	1 STAGE	2 STAGE	3RD STAGE
	1-2 YEAR	3-5 YEAR	6-8 YEAR
1 COMPRESSOR SECTION			
Minor element	*		
Front Frame		*	
Casing			
Vane	*		
Drive shaft		*	
Rotor blade		*	
Disc		*	
2 COMBINATION SECTION			
Minor element	*		
Casing	*		
Combination liner		*	
3 TURBINE SECTION			
Minor element	*		
Blade	*		
Wheel		*	
Nozzle	*		
4 EXHAUST SECTION			
Minor element	*		
After burner casing	*		
Diffuser casing			*
Flameholder			*

SOURCE: KIAT STUDY REPORT

When one considers the major cost drivers of aircraft production and development, it has been found that engine and fuselage costs comprise approximately 50 percent of total aircraft system costs while the other 50 percent is accounted for by accessory kits (19-203). A major portion of the accessory kit is electrical and communications equipment. The R.O.K. expects that technological spillover in this area holds particularly bright prospects for the Korean economy as well as promising decreasing costs for the cost-driving elements of advanced aircraft.

Indeed the aero industry, as a technology intensive industry will effect improvement in system engineering, electronic engineering, metallic materials engineering, hydraulic machinery and tooling engineering. (19-12). The cumulative impact of the benefits of these technologies is expected to lead a transition from the R.O.K.'s presently labor instensive export industry to a technology and capital intensive industry.

COMPARISON: JAPANESE COPRODUCTION

The author fully concedes that no two coassembly efforts for two different countries are likely to yield exactly the same results. On the other hand, the author also feels there is significant value in surveying the impact of similar program efforts in countries whose industrial capabilities were similar to the ROK's upon entry into a coproduction/coassembly effort for sophisticated aircraft.

In the 1950's Japan began to develop a modern aircraft industry by entering into coassembly and coproduction agreements with the United States. The emphasis again was to begin with less complex systems and as the "learning curve effect" developed progress into state of the art systems.

Japan began its efforts with the T-33A, F-86F, and P2V7. When a relatively sophisticated aircraft industry had evolved Japan coproduced the then advanced F-104J in 1961.

In the Japanese programs, U.S. firms provided designs and information at relatively low cost. Royalties and fees ordinarily amounted to about 5 to 7 percent of the purchase price of the item liscensed (12-178). One U.S. executive stated, "We were paid to put them in business, and we gave them everything we had (12-83)." The U.S. provided blueprints, design drawings, planning papers, specification and all process specifications. Japan had no difficulty in getting any documents desired. In addition, they obtained considerable "know-how" from the representatives of the various American companies.

A 1967 Rand Corporation study (Aircraft Procurement and Coproduction Strategy) of Japanese coproduction concluded that most system specific technology can be transferred in written form, and that the transfer of general and firm-specific technology requires a process of general education and occupational training with more personal interaction. It is unclear at this stage of the Korean coassembly program of the F-5E/F how much emphasis will be placed on aircraft industry technology transfer, and which type of technology would receive the emphasis.

If the R.O.K. can accept Japan's precept that technology transfer was primarily effected by access to and availability of certain design and planning documents and specifications then emphasis on system-specific technology would seem a logical choice. General technology transfer would appear to require less emphasis in the case of the R.O.K. in the F-5E/F coassembly stage for several reasons:

1. Japan entered into coproduction for aircraft which it did not have in its active inventory and therefore had developed no level of familiarity with the aircraft whatsoever. Korea has, however, had the F-5A aircraft in its active inventory since 1965 and the F-5E since 1975. The R.O.K.A.F. therefore has had operating and maintenance capability for the F-5 for 15 years.

2. The R.O.K. has already procured and produced extensive tooling and machinery for the F-5E in support of depot maintenance requirements. Much of this tooling technology and capability is expected to be directly transferrable to the F-5E coassembly, whereas Japan was obliged to develop its tooling technology from scratch for coproduced aircraft. Examples of the R.O.K. capability are:

A. Landing gear system: The R.O.K. is producing the brake system, tire assembly, and gear retraction mechanism. Wheel disk and shock street production requires refinement (19-214)

B. Tires: All aircraft tires are being produced internally (19-220)

C. Hydraulic system: Items in production include plunger pumps, staffa valves, directional valves, actuating cylinders, hoses, and brakes. Variable volume pumps, pressure regulators, relief valves and high pressure hoses could be produced within a few years (19-226).

D. Communication equipment: Communication and auto pilot systems could be produced in-country because of extensive capabilities in VHF, UHF, and DF communications systems.

E. Aircraft instruments: This is the most deficient area in Korean manufacturing capability. It is estimated that the R.O.K. could produce 95 percent of its aircraft instrument requirements by 1985 (19-).

3. The final reason general technology transfer does not seem to require as much emphasis as system-specific technology is rather intangible. The Korean people are an intensely proud and patriotic people. They perceive an intense and constant threat from North Korea. In coping with the North Korean threat the Korean people have historically demonstrated great intensity and dedication for the support of their government and its policies. A national declaration encouraging technicians and managers to apply ingenuity to improve upon available general and firm-specific technology would almost certainly be universally accepted in Korean industry. Behavorial scientists would contend that people motivated to such a degree will tend to acquire general technology much of their own volition.

The intent of the preceding agreement was not to exclude the desireability for the R.O.K. to purchase firm-specific and general technology, but merely to emphasize the difference in capabilities between the R.O.K. and Japan prior to their respective entries into the advance aircraft production arena. The comparison serves to isolate the primary area which should be of R.O.K. concern for effecting technology transfer in the F-5E/F coassembly effort. The following section will deal more specifically with concerns and possible problem areas in the entire spectrum of the R.O.K. coassembly of the F-5E/F.

COMPARISON: ROC COASSEMBLY

The following chart provides an illustrative depiction of the similarities between the proposed R.O.K. coassembly program and the ROC F-5E coassembly program, 1973-1980 (19-). The author notes that in addition to extensive similarities between the programs of the two countries, both countries entered coproduction at similar technological and economic thresholds. Based on these similarities the author makes a recommendation for the R.O.K. to conduct in-depth study of the ROC coproduction and its results in order to extrapolate expected outcomes of the ROK program.

ROK-ROC PROGRAM SIMILARITIES

1. Overall economic levels of both countries similar.

	ECONOMIC GROWTH		EXPORTS	$PER HEAD
	1978	1979	Latest 3 Months	
ROC	12.9%	8.5%	3,877M$	1430
ROK	11.6%	9.0%	4,177M$	1210

2. ROC PRE-COPRODUCTION EXPERIENCE

   .USAF F-4 Depot Maintenance,

   .UH-1H coassembly, 1969-1980

   .12 F-5B purchased in 1973 (opera tional experience prior to coassembly of F-5E).

3. PROGRAM EQUIPMENTS PROVISIONS SAME IN BOTH CASES. EXCEPTION: ROC ENGINE WAS GFE WHEREAS ROK ENGINE IS INDUSTRY TO INDUSTRY PROVIDED.

4. BOTH PROGRAMS IMPLEMENTED BY SIMILAR 5-STAGE PROCESS.

5. ROC PROGRAM WAS EXTENDED BY 40 AIRCRAFT. ROK ANTICIPATES PROGRAM EXTENSION BEYOND THE 68 SCHEDULED AIRCRAFT. (19-)

EXPECTED PROBLEM AREAS

The author has mentioned many positive aspects for the F-5E/F coassembly program in this and previous chapters; not the least of which were the strong background of the Northrop Company in providing coassembly and coproduction programs to foreign governments and the extensive F-5A and F-5E operating and maintenance background of the R.O.K. However, this is the ROK's initial attempt at a program requiring advanced aircraft technology on a large scale. The author has considered managerial and planning requirements as well as industrial and economic planning factors to develop five likely areas of difficulty for implementing the F-5E/F coassembly program. The author also points out that these problem areas constitute only his perception of areas expected to experience difficulty if thorough planning and management are not exercised.

1. PLANNING AND ORGANIZATION

One of the truly critical areas is the planning phase for program implementation. It is absolutely essential that the ROK and MND fully comprehend the substance and implications of the Northrop plan. The obvious language barrier is perhaps the least dangerous element for consideration. The more subtle differences such as social and cultural morals, management-worker relationships, overall logistical capabilities, national worth of the effort are all variables that pose significant deltas between American industry and Korean industry. U.S. and Northrop planners as well as ROKG and MND officials must be fully conscious of these deltas as plans are developed and prepared for execution*

---

* i.e. The management-worker relationship in Korean industry is rigidly structured. Management provides direction to labor but does not provide for nor promote feedback from labor. The end result is, a management structure that operates in a situational vacuum.

No amount of planning will be effective unless the premises upon which it is based are valid.

Another form of planning must consider the dichotomy of the acquisition organization between the U.S. and the R.O.K. The American team consists of an extensive centralized organization comprised of Northrop, USAF, AFSC, AFLC and other vendors. The Korean participants are on the other hand decentralized, recently established (KIAT), and inexperienced in fighter aircraft coassembly. KAL will be the in-country nerve center of the program. The airline is a non-government agency and may conceivably experience great difficulty in integrating the coassembly effort with the U.S. team and R.O.K.A.F. Lines of communication and coordination must therefore be thoughtfully planned and provided.

2. MANAGEMENT AND COORDINATION

This problem area is an adjunct to the previous area mentioned, but is somewhat different in scope. A management interface arena must be established to deal with specific program related issues rather than blanket and arbitrary requirements. With the multiple organizations and agencies involved responsibilities must be clearly defined. When problems arise, it is important that face-to-face meetings of concerned parties are held to expeditiously formulate mutually agreeable solutions (9-). The emphasis for management communication and coordination must therefore be provided not only for inter-country agencies but must also be well developed for intra-country problem solving. When working coordination with two countries, there are possibly cause problem due to cultural difference for instance R.O.K. is more rank oriented rather than desk oriented.

3. MATERIAL SHORTAGES AND DAMAGES

Delays in GFE and CFE materiels and damages upon receipt of shipments in-country could significantly impact program schedules and costs. Lead time for most GFE items ranges from 20 to 29 months. In some cases GFE lead time is five months longer than the lead time for the identical item as CFE (21-). In other coproduction programs it has been found...

> "(w)hen the late equipment is delivered, it is generally more difficult to install it in the airframe because other assembly work has been done and other equipment has been installed (3-88).

The problem associated with long lead time items is the possibility for either overestimation or underestimation of requirements. Overestimates can result in excessive inventories of high value items while underestimation results in assembly delays or complications as mentioned above.

In addition to the long lead shortages caused by not adequately anticipating requirements and lead time, an artificial shortage can be caused by shipment of damaged units or damage incurred by units during shipment.

"GFE is delivered to the contractor, who performs appropriate receiving inspections and repairs an item if necessary. The item is then packed for shipment to the country coproduction facility. At the coproduction facility, the item undergoes another inspection based on the same work order used by the contractor. If the item does not pass inspection a problem may arise. (9-). If a problem does indeed arise, the faulty unit will either delay aircraft assembly, or if sufficient time exists to repair the unit before scheduled installation; men and materiel resources must be redirected to perform the unscheduled maintenance.

One can readily see the possible impacts of incorrect requirements determination, poor quality control procedures, and incorrect packing and shipping of long lead time items. These issues should be carefully pursued by all participants during scheduled program review meetings in order to minimize their effects.

4. MANPOWER AVAILABILITY

A manpower shortage appears imminent for skilled technicians and mechanics and middle managers in both the R.O.K.A.F. and with the R.O.K. contractors. Korean sources believe that the F-5E/F coassembly program will require 750 personnel at its peak production phase. KAL plans are to transfer a large number of personnel from the Hughes 500 MD program. However, even this measure may not provide a permanent solution since it (KAL) expects to enter into another contract for the 500 MD in mid-1980 (22-3).

In addition, the R.O.K.A.F. is expanding its F-4 depot maintenance program. The reader will recall from Chapter II that KAL has already been contracted to conduct depot level maintenance for all US F-4 aircraft in the Far East. The expansion is expected to also decrease the number of technicians, mechanics and managers available to KAL and Sansumg for the F-5 program. KIAT has implemented a remedial program to anticipate the expected shortage of trained personnel. The proposed program includes recruiting retired engineers from the US and Europe and sending recent graduates of Korean schools abroad for technical training that emphasizes practical skills (79:63). In addition Hankuk Aviation College (one of three primary sources of Korean aviation engineers) has proposed a seven year development program totaling $22 million, which includes a new graduate school (9:43). The ROKG and ROKAF must monitor these remedial programs and ensure that required numbers and adequately trained personnel are avail-

able in order to meet program needs.

5. INFLATION

Though inflation is a standard issue of concern in industries worldwide, it is a no less valid subject for planning. In apportioning funds for items which are renegotiated annually (overhead rates, technical order maintenance, and provisioning documentation and planning) the R.O.K. must consider the effects of US inflation as well as home inflationary trends (9-43). The growth factor imposed by inflation raises possibilities

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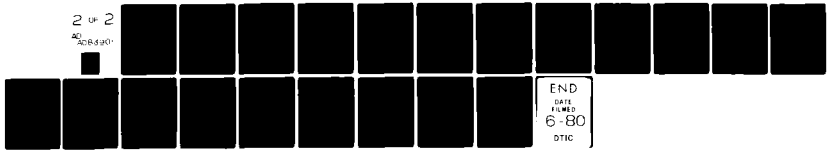

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for misapportioning of funds on renegotiable contracts during the coassembly program.

ASSESSMENT

This section will assess the R.O.K. - F-5E/F coassembly in the light of potential for meeting R.O.K. national objectives. Discussions in this chapter and previous chapters have alluded the R.O.K. coassembly objectives, however, they will be specifically presented here with appropriate rationale. The national objectives of Korea will have to be met through a set of criteria for measuring them. These criteria and the prospects for fulfillment will also be presented. When viewed realistically it is hoped that a rational judgment may be made by the author with respect to the worth of the proposed F-5E/F coassembly program for meeting R.O.K. objectives.

Chapter II presented an comparison of North Korean and South Korean military forces. With respect to air forces, the North possess an undisputed numerical advantage; an advantage that may or may not be presently offset by the generally higher quality of South Korean F-4 and F-5 fighter aircraft ($_{4-107}$). The F-4 Phantom is supposedly superior in some region to the Soviet built MIG-21 now flown by North Korea, however, R.O.K. military strategists note that during the Vietnam conflict the MIG-21 enjoyed a favorable kill ratio of 1.1:1 over U.S. planes which were predominantly F-4 models ($_{8-48}$). Although the kill ratio advantage may have been due to a number of factors specific

disadvantages of the F-4 were cited:*

"...the F-4 Phantom exudes a highly visible 20 mile trail of smoke, the prime aircraft used by the North Vietnamese, the MIG-21, is much smaller than an F-4. We had a tremendous problem with visual acquisition...In excess of 50 percent of our pilots that were shot down never saw what shot them..they had a small airplane that was hard to see, ours was big and easy to see and had this big smoke plume. They had all the advantages (Dayton Daily:4B).

The preceding statement was made by U.S.A.F. Lt. Col. Steve Dwelle. Colonel Dwelle is the commander of the USAF Aggressor Squadron at Nellis AFB, Nevada. The Aggressor squadron flys the F-5E and assumes the role of a Soviet air-to-air fighter squadron to train USAF and allied pilots against Soviet tactics and capabilities. The F-5 is used because it closely approximates performance and appearance of the MIG-21 in aerial combat (Dayton News:4B).

On the basis of the role that the F-5E plays in US combat training for fighter pilots, it appears reasonable to assume that the choice for coassembly of F-5E and F-5F models is a good one for promoting R.O.K.A.F. ability to deal with the MIG-21 of the North Korean Air Force. A more rigorous assessment of the coassembly program is developed on the following page.

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*North Vietnamese pilots used ground control radar to guide them against USAF fighters. In combat over North Vietnam radar guides were extremely effective in guiding MIG-21s to kill American fighters (Dayton News:4B).

Figure 8

PROGRAM ASSESSMENT

Bases for Assessment

1. Historical context of U.S.: SA toward R.O.K.
2. R.O.K. long term objectives for the aeroindustry.
3. Criteria for success.
4. Goals of the F-5E/F program itself.
5. R.O.K. military needs and economic condition.

	PROGRAM OBJECTIVES	R.O.K. LONG TERM OBJECTIVES
*OVERALL ASSESSMENT	△/0	0
1. Technology Transfer	△/0	0
2. Spill-over effect	0	0
3. Psychological effect & U.S. - R.O.K Relationship	0	0
4. Other expected problem areas		
*Quality Control	△/X	0
*Management and Coordination	△/X	0
*Planning and Organization	△/X	0
*Material Shortage and Damage		△
*Manpower Availability	△/X	0

Note: △/0 indicates program uncertainty with positive prospects possible. Indicates possible problem area.

0: bright, positive

△ uncertain

X: Negative. Need development.

The overall assessment on the previous table is rated questionable because of two considerations; potential for coassembly program success, and contribution toward ROK long term objectives for self-sufficiency. Primary contributors to this overall rating are the uncertain and negative evaluations for technology transfer, quality control, management and coordination, planning and organization, materiel shortage and damage and manpower availability.

Technology transfer does not hold bright prospects for meeting ROK coassembly objectives. The US technology disclaimer, Northrop reluctance, and ROC lessons learned all seem to indicate a minimal level of technology transfer will occur. It appears that the ROK will have to acquire the desired technological advancements from without the coassembly program.

Even though program technological transfer will not meet ROK objectives, the act of advanced aircraft coassembly will in itself provide a stong psychological boost to the Korean people in general. Another expected psychological impact is increased confidence by foreign investors who became reluctant to invest in Korea after the Dong sun, Park Affair (Koreagate).

As previously mentioned, the general category of expected problem areas requires full attention. Quality assurance programs must be fully developed by the ROK in order for the ROK to overcome its tendency toward reverse engineering. Management and coordination require more attention for implementing the first-time advanced fighter aircraft coassembly for the ROK. The ROKAF and MND must coordinate closely with ROK contractors. Instrumental to management and coordination will be program planning and organization. Lack of participation by the ROK in initial planning efforts as well as KAL and Samsung inexperience compound problems for effective planning and organization. Material damage and shortage and manpower

shortages are less complex issues; however, they also are instrumental for program success. The long lead time associated with GFP and personnel training make these items that also require immediate attention.

CHAPTER SUMMARY

This chapter has presented an assessment of the F-5E/F coassembly program. The assessment would be much more accurate and specific if a formal MOU had been signed. However, such is not the luxury permitted by time for this author. Still, several key assessments are possible based on preliminary program information acquired.

The issue of technology transfer promises to be highly important. Carter Administration policy as well as the willingness of Northrop to provide technological information will determine the extent of technological transfer.

The issue of economic spillover of technology is also dependent on the type of technology provided by Northrop. The R.O.K. must make significant advances in metal forming and machining and manufacture with complex metals in order to acquire an advanced fighter aircraft fuselage, engine and wing production capability.

A comparison to Japan's coproduction history indicates the R.O.K. has more knowledge and expertise of the item subject for coassembly than did Japan. Therefore, the R.O.K. has some of the basic ingredients for developing its own firm-specific and general technology. However, emphasis will be required to acquire system-specific technology in order for the R.O.K. to more fully develop industrial manufacturing capabilities.

Even though the R.O.K. has had a maintenance and operating capability for the F-5A since 1965, this is Koreas first effort at an advanced fighter coassembly program. Therefore some problem areas should be expected. The author believes that most likely candidate areas include

planning and organization, management and coordination, materials shortages and damages, manpower availability in R.O.K. industry and the R.O.K.A.F. and the effects of inflation, in the U.S. as well as the R.O.K., on contract items renegotiated annually. Attention to these potential problem areas to prevent unnecessary cost and schedule impacts should promote attainment of R.O.K. goals and objectives.

From his research the author was able to ascertain three primary R.O.K. objectives for the coassembly program:

1. To counter the military threat of North Korea,

2. to promote military and economic self-sufficiency, and

3. to permit the R.O.K. to advance from a labor intensive export economy to a technological or precision export industry.

In order for these Korean objectives to be met, the author proposed four primary criteria which if satisfied should promote R.O.K. objectives and provide a successful coassembly program. The criteria developed are:

1. the level of technology transfer permitted to take place will dictate the rate and complexity of Korean technological advancement.

2. economic spillover will provide spin-off technology for consumer goods for sale in-country and for export,

3. quality assurance procedures must advance with technology in order to insure reliable military weapon systems and consumer goods, and

4. the U.S. - R.O.K. security relationship should be strengthened as a result of a successful coassembly program.

The objectives of the R.O.K. and criteria for success developed in this chapter will be used as a basis for answering research questions and presenting the author's conclusions and recommendations in Chapter V.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

This chapter is the culmination of issues presented in earlier chapters. Chapter II developed the historical trend of U.S. security assistance to the R.O.K., Chapter III presented the F-5E/F coassembly program, and Chapter IV provided the author's assessment of the co-assembly program. The information divulged and issues developed in those chapters form the sole bases for the conclusions and recommendations which will follow in this chapter.

SUMMARY OF RESEARCH DESIGN

U.S. security assistance to the R.O.K. has been instrumental for maintaining South Korea's military security and for promoting military and economic development. The basis for American security assistance in early years (1950-1960s) was grant aid. As Korea gained economic momentum and American security assistance policy evolved, the primary basis for U.S. security assistance became FMS in the 1970s.

The proposed F-5E/F coassmebly program is a combination of FMS and industry-to-industry sales. Although a final MOU has not been signed, this research effort used available program planning information to analyze the potential for the coassembly effort to meet the military and economic objectives of the R.O.K. within the historical context of U.S. security assistance to the R.O.K. The following conclusions and recommendations are intended to assess the net worth of the F-5E/F co-assembly program for promoting R.O.K. military and economic objectives. In addition, the author intends to identify potential problem areas for implementation of the program and to recommend management and planning

actions to avoid those potential problems.

RESEARCH QUESTIONS AND CONCLUSIONS

Question 1. How does the F-5E/F coproduction decision relate in the historical context of Security Assistance programs between the U.S. and R.O.K.? Chapter II presented the evolution of U.S. security assistance to the R.O.K. U.S. security assistance was determined to have a two-fold purpose:

1. to provide the military strength necessary to repell any potential attack from the hostile and offensively postured North and,

2. to free the Korean economy from bearing the extreme financial burden of providing that necessary deterrent; thereby permitting the economy to grow and develope to the point of supporting a self-sufficient defense industry.

Although Korea is by no means yet economically nor militarily self-sufficient; economic development via the Five Year Plans has been so successful that the R.O.K. is now in need of advanced aircraft technology in order to further develope its military industrial base. An advanced aircraft production capability is deemed essential for eventual military self-sufficiency. The F-5E/F coassembly program will provide some of the required technology while at the same time not presenting an unbearable economic burden to the R.O.K. Therefore, the decision for providing the R.O.K. the F-5E/F coassembly program appears to be fully congruent with the historical intent and trend of U.S. security assistance.

Question 2. Did the coproduction decision consider the needs and best

interests of the R.O.K. military, defense industry, and economy? The answer to this question is more effectively provided in the context of the potential contribution of the coassembly program for:

1. providing an improved capability for meeting the military threat from North Korea,

2. contributing new technology for more sophisticated military and civilian aircraft production in-country and,

3. continued economic growth.

Chapter V provided a revealing discussion of the disadvantages of the F-4 aircraft in combat against the MIG-21 during the Vietnam conflict. The USAF Aggressor squadron at Nellis AFB, Nevada uses F-5Es to stimulate MIG-21s in air-to-air combat training for American fighters. The MIG-21 is the most advanced figther aircraft in the North Korean Air Force and the greatest air-threat for South Korean fighters. The F-5E/F provides a small, clean and capable counter to the MIG-21. In addition, the F-5E/F will be logistically supported by an already existing operating, maintenance and supply system, therefore making it supportable by an in-place logistics system.

Chapters III and IV discussed the South Korean capacity for advanced aircraft and component production. The results showed an extremely basic capability. Forming advanced metals, milling capability, and quality control procedures all require extensive development. It is anticipated that the technology transfer to be provided by the F-5E/F coassembly program will contribute a degree of system-specific technology for military - R.O.K. capacity and civilian aircraft production. However, the magnitude of technology transfer will depend upon Northrop willingness to sell it and U.S. government support or non-support.

The F-5E/F coassembly program as discussed in Chapter III is expected to cost $500 - $600 million and will be implemented in five stages versus an originally planned seven stage implementation. The elimination of two stages is expected to save the R.O.K.G. $6 million. In addition, the F-5E/F is less expensive than a more advanced aircraft such as the General Dynamics F-16. Therefore, the F-5E/F program provides advanced aircraft technology and an aircraft that is suitable for dealing with the North Korean air threat at reasonable cost. In conjunction with the spillover of technology into civilian industry these aforementioned factors should contribute to continued economic growth at minimal cost to the economy.

In view of the contribution of the F-5E/F program toward meeting the North Korean threat, technology transfer, spillover effect, and low cost to the R.O.K.G.; the author concludes that the program decision generally does consider the best interests of the R.O.K. military, defense industry and economy.

Question 3. How can current knowledge and lessons learned from previous coproduction endeavors be used for developing a R.O.K. plan of action: The coassembly program as it was presented in Chapter III was the result of planning primarily by the Northrop Corporation and the U.S.G. At the present, there is a degree of anxiety on the part of the R.O.K. because of limited participation in the planning effort. The R.O.K.G. MND, KAL, and Samsung must coordinate the effort with a great number of Air Force Agencies and the Northrop Corporation. The complex structure of USG, Air Force and Northrop agencies in conjunction with limited knowledge by the R.O.K. of planning premises indicate that future programs

should include greater participation of the R.O.K. for program planning.

In addition, in Chapter IV Japanese coproduction efforts indicated that technology transfer was effected virtually without restraint. As a result Japanese industry developed rapidly in technological capability. Japan is now one of the most industrialized and advanced nations in the world. On ther other hand, R.O.K. survey teams sent to investigate the ROC F-5 coproduction program found that Northrop was not particularly anxious to provide extensive technological transfer. Since the acquisition of advanced technology is a primary concern of the R.O.K. a plan of action by South Korea should include emphasis for obtaining necessary technical data and packages from Northrop.

Question 4. What plan of action should the R.O.K. follow to ensure successful implementation of the program? The R.O.K. can employ several approaches to improve the probability for successful program implementation. The first of these is to identify as soon as possible key individuals who will manage the program for the R.O.K.G., R.O.K.A.F., KAL, and Samsung. These individuals must become intimately involved in program activation planning and must fully coordinate planning and implementation in-country and out of country with the USAF and Northrop.

A second tool available is to enter into a contract with the ROC and to have Taiwan provide a working level analysis of the ROC coproduction program with Northrop. The advantages of this approach is that it would provide details of the actual experience of a country in a very similar economic and military position as the R.O.K. The information gained could be invaluable for gaining insights to unexpected difficulties encountered as well as uncovering any oversights in Northrop planning.

A final plan of action for the R.O.K. should include measures to ensure that the coassembly program provides improved quality control and management techniques. Quality control was pointed out as a major weakness in R.O.K. industry by Senators Humphrey an Glenn in 1978. In order for the R.O.K. to take advantage of advanced aircraft technology, improved quality assurance systems must be developed to control the outputs of improved technology. Therefore, regardless of the quality control issues surrounding the F-5E/F coassembly program, the R.O.K. should strongly consider quality control training abroad in countrys such as Japan and the U.S. for its military and civilian quality assurance engineers.

RECOMMENDATIONS

The Korean government is at a pivotal point in its quest for an indigenous advanced aircraft industry. Conditions appear to be favorable in that the coassembly effort is with an aircraft that incorporates advanced technology yet is mechanically relatively simplistic. The aircraft is also presently in the R.O.K.A.F. inventory which means the logistics infrastructure already exists in addition to a degree of firm-specific and general technology for the F-5.

However, the R.O.K. is devoting significant financial and human resources to this effort, resources which have to be diverted from other uses within the R.O.K. industry. To obtain maximum benefits and utility from invested resources the R.O.K. should take every possible measure to learn from the ROC F-5 coassembly program and perhaps retain ROC experts in a consultative role for the duration of the R.O.K. coassembly program. This consulting contract should assist the ROK in avoiding expected problem areas and to promote quantity control techniques.

Prior to program utilization KAL and Samsung must be encouraged to recruit engineers and program managers. This effort should include planning for acquiring the projected 750 personnel required for F-5E/F coassembly, coordinating manpower requirements and availability for another Hughes 500MD contract by KAL and the planned depot expansion for the F-4 aircraft. The R.O.K.G. must not lose the overall perspective especially with the severe shortages in these fields.

Long range planning for the R.O.K. should also include continued improvement of quality assurance capabilities and vehicles for maximizing technological spillover into the non-defense sector. An aviation quality assurance agency paralleling the American Federal Aviation

Agency (FAA) should be developed and given responsibility for improved quality control in the aero industry. This agency should promote quality control expertise exchanges with the United States as well as with other advanced countries like Japan and European governments. Additional long range planning by the ROK should include the establishment of a program management team in the ROKAF. The team should be composed of dedicated and knowledgeable international logistics specialists. The team would be chartered to develop an intimate working relationship with the USAF, Northrop Company, MND, KAL, and Samsung.

Finally, Korea should develop a plan for disseminating acquired technology and quality assurance techniques to non-defense industry. This thesis pointed out the economic benefits as well as the effects on national morale when technology advances provide an improved standard of living for a people. Long range planning for judicious dissemination of acquired technology and quality assurance should accelerate the benefits derived and their improvement.

In conclusion, the author is optimistic of the prospects for success in this effort. Emphasis on Korean long range planning and aggressive participation will optimize military and economic objectives and provide the foundations for more complex efforts in the future.

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ABBREVIATIONS

AFLC: Air Force Logistics Command (USAF)
AFPRO: Air Force Plant Representative Office (USAF)
AFSC: Air Force Systems Command (USAF)
AID: Agency for International Development (US in ROK)
ALC: Air Logistics Center (USAF)
AMG: American Military Government (US in ROK)
ASD: Aeronautical Systems Division (USAF)
BPMA: Bureau of Politico - Military Affairs (US)
CAC: Combat Air Command (ROKAF)
CFC: Combined Force Command (USOROK)
CFE: Contractor Furnished Equipment (US)
DCP: Direct Commercial Program (US)
DOD: Department of Defense (US)
DSAA: Defense Security Assistance Agency (US)
FAA: Federal Aviation Agency (US)
FIP: Force Improvement Program of ROK 1976 - 1980
FMS: Foreign Military Sales (US)
FMSA: Foreign Military Assistance Act (US)
GA: Grant Aid (US)
GFE: Government Furnished Equipment (US)
GNP: Gross National Product
IFSPO: International Fighter SPO (USAF)
ILC: International Logistics Command (USAF)
IMET: International Military Education and Training (US)
KAL: Korean Air Line (ROK)
KIAT: Korean Institute of Aeronautical Technology (ROK)
LOA: Letter of Appreciation
LOO: Letter of Offer
MAAG: Military Assistance Advisory Group (US)
MAP: Military Assistance Program (US)
MND: Ministry of National Defense (ROK)
MOU: Memorandum of Understanding
PDM: Presidential Decision Memorandum (US)
ROC: Republic of China
ROK: Republic of Korea
ROKG: Republic of Korea Government
ROKAF: Republic of Korea Air Force
SA: Security Assistance (US)
SA-ALC: San Antonio Air Logistics Center (USAF)
SE: Support Equipment
SLOCs: Sea Lanes of Communication
SPO: Systems Program Office (USAF)
TFC: Total Force Concept (US)
UNKRA: United National Korean Reconstruction Agency

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Yu, Kun Woo was born in Pusan, Korea on April 20, 1940. Lt. Col. Yu graduated from the Korean Air Force Academy in 1965 and began his flying career with the C-46 and C-54. In 1970 he began a seven month tour in South Vietnam as a C-54 pilot supporting allied operations. Following his Vietnam assignment Lt. Col. Yu performed instructor pilot duties in the C-46 and C-123K until 1975. Later he studied Industrial Engineering at the Korean Advanced Institute of Science in a non-degree granting program. Following his one year at the Korean Advanced Institute of Science, Lt. Col. Yu served at ROKAF HQ as a Systems Analysis Officer. In 1978 he resumed his advanced education when he was selected to attend the Air For Institute of Technology at Wright-Patterson AFB, Ohio. Lt. Col. Yu's subsequent assignment after AFIT graduation will take him back to ROKAF HQ, Seoul, Korea.

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This study reviews the proposed F-5E/F coassembly program by the ROK. The review is conducted within the context of the historical trend of U.S. security assistance to the ROK and ROK military and economic needs and objectives. Program analysis and assessment include an evaluation for the potential of the coassembly program to fulfill ROK needs and objectives. Assessment is further augmented by a review of lessons learned by ROC and Japanese coproduction/coassembly programs with the U.S. Finally, the author

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identifies potential problem areas and makes recommendations for solutions.