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A report prepared for

UNITED STATES AIR FORCE PROJECT RAND

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PREFACE

This report summarizes a Rand study of ways of offsetting an appreciable part of the large dollar costs connected with the planned NATO procurement of the Airborne Warning and Control System (AWACS). The research was conducted and the analysis performed during the summer and fall of 1975; it reflects, therefore, the conditions and circumstances prevailing at that time. Political, economic, and technological considerations affecting AWACS, NATO, and the offset issue were then in flux, and this situation continued between completion of the work reported here (late 1975) and publication of this report.

The project entitled "NATO AWACS Offset Study" was initiated in response to a request from the Deputy Chief of Staff for Research and Development at the end of May 1975 for "a broad, innovative assessment of offset opportunities, both internal and external, to the AWACS program." From the standpoint of several of the participating NATO countries, the large expenditures--in excess of $1 billion--associated with their potential procurement of the system warrant special measures by the United States to reduce or "offset" the resulting outflow of dollars in order to make procurement politically, as well as economically, more acceptable to the Europeans.

The severe time constraints under which the research was done resulted from a schedule imposed by the fall and winter 1975 meetings of the NATO Conference of National Armaments Directors (CNAD) and the Ministerial Defense Planning Committee (DPC), respectively, at which further decisions relating to AWACS procurement were to be considered. Because of this time element, as well as the complexities of the subject, we were not able to explore some aspects as thoroughly as we would have liked. Time constraints also limited our ability to obtain current data in some cases. Findings of the research were reported to the Air Force (by way of several briefings) in the late months of 1975. This report incorporates the product of a subsequent review process, but for practical purposes the data used are of December 1975 vintage. Occasional references to anticipated events of early 1976

have been retained, although we were not able to complete the review process and publish the report until after those events had occurred. For example, the influence of policy decisions made subsequent to December 1975 by CNAD, DPC, and the U.S. Defense Department has not been addressed in the report. In a situation so characterized by frequent policy actions, no report of this sort can possibly be as "current" as would be desirable.

The study summarized here does not address the military issues connected with procurement and deployment of an AWACS force in NATO. Instead, it proceeds from the assumption that the military case for a NATO AWACS force has been established, and addresses the question of how to "offset" some part of the costs connected with that force. The military issues connected with procurement of the force (e.g., the role of AWACS in supplementing the present NATO air defense system; the savings to NATO that may be realized over the lifetime of AWACS as a result of reducing the number of interceptors needed for air defense; the potential improvements in NATO command, control, and communication; the vulnerability and countermeasures associated with the system) have been previously studied in the Department of Defense and are undergoing further study in NATO.

Although analysis of offsets for AWACS procurement would seem to be a fairly concrete and narrow problem, in fact it is closely connected with some of the most important and troublesome issues of U.S. NATO policy, including standardization and rationalization of forces; the "two-way street" in NATO weapons development and procurement; cohesion within the alliance, as well as political matters within the NATO countries; and various international economic and financial issues extending outside, as well as inside, the alliance. While focusing on the AWACS offset problem, we have also made an effort to evaluate how alternative solutions to offsets might affect these larger policy issues. Consequently, we hope that the study will be useful to those parts of the Air Force and the Defense Department, as well as of other agencies, that are concerned not only with AWACS offsets but with these broader issues as well.

In doing this study, we have been assisted by discussions at NATO Headquarters in Brussels with members of the NATO International Staff, the International Military Staff, the U.S. Mission to NATO, the National Armaments Directors' representatives, and the NATO Industrial Advisory Group, as well as with representatives of the Air Force, the Director of Defense Research and Engineering, and other parts of the Defense Department in Washington, D.C., and of the Boeing Company in Seattle. Briefings of the research and the findings were presented to a number of audiences, including members of the Air Staff, the Assistant Deputy Chief of Staff for Research and Development, the Assistant Secretary of the Air Force for Research and Development, and the Director of Defense Research and Engineering, and we have benefited from the discussions following these briefings. We have also profited from comments and criticisms of several colleagues, especially Malcolm W. Hoag, Charles T. Kelley, Jr., and Horst Mendershausen at Rand, and Professor Edward E. Leamer of the University of California at Los Angeles. We are indebted to Cheryl Cook for drafting part of Sec. VI. Of course, none of these individuals is responsible for the analysis or interpretations presented in the report.

SUMMARY

A three-month Rand study of ways of offsetting an appreciable part of the large dollar costs connected with the planned NATO procurement of the Airborne Warning and Control System (AWACS) is described, and various offset strategies for making the acquisition of AWACS politically and economically more feasible and attractive for the participating NATO countries are explained and evaluated. It is assumed that the case for AWACS has been established on military grounds, and the problem of offsets is considered from that premise. In this context, the term *offsets* refers to any measures that will reduce the dollar component of AWACS costs to NATO buyers, or provide additional dollar earnings or other economic, technological, or political benefits to participating countries.

The issue of offsets is closely related to other larger, and from the standpoint of U.S. defense and foreign policy interests, more important issues, among them: standardization and rationalization of NATO forces; the "two-way street" in weapons development and procurement within the alliance; and political cohesion within the NATO alliance, in light of the special political and economic conditions prevailing in particular NATO countries. Throughout the study, an effort is made to take these larger issues into account in evaluating alternative solutions to the AWACS offset problem.

Alternative offset strategies are formulated and evaluated in relation to the different motives and objectives of potential NATO participants, which include: stimulating production and employment, especially in high technology industries; encouraging technology transfer as it relates not only to AWACS but to high technology in other military and nonmilitary fields as well; and contributing to improvements in the balance of trade and international payments. The emphasis placed on these and other objectives differs among the NATO countries. Because each objective leads in a somewhat different direction with respect to the design of a preferred package of offsets, it is important to be as clear and precise as possible about the particular objectives that motivate individual NATO countries in seeking offsets.

For purposes of the study, the principal NATO countries are divided into several groups with respect to these primary objectives:

1. Minor concern with offsets, and relatively major concern with price--the Federal Republic of Germany, the Netherlands, and perhaps Denmark and Norway.
2. Concern with employment, especially in defense industry--the United Kingdom, Italy, and Belgium.
3. Interest in technology transfer--France and, to some extent, the United Kingdom.

The offset problem itself is divided into several parts: *internal offsets*, relating to European participation in production, systems integration, or logistic support for AWACS; *external military offsets*, relating to the possible procurement by the United States of other European military systems; and *external nonmilitary offsets*, relating to nonmilitary European products whose development or procurement by the United States promises to offset the costs of NATO acquisition of AWACS.

INTERNAL OFFSETS

Internal offsets were the subject of a ten-month study by the Boeing Company done in 1975 and the early part of 1976, although they are also considered briefly in this report. Several suggestions concerning the Boeing study are advanced. These include some possible simplication of the extremely complicated procedures involved in certifying eligible and qualified European producers, and possibly modifying or dropping the proportionality restriction requiring that European industrial participation be exactly proportional to country shares in the AWACS procurement. The possibility of performing in Europe various functions connected with the operating costs of the system is also considered.

EXTERNAL MILITARY OFFSETS

In developing a list of external military offset candidates, current views on their costs and performance relative to U.S. and

alternative foreign programs are presented. Because data are limited, the study relies heavily on discussions with and opinions of experienced people in the Department of Defense and the Air Force in Washington, D.C., as well as in the U.S., British, French, Canadian, and German delegations to NATO. The resulting survey should illustrate options that seem worthy of further investigation in (1) land warfare systems, e.g., tanks, antitank weapons, light-attack helicopters, antiaircraft weapons; (2) naval warfare systems, e.g., ship defense and antiship missiles; and (3) air warfare systems, including both aircraft and aircraft armament. From this cursory evaluation of specific candidate systems, it is possible to formulate a large number of illustrative options for meeting even very large offset targets.

Implementation of these military offsets can proceed in several ways, and the choice among them can affect substantially the amount of U.S. expenditure that would be credited as offset. One way would involve direct U.S. purchase of an item manufactured in another NATO country. Another would involve obtaining a license from a European developer to produce the item in the United States, in which case only the license and royalty fees would likely be considered an offset.

EXTERNAL NONMILITARY OFFSETS

Including *non*military products as potential offsets reduces the inefficiencies of using offsets as a procurement strategy. It also suggests certain long-run adjustments, such as reduction or removal of trade barriers, which would lead to more efficient resource use in NATO as a whole and remove some of the motives for offsets.

The method used for identifying efficient NATO producers, who could make substantial contributions to an external nonmilitary offset program, involves calculations of the relative unit costs of product categories in the United States, and in the NATO/AWACS countries, and trends over time in these relative costs. The calculations permit identification of product categories in which some NATO countries appear to have a competitive advantage compared with the United States. Hence, these products are likely to provide promising candidates for incremental, nonmilitary exports from these countries to the United States.

However, the crucial question is why, if these product categories are so "promising," they are not already being imported into the United States in suitable quantities? The answer involves the existence of trade restrictions, such as Buy America restrictions on government procurement, or other nontariff or tariff barriers to commercial imports. Thus, the final step in identifying promising nonmilitary offset candidates is to determine the extent to which trade barriers are inhibiting the flow of commodities with low relative costs and high export potential into American markets.

Based on these steps, the study concludes that the most promising product categories for nonmilitary offsets are electric machinery, nonelectric machinery, nondurables, and transport equipment. The policy implications of this conclusion (e.g., an "AWACS-round" of trade negotiations and trade liberalization, or a "NATO-round") are then examined, together with the potential for traffic on the "two-way street," and closer economic as well as military integration among the members of NATO.

Also in the category of nonmilitary offsets, we briefly consider the potential role of financial transfers or loans, recalling the precedent for use of this device by the Federal Republic of Germany in the early 1970s to offset part of U.S. military expenditures in Europe. One possible variant of financial transfers would be a "rental" arrangement in which the United States would buy AWACS for NATO, with NATO countries providing rental payments to cover amortization and interest for servicing the initial investment outlay.

Financial transfers have certain particularly attractive features, including their simplicity and the precedent for their use in the earlier FRG offset agreements. This device would also make a contribution, although indirectly, to the objectives of increasing employment and technological progress in Europe through the AWACS offset program.

Two other categories of nonmilitary offsets are considered briefly: outlays of U.S. government research and development funds for energy technology in Europe; and a program of educational fellowships in engineering and technology covering the costs of graduate training in the United States for students from the NATO/AWACS countries.

ALTERNATIVE STRATEGIES

Because of the conflicting objectives of different NATO countries in seeking offsets, formulating a preferred offset policy for the United States confronts a central difficulty: a policy tailored to meet the objectives of one country will probably not suit those of another. For example, substituting a different engine in AWACS, making the airframe compatible, and installing and integrating system components in Europe may appeal to the interests of the French and British in "technological participation" and aerospace employment. But these "gains" are likely to result in appreciable increases in costs of the delivered system, thereby cooling Germany's enthusiasm for AWACS. Opportunities for "fine-tuning" of offset strategies to accord with the particular objectives of individual countries, *without* such spill-over effects, are likely to be most promising where offsets take the form of external military procurement or financial transfers.

Alternative offset strategies are distinguished by the emphasis they place on one or more of the offset types described above: offset strategy 1 (OS1) concentrates on *internal offsets*; OS2 on *external military offsets*; OS3 on *external nonmilitary offsets*; OS4 on *financial transfers*; and OS5 on a *mixture* of these several elements. Other combinations can be devised not only for OS5, but for each of the "pure" strategies.

Six criteria are used to evaluate these five alternative strategies: employment, technology transfer, balance of payments considerations, efficient resource use (reflected by the delivered price of AWACS), alliance political considerations, and implementation difficulties. Although the target level for offsets can be varied, as well as the strategy for reaching it, for illustrative purposes a NATO buy of 25 aircraft is assumed with a benchmark unit price of $60 million, and a total offset target of $1 billion, or two-thirds of the total cost. The selected target appears to be large enough to be politically (and financially) significant, and yet perhaps small enough to be feasible to reach.

Each offset strategy is obliged to reach this target, with success evaluated according to the six criteria, based on a qualitative ranking.

To provide quantitative estimates of the performance of the several strategies with respect to some of the criteria would require further work.

For illustrative purposes, the content of OS1, *internal offsets*, consists of three parts: the maximum Boeing estimate for European co-production (36 percent of the total AWACS cost); the accrual of operations costs in Europe, rather than in the United States; and an export "feedback" credit, which draws on a precedent established in the earlier offset arrangements between the Federal Republic of Germany and the United States going back to 1968.

Among the numerous ways in which OS2, *external military offsets*, can be applied to arrive at the stipulated target figure of $1 billion, three variants are described: a variant based on land forces, and involving an "Americanized" version of the Leopard II tank; a naval variant involving European participation in development and production of the Shipboard Intermediate Range Combat System (SIRCS); and an Air Force variant involving the purchase of jet trainers and the advanced Harrier. Many other variants of OS2 can be devised.

In devising an *external nonmilitary offset strategy*, OS3, several variants are also possible. One example involves removal of Buy America restrictions on government procurement of nonmilitary goods and services abroad. According to our estimates, this would result in annual increases of U.S. government imports from NATO countries of over $300 million if Canada is included, and over $150 million from the NATO countries excluding Canada. Moreover, these offsets would be *annually recurring*, unlike the one-time character of the other offsets we have been considering. Consequently, when capitalized at an interest rate of 10 percent, the offset value of these import increases would be more than $3 billion and $1.5 billion, respectively, under OS3--thereby substantially exceeding the $1 billion offset target. If needed, these increases in European exports could perhaps be supplemented by outlays for energy R&D in Europe, and by a program of NATO fellowships for advanced study in engineering and technology in the United States.

An offset strategy focused on *financial transfers*, OS4, could take the form of medium term financing provided to the NATO countries in

the form of U.S. Treasury purchases of NATO government securities, or through Export-Import Bank loans. Together with the export "feedback" credit referred to earlier, such financial transfers could easily meet the $1 billion target figure.

The *mixed strategy*, OS5, seeks to combine the more attractive features of the other strategies: an internal offset component based on Boeing's lower-bound estimate (21 percent of total AWACS costs); a selected military component; partial removal or reduction of Buy America restrictions on government procurement; and financial transfers plus export "feedback" to fill out the remainder of the $1 billion target.

Our evaluation leads us to conclude that the preferred alternatives lie either in OS2, the external military offset strategy, or OS5, the mixed strategy. If efficiency of resource use within the alliance were the only criterion, instead of being one among the six, then OS3, external nonmilitary offsets, would be preferable to OS2. The reason for the greater efficiency of OS3 is simply that the scope for arriving at efficient combinations of commodities and services as offsets for AWACS is widened under this alternative by inclusion of *civil* sector transactions, rather than confining the offsets to military transactions as in OS2. Moreover, because of the current strength of the U.S. balance of payments and the appreciation of the dollar in foreign exchange markets, it would be especially appropriate in the mid-1970s for the United States to consider moving in the direction suggested by OS3. Although, for reasons discussed more fully in the study, implementation of OS3 would be difficult and reaction to it among our NATO allies uncertain, its potential value as a major U.S. policy initiative, with significance for political as well as military relationships within the alliance, might make worthwhile an effort to confront and surmount these difficulties.

The AWACS offset issue relates to several larger and longer term policy problems, including standardization and rationalization of NATO forces and equipment, the "two-way street," and the problems of political cohesion within the alliance as a whole. It is therefore important that the choice of an offset strategy be consistent with and, indeed, conducive to the salutary evolution of U.S. policy on these larger issues.

Concerning these issues, two positions seem to exist within NATO:

- o A "protectionist" position, which construes the two-way street and the move toward standardization and rationalization in terms of *a guaranteed and equal flow* of procurement between the United States and its NATO partners.
- o A "competitive" position which, while striving to attain agreed positions on NATO-wide military requirements and freer bidding and competition among potential suppliers, leaves open the question of exactly how the balance in the two-way flows will work out.

While both positions consider a two-way street, one position would guarantee that there is equivalent traffic in both directions. The opposing position, the competitive position, would make sure the barriers are removed on both sides of the street, but would leave the intensity of traffic in each direction to be determined by the functioning of competitive forces, and the relative efficiency among alliance members in responding to the competition.

The protectionist position is reflected in some of the discussions in the Eurogroup and its communications to the Secretary of Defense.

Although the subject plainly requires more detailed study, resolution of these issues should be handled so as to make it *less likely that offset issues will arise in the future*. In an important sense, the notion of specific "offsets" tied to a specific new system procurement is itself a reflection of the "protectionist" position described above. In effect, "offsets" imply that the functioning of the competitive process would be altered and supplanted by an explicit tying of some form of "bartered" sale, in exchange for the specific military procurement under consideration. To avoid this problem in the future, we suggest several specific and major changes in NATO policies and procedures:

1. An effort within NATO to arrive at a statement of agreed plans and military requirements on a NATO-wide basis over a substantial

period of five years or longer, something analogous to the Five-Year Defense Plan (FYDP) in the Defense Department.

2. Competitive bidding within NATO as a whole, both on R&D relating to the FYDP, and subsequently on procurement contracts as well. Government subsidies, reflecting national priorities and presumed externalities relating to particular technological fields, would affect competitive bids, but the contracting decision by the NATO members would be based on price and quality after these subsidies were applied by the respective governments.
3. A collective effort by NATO countries to reduce their trade barriers, including both the "Buy America" and "buy domestic" restrictions on government procurement, and other tariff and nontariff barriers to commercial procurement in NATO, as a whole.
4. Licensing arrangements on a standby basis by foreign military suppliers, to protect individual countries from an undesired degree of external dependence on those suppliers.

There is an important link between the AWACS offset problem and these larger NATO issues. In moving from OS1, the pure internal offset strategy, to the other strategies (especially OS3, but also OS5, the mixed strategy), what we are advocating is essentially *a movement away from the protectionist position, and instead a move in the direction of a competitive interpretation of the two-way street*. Indeed, the protectionist direction seems to us to lead toward a form of standardization that is likely to be costly and inefficient; in other words, to standardization *without* rationalization.

CONTENTS

I. THE "OFFSET" PROBLEM AND ITS SETTING

PURPOSE AND TERMINOLOGY

At the April 1975 meeting of the NATO Conference of National Armaments Directors (CNAD), several NATO nations agreed to take the first steps toward procurement of a NATO force of E-3A Airborne Warning and Control System (AWACS) aircraft. This decision was confirmed by the Ministerial Defense Planning Committee (DPC) meeting in May 1975. These first steps included the funding of contract definition studies of the air vehicle and the ground environment interface for the new system undertaken, respectively, by the Boeing Company and the Eutronic Corporation.

Because NATO procurement of a reasonable AWACS force will cost in excess of $1 billion, several countries that may participate are keenly interested in exploring various measures to offset the financial burden of the procurement, and thereby to make the program politically as well as economically more acceptable to their governments and parliaments. In this context, the term *offset* refers to measures that are expected to reduce the dollar costs of AWACS, or to provide additional dollar earnings or other economic, technological, or political benefits to the participating countries.

Part of the ten-month air vehicle study, begun by Boeing in July 1975, considers opportunities for NATO countries to engage in "industrial participation" in the planned program, with a target of at least 25 percent in dollar value for such "internal" offsets. However, in view of the program's total cost, as well as for other reasons, a wide range of potential offsets, not confined to the internal ones, warrants examination. This is the purpose of the Rand study described in this report: to design and evaluate various offset "packages" and strategies for making the acquisition of AWACS more feasible and attractive for the participating countries. Inasmuch as the longer term Boeing study focuses on internal offsets, we emphasize potential offsets *external* to the AWACS procurement, although we include some consideration of internal offsets as well.

Because offset terminology is sometimes obscure, its initial clarification is worthwhile. The term *offset* is itself a source of ambiguity because its use in the present context is different from its principal prior usage in NATO, when it referred to U.S. insistence that its NATO allies--Germany, in particular--undertake various measures to "offset" the flow of dollars from the United States to Europe to support U.S. forces there. These "classical" offsets were to consist of incremental military and nonmilitary imports from the United States and other offsetting financial flows from Europe into the United States.[1] The intent of these offsets was to reduce pressure on the U.S. balance of payments resulting from U.S. dollar disbursements in Europe.

The German precedent, however, does not exactly apply in the present context. Relief of balance of payments pressures, generated by the prospective procurement of AWACS from the United States, is only one among several motives and reasons why various NATO countries are currently interested in offsets. We discuss these differing motives and objectives in Sec. II.

Although we use the term *offset* in this report because of its convenience and familiarity, other terms are used or preferred by various participants in the current discussion of the issue. The Belgians speak of *compensation*, while the French use that term or, alternatively, *juste retour* (i.e., fair return), and the Canadians refer to *quid pro quo* to convey what they have in mind. The term formally preferred by the NATO International Staff is *participation with compensation*. These terms perhaps convey more accurately the flavor of the current dialogue involving offsets in the context of AWACS procurement for NATO: more is intended by the terminology than simply balance of payments offsets.

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[1] Included in the calculation of these earlier offsets was a 20 percent "feedback" effect, reflecting the estimated increase in FRG imports from the United States resulting from U.S. expenditures in Germany. We make a similar allowance for this feedback effect in later calculations of offsets for AWACS expenditures by NATO countries in the United States (Sec. VI, p. 59). For a more detailed discussion of the German offset precedent and the arbitrariness of identifying "true" offset items, see Horst Mendershausen, *Troop Stationing in Germany: Value and Cost*, The Rand Corporation, RM-5881-PR, December 1968.

Indeed, under an international financial system of flexible exchange rates, such as currently prevails, concern for balance of payments effects diminishes, or even entirely disappears, compared with a system of fixed exchange rates. Whichever of the terms is used, they have in common the principle of a protectionist corrective to normal trade flows, with various arguments and objectives introduced to justify the offset that is sought.

A further distinction needs to be made between *internal* and *external* offsets. Internal offsets relate to European participation in RDT&E, production, integration, logistics support, or maintenance connected directly with the procurement and operation of AWACS. While presumably reducing dollar outflows from Europe, such internal offsets can, and indeed are likely to, increase *total* AWACS costs. External offsets relate to the incremental dollar earnings in Europe that would arise from increased sales by the NATO countries to the United States of other military, as well as nonmilitary, goods and services.

As one widens the range of choice, by moving from internal to external offsets, and from external *military* to external *nonmilitary* goods and services, the opportunity to realize an efficient and mutually advantageous outcome for all parties concerned is expanded. However, this gain is probably realized at the cost of reducing the clarity or certainty with which a particular external offset can be linked to the AWACS procurement itself. This point, which is important for political and negotiating reasons, is developed later in the report.

Although this study is primarily concerned with the design and evaluation of alternative ways of offsetting part of the costs of acquiring AWACS by NATO, one cannot probe the offset issue very deeply without becoming keenly aware of its relationship to other larger--and from the standpoint of U.S. defense and foreign policy interests, more important--issues as well. The offset issue is, as it were, the top of an iceberg below whose surface lie some of the most important and troublesome aspects of U.S. relationships with our NATO allies, including:

1. Standardization/rationalization, and the "two-way street," which Secretary of Defense Schlesinger called for in his NATO statement in December 1974. These are all general concepts, but some NATO members see them in very different ways. Moreover, these differences turn out to be closely correlated with the differing positions maintained by the NATO countries with respect to the specific issue of offsets for AWACS procurement.
2. The special political and economic conditions prevailing in particular NATO countries. These include, for example, the existence of economically weak but politically strong industries and trade unions, resulting in pressures for economic protectionism and other policies to support the maintenance of sometimes inefficient and noncompetitive industries. Indeed, part of the motivation for offsets in the case of AWACS procurement arises from these same protectionist positions.[1]
3. The political cohesion of the NATO alliance, which has evidently been strained in the past by the U.S. failure to live up to commitments to find suitable offsets for previous NATO procurements of U.S. systems. For example, the credibility of such a U.S. commitment has allegedly been undermined by such a failure in the case of the C-130. On the other hand, strains on the cohesion of the alliance might also arise from cost overruns and slippage of quality coming in the wake of politically motivated, but technologically ill-conceived, offset contracts or subcontracts.
4. The military effectiveness of the alliance, which may be appreciably impaired by the malfunctioning of systems whose procurement and production are shared on the basis of political considerations, rather than technical and operational merit.
5. The increasing likelihood of multilateral participation in

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[1] On the other hand, under certain special circumstances offsets may actually lead to a more efficient outcome than would otherwise have resulted. This point will be developed further in Sec. V, which deals with nonmilitary offsets.

> the development and procurement of new weapons systems, because of their increased complexity and rising costs, and of the smaller-sized buys that any single country, including the United States, can sustain. An important consequence of this trend (reflected by the lightweight combat fighter aircraft, as well as by the pending AWACS procurement, and also by the planned new-tank procurement) is that some form of financial offsets and technological participation, for the perceived benefit of participating alliance partners, is likely to be an increasingly important facet of new weapons development and procurement.

All of these important and timely issues are closely linked with the concrete issues of offsets for AWACS procurement, and we will have more to say about them later in this report.

OUTLINE OF THE STUDY

Following a brief review of the objectives underlying European interests in offsets (Sec. II), we divide the offset problem into several parts: *internal offsets*, relating to the production, systems integration, or logistic support for AWACS (Sec. III); *external military offsets*, relating to the possible procurement by the United States of other European military systems (Sec. IV); and *external nonmilitary offsets*, relating to nonmilitary European products whose development or procurement by the United States looks promising as a potential offset for NATO acquisition of AWACS (Sec. V). We also consider in Sec. V the possible role of financial transfers or intergovernmental loans, along the lines of the FRG precedent referred to earlier. Alternative offset packages or strategies are formulated in Sec. VI and evaluated with reference to differing motives and objectives of the potential NATO participants.

To the extent that our analysis uncovers promising candidates for offsets, a key question arises: Why haven't these opportunities been seized upon before? Part of the answer probably lies in restrictive U.S. trade policies--"Buy America" restrictions on government

procurement, and tariff and nontariff barriers to commercial procurement. We refer to this point in more detail later and discuss its implications for appropriate U.S. policies and actions to help meet the offset problem.

Throughout the report, but especially in Sec. VI, we try to treat the problem of offsets for AWACS procurement in relation to the larger and more general problems of standardization and rationalization, the "two-way street," multilateral participation in new systems development, and other issues mentioned above. The recent history of the F-16, as well as the pending AWACS procurement, suggests that we are dealing here with a major and pervasive issue transcending each individual procurement. Consequently, our hope is that this study will be of use to the Air Force and other parts of the Department of Defense in formulating policies with respect to the larger set of issues, as well as with respect to the immediate AWACS problem.

II. EUROPEAN OBJECTIVES AND MOTIVES FOR OFFSETS

GENERAL CONSIDERATIONS

In connection with both internal and external offsets to the planned NATO AWACS procurement, it is important to clarify the precise objectives that motivate potential NATO buyers and affect their willingness to share the common costs of a collective NATO buy rather than to procure on an individual country basis. During our discussions with both Europeans and Americans in Brussels and in Washington, D.C., various reasons were cited as underlying and explaining the interest in offsets shown by different NATO members:

1. *Stimulation of production and employment*, especially in high technology industry. The Organization for Economic Cooperation and Development (OECD) recently projected a 10 to 20 percent decrease in industrial production during the first half of 1975 in Germany, France, and Italy, with an accompanying doubling of aggregate unemployment in these countries. A special variant of this reason for offsets lies in the interest of particular NATO countries in sustaining their domestic defense industries whose production and employment status, as well as future prospects, are depressed. This concern is obviously more intense in countries where defense production is a large proportion of total production in the aerospace and heavy metallurgical industries (such as the United Kingdom and France) than in countries where defense production is a much smaller share of the total (such as Germany).
2. *Encouragement of "technology participation,"* or technology transfer relating to the AWACS system in particular, but more generally relating to high technology developments in other military and nonmilitary fields as well. The current emphasis placed on this reason recalls the heated, but not very lucid, discussion in the late 1960s of the growing technology gap

between the United States and Europe, and the alleged "challenge" that this gap signified for Europe's economic "independence."[1] This relates to some European countries' concern that their defense industries will become specialized in "lower" technology weapons systems for export (e.g., to OPEC countries) while Europe will rely increasingly on imports from the United States for more advanced systems.

3. *Concern with balance of trade and international payments considerations*. As previously noted, this was the principal reason for U.S. concern with the classical offset problem in the late 1960s and early 1970s, arising from U.S. expenditures in central Europe for meeting troop stationing costs. Under the present system of floating, rather than fixed, exchange rates, these trade and payment considerations really relate to a somewhat different objective, namely that of protecting exchange rates, rather than allowing some depreciation--however small--to occur as a result of dollar outlays by individual countries for AWACS.

Underlying some of these more or less specific objectives is a somewhat looser, but not necessarily less important, political and psychological dimension. Several NATO countries are concerned that the absence of appropriate offsets would somehow erode their prestige and stature within the alliance, a matter on which their sensitivity is generally more intense than is their willingness to provide resources adequate to sustain or to "earn" a more influential role in the alliance. In this context, some Europeans see the subject of offsets as a contributor to redressing the predominant U.S. role in the alliance. This is, of course, a familiar problem that arises in connection with a wide range of other problems besides offsets, and bears sharply on the cohesion of the alliance as a whole. In the case of offsets, this

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[1] J. J. Servan-Schreiber, *The American Challenge*, Atheneum, New York, 1968. Marc de Brichambaut, *Technological Exchange Between the United States and Europe: An Attempt in Explaining Shifting Perceptions*, The Rand Corporation, P-5392, September 1974.

sentiment complicates the problem further. For example, where issues of national pride and prestige are involved, a simple approach to the offset problem--such as lowering the price of the system through some form of U.S. direct price subsidy for NATO procurement--may not be nearly as palatable as some less efficient, but in other ways more gratifying, solutions.

Each of the particular objectives that motivate individual NATO countries in seeking offsets leads in a somewhat different direction with respect to the design of a preferred package of offsets. For example, if the principal concern is with trade and payments, and foreign exchange rates, then the simplest, quickest, and most effective means of meeting this objective may be for the U.S. government to buy short- or medium-term government securities from the NATO countries that value this objective most highly. Such an approach would follow the precedent of German purchases of U.S. Treasury bonds as an offset to part of the U.S. troop stationing costs in the Federal Republic of Germany in 1973 and 1974.

If, on the other hand, stimulating aggregate employment were the principal objective sought by a particular NATO country, then a suitable offset package might appropriately focus on the relative labor intensity of various possible increases in U.S. purchases of goods and services from these countries. If the concern is not with aggregate unemployment, but rather with unemployment and depressed output levels in particular industries such as the defense sector (assuming that labor and capital are relatively immobile between this sector and others), then an appropriate offset package should emphasize instead increased imports by the United States (or perhaps by other countries participating in some sort of a triangular trade arrangement), concentrated in these specific underemployed industries. It might be still more desirable, in this latter case, to use intergovernmental loans from the United States to support appropriate monetary and fiscal measures that would be aimed directly at reducing unemployment in the affected industries; for example, by an easing of credit or by appropriate tax incentives to those industries.

If, instead, the objective of principal concern were technology

transfer, then a preferred package of offsets should emphasize participation jointly with the United States by the interested NATO country or countries in the *early* design and development stages of a new weapons system. In cases such as the AWACS, where the development of the system is already largely completed and hence multilateral participation in design and exploratory development is precluded, a preferred package of offsets should perhaps stress, as a second-best alternative, industrial licensing of European firms by U.S. manufacturers to produce components on which American firms presently hold patents. Some European countries, however, are already technologically capable of and internationally competitive in producing certain AWACS components. Subcontracts negotiated on a build-to-print basis to buy those components from such countries may not contribute to the objective of technology transfer.

In Sec. VI we discuss this important relationship between the objectives that underlie the interest in offsets and the design of offset packages tailored to the interests of particular NATO countries. The intervening sections are, in a sense, building blocks for applying this approach in the specific AWACS context. With this subsequent use in mind, it is appropriate at this point to summarize what we know--or *think* we know--about the objectives that seem primarily to motivate the individual NATO countries in their approach to offsets.

OBJECTIVES OF PARTICULAR COUNTRIES

The objectives we attribute to specific NATO countries are subject to major qualifications and are largely based on our conversations in August 1975 with representatives of the National Armaments Directors' Staffs at NATO Headquarters, with members of the NATO AEW Program Office, with the Boeing Company, and with U.S. government officials and officers of the military services in Brussels and in Washington, D.C. These interviews have been supplemented by some documentation, although of a very limited sort. Furthermore, it is obvious that the views within each of the countries' governments vary and are subject to change: ministries of defense (MODs) surely have different objectives in considering "offsets" than have ministries of finance, or ministries

of labor, or political and parliamentary leaders. Therefore, in attributing particular objectives to particular countries, we are at most calling attention to the central tendencies within each of these pluralistic structures, and to ways in which these central tendencies differ among the participating countries. Nevertheless, with the above qualifications, the principal countries can be divided into several groups with respect to their primary objectives in seeking offsets:

- *Minor concern with offsets, relatively major concern with price*---the Federal Republic of Germany, the Netherlands, and perhaps Denmark and Norway.

The Federal Republic seems to be relatively unconcerned about offsets. It is convinced that the military case for AWACS is strong: the system is needed and will provide a substantial improvement in the air defense and command and control capabilities of NATO forces. The German defense budget, however, is tightly constrained, and there is a consequent need to pay for AWACS by substituting it for other planned outlays, either through their elimination or stretch-out over time. Consequently, the German interest is in keeping the total costs of AWACS as low as possible. Hence, any offset arrangements with other countries, whose effect is to raise the delivered costs of the system, are strongly opposed by the Germans. In addition to keeping the unit costs of the system as low as possible, the Germans are also concerned that their share of a collective NATO buy of the system, if it is acquired on a collective basis along the lines set by NATO infrastructure cost-sharing precedents, be kept to a level of not more than 20 to 25 percent of the total.

The orientation of the Netherlands appears to be similar to that of the Federal Republic. For example, in a general discussion in the Defense Planning Committee earlier this year, the Dutch Defense Minister indicated that his country would be more interested in freer access to the U.S. market in order to increase its exports of cheese, than in specific offset arrangements tied to particular new weapons procurements. Although the discussion in which this observation was made did

not relate to AWACS specifically, but rather to the general problem of the so-called "two-way street" in weapons development and procurement, the comment is reflective of the Dutch position. It also bears on some of the later discussion in Sec. V concerning the role of trade barriers and their removal as a possibly important U.S. policy instrument for dealing with the general problem of offsets.

Based on less reliable information, it is our impression that Denmark and Norway conform more or less closely to the German and Dutch position.

- o *Concern with employment, especially in the defense industry*--the United Kingdom, Italy, and Belgium.

With the highest unemployment rate in western Europe, Italy is suffering from a combination of structural and cyclical unemployment, especially in the manufacturing industry. Hence, its main interest in offsets relates to the possibility of obtaining some relief for this problem, especially in high technology defense industry, through offset purchases or subcontracts placed in Italy for parts of the AWACS system.

The United Kingdom's principal interest in the short-term is also that of relieving unemployment, especially in the aerospace industry. Given the political as well as economic strength of British trade unions, acquisition of AWACS would be problematical unless it carries with it some prospect for relief of the unemployment problem through some form of offsets. Although the unemployment objective is primary, the problem of unemployment in the United Kingdom is less chronic and structural than in the case of Italy. Consequently, an important secondary objective for the British is technology transfer.[1] A further objective of concern to the United Kingdom relates to increasing exports

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[1]Britain's concern with the high costs and low yield of government subsidies to aerospace technology has been increasing. Consequently, measures to save domestic R&D outlays by technology transfer from abroad are likely to be of growing interest to the British. See "The Profit and Loss Accounts of State-Aided Technology," *The Financial Times*, London, February 11, 1976.

through some form of offset agreement, as a way of helping to meet the severe balance of payments problem and to relieve pressure on the British pound.

Although the Belgians are not among the prospective contributors to the AWACS buy, their interest in offsets with respect to foreign weapons acquisition in general derives principally from an acute unemployment problem in Belgian defense industry. That is why, for example, the U.S. decision to consider purchasing 30 mm machine guns from Belgium turned out to be a crucial factor in the Belgian decision to participate in the F-16 buy.

o *Technology transfer*--France.

Although France has not indicated its intention to participate in the AWACS procurement, it seems clear that, were it to do so, it would be principally interested in some form of offset that contributed to technology transfer, especially with respect to engine technology and computer technology. While this objective seems to be primary, the French are also concerned with sustaining employment in their aerospace industry.

Canada does not fit conveniently into any of these groups. One of its senior representatives informed us that his country has "no official offset policy," although immediately adding that from the standpoint of "taxpayer interest," some form of quid pro quo contributing to employment and exports in Canada would definitely make AWACS procurement more politically salable.

The differing and conflicting objectives of potential NATO participants seriously complicate the problem of formulating a preferred offset policy. Offset arrangements tailored to the objectives of one country may not appeal to another. Yet it is hard to design an offset arrangement for one country that will not spill over to affect others with very different interests. For example, using as the power plant for AWACS the GE-SNECMA CFM-56 in place of the Pratt-Whitney TF-33 would contribute to meeting French interest in technology participation, but would adversely affect German interest in keeping the price of the

delivered system as low as possible. On the other hand, emphasis on achieving the lowest possible price of AWACS--even by a subsidy from the United States if that were feasible--would not meet other interests and objectives of concern to several prospective NATO participants.

III. INTERNAL OFFSETS

Boeing's longer term, more detailed study, undertaken together with NATO's AWACS Project Office (NAPO), concerns offset possibilities *internal* to AWACS. The emphasis of the Rand effort summarized in this report is on external offsets. Nevertheless, some consideration of the internal side of the problem is a necessary input to the formulation and evaluation of alternative offset strategies in Sec. VI. In this chapter we present some observations on internal aspects, beginning with several comments on the Boeing NAPO study. None of the observations is intended as criticism of the study, but rather as suggestions which may be of some use in pursuing it.

METHODS AND PROCEDURES OF THE BOEING STUDY

The Boeing Company study consists of two phases. The first, which ended in mid-November 1975, will produce preliminary cost estimates of the NATO AWACS production run (12 to 50 aircraft), an estimate of the cost and degree of European industrial collaboration, and certain technical studies. The final phase, due in the spring of 1976, will result in a firm cost proposal and contain a complete technical evaluation of the "enhancements," or special features, to be added to the basic USAF aircraft for the NATO mission.

We address here only the part of this work dealing with European "industrial participation."

Selecting Firms

The present plan of the Boeing NAPO study involves a complex procedure for ascertaining the capabilities of potential producers. This procedure involves, first, a preliminary description by Boeing and its American subcontractors of particular components of the system, which are being circulated in the form of a large number (695 to date) of bid packages to a large number of possible European producers (perhaps 100 to 150) to ascertain their interest in producing the item in question. The list of eligible firms is to be further reviewed and expanded by the Ministries of Defense of the NATO countries.

Second, the procedure will involve transmission by Boeing, or the other American AWACS subcontractors, of detailed drawings of the system components. In one case, 6500 production drawings of particular components will be transmitted for the purpose of eliciting budgetary estimates from respondent firms.

Next, while these budgetary estimates are being prepared and transmitted to Boeing, vendor survey teams will make site visits and conduct discussions with all responding firms that have expressed interest. Separate evaluations of the budgetary estimates will then be made in Seattle.

The final step in this process is to produce requests for proposals (RFPs) for submission to firms that appear to be qualified and certified by the MODs, according to the prior steps. Thereafter, responses to the RFPs will have to be evaluated early in 1976.

What concerns us about the process is its complexity, as well as its possibly perverse incentives and consequences. For example, it is not implausible that firms which, although technically qualified, are already competing favorably in existing markets and have a relatively high degree of capacity utilization in their present plant, will choose *not* to respond. On the other hand, firms that are less qualified but have greater need for additional business, may be more likely to respond. Furthermore, the role of the MODs in certifying or expanding the lists of eligible firms is another factor whose impact on the quality of the outcome is hard to fathom. It is possible that firms will be promoted by MODs in particular countries for reasons relating only secondarily to technical proficiency.

Perhaps a simpler process might be devised that would forgo the breadth of this broadcast method of canvassing eligible firms, and instead would rely either on Boeing or its American subcontractors to identify those European firms with whom they have engaged in licensing or co-production activities in the past with successful results. Indeed, the outcome of the present procedure may well turn out this way anyhow, if the procedure generates such a tremendous burden of paperwork and communication as to make it inoperable.

Evaluating Lead Time

Responses to the Boeing bid packages will require careful evaluation with respect to production lead time. The first NATO AWACS aircraft is currently scheduled for delivery in 1978, including time for system integration and checkout. This is predicated on NATO picking up the thirteenth AWACS aircraft, that is, the first aircraft following the twelve to be procured by the United States Air Force with funding that is already firm. If there is a delay in the first NATO delivery, the AWACS production line would close down, further increasing AWACS unit cost due to subsequent start-up expenses. Therefore, if European firms are to participate, they are constrained to producing those items which can be available sufficiently early to conform to this schedule. Since these firms will not be selected until some time in early 1976, the type of equipment that can be procured from them may well be limited to rather short lead time items, or standard off-the-shelf components, thus severely restricting the offset objective of technology transfer.

In addition, there is a problem of termination liability on long lead time items. Longer lead time contracts should be placed before the end of 1975. It is unlikely that any of the European NATO countries can obtain funding that fast. Therefore, the United States may be required, as part of its share, to fund most or all of the long lead time items. However, if the contracts are later terminated, for whatever reasons, the burden of these termination liabilities is likely to be a source of contention between the United States and the participating countries.

Establishing Cutoff Points

Other problems and difficulties are involved in the process of quantifying European producers to reach initial offset targets. For example, with respect to some of the high technology items, especially computers and electronic components, qualified European co-producers are likely to purchase significant inputs from the United States and Japan. It is our understanding that such offshore purchases will be taken into account to adjust the calculated offsets if the purchases are *more* than $500,000, but will be ignored if they are *less*. This

arbitrary cutoff point has evidently been decided on by NAPO in order to simplify the already complex process. However, such a threshold seems of doubtful merit, and is likely to lead to various accounting artifices (e.g., in labeling or timing of purchases in a given year) to qualify particular firms and purchases, with only illusory effects on the "real" offsets that ensue. As a general rule, it would be preferable simply to subtract first-round offshore purchases from the calculated offsets.

Adjusting the Offsets

A further complexity arises from the evident necessity to revise the list of eligible producers, as well as the amount of industrial participation by particular European producers, to conform to each NATO country's subsequent decision on how many AWACS aircraft it proposes to buy. If, for example, firms in the United Kingdom were earmarked to receive a larger share of the offset total than firms in the Federal Republic, but the latter is buying a larger share of the AWACS force, then the earmarked offsets will have to be adjusted accordingly. This proportionality restriction contributes to an inefficient outcome, and seems likely to raise the attendant costs of offsets, as well as add further complexity to the process.

Would it not be possible to obtain from those NATO countries--at least those who are members of the European Economic Community--an understanding *to treat internal offsets contracted for in any part of the EEC as contributing to the overall offset target, rather than having to reach targets within each of the buying countries proportional to their separate purchases*? It should be evident that this effort to "widen the market" would have benefits from the standpoint of administrative simplicity as well as production efficiency.

Enforcing Contractual Commitments

In subcontracting with European participants, Boeing intends to use the same sort of fixed price contractual arrangements that it has applied to its American subcontractors in the production of the USAF AWACS. However, as the number of participants grows, bringing with it a larger number of European firms that have not participated in the

prior production effort, problems of enforcing these contractual commitments will intensify not only with respect to the adequacy of the fixed price provision, but also with respect to schedule slippages and possible inadequacies in performance as well. These contractual enforcement problems constitute another source of the increased costs likely to be associated with significant amounts of internal offset efforts. *They perhaps suggest that external offsets may be more efficient, at this stage of the game, for meeting any given overall total offset target.* In any event, it would be useful for Boeing and the Air Force to make full use, in the NATO AWACS effort, of whatever contractual arrangements and experience General Dynamics is developing for the co-production in Europe of the F-16 aircraft, in order to minimize subsequent renegotiation problems and costs accompanying NATO AWACS.

Presenting Results

In the evaluation of internal offset targets and packages, the central focus of the process should be on the increased costs of achieving various offset goals.[1] There also should be a rough estimate of the uncertainty attached to each cost estimate. This uncertainty is likely to increase as the percentage of offsets increases.

The Boeing NAPO study displays the results of its industrial participation analysis in the form of a range of values, showing the relationship between increased system costs and the size of the internal offsets between 0 and 25 percent for varying levels of AWACS procurement.[2] For a number of reasons already alluded to, we would anticipate that most offsets will increase costs probably at all points above a quite modest offset target.

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[1] One can posit a relationship between the increased costs of the system as the dependent variable, and the percentage of internal offsets and the size of the NATO buy, as the independent variables. The schedule of delivery for the NATO AWACS, as well as the quality of the system, can be thought of as a similarly determined outcome, affected by the same two independent variables.

[2] See "Executive Summary" and "NATO Industrial Collaboration," in Boeing Aerospace Company, *NATO AWACS*, NAPO/PM (75)-323, Seattle, Washington, November 12, 1975.

As a decisionmaking tool, it seems to us that presenting results in this form is an excellent idea. It will place squarely before the Conference of National Armaments Directors and the Defense Planning Committee the central tradeoff issue that is involved in their decision on internal offset goals.

SOME POSSIBLE CANDIDATES FOR INTERNAL OFFSETS

Integration

One interesting and potentially lucrative source of internal offsets being considered by Boeing relates to having a European firm do the assembly and integration of the mission avionics in aircraft provided by Boeing. This integration function could itself offset as much as 4 to 6½ percent of the delivery cost of AWACS. Performing it in Europe would be the largest contributor to the overall offset target, as well as possibly facilitating technology transfer through increased familiarization with this aspect of the component technology. However, since European capability to perform this function may not be sufficient at the start, a penalty might be paid, either in terms of cost or delivery time, if the *initial* NATO AWACS aircraft were to be handled in this manner. Instead, a preferable mode might be for the designated European firm(s) to send a suitably constituted team to the United States to work with Boeing on the system integration of the initial NATO aircraft, with subsequent deliveries to be assembled and integrated in Europe after the European team(s) become fully familiar with the task.

Propulsion

The USAF AWACS will be powered by four modified Pratt and Whitney TF-33s, each delivering approximately 22,000 lb thrust and driving a 150 KVA generator. In its earlier short term study of offsets, Boeing considered three alternative powerplants for the NATO AWACS and rejected two of them (the Rolls Royce RCO-43 and the RB-235). The third engine, the GE/SNECMA CFM-56, is considered acceptable if accompanied by some modification of the nacelle struts or the landing gear, but a decision on this engine is still pending.

The issue of alternative powerplants warrants and is receiving further and serious consideration. Use of the TF-33 would, in all probability, be the most economical solution, but cost considerations need to be combined with others in arriving at a decision.

The net impact on unit cost of using a different engine for AWACS would be the difference between the cost of four TF-33s (about $3 million) and the cost of four other engines, plus the cost of qualifying the new engine in the 707. Boeing has estimated that it would cost $40 million to certify the 707 with the GE/SNECMA CFM-56, and the engines (including nacelles) would add another $2 million to the cost of such aircraft. Whether or not this would be worthwhile depends on several factors, including its effect on French participation in the AWACS buy, and the reaction of other European buyers as to whether this offset would be worth the higher price. In any event, the maximum possible offset is $3 million per aircraft, i.e., roughly 5 percent.

Used 707s for AWACS

Boeing has concluded a brief study on converting 707s now in airline service in Europe to AWACS aircraft. The results of the study show that it would cost more to convert an existing aircraft than it would to purchase a new aircraft.

Boeing's estimates of conversion cost are given in Table 1. Since these costs exceed the cost of a new airframe, it was concluded that the purchase and conversion of used 707s is not economic. The study postulated the conversion of the used aircraft to essentially new aircraft. The results might have been quite different if, instead, it had been assumed that any 707 type commercial aircraft could be gutted and outfitted with the mission avionics with a minimum change to the airframe envelope. Obviously some modification cost would be incurred for the antennas, radar rotordome and strut, and re-engining the aircraft. If the costs for a minimum modification program were to approach or be only slightly below that of a new aircraft, the new aircraft would still be preferred. This option seems to warrant further study.

Table 1

BOEING ESTIMATES OF COST OF CONVERTING 707s
TO AWACS AIRCRAFT

(In $ million)

Item	707-120	707-320
Purchase price or resale value	1.5-2.0	4.5-6.6
Tooling cost	0.1	0.1
Modification cost	14.0-16.2	12.6-14.7
Total cost per aircraft	15.6-18.3	17.1-21.4

Basic Avionics

If we are really seeking to evaluate the full range of possibilities in the area of internal offsets, then a complete European basic avionics package (i.e., communications and navigation equipment, and flight instruments) should be included in the evaluation. It was not clear from either Boeing reports, or from our discussions with Boeing people, just how much of the basic avionics are currently being considered for offset.

Operations

Finally, offsets may be achieved, at least in part, in the operations of the system. Here, real offsets--i.e., European substitution for U.S. participation--are more difficult to recognize. Boeing has estimated that the following costs would apply for the planned USAF fleet of 12 aircraft, based on USAF cost factors, and these should be appropriate for NATO operations as well. Because of the substantial maintenance costs associated with the large amount of avionics on board, the estimated annual operating cost per aircraft (i.e., $90 million/12 aircraft = $7.5 million) seems to us low for the planned level of flying hours. This cost is 13 percent of the aircraft cost.[1]

[1]While the Air Force currently has no airplanes similar to the AWACS configuration which could be used as an analog, the Navy flies ASW airplanes which have substantial avionics payloads. These aircraft

Table 2 gives Boeing's estimates of operations costs. Only some of the items listed are candidates for offset: the costs for depot, spares, training, and "other"--a total of $30.3 million per year if completely performed in Europe. We estimate that performing these functions in Europe would probably amount to offsets of about $3 million per year per aircraft. The size of offsets through operations costs would thus be substantial. For a NATO AWACS buy of 25 aircraft, offsets would be $75 million per year.[1]

Table 2

BOEING ESTIMATES OF AWACS ANNUAL OPERATIONS COSTS

(In $ million)

Operating Cost Category	Cost Per Year for 12 Aircraft
Main Operating Base	34.2
Forward Operating Base	7.0
POL	18.4
Depot	10.8
Spares	11.7
Training	4.4
Other	3.4
Total	$89.9

SOURCE: Discussions with Boeing staff, August 1975.

GENERAL LEVEL OF INTERNAL OFFSETS

Boeing's initial estimates of the possibilities for direct production offsets, and the subsystem areas in which they will occur, are summarized in Table 3.

It should be noted that six areas account for almost all of the

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have experienced annual operating costs between 15 and 20 percent of procurement costs, a figure that is probably more reasonable than the 13 percent quoted here.

[1]The AWACS buy of 25 aircraft is assumed for analytical purposes in comparing offset strategies. See Sec. VI.

Table 3

BOEING ESTIMATES OF PRODUCTION OFFSETS

(In $ million)

Aircraft Subsystems	Percentage of Total Production Cost for 32 AWACS[a]
Integration and checkout (ICO)	4-6½
Radar	2½-4
Data processor	1-2
Communications	2-4½
Displays	1½-2
Aircraft components	2½-5
Nacelles	2½-3
Engines	3-5
Other	2½-4
Total	21½-36

SOURCE: Discussions with Boeing staff, August 1975.

[a]Percentage offsets are derived based on some absolute level of program costs. The value of this level was not disclosed, nor could it be until the results of the potential offset participants costs are completed in the fall of 1975. It can be assumed for now that 32 aircraft would cost approximately $2 billion. As noted earlier, we assume in the present study a buy of 25 aircraft for purposes of comparing the several offset strategies.

estimated production offsets: integration and checkout, radar, communications, aircraft components, engines, and "other" (which itself is composed of several small items). Together the six areas would entail offsets ranging between 16½ percent and 30 percent of total procurement costs. We make use of this range in constructing several alternative offset options in Sec. VI.

One final comment on internal offsets is warranted. In view of the large contractor interests involved, the Air Force should consider seeking independent NATO assessment of the various alternatives for internal offsets developed by Boeing's study. Whether this assessment

can best be done by the NATO AWACS Project Office alone, or by the SHAPE Technical Center, or by the several Ministries of Defense, we cannot say. As it stands now, however, the United States may be open to charges of bias in the internal offset portion of the NATO AWACS sales effort. By contrast, the United States may come out ahead no matter what the outcome of a NATO analysis: if NATO sustains the Boeing findings, we would not be vulnerable to charges of bias; if NATO reverses the Boeing findings and the change proves costly or troublesome or both, it was a NATO decision.

IV. EXTERNAL MILITARY OFFSETS

In the context of the present study, external offsets are any offsets lying outside the AWACS program. In this section, we concentrate on external military offsets, i.e., European military equipment whose development or procurement may be promising as AWACS offsets. External nonmilitary offsets are discussed in Sec. V.

An important difference between internal and external offsets is that the latter offer substantially more opportunities for finding a match between one party's capability and another's need. In addition to opening the search to include virtually anything made by the party needing offsets, external offsets make it possible to distribute benefits over time (e.g., some now, some later) and, if desired, to particular industries. Also, external offsets are more easily tailored to suit particular objectives such as technology transfer or employment. On the other hand, external offsets may be considered less certain by the recipients to the extent that they involve promises of *future* actions by the United States. Moreover, external offsets are harder to tie to a particular program such as AWACS. For example, it may be difficult to persuade a country that a U.S. purchase of a tank gun from that country is really an offset for AWACS. They could argue that we would have likely bought the gun anyway, if it were cost effective. Of course, a reasonable counterargument can be made by recalling the precedent of the previous offset arrangements. In the late 1960s and early 1970s, the United States accepted, as a major (more than 50 percent) part of the offset account with Germany and other NATO countries, their purchases of military equipment in the United States.

In addition to helping offset a NATO purchase of AWACS, the military offsets discussed in this section would contribute to the "two-way street" envisaged in the Mason-Schlesinger dialogue and in the activities of Eurogroup. They would also be in accordance with the Culver-Nunn Amendment to the FY 1976 Defense Authorization bill, which requires that the Secretary of Defense provide for the acquisition of equipment that is standardized or interoperable with equipment of other members

of NATO, whenever such equipment is designed primarily for use by U.S. forces stationed in Europe.

On balance, then, internal offsets offer one set of advantages and external offsets another. Any given offset package could well include both elements.

METHOD AND DATA SOURCES

A thorough evaluation of military offset possibilities would include:

- An examination of the military equipment needs of the buying country.
- A survey of military equipment available (and in development) in the buying country and in potential supplier countries.
- A cost-effectiveness analysis of the capabilities of existing or planned military equipment to meet the buyer country's needs.

Offsets could then be selected based on a combination of cost-effectiveness and other considerations (e.g., political). For the present study, however, limitations of time and available data did not permit an evaluation of alternatives. Cost data were especially hard to get, as were out-year replacement schedules and detailed performance data. Even had such data been available, the evaluation would still be incomplete in that detailed evaluations of the *relative* effectiveness for various purposes of European and American systems would be required before firm decisions were made. The analysis is also subject to several other limitations:

First, only complete weapons were considered. We did not include subsystems, such as radars or fire control systems, which would probably be excellent offset candidates.[1] However, the complete weapons seem more important because of their greater potential contribution

[1]See, for example, the May 1975 USAF NATO Initiatives Action Group report on "Swap of Buys."

to offset, and there were more than enough complete systems to examine in the time available.

Second, we did not perform detailed analytical comparisons of alternative weapons for a given mission. Instead, we relied heavily on expert opinion from people intimately acquainted with both U.S. and foreign programs and requirements.[1] Although this process is manifestly inexact, its results are useful for our present purpose of illustrating the range of options worth further exploration.

Finally, in estimating the value of various offset packages, it was often, although not always, necessary to estimate unit costs and the likely size of a U.S. buy of the various items.

From discussions with the sources listed in fn. 1 below, as well as from reference to standard works such as *Jane's All the World's Weapons Systems*, there emerged a useful illustrative list of the most promising weapon candidates for external military offset. Although the list is largely based on our impressions, it nevertheless represents a good starting point for further analysis of candidates for external military offsets.

Before presenting the list of offset candidates, we outline some ways in which external military offsets might be implemented.

ALTERNATIVE WAYS OF IMPLEMENTING OFFSETS

There are several ways in which the United States could purchase items as part of an offset package, and the choice among them can affect substantially the amount of U.S. expenditure that would be credited as offset.

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[1] Our principal sources in the United States included contacts in the offices of the Director of Defense Research and Engineering; Assistant Secretary of Defense (Program Analysis and Evaluation); Assistant Secretary of Defense (International Security Affairs); Defense Security Assistance Agency; Joint Chiefs of Staff (J-5); the Department of State (Office of Politico-Military Affairs); and the NATO Initiatives Action Group in Air Force Headquarters. Our principal overseas sources included members of the U.S., Canadian, British, French, and German delegations to NATO; members of the NATO International Staff; and (by telephone and telegram) members of the U.S. Military Assistance Advisory Groups and Defense Attaché Offices in Bonn, London, Paris, and Rome.

The simplest case would involve direct U.S. purchase of an item manufactured in another NATO country. In this case (assuming no subcontracting or equipment purchase in the United States), the entire transaction would be counted as offset.

At the other extreme, the United States could obtain a license from a European developer to produce the item here. If all the work were done in the United States, however, the only offset would be the license and royalty fees, typically about 15 percent of the program cost.

Between these two extremes, some combination of licensing and overseas material purchases and subcontracting could yield offsets ranging from the 15 percent corresponding to U.S. production of the complete item under license, to approximately 110 percent, corresponding to U.S. purchase of license rights (for an assumed 10 percent) as insurance while buying the item overseas. This last option, while more costly than a straight purchase, may allay the fears of those concerned with the reliability of overseas sources as suppliers of U.S. military equipment.

CANDIDATE WEAPONS FOR EXTERNAL MILITARY OFFSETS

In developing the following list of potential offset candidates we used two principal criteria: (1) cost-effectiveness relative to U.S. and foreign alternatives and (2) impact on standardization.[1] The resulting list contains those weapons that, in our opinion, met these criteria at least roughly and that deserve more detailed consideration.[2]

It is convenient to discuss the candidates under the basic headings

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[1]Because of limited availability of reliable data on cost and effectiveness, it was necessary, as noted earlier, to rely heavily on expert opinion in developing this list.

[2]Some examples of weapons that were *omitted* by these criteria include Dardo (an Italian ship defense weapon) and Naval Crotale (a French ship defense weapon) on standardization grounds; AMX 30 (a French tank) on cost-effectiveness grounds--it lost a NATO competition with the FRG Leopard I; and Sea Wolf (a British ship defense missile) and Swingfire (a British antitank weapon) on a combination of expert opinion and effectiveness grounds.

of land warfare, naval warfare, and air warfare. Some items (e.g., attack helicopters) could fall under two or even three of these headings, but these divisions are used by both ODDR&E and NATO, and it seems reasonable to retain them here.[1]

Land Warfare[2]

According to the sources we have consulted, the most promising land warfare areas in which to look for external offsets are tanks, antitank weapons, artillery (including rockets), and antiaircraft weapons.

Tanks. The *Leopard* main battle tank began development in the Federal Republic of Germany (FRG) in 1957. The first production version was delivered in 1965. Since then over 3000 Leopards have been delivered to Germany, Belgium, the Netherlands, Italy, and Norway. The Leopard is being built in the Federal Republic and, under license, in Italy. A modernized version, the Leopard II, has been built in prototype form, and one has been delivered to the U.S. Army for testing. It features a high power-to-weight ratio and excellent mobility and has been commented on favorably by numerous U.S. officials. In its present form, the Leopard II is expected to cost about the same as its U.S. counterpart, the XM-1, although there is great uncertainty over the cost estimates for both tanks. In an attempt to reduce the cost of Leopard II, the Federal Republic is developing an "Americanized" version, which will feature an unspecified lower cost--with some reduction in capability. The Americanized Leopard is scheduled to compete with the winner of the U.S. Main Battle Tank competition (between Chrysler and General Motors) in September 1976.[3]

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[1]ODDR&E uses the terminology land warfare, ocean control, and air warfare, while the NATO Armaments Groups are divided into Army, Navy, and Air Force sections.

[2]Additional information related to the material discussed in this section is presented in App. A.

[3]Given the depressed state of the automobile industry in the United States, purchase of a European tank would present some of the same sorts of political difficulties mentioned in Sec. II in our comments on unemployment in European defense industries. Under the circumstances, some form of licensing and coproduction of the Leopard tank in the United States might be a practical solution.

The *FMBT 80*, a proposed main battle tank to be developed jointly by the FRG and the United Kingdom, could be interesting if it comes to fruition. This is especially true because the tank is in an early enough stage of development to permit some agreement on its configuration.

Antitank Weapons. There is a great flurry of activity on both sides of the Atlantic in the area of antitank weapons. The most promising European candidates for possible U.S. purchase are the *Armbrust*, *Milan*, and *HOT*.

Armbrust is a short-range (300 m), man-portable, shoulder-fired, expendable, antitank weapon being developed by the FRG. It is designed to replace older short-range weapons such as the U.S. LAW. Armbrust will be tested in the United States. The principal issue with regard to U.S. procurement of Armbrust is the doctrinal one of where Armbrust fits into an overall antitank defense.

Milan is an antitank missile system developed jointly by the FRG and France. It is a wire-guided, man-portable weapon similar to the U.S. TOW, but with shorter maximum range (2000 m vs. 3000 m) and lower weight. Milan fills a gap in U.S. antitank weapons between the 1000 m man-portable Dragon and the 3000 m vehicle-mounted TOW. Milan is in production. It performed well in tests in the United States (Ft. Ord) in 1974. Present cost estimates put Milan in the $8000 per unit category, vs. $8000 for Dragon and $4500 for TOW. These numbers, however, reflect the relative production of each missile; at equivalent points in production, one could reasonably expect the missiles to rank in price as they do in range, i.e., Dragon, Milan, and TOW.

HOT is a tube-launched, wire-guided missile, similar to Milan and TOW but with longer range (4000 m) than either. It operates primarily from vehicles and helicopters. The missile was developed by the same organization responsible for Milan. HOT has been purchased by the FRG and is in production. Present cost estimates are $10,000 per missile, but this should decrease with increasing production.

Light-Attack Helicopters. Three European-developed light-attack helicopters--the Anglo-French *Gazelle*, the German *B0115*, and the Italian *Ag129*--all appear responsive to a U.S. need for an Advanced Scout

Helicopter (ASH). These helicopters range in gross weight from just under 4000 lb to 5300 lb and can all carry antitank missiles. Gazelle is operational, and the BO115 and the Ag129 are being developed from the BO105 and the Ag109, respectively.

Artillery. Two joint artillery development projects appear to offer good opportunities for offset. The FRG, the UK, and Italy are cooperating in the development of a towed 155 mm howitzer (*FH70*) and a self-propelled version (*SP70*). Both are considered by knowledgeable observers to be serious contenders for introduction into the U.S. inventory. The FH70 is scheduled to start production in mid-1976, the SP70 will start development trials in 1976.

Artillery Rockets. Several European and international artillery rocket programs are of potential interest to the United States, notably the FRG *LARS*, the French *RAP14*, and the US/UK/Italian *RS80*. LARS and RAP14 have maximum ranges of about 15 km, while the proposed RS80 is expected to be in the 20-30 km range. All of these are potential competitors for the U.S. Ground Support Rocket System (GSRS), development of which began this year.

Antiaircraft Weapons. The French *Javelot*, a short-range, low altitude, surface-to-air, multiple-rocket antiaircraft weapon, and the FRG *Flakpanzer Gepard*, a twin-35 mm antiaircraft gun system, are both interesting candidates for an offset package. The United States is working with France in developing the Javelot, and we are testing the Gepard.

Miscellaneous. In addition to the specific items named above, several other less well-defined concepts may offer substantial offset possibilities. For instance, NATO is interested in developing a *four-weapon antitank family* (short-range, man-portable; 1000 m man-portable; medium-range, crew-portable; and a helicopter-borne long-range weapon) for use in the 1985-1995 time period. Also, there is a program in being to develop a *common NATO rifle* for the post-1980 period. *Combat bridging* is an area in which the UK is known to be especially good. A post-1980 *family of combat vehicles* is currently under study in NATO.

Electronic countermeasures and *tactical communications* for land forces are two areas in which offset opportunities could arise.

Finally, European-developed *guns*, in all calibers, are deemed by many observers to be worthy of serious consideration for procurement for U.S. forces.

Naval Warfare

Due to a substantial U.S. technological lead in several important naval areas--notably ship defense and antiship missiles--European-developed naval warfare systems do not offer as many offset opportunities as the corresponding land warfare systems. There are, nonetheless, several opportunities that seem worthy of consideration.

Ship Defense. The French-developed *Catulle* (a naval version of Javelot, discussed above) represents a novel approach to ship defense. The United States is actively monitoring this program.

The Franco-German *Marine Rolland II* and the German *Kumar* are examples of ship defense missile systems that could be compatible with the U.S. *SIRCS* (Shipboard Intermediate Range Combat System). All of these programs are in development, and it has been suggested that if the involved countries could agree on a common threat, the programs could possibly be merged.

Antiship Missiles. Existing European programs in this area are generally thought to be inferior to the U.S. Harpoon. There is, however, an ongoing effort in NATO to develop a *Second-Generation ASM*. U.S. personnel allege that the present specifications for the missile are inadequate (especially the range), but if mutually acceptable specifications can be agreed on, this could be an offset opportunity.

A British program, the *Sea Skua* helicopter-launched antiship missile (less than one-fourth the weight of Harpoon) is a potentially useful weapon against smaller ships.

Miscellaneous. Other potential offset candidates in the naval warfare area include two British programs: the *Project 7511 lightweight torpedo* intended for use by surface ships and aircraft and the *Sea Harrier*, intended for use aboard the Royal Navy's Through-Deck Cruisers. The Sea Harrier may be of particular interest to the U.S. Navy as a result of a recent change in emphasis from large-deck to small-deck carriers like the CVLNX.

The United States is the highest cost shipbuilder in the world. Several European countries (e.g., the United Kingdom and the Federal Republic) have demonstrated an ability to build good ships at competitive prices. Thus, from a technical and cost standpoint, procurement of U.S. naval *ships* in Europe could be attractive. The feasibility of this, of course, depends on political and other considerations at least as much as on technical ones.

The British have demonstrated a capability to design and produce *hovercraft*, which may be useful for mine countermeasures.

Finally, European *mines* and mine technology are reputed to be excellent and very competitive with U.S. products.

Air Warfare

Although U.S. aerospace technology in general enjoys a substantial lead over its European counterparts, there are several European-developed items that may be of interest as parts of an offset package.

Aircraft. The most well-known of these is probably the British Harrier VTOL aircraft, the AV-8A version of which was purchased directly from the United Kingdom by the U.S. Marine Corps and is now being developed by McDonnell Douglas into an *Advanced Harrier* to be known as the AV-8B. (An earlier plan to develop an AV-16 Advanced Harrier, with a new engine, has been abandoned.) Under present plans, the British would produce 40-50 percent of the aircraft, and with expected orders and costs, this could yield an offset of $500-600 million.

Other European aircraft that look attractive for possible U.S. purchase include the British *Hawk*, the Franco-German *Alphajet*, and the Italian *MB 339* jet trainer/light strike aircraft. This idea is particularly attractive for two reasons. First, it ties in nicely with a proposal advanced by the USAF NATO Initiatives Action Group to train all NATO jet pilots in the United States. This proposal has been favorably received in DoD and is receiving high-level NATO consideration. Such a program would require about 200 new trainer aircraft. A second reason these aircraft are attractive for overseas purchase is that the concern for interruptions in production, so often voiced as a rationale for "Buy America," is not likely to be important for a trainer. Present

cost estimates place the unit cost of Hawk, Alphajet, and MB 339 at $2.3 million versus $1.34 million for the closest U.S. competitor, the Rockwell International T-2C, earlier versions of which have been in production in the United States for several years. Increased orders for one of the European trainers, however, would be expected to lower their cost substantially.

Aircraft Armament. Two dogfight missiles--the French *Matra 550 "Magic"* and the British *SRAAM* (short-range, air-to-air missile)--are potential entrants in the anticipated U.S. competition to develop a follow-on missile to the AIM-9 Sidewinder. Either of them would be worth considering for inclusion in an offset package.

Two weapons with offset potential under development in the Federal Republic are the *Jumbo* and *Strebo*. Jumbo is a rocket-powered stand-off missile with a range of up to 40 km. A 2500 lb weapon with a variety of warheads, it uses inertial guidance for midcourse and TV near the target and can be launched from low or high altitudes. Strebo, a large (10,000 lb) sideward dispenser intended for carriage on the MRCA, can deliver submunitions in a selectable pattern from low-altitude level flight. It is intended to be used in attacking airfields. Although too heavy in its present form for existing U.S. aircraft, the Strebo concept may nevertheless be worth further consideration.

Other possible offset candidates include the British *XJ521* air-to-air missile designed as a Sparrow replacement, and a *2.75" folding-fin aircraft rocket* being developed by Belgium and Canada for attacking sheltered aircraft.

ESTIMATING THE DOLLAR VALUE OF VARIOUS OFFSET ALTERNATIVES

As already emphasized, data on the costs of foreign-developed weapons are extremely difficult to obtain. For this reason, it is not generally feasible to combine unit cost figures with "reasonable" U.S. purchases to estimate the offset corresponding to each weapon type. From data we do have, however, it seems clear that the potential for offset purchases in Europe exceeds by several times any conceivable amount needed to offset a European purchase of AWACS.

For example, a European purchase of 32 AWACS at $60 million each

(both figures on the high side) yields a transaction value of $1.9 billion. A U.S. purchase of 3300 Leopard II tanks (the proposed purchase of XM-1) would yield approximately $3.3 billion in offsets. A buy of 300 Advanced Harriers (AV-8B) would yield between $500 and $600 million in offsets to the United Kingdom, allowing for the fact that it would receive only about 40 percent of the contract value, while 60 percent would remain in the United States. Purchase of 200 each of either the Hawk, Alphajet, or MB 339 jet trainers to support the training of NATO jet pilots in the United States would yield over $400 million in offsets.[1] Selection of the BO115 or Ag129 for the Advanced Scout helicopter could yield approximately $125 million in offsets for 96 aircraft. Addition of the FH70 155 mm howitzer to the U.S. inventory could yield $600-700 million if it were used to replace existing howitzers. The list could easily be extended, but it would simply reinforce the conclusion already stated: There is more than enough military offset potential in Europe to offset a European purchase of AWACS. Potential offset amounts, corresponding to the various weapons for which we could obtain data, are summarized in Table 4.

RESULTS AND CONCLUSIONS

Several considerations have to be taken into account in constructing an external military offset package. Among these are the desired offset size and distribution of offsets by the recipient country, industry, and time period, as well as the cost and performance characteristics of the candidate systems. As noted earlier, all of these considerations would clearly have to be analyzed with greater care than we have devoted to them in this study. Nevertheless, the illustrative list of offset candidates discussed above includes a wide range of items that seem likely to stand up to further scrutiny. Rather than discuss the merits of different packages, it should be sufficient for our purposes here to observe that there appear to be *many* offset opportunities covering a wide range of existing weapons, weapons in

[1] At present prices. At a more realistic price, the purchase would yield about $260 million in offsets.

Table 4

ESTIMATED OFFSETS RESULTING FROM U.S. PURCHASE OF SELECTED EUROPEAN-DEVELOPED WEAPONS

Offset Candidate	Unit Cost ($ million)	Assumed Size of a "Reasonable" U.S. Buy	Estimated Offset for U.S. Purchase Overseas ($ million)
Land warfare			
Leopard II	1.0[a]	3,300[b]	3,300
Americanized Leopard	0.8[c]	3,300[b]	2,640
Armbrust	0.0004[a]	50,000[d]	20
Milan	0.008[e]	50,000[d]	400
HOT	0.01[f]	50,000[d]	500
Gazelle	0.345[g]	96[h]	33
B0115	1.3[e]	96[h]	125
Ag 129	1.3[i]	96[h]	125
FH 70	0.4[a]-0.46[g]	1,600[d]	640-740
SP 70	0.6-1.2[g]	800[d]	480-960
Flakpanzer Gepard	1.6[e]-2.4[a]	400[d]	640-960
Naval warfare			
SIRCS	5-50[j]	300[j]	1,000[k]
2nd generation ASM	0.250[l]	500-1,000[d]	125-250
Sea Skua	0.12[g]	1,000[d]	120
Project 7511	0.24[g]	4,000[d]	960
Sea Harrier	5-6[m]	100[d]	500-600
Air warfare			
Advanced Harrier	4.5-5[m]	300[m]	540-600[n]
Hawk	2.3[g]	200[o]	460
Alphajet	2.3[p]	200[o]	460
MB 339	2.3[p]	200[o]	460
Matra 550 "Magic"	0.045	5,000[d]	225
SRAAM	0.043[g]	5,000[d]	215
Jumbo	0.034[a]	4,000[d]	136

[a] From U.S. Military Assistance Advisory Group (MAAG) in Bonn.

[b] The expected buy of the XM-1 is 3312 plus 11 prototypes. DMS, Inc., *DMS Market Intelligence Reports*, Los Angeles, California, August 1975.

[c] Estimated at 80 percent of Leopard II.

[d] Rough estimate based on existing inventories or objectives for comparable equipment.

[e] *Federal Republic of Germany Reply to the Questionnaire for the 1974 Defense Planning Review* (U), Ministry of Defense, Bonn, 31 July 1974.

[f] From U.S. MAAG in Rome.

[g] From Assistant U.S. Air Attaché, London.

[h] Proposed buy of the Advanced Scout Helicopter (ASH). DMS, Inc., *DMS Market Intelligence Reports*, Los Angeles, California, August 1975.

[i] Assumed to be the same as the B0115.

[j] Estimate from ODDR&E (Ocean Control). The wide variation in cost corresponds to the differing requirements of ships as a function of their size. The smaller number corresponds to a 1000 ton ship, the larger number to an aircraft carrier.

[k] Assumes that an average SIRCS installation costs $10,000 per ship and that one-third of the manufacturing is done in Europe.

[l] Assumes 2nd generation ASM is supplied to United States without guidance. Estimate from ODDR&E (Ocean Control).

[m] From Col. J. R. Braddon, NAVAIR (PMA257).

[n] This amount, which would go to the UK under the license agreement with McDonnell Douglas, is 40 percent of the program cost.

[o] USAF NATO Initiatives Action Group (NIAG) estimate of the number of trainers required to train NATO jet pilots in the United States.

[p] Assumed equal to Hawk.

development, and "conceptual" weapons with enough promise of competing favorably with counterpart U.S. systems that they are being, or could be, purchased in Europe for the United States. Also, although not discussed here, there are opportunities in the area of subsystems and services. In sum, the range of military options for implementing offsets, the "two-way street," and standardization of weapons with NATO, is extremely broad.

Yet an important caveat should be emphasized. We have tried to develop a "shopping list" of European weapons that seem to be reasonable candidates for competing favorably on efficiency grounds with counterpart U.S. systems. Our list may, indeed, be the best one available. Yet we are frankly uneasy about it, partly because we have not performed any thorough systems analysis to support even one member of the list, and partly because we could not discover that anyone else had done so either. Therefore, the prudent inference is to treat Table 4 as illustrating possible candidates rather than advocating particular items.

V. EXTERNAL NONMILITARY OFFSETS

U.S. IMPORTS OF INDUSTRIAL COMMODITIES

Purpose of Analysis

In this section we extend the range of AWACS offsets to include nonmilitary products. This extension adds flexibility to the offset selection process and could yield a significant reduction in the cost of the overall offset package. Offsets are nontariff distortions to international trade because they force transactions to take place that normal market incentives would not induce. Consequently, if offsets were restricted to internal and external military procurements, the cost of achieving a satisfactory offset target could be substantial relative to the total cost of AWACS without offsets. The inclusion of nonmilitary products as potential offsets reduces the inefficiencies of using offsets as a procurement strategy. It also suggests certain long-run adjustments--such as reduction or removal of "Buy America" and other trade restrictions--that would lead to more efficient resource use in NATO as a whole, and would remove some of the motives for offsets.

Internal offsets can only be rationalized on purely economic grounds, where they are viewed as responses to the Buy America policy. This policy, a nontariff trade barrier, may have excluded NATO companies that could have produced AWACS components more efficiently than the U.S. firms that were actually chosen. It should, of course, be apparent that the preference for domestic suppliers need not be founded on blind jingoism. Proximity, common language, and ease of acquiring information are all economic arguments favoring domestic suppliers. Avoidance of dependence on foreign sources of supply can also be formulated as an effective argument whose aim is to reduce the probability that such dependence might be used to extract short-run monopoly profits from U.S. buyers, or for political purposes.

The methodology used to identify promising offset candidates within the class of industrial commodities is straightforward. However,

as discussed below, implementation of this methodology is constrained by data limitations. The efficiency (relative to the United States) of producing each class of industrial commodity is calculated for most of the NATO countries that are potential participants in the planned AWACS procurement ("NATO-AWACS countries"). These calculations are performed over time, and the level and growth of exports are also computed by country and commodity. Clearly, those commodities displaying both lower relative costs and significant export growth are promising candidates for offsets.

However, once they are identified, the following question must be answered. If they are so "promising," why are they not already being imported into the United States in sufficient quantities to reflect their comparative advantage? Imports into the United States from the NATO-AWACS countries will be less than optimal whenever a trade restriction like a tariff or nontariff barrier is present. Thus, the final step in identifying promising offset candidates is to establish the existence of trade barriers for commodities with low relative costs and high export growth.

Method and Data Sources

The methodology used is composed of two distinct parts. The first identifies efficient NATO-AWACS producers, and the second measures the degree to which trade between the NATO-AWACS countries and the United States is impeded by tariff and nontariff barriers. Appendix B discusses these two methods and describes the data used in applying the methodology. Appendix B also contains some technical results used in the selection process, as well as the materials assembled to identify low cost/high export producers.

The method for identifying efficient NATO-AWACS producers who could make substantial contributions to an external nonmilitary offset program is simple and straightforward. Identification required calculation of:

1. Comparative prices of products of the United States and the NATO-AWACS countries (relative costs).

2. Trends over time of relative costs.
3. Trends over time of exports by the NATO-AWACS countries to the world and to the United States.
4. Indications of the capability of NATO-AWACS countries to supply additional exports to the United States (level of output).

These calculations were based on two data sources: the United Nations (UN) *Growth of World Industry* data (1972), which were used to estimate (1) and (2); the Organization for Economic Cooperation and Development (OECD) data (1968, 1970, 1972) for annual imports and exports for a large number of countries, which were used to estimate (3) and (4).

Several serious difficulties are presented by these data. Specifically, the data cover very heterogeneous commodities and do not make proper allowances for quality differences within any given product line. These problems, discussed in more detail in App. B, clearly limit the reliability of our results.

Having identified those products with low relative costs and increasing export levels, we then measured the tariff and nontariff barriers that impeded the flow of these offset candidates into the United States. If there were no trade barriers for any of these offset candidates, then we could not argue (on efficiency grounds) that their import into the United States should be increased. The calculation of tariff barriers and their conversion into effective rates of protection had already been done by Baldwin and Ozello, as described in App. B.[1]

In assessing the importance of nontariff barriers, we restricted our attention to the Buy America Act, which is generally considered to be one of the most important nontariff barriers; i.e., it causes significant trade distortions relative to other nontariff barriers.[2] This

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[1]Their calculations were based on data contained in the input/output tables of the Department of Commerce for the years 1958 (Baldwin) and 1967 (Ozello).

[2]For example, Richard N. Cooper argues that "the only nontariff distortions to trade that should cause concern in the presence of an adequate adjustment mechanism are those that are specifically aimed at foreign trade--at impeding particular imports or stimulating particular

policy may contribute significantly to the low level of participation by companies in NATO countries in the AWACS development program. Perhaps because of the Buy America Act, the prime contractor relied primarily on U.S. companies and, consequently, European companies may have been excluded from the AWACS program without fair consideration of their capabilities and costs.[1] If this is true, then the Buy America Act would constitute a major efficiency reason for offsets. However, it should be noted in passing that the United States is not the only country that engages in "Buy Domestic" procurement policies. Almost all European countries pursue such policies even when there is no specific legislation requiring domestic preference. Indeed, it has been estimated that France's propensity to procure from domestic companies was "almost the same as estimated for the United States."[2]

The Buy America Act was promulgated in 1933 and requires the purchase of domestic commodities by U.S. government agencies unless:

> . . . (a) the head of the agency determines their purchase would be inconsistent with the public interest; (b) the agency head determines their cost would be unreasonable; or (c) the materials are not available in the United States in satisfactory quantity or quality.
>
> An executive order issued in 1954 establishes specific guidelines for implementing the Buy America Act. First it provides that materials shall be considered of foreign origin if foreign products account for 50 percent or more of the cost of all products used in the materials. Secondly,

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exports. Unlike domestic taxes and subsidies which affect trade but are not aimed at trade, these measures discriminate between domestic producers and foreigners, and in that respect are like tariffs. Such measures include quotas, customs valuation procedures, antidumping regulation, export credit subsidies, and buy-domestic government procurement policies of which the last is undoubtedly the most important apart from restrictions on imports of agricultural products and textiles." See Chap. 30, "The Nexus Among Foreign Trade, Investment and Balance-of-Payments Adjustment," in R. E. Baldwin and J. D. Richardson, eds., *International Trade and Finance*, Little-Brown & Co., Boston, 1974.

[1]The Culver-Nunn amendment to the FY 1976 Defense Authorization Bill may reduce the influence of the Buy America Act on U.S. government procurement policies.

[2]R. E. Baldwin, *Nontariff Distortions of International Trade*, Brookings Institution, Washington, D.C., 1970.

> a domestic price shall be considered unreasonable if it exceeds the delivered cost of the foreign material, including the duty, by more than 6 percent.[1]

In 1962, the Department of Defense, for alleged balance of payments reasons, increased the 6 percent to 50 percent.

The first empirical study of the effects of the Buy America Act was conducted by Baldwin.[2] Using 1958 data on government imports of selected commodities in conjunction with the 1958 input/output tables, he estimated that without the Buy America provisions, government imports would have been $231 million, whereas in fact they amounted to only $37 million.[3] The ratio of actual imports, M_a, to hypothetical imports, M_h, was about 0.16, implying that the discrimination coefficient, α, for 1958 was:

$$\alpha = 1 - \frac{M_a}{M_h} = 0.84.$$

In the absence of discrimination, imports would have been approximately 6.3 times the actual imports. The discrimination coefficient, α, is equal to zero and unity, respectively, when there is no discrimination against foreign suppliers and when there is perfect discrimination. An intermediate value like 0.90 means that government imports would have been 10 times as large in the absence of a Buy America policy.

Richardson performed a more sophisticated and detailed analysis of the Buy America Act using the 1963 input/output tables together

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[1] Chapter 10, "Nontariff Distortions of International Trade," in Baldwin and Richardson, op. cit.

[2] Baldwin, op. cit., pp. 71-75.

[3] This constituted approximately 0.25 percent of federal domestic purchases and was distributed as follows: airplanes, aircraft engines and other aircraft parts, $29.6 million; communications equipment, $2.6 million; machine tools and metal working machinery, $0.5 million; other machinery, $0.6 million; electrical transmission equipment, $2.6 million; electronic components, $0.1 million; miscellaneous electrical machinery, $0.9 million; miscellaneous vehicles, boats, etc., $0.5 million.

with data on actual government imports by eight broad commodity classes.[1] The actual and hypothetical government imports and the eight estimated discrimination coefficients are presented in Table B.5 of App. B. The government's propensity to import is assumed to be identical to that displayed by the private sector. That is, in the absence of discrimination, the ratio of government imports to total government purchases (for each of the eight commodity classes) is the same as the corresponding ratio in the domestic sector.

Ordnance is the first of the eight commodity classes presented in Table 5 below and in Tables B.5 and B.6. The items comprising ordnance are small weapons and ammunition that are comparable to those used in the private sector. Consequently, the calculation of hypothetical government imports for this category is based on conventional ordnance purchased in the domestic sector. The ordnance category thus *excludes* military systems, like the external military offsets of Sec. IV, for which there is no civilian counterpart. However, it should be noted that, while we refer to the reduction and ultimate elimination of trade barriers like the Buy America Act as *nonmilitary* offsets, they would also have long-term effects on the production and sale of military systems (for example, in terms of prospective incentives and markets impinging on European R&D efforts), which are not captured by the estimates in Tables B.5 and B.6 of App. B.

Based on these data, the total actual government imports were $61 million whereas the total hypothetical government imports were $217.8 million. The ratio of M_a to M_h is approximately 0.28, implying that the average discrimination coefficient, $\bar{\alpha}$, is 0.72. A direct comparison between Baldwin's 1958 study and Richardson's 1963 study is not possible because of methodological differences. However, it does appear that government discrimination declined between 1958 and 1963. Nevertheless, it is clear that government discrimination remained high in 1963.

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[1] J. D. Richardson, "The Subsidy Aspect of a 'Buy American' Policy in Government Purchasing," in United States Congress, Joint Economic Committee, *The Economics of Federal Subsidy Programs*, U.S. Government Printing Office, Washington, D.C., 1972.

Table 5

EFFECTIVE RATES OF PROTECTION (ERP) BY INDUSTRY GROUP, 1972, AND ACTUAL GOVERNMENT INPUTS, M_a, HYPOTHETICAL GOVERNMENT IMPORTS, M_h, AND DISCRIMINATION COEFFICIENTS, α, BY COMMODITY CLASS, 1967[a]

Industry Group	ERP	Commodity Class	M_a ($ million)	M_h ($ million)	α
Ordnance and accessories	0.27	Ordnance	24	137	.82
Food and kindred products	0.23	Nondurables	11	122	.91
Tobacco manufactures	0.28				
Broad and narrow fabrics	0.86				
Misc. textile goods	-0.12				
Apparel	0.35				
Misc. fabricated textiles	0.43				
Paper and allied products	-0.03				
Paperboard containers	0.14				
Printing and publishing	0.02				
Chemicals	0.03				
Plastics	0.14				
Drugs	0.10				
Petroleum refining	0.24				
Rubber	0.09				
Leather tanning	0.02				
Footwear	0.20				
Lumber and wood products	0.00	Lumber, wood, stone, etc.	1	7.2	.86
Wooden containers	0.11				
Household furniture	0.07				
Other furniture	0.08				
Glass and glass products	0.15				
Stone and clay products	0.21				
Primary iron and steel	0.06	Metal products	4	40	.90
Primary nonferrous metals	0.03				
Metal containers	0.21				
Heating and plumbing	0.11				
Stampings and screw machine products	0.01				
Other fabricated metal products	0.09				
Engines and turbines	0.02	Nonelectric machinery	8	58	.86
Farm machinery	-0.06				
Construction, mining, and oil field machinery	0.06				
Materials handling machinery	0.10				
Metalworker machinery	0.06				
Special industry machinery	0.07				
General industry machinery	0.07				
Machine shop products	0.08				
Office computing machines	0.04				
Service industry machines	0.06				
Electric industrial equipment	0.07	Electric machinery	20	226	.91
Household appliances	0.05				
Electric lighting	0.12				
Radio, television, and communication equipment	0.07				
Electronic components	0.02				
Misc. electrical machinery	0.17				
Motor vehicles and equipment	-0.01	Transportation equipment	92	156	.42
Aircraft and parts	0.06				
Other transportation	0.07				
Scientific and control instruments	0.71	Instruments, misc.	7	53	.87
Optical, opthalmic, and photographic equipment	0.12				
Misc. manufacturing	0.22				

[a]The estimates of ERP are from Baldwin, op. cit. The calculation of α is based on Richardson, op. cit., and applied to the 1967 Input-Output tables.

We have repeated Richardson's calculations for the 1967 input/output table. The data on actual government imports by the eight commodity classes were obtained directly from the Department of Commerce. Table B.6 of App. B displays actual government imports, hypothetical government imports, and the discrimination coefficients for the eight commodity categories.

Based on these data, the total actual government imports were $167 million whereas hypothetical imports were $799 million, the ratio of M_a/M_h being approximately 0.21. This implies that the average discrimination coefficient $\bar{\alpha}$ is 0.79. The increase in $\bar{\alpha}$ from 0.72 in 1963 to 0.79 in 1967 suggests that the government's Buy America policy became no less restrictive during this period. Although we lack comparable data beyond 1967, a crude measure of the relative restrictiveness of the Buy America policy for later years was devised, focusing especially on merchandise defense imports between 1964 and 1974.[1] Although rough and ready, this evidence suggests that government discrimination in the purchase of foreign commodities did not decline over this 11-year period.

In 1975 dollars the difference between actual and hypothetical imports would be approximately $760 million. About 40 percent of U.S. imports originate in NATO countries including Canada, and 20 percent excluding Canada. Therefore, we estimate that U.S. imports from NATO, including and excluding Canada, would increase by $313 million and $156 million per year, respectively, if government discrimination were completely eliminated ($\alpha = 0$). It should be emphasized that since these increases would recur annually, their capitalized values are much higher compared with the other forms of nonrecurring offsets we have been

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[1] A very crude measure of the change in the Buy America policy since 1967 was obtained by calculating the ratio of merchandise defense imports to total merchandise imports. This was done for the years 1964-1974. During this period, the ratio declined from 0.0129 in 1964 to 0.0039 in 1974. This decline is considerably greater than the decline in the ratio of defense expenditures to GNP, and hence the former decline cannot be entirely explained by the latter. The ratio of merchandise defense imports to defense expenditures remained relatively constant between 1964 and 1974, approximately 0.005.

considering. At an interest rate of 10 percent, the capitalized value of these annual increases in U.S. imports is $3 *billion* and $1.5 *billion*, depending on whether Canada is included or excluded, respectively.

Results and Conclusions

In determining whether a particular commodity is an offset candidate, we required that it be subject to either a tariff or nontariff barrier, as an indication of limitations on European exports to the U.S. market. Table 5 presents information on the effective rate of protection for each of the 51 industry groups comprising eight broad commodity classes; the discriminatory effect of the Buy America Act is presented for each of these eight commodity classes. From this table it is clear that each of the eight commodity classes is subject to significant government discrimination (reflected by the discrimination coefficients), with electric machinery the highest and transport equipment the lowest. For electric machinery, actual government imports in 1967 were $20 million, while in the absence of discrimination such imports would have reached $226 million. For transportation equipment, actual government imports were $92 million, whereas in the absence of discrimination they would have been $156 million. The effective rate of protection (ERP)[1] for the 51 industry groups shows that in most cases tariffs are impeding the flow of goods into the United States.[2] Based on both the effective rate of protection and the degree of government discrimination, none of the commodity classes can be ruled out as a potential candidate for offsets. Based on these criteria, the most promising candidates are instruments, electric machinery, metal products, nonelectric machinery, and nondurables.

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[1]The effective rate of protection is the maximum proportion by which tariffs allow the domestic value of inputs used in a given productive process to exceed their value at the world market price.

[2]These calculations are estimates by Baldwin for 1972 based on the 1958 input-output tables. A more recent study by Ozello uses the 1967 input-output tables and the actual tariffs imposed during 1973. His industrial classification is also much finer with 378 industry groups and, therefore, not exactly comparable with Baldwin's estimates. However, the ERP is quite high in electric machinery, instruments, metal products, transportation equipment, and nonelectric machinery.

The analysis of relative costs, based on United Nations data, revealed that the United States was the highest cost producer for several nondurables (beverages, footwear, other chemical products, and nonmetal products) and for transport equipment; intermediate for wearing apparel, wood products, paper, and industrial chemicals; and lowest for tobacco, textiles, and rubber products.

Analysis of the OECD data provided measures of total exports by NATO-AWACS countries as well as their exports to the United States for 1972. The change in their exports between 1970 and 1972 was also calculated. Based on these calculations, the industry groups that appeared most promising as offset candidates were nonelectric machinery, transportation equipment, and electrical machinery (see Table B.4, App. B). Unfortunately, we were unable to calculate relative costs for either nonelectric machinery or electric machinery from the UN data.

Our *tentative* conclusion, based on the analysis of trade barriers, relative costs, and size of exports from NATO-AWACS countries, is that electric machinery, nonelectric machinery, nondurables, and transportation equipment are the most promising candidates for external nonmilitary offsets.

The external nonmilitary offset strategy can be implemented in a number of ways, the first of which is to eliminate the Buy America policy, thereby reducing the effective rate of protection for those offset candidates we have just mentioned. This most direct procedure for achieving external nonmilitary offsets can be viewed as an "AWACS round" of trade negotiations, with initial concessions coming from the United States, synchronized to be more or less in concert with NATO procurement of AWACS, and leading to reciprocal removal of Buy Domestic trade restrictions by the NATO countries as well. Even if this two-sided reduction of certain trade restrictions were to be extended to non-NATO "most-favored-nations" in order to avoid conflict with the nondiscriminatory provisions of the General Agreement on Tariffs and Trade, the principal impact would be on trade between the United States and other NATO countries in accord with the trade patterns discussed earlier.

Another approach is to recognize that AWACS is one of several

important weapon systems that will be considered by NATO in the next decade and that all of these military systems comprise only a small percentage of the total trade among NATO countries. This suggests that a "NATO round" of trade negotiations might be the long-run solution to the offset problem. Once again the principal *initial* concessions would be by the United States, with reciprocal liberalization by the other NATO countries to follow shortly. These concessions would not be conditional on any specific weapon system procurement by the NATO countries, but would recognize that NATO participation in the development of U.S. military and nonmilitary systems has been restricted by trade barriers. The flow of traffic on the "two-way street" between the United States and NATO would be altered, although there would be no guarantee that the flows in one direction would equal the flows in the other. In fact, flows along the 105 two-way streets linking the fifteen NATO countries would improve as a consequence of these trade negotiations. This would enable countries to specialize in the production of goods in which they have a comparative advantage, contributing to more efficient resource use within the alliance as a whole.

We explore these implementation matters in more detail in Sec. VI.

OTHER CATEGORIES FOR POTENTIAL OFFSETS

Financial Transfers[1]

A major concern of several NATO-AWACS countries is that the large AWACS acquisition must be financed out of current defense budgets. A one-shot withdrawal of this size from annual government budgets to purchase a system produced in the United States poses both political and economic problems. A common complaint would be "National military programs will be jeopardized, unemployment will rise, and exchange rates will move against us."

A method of offsets that allays these problems is U.S. purchase of NATO-AWACS government securities during the AWACS procurement. This

[1]This subsection draws heavily on work done by our colleague, Cheryl A. Cook.

procedure was used by the FRG in 1972-1974 to offset U.S. military expenditures in Germany. For example, in 1972 and 1973 the FRG government purchased $700 million of U.S. government bonds, including forgone interest as well as the principal repayable in 4½ years, as an offset of about 15½ percent to the $4.5 billion of U.S. military expenditures in Europe in those years. If this same formula were adopted for AWACS, the United States would purchase $233 million of securities from NATO-AWACS countries, assuming a NATO outlay of $1.5 billion for AWACS.

This offset arrangement has several attractive features. It is simple, direct, and precedented; furthermore, in contrast with internal offsets, it creates no inefficiencies in the AWACS production process and provides a natural and flexible instrument for easing the financial burden of the AWACS purchase. Instead of charging the entire cost of AWACS to the year in which it is acquired, the purchase can be allocated over the life of the system. There is, of course, nothing radical in this proposal. It is precisely the way individuals, companies, and countries finance the purchase of durable goods.

A variant of this is the rental of AWACS by the NATO countries--a special case of financial transfer with ownership being retained by the United States. In effect, funds that could be loaned to NATO countries would, under the rental agreement, be used *by the United States* to purchase the system. "Renting" AWACS to NATO countries would provide amortization and interest payments to service the initial investment outlay.

Although financial transfers would not directly contribute to the objectives of increasing employment and technology transfer, which are of concern to several important NATO countries, such transfers could contribute indirectly to these objectives. Moreover, these contributions could be appreciable. For example, by easing the financial burden of AWACS procurements, transfers can free domestic funds for investment in domestic R&D, or for stimulating domestic employment in the NATO countries.

Figures 1 through 3 show the yields by quarter, 1969-1975, of short, medium, and long term government securities for the major NATO AWACS countries and the United States. Instruments like these would

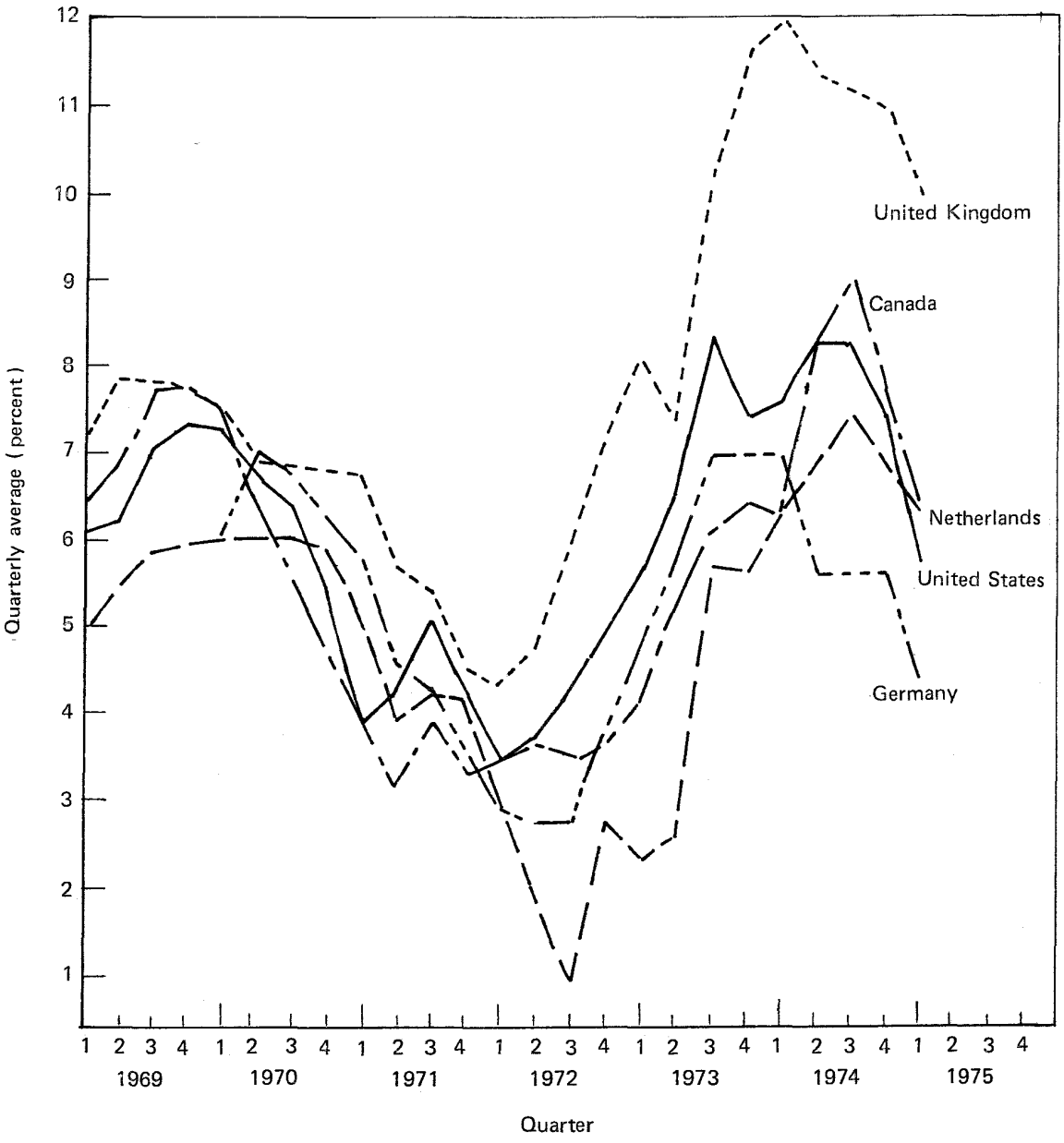

Fig. 1 — Yields for short term (3-month) government securities

be candidates for the financial offset program. One practical way of implementing this would be for the Export-Import Bank to extend credit on a preferred basis to NATO buyers of AWACS. We will have more to say about implementation considerations in Sec. VI.

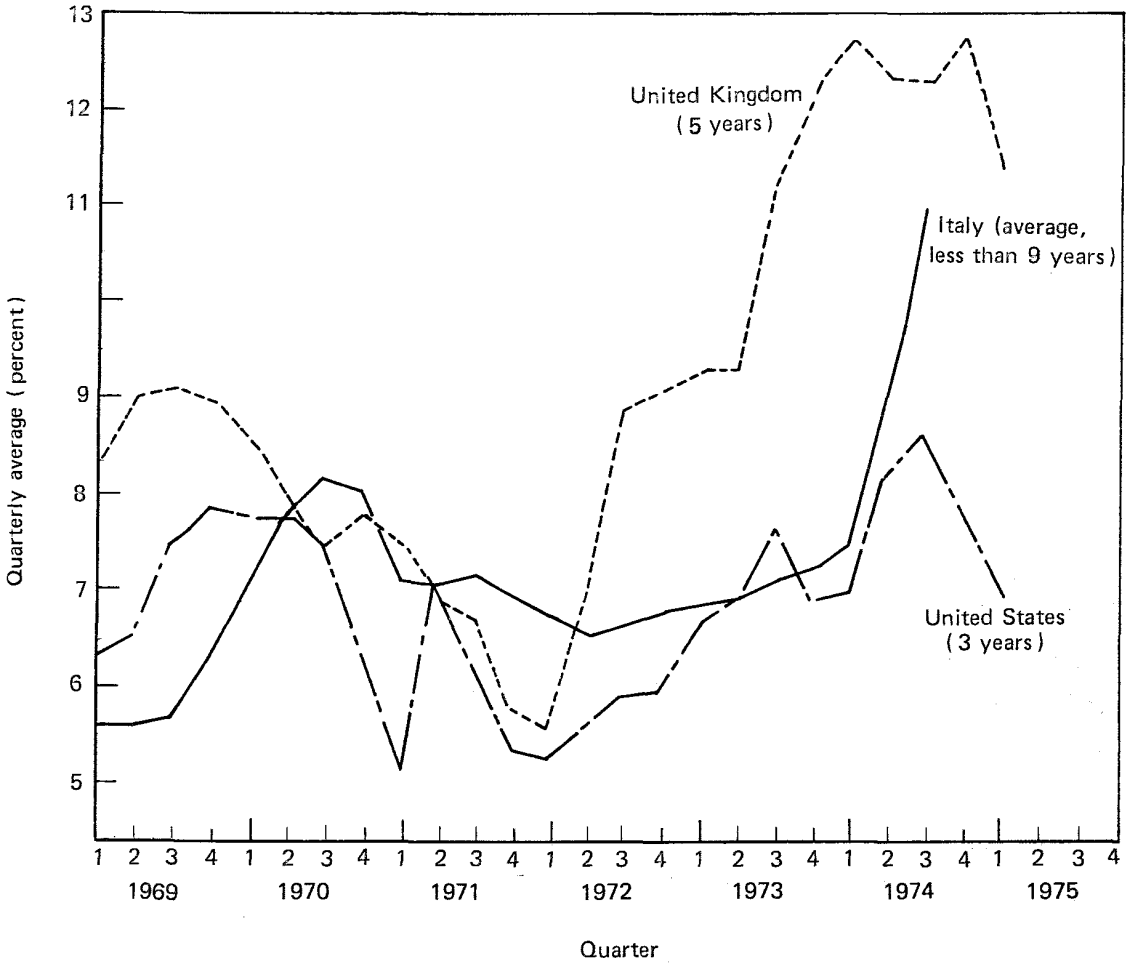

Fig. 2 — Yields for medium term government securities

Energy Research and Development

The purpose of this section is to consider possibilities for offsets in the energy programs of the NATO AWACS countries. Time limitations preclude more than cursory analysis, but the preliminary results could be expanded by further work.

We first reviewed the energy programs of the NATO countries in order to compare them to the energy program of the United States and, in making the comparison, to try to identify potential offset possibilities. Such possibilities may be pursued by the following instruments:

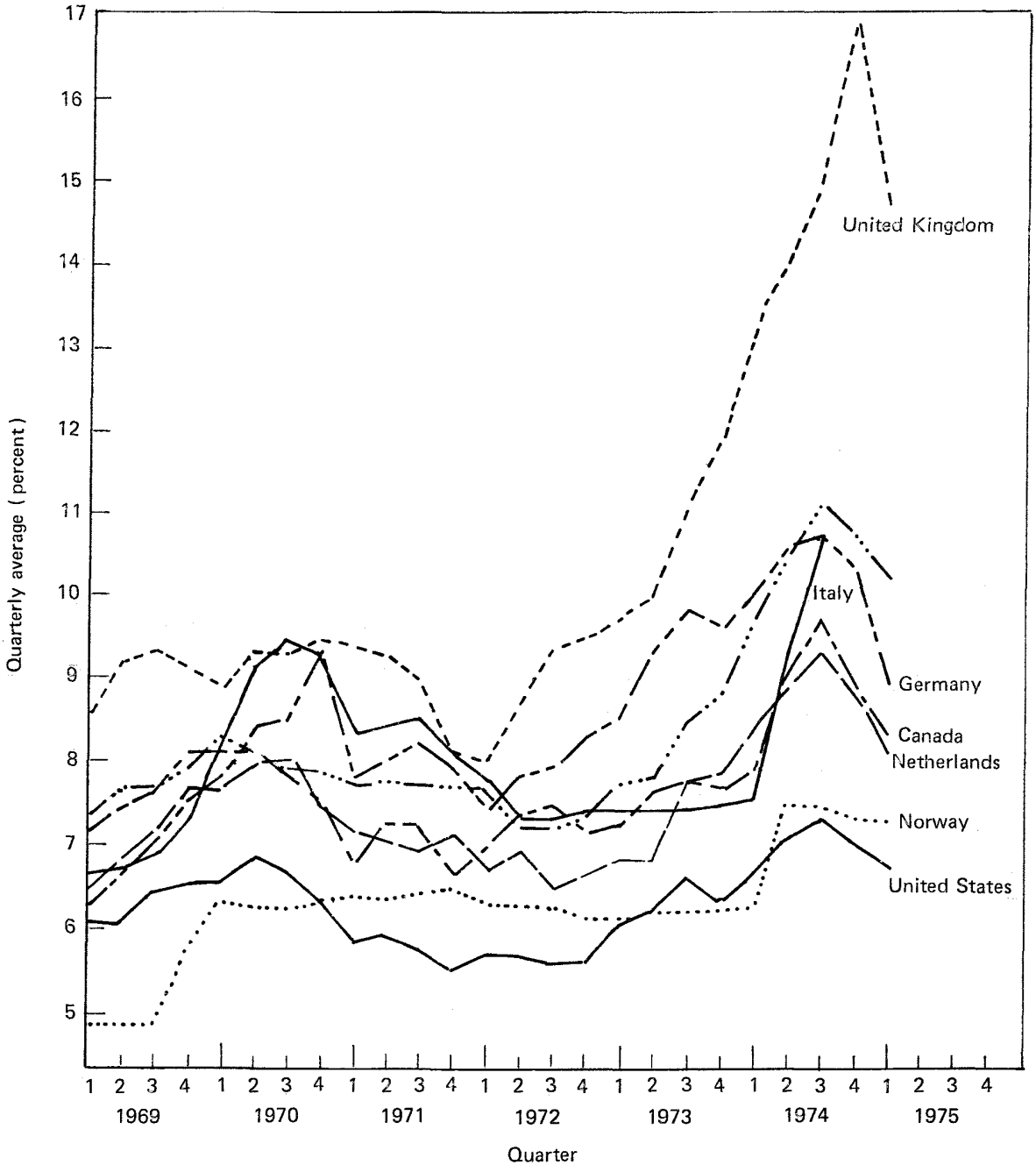

Fig. 3 — Yields for long term (10-year or more) government securities

- o United States subsidy for *research and development* in energy, or contracts for research and development in NATO AWACS countries.
- o Purchase by the United States of *equipment* from NATO AWACS countries for use in either the research, development, or production stages of energy production, conversion, or resource extraction processes.
- o Contracts by the United States for development and construction of *pilot plants*, full-scale demonstration plants, or production plants for energy production, conversion, or resource extraction.

Several recent reports were consulted that deal with the U.S. and Canadian Energy Programs, and the energy programs of the other NATO AWACS countries, although in lesser detail.[1]

From these sources, several specific offset candidates seem worth considering. They are discussed below.

The United States has concentrated its nuclear energy development on the breeder reactor. During the 1973 fiscal year, approximately 42 percent (about $260 million) of a total U.S. energy research and development budget of $622 million was allocated to the development of the liquid metal fast breeder reactor (LMFBR). The gas cooled fast reactor (GCFR) and the molten salt breeder reactor (MSBR) received much smaller support. The U.S. Atomic Energy Commission position was that only one of the three alternatives could be developed, and their choice is the LMFBR.[2] Under the Energy Research and Development Administration (ERDA), funding for LMFBR development has been reduced, although still an important part of the program.

The LMFBR has also been selected for development by the United Kingdom and France.[3]

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[1] Brookings Institution, *Energy and U.S. Foreign Policy*, a report to the Energy Policy Project of The Ford Foundation, p. 421.

[2] H. C. Hottel and J. B. Howard, *New Energy Technology, Some Facts and Assessments*, MIT Press, Cambridge, Massachusetts, 1971, p. 253.

[3] Ibid.

France has a breeder reactor, the Phoenix, in current operation and transmitting to the national grid with high reliability. At 250 megawatts, it is smaller than the 350 megawatts of the planned U.S. demonstration plant at Clinch River, but the latter has not yet been constructed. Construction of the Phoenix began in 1969, and the reactor became critical in August 1973.[1] A larger reactor, the Super Phoenix at 1200 megawatts, is being planned, with construction expected to begin in 1976.

The United Kingdom has in operation a prototype fast reactor (PFR) at 250 megawatts which reached criticality in March 1974. Construction of a 1300 megawatt commercial reactor is planned which is expected to reach criticality in 1981.

In some respects, the United States appears to be behind both France and the United Kingdom in development of commercial LMFBRs. Consequently, a potential offset for the United States would be for the United States to provide some financial participation for development of breeder reactors in either of these two nations. For example, the United States might reduce its LMFBR funding at home to support prototype construction in France or the United Kingdom, while developing prototypes at home for one or both of the other alternatives. The French and/or British might thereby receive a substantial "offset," while the pursuit of several options would provide a hedge against the possible failure of any particular nuclear technology.

Any offset possibility in the nuclear energy field must be considered in the light of the technical problems, as well as political difficulties, associated with it. The problems of nuclear plant safety, possible sabotage, and environmental effects (disposal of heat and nuclear waste) are serious. In addition, French policy has been to avoid any dependence on the United States or U.S.-based firms for supply of its energy requirements, thereby making it especially difficult to agree on a joint development program. However, the French are building light water reactors under license from Westinghouse.

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[1] U.S. Atomic Energy Commission, *Environmental Statement: Liquid Metal Fast Breeder Reactor Program*, December 1974, pp. 6-9 of Vol. I.

Notwithstanding the difficulties, given the similar research and development efforts in the nuclear energy programs of several of the NATO countries, it may be worthwhile to pursue joint development programs.

Much of the coal mining equipment used in the United States is purchased from Western European manufacturers. Purchasing additional coal mining equipment from Germany, France, and/or the United Kingdom might be another offset candidate. Good candidates for purchase are long wall mining systems whose price range is $1 to $5 million. These systems are particularly useful in mining U.S. western coal resources. In fact, a great deal of the equipment used in European mines could be used in mining western coal resources in the United States.

Crude oil and natural gas from the North Sea are the main possibilities for Western Europe to increase its own energy supply and decrease its dependence on the Arab nations for oil. Both Norway and the United Kingdom appear to have equal reserves in their respective sectors amounting to about 6.0 to 9.5 billion barrels of oil.[1] Offshore oil rigs needed to exploit these resources are produced primarily by U.S.-based firms. A potential offset by the United States is for U.S. firms, perhaps with government financial or other encouragement, to help provide the capability to the United Kingdom or Norway to build their own drilling rigs rather than purchase them from U.S.-based firms. This could be accomplished either by U.S.-based firms establishing plants in either of the two nations or providing them with licenses to build them.

Educational Fellowships in Engineering and Technology

Services, as well as manufactured products, offer an opportunity for external offsets. For example, students from NATO countries could come to the United States for graduate training with support from the U.S. government as a form of offset. Although the political feasibility of this proposal is open to question, we present below some illustrative calculations of an offset component in this field.

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[1] Brookings Institution, op. cit., p. 127.

The average annual cost of education (tuition, fees, room and board) at the leading private universities in the United States is $5894.[1] Adjusting this cost by an annual inflation rate of 6 percent yields an average annual cost per student of $7800. If we assume, for illustrative purposes, a NATO fellowship program of, say, 200 per year, each for three years, the total cost for a ten-year program would be about $47 million.[2]

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[1] *Time*, September 8, 1975.

[2] This assumes the final set of three-year fellowships is awarded in the tenth year.

VI. CONCLUSIONS: ALTERNATIVE OFFSET STRATEGIES, AND IMPLICATIONS FOR OTHER NATO ISSUES

Because the objectives and motives underlying the interest of NATO countries in obtaining offsets for AWACS procurement differ and conflict sharply,[1] they obviously complicate the problem of formulating a preferred offset policy for the United States: a policy tailored to meet the objectives of one country will not likely suit those of another. For example, substituting a different engine in AWACS, making the airframe compatible, and installing and integrating system components in Europe may appeal to the interests of the French and British in "technological participation" and aerospace employment. But these "gains" are likely to result in appreciable increases in costs of the delivered system, thereby cooling Germany's enthusiasm for AWACS. Moreover, it is not possible to devise separate offset arrangements for each country because there are likely to be spillover effects, e.g., affecting total system costs, that impinge on the other countries as well.

Consequently, there are important respects in which alternative offset strategies have a "zero-sum" character: gains by one participating country may be realized at the expense of others. We will try to take these points about conflicting objectives explicitly into account in evaluating alternative strategies.

PROCEDURE

The preceding sections have provided a foundation for formulating alternative offset strategies (OS). The distinguishing characteristic of each strategy lies in its emphasis on one or more of the particular types of offset elaborated in these sections:

- Offset strategy 1 (OS1) concentrates on *internal offsets*.
- OS2 on *external military offsets*.
- OS3 on *external nonmilitary offsets*.

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[1] See above, Sec. II, pp. 7-9.

- o OS4 on *financial transfers.*
- o OS5 on *a mixture* of these several elements.

The strategies illustrate, rather than exhaust, the possibilities. Not only can other mixed strategies be devised, but even within each "pure" strategy several variants are possible, as we illustrate later.

Evaluation of the alternatives is based on six objectives and constraints:

1. Employment.
2. Technology transfer.
3. Balance of payments.
4. Efficient resource use (reflected for example, by the delivered price of AWACS to European buyers).
5. Alliance political considerations.
6. Implementation difficulties.

The target level of offsets can be varied, as well as the strategy for reaching it. For convenience and simplicity, we assume a NATO buy of 25 aircraft with a benchmark unit price of $60 million. The benchmark price is a rough estimate of the delivered price *without* special *internal* offsets. With offsets, costs are likely to rise, for reasons discussed in Sec. II.[1]

We use an offset target of $1 billion, or two-thirds of the total cost, for illustrative purposes. This target we consider large enough to be politically significant, yet perhaps small enough to be feasible to reach.[2] Each offset strategy, then, is obliged to reach this target, with the success of the strategy evaluated according to the six criteria, based on a qualitative ranking.

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[1] In this case, the percentage of offsets should be calculated in the benchmark price, *not* the new price, in order to maintain comparability in evaluating the several strategies.

[2] Of course, other target levels can be established, resulting perhaps in different *relative* performance of the several strategies as the target varies.

In evaluating the several offset strategies, our procedure involves qualitative judgments concerning the performance of each strategy with respect to the six criteria listed above. To express these judgments in a summary form at the end of this section, we use a 3-point ranking: 1 = positive; 2 = negligible; 3 = negative. The intensity or magnitude of these effects is not evaluated. To estimate these magnitudes would require further work, for example, with respect to the magnitude of the balance of payments or employment effects associated with the various alternatives.

Moreover, we implicitly assume that the *military effectiveness of the resulting AWACS is held constant over all of the alternatives.* Thus, we do not take into account worries that have been expressed, for example, by the Germans, that if extensive subcontracting and co-production of components of the system occur, there may be shortfalls in performance, maintainability, and longevity of the system.

We have had occasion to refer to the "classical" offset precedent of German offsets for U.S. troop stationing costs in central Europe. One neglected aspect of that precedent is worth mentioning here because it will affect some of the following discussion and calculations. Beginning in 1968, the FRG was generally given a credit in the U.S.-FRG offset negotiations for a 20 percent so-called feedback effect. This allowance assumed that the equivalent of 20 percent of U.S. military spending in the Federal Republic would return within a short period of time to the United States through other accounts, i.e., would serve to increase U.S. commercial exports. For example, in the FY 1972-1973 offset agreements, it was estimated that $0.9 billion, reflecting 20 percent of the gross expenditure by the United States of $4.5 billion in Europe for the two years, would result in such "feedback" exports, and the formal negotiated arrangements made this allowance. We will make a similar allowance or credit in connection with the calculations relating to each of the offset strategies described below, using a figure of 18 percent to be on the conservative side.[1] This credit

[1] In making this calculation, we assume a marginal propensity to consume in the United States of 0.9. Then the Keynesian export, or investment, multiplier is calculated as m = 1/1-0.9 = 10. Next, we

would apply only to the portion of the AWACS buy *spent in the United States* and would, of course, have to be acceptable to the participating NATO countries in the same manner that the United States accepted the feedback credit when the Germans negotiated their offset agreements with us.

Besides varying the overall target level for offsets, and devising alternative strategies to meet it, there is an opportunity to adopt somewhat different strategies for dealing with different countries. However, the opportunity for this "fine tuning" of strategies is distinctly limited, because of the spillover effects noted earlier in this section. For example, trying to emphasize OS1, the internal offset strategy, in one or two particular countries, say the United Kingdom and France, would spill over into other countries through its effect on system costs. Although such a spillover might, in turn, be offset by some form of side payment from the benefiting countries to the others, this procedure would no doubt be complicated and hard to negotiate. Similarly, attempting to concentrate on OS3 (external nonmilitary offsets) through the removal or reduction of trade restrictions would be hard to confine to a single country because the main participants are members of a single common market. Hence, trade liberalization applying to one would benefit the others as well. (Indeed, pursuing trade liberalization on any basis other than a *global* one is likely to run into serious political problems with other countries; for example, with the Japanese and Latin Americans.)

Opportunities for fine tuning seem, in fact, to be most promising in the case of OS2, external military offsets, and OS4, financial transfers, because the spillover effects associated with each of these are manifestly more limited. For example, American purchases of, say, the French *Catulle* for ship defense as a component of OS2 could be combined with U.S. government purchases of German or British government securities,

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assume a U.S. marginal propensity to import of 5 percent. On the average, over 40 percent of U.S. imports come from Western Europe and Canada: about 17 percent from Western Europe, and 25 percent from Canada (OECD, *Trade By Commodities*, 1968, 1970, 1972). On the assumption that this average ratio also applies to marginal imports, the export "feedback" from European expenditures in the United States for AWACS is $10 \times (0.05) \times (0.40) = 0.20$.

without either of these forms of offset impacting on the countries to which it was *not* applied.

For these reasons we do not attempt any individual country "fine tuning" of offset strategy, but direct our formulation and evaluation of the alternatives to a NATO-wide level. Given more time, some fine tuning on a country-by-country basis might be possible.

ALTERNATIVE STRATEGIES

Internal Offsets (OS1)

Notwithstanding the few additional ideas we have put forward in Sec. III for internal offsets, our estimate of the maximum level of coproduction and industrial participation is drawn from the ongoing Boeing study. As described in Sec. III, this estimate is 36 percent of the total, with the largest dollar components in integration and checkout, and engines.[1]

This still leaves a gap of $460 million to reach the $1.0 billion offset target. Part of this gap can be filled by the export "feedback" credit discussed above. Another way of filling the gap might be to incur in Europe that portion of AWACS operating costs relating to depot, spares, training, and miscellaneous, as suggested in Sec. III. Three years of savings in operating costs by this means would reach approximately $225 million (undiscounted). As Table 6 indicates, OS1 falls short of the $1 billion target. We considered the possibility of substituting tankers for AWACS aircraft, which, although not an offset but a possible savings to the program that might be used with any offset strategy, could help to reach the target level. We concluded that there are too many technical questions, which are not now answerable, to permit this concept to be properly evaluated.

With respect to the *employment* effects of OS1, these would be *positive* for the participating countries, and would be concentrated in the aerospace industries with which they are especially concerned.

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[1] See Sec. III, p. 24. In effect, we assume that anything above the 36 percent level would run into prohibitive penalties with respect to cost or performance or delivery.

Table 6

OFFSET STRATEGY 1: INTERNAL OFFSETS

(In $ million)

1. European production offsets (maximum Boeing estimates)	540
2. Operations costs incurred in Europe (three years operating costs)	225
3. Export feedback ((25 aircraft × $60 million × 64%) × 18% feedback credit = $173 million)	173
Total	938

SOURCE: Section III.

There would also be a positive effect on *technology transfer* resulting from OS1. However, the build-to-print nature of the industrial participation arrangements would limit this effect in comparison, for example, with what it would be if European countries were involved in the earlier stages of a new system development.

Balance of payments effects would be positive, although the savings in dollar expenditures for AWACS would be partly diluted as a result of two factors: the import of some component inputs for parts of the system fabricated in Europe; and the increase in imports from abroad resulting from the increased domestic income and employment generated in Europe by domestic production.

Beyond a modest offset (≤ 20 percent), the effect of OS1 on *efficient resource use* would be negative, reflected in a likely increase in the delivered price of AWACS to European buyers.

In general, it should be expected that the impact of OS1 on the *politics* of the NATO alliance would be positive, although some of these positive effects would be diminished by the increased price of AWACS to European buyers, and perhaps as well by later recriminations that might arise from time slippages or cost overruns, and performance degradation, as discussed in Sec. III.

Although Boeing and NAPO efforts to work out suitable arrangements for European industrial participation are impressive, our judgment is

that the *implementation* difficulties of OS1, relating both to the timing and complexity of the procedures that are involved, would be substantial. Hence, our estimate for this dimension of performance is negative, for reasons described more fully in Sec. III. To the extent that the present plan to maintain exact proportionality between the size of individual countries' purchases and the magnitude of their sharing in industrial participation is relaxed, as we have proposed in Sec. III,[1] the implementation problems associated with OS1 would be considerably eased.

External Military Offsets OS2

As discussed in detail in Sec. IV, there are many possible ways of arriving at the $1 billion offset target through the purchase by the United States of military systems in NATO countries that participate in the purchase of AWACS. Moreover, there is a good precedent for this strategy in the U.S.-FRG offset arrangements which during FY 1972-1973 included an allowance of $1.2 billion of German military purchases in the United States as an offset to U.S. troop disbursements in the Federal Republic.

Allowing for the 18 percent export "feedback" from the $1.5 billion European expenditure in the United States for AWACS, the required level of U.S. military purchases in AWACS countries is $730 million ($1.0 billion - 0.18(1.5)).

In pursuing OS2, two points should be stressed. One is that the particular purchases selected should contribute to advancing standardization and rationalization of equipment for NATO as a whole. Hence, emphasis in U.S. purchases should be on items that are good candidates for potential procurement by other NATO members as well. The second problem is to convince the participating European countries that planned U.S. military purchases are linked to their procurement of AWACS, and would be less likely to occur otherwise. It should be possible to make this latter point more persuasive by referring back to the FRG

[1] See Sec. III, p. 18.

precedent of offset allowances for German military purchases in the United States. Based on the discussion in Sec. IV, Table 7 summarizes some of the most promising ways for arriving at the $730 million offset target through OS2.

Table 7

OFFSET STRATEGY 2: EXTERNAL MILITARY OFFSETS
(In $ million)

1. (a)	Land forces variant: "Americanized" version of Leopard II[a]	>730
	or	
(b)	Naval variant: European participation in development and production of U.S. SIRCS (Shipboard Intermediate Range Combat System)	>730
	or	
(c)	Air Force variant: 200 jet trainers (Hawk, Alphajet, or MB-339), plus Advanced Harrier	250 500
2.	Export feedback	270
	Total	>1000

SOURCE: Section IV.

[a]Although a wide range of uncertainty surrounds the Leopard costs, as well as those of its closest U.S. counterpart, the XM-1, a purchase of 700 or more Leopard II tanks would amply meet the target. Coproduction in the United States and Germany of a larger total buy would provide another way of reaching the $730 million offset target.

In evaluating OS2 according to the six criteria, we judge that it performs as well as OS1 with respect to the employment, technological transfer, and balance of payments criteria, and better with respect to its effect on efficient resource use (because it avoids an increase in the delivered AWACS price). It is probably easier to implement than is OS1, in light of the Culver-Nunn amendment to the Defense Authorization Act enacted in July 1976, which gives the Secretary of Defense authority to purchase military equipment in Europe in the interests of standardization and rationalization of NATO forces, taking into account the costs, quality, and availability of the equipment to be procured.[1]

[1]PL 94-361.

We also conclude that OS2 is likely to affect alliance political sensibilities as favorably as, or more favorably than, OS1. In part, this judgment follows from the close linkage between OS2 and the recent discussion in the Defense Planning Committee, the Eurogroup, and elsewhere concerning the "two-way street" and the desirability of opening the procurement systems of NATO countries to a fair and equitable functioning of the competitive market. In those cases where European systems are competitive in cost and quality (which is the basis for our formulation of the above list), but where their access to the U.S. market has been restricted, U.S. procurement from other NATO countries should have a distinctly beneficial political effect within the alliance.

External Nonmilitary Offsets (OS3)

The principal idea underlying OS3 is the expansion of U.S. imports of *non*military goods and services from the NATO AWACS countries by the removal of tariff and nontariff barriers which presently restrict those imports. Numerous variants of OS3 can be formulated. For example, one variant could emphasize the removal of tariff and nontariff barriers to commercial imports of industrial commodities, or nonindustrial commodities as well. Another variant could focus on the removal or reduction of Buy America restrictions on government procurement of nonmilitary goods and services abroad. Still another might involve contracting for energy research and development, or engaging in the joint funding of R&D, in such areas as breeder reactors in France and/or the United Kingdom, in which these countries may be technologically advanced. Another ingredient of nonmilitary offsets could include some allowance for U.S. government financial support for a large number of NATO fellowships in engineering and physical sciences for advanced study in the United States.

The principal practical difficulty associated with OS3 from the standpoint of the AWACS offset problem is that policy responsibility for the issues with which it is connected are widely dispersed throughout the U.S. government. Unlike OS1 and OS2, for which the principal responsibility resides in the Department of Defense, OS3 includes a wide range of issues connected with U.S. commercial policy, and

hence involves jurisdictions shared by the Departments of State, Treasury, Agriculture, and Commerce, and the Congress.

To illustrate concretely the content of OS3, we have tried to simplify these implementation problems by concentrating on the increases in U.S. imports from the NATO countries that could be accomplished by removal of the Buy America restriction on U.S. government nonmilitary procurement. Clearly, this action would be all the more beneficial to the alliance as a whole if combined with relaxation or removal of similar domestic restrictions that now exist in other NATO countries as well.

Table 8 illustrates one version of OS3. It focuses on removal of Buy America restrictions that have been identified in the comparative-cost analysis of Sec. V as promising candidates for export to the United States. The resulting increases in U.S. imports amount to over $300 million (or $150 million if Canada is excluded from the exporting countries). As noted in Sec. V, these offsets would be annually recurring,

Table 8

OFFSET STRATEGY 3: EXTERNAL NONMILITARY OFFSETS

(In $ million)

1.	Estimated *annual* increase in U.S. government imports from NATO countries with removal of Buy America restrictions:			
	Ordnance	54		
	Nondurables	53		
	Lumber, wood, stone products	3		
	Metal products	17		
	Nonelectric machinery	24		
	Electric machinery	109		
	Transportation equipment	31		
	Instruments, and miscellaneous	22		
	Total (including Canada)	313	(excluding Canada)	157
2.	Energy R&D (e.g., European breeder reactors)	~370		
3.	NATO educational fellowships	~ 47		
4.	External export "feedback"	270		
	Total	1000		

SOURCE: Section V.

unlike the one-time character of other offsets we have been considering. Consequently, when capitalized at an interest rate of 10 percent, the offset value of these import increases would be $3 billion and $1.5 billion, respectively, under OS3--substantially *exceeding* the $1 billion offset target specified earlier. Although capitalizing this annual flow is the correct procedure, if we do *not* do so, we have--with the $270 export "feedback" allowance--a gap of over $420 in further offsets to arrive at the original $1 billion target. For illustrative purposes, we assume that, under OS3, this gap might be filled through energy research and development in Europe, and through NATO graduate fellowships, as discussed in Sec. V.

As already noted, OS3 has much to recommend it on each of the several criteria, with the exception of its serious implementation problems. Although the implementation problems within the U.S. government would be substantial, it is not implausible that, arguing from the basis of the Culver-Nunn amendment, the Defense Department could make an important contribution to a liberalization of other governmental nonmilitary procurement from abroad as well. Concerning the political repercussions with the alliance, further investigation would be necessary to ascertain likely reactions of NATO countries. Indeed, the direction toward which OS3 points is a "common market for NATO," not confined to the EEC members alone. The implications of such a development would be far-reaching and complex, and require more consideration than we have had time to give them in this study.

Although implementation of OS3 would be difficult, its potential value as a major NATO policy initiative by the United States--with significance for political as well as economic and military relationships in the alliance as a whole--might make it worthwhile to confront and surmount the difficulties. For an administration disposed to move in this direction, declaratory and diplomatic actions would be needed along lines quite different from those associated with the other offset strategies. Such implementing actions would likely warrant particular steps and statements by the United States, including the following:

1. Affirmation that specific offsets tied to a specific new system procurement constitutes, in effect, quasi-barter transactions with perverse effects on the efficient use of resources within the alliance.
2. In order to *avoid* any special offset tied to NATO purchase of AWACS, or other systems in the future, the United States would declare its readiness to *remove* the rule that American government purchases abroad are permitted only when the prices of comparable American goods are more than 50 percent higher than foreign counterparts.[1]
3. We estimate that step 2 would generate a present value of over $3 billion of additional imports into the United States from other NATO countries, or $1.5 billion excluding imports from Canada (amounts that dwarf the offset target for AWACS that has been set in this study).

Financial Transfers (OS4)

Probably the quickest and most simple strategy for offsets is to provide financial assistance to those NATO countries anxious to ease the financial burden of purchasing AWACS. As discussed in Sec. V, this could take the form of U.S. government purchases of medium term European securities, as in the case of the FRG purchase of U.S. securities in the early offset arrangements with the United States. Another form OS4 might take would be for the Export-Import Bank to extend medium term credits at its usual 8 to 8½ percent interest rate for medium term loans (well below that prevailing on European capital markets) to the AWACS buying countries. As in the case of FRG purchases of U.S.

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[1] When this rule was originally imposed, the United States was experiencing large balance of payments deficits on current account, leading to the so-called gold-flow problem. By contrast, the U.S. current account is now running a large surplus--a particularly appropriate time for removing the Buy America rule. Moreover, under a regime of flexible exchange rates, individual sales and purchases can more appropriately be considered on their merits, with any balance of payments implications to be properly worked out within the general foreign exchange market.

Treasury notes, the interest rates might also be "foregiven," as an offset credit. Table 9 is an illustration of the OS4 strategy.

Table 9

OFFSET STRATEGY 4: FINANCIAL TRANSFERS

(In $ million)

1. Medium term financing by U.S. Treasury, or Export-Import Bank	730
2. Export "feedback" credit	270
Total	1000

SOURCE: Section V.

With respect to the various evaluation criteria we have used, OS4 would be particularly effective from the standpoint of implementation, efficient resource use (since the delivered price of AWACS would be unaffected), and short-term balance of payments effects. Of course, the latter effects would in turn lead to pressure on the balance of payments and exchanges in a subsequent period in order to meet debt service obligations. The only real resource transfers involved would be confined to the extent of government subsidy that might be built into OS4. Nevertheless, OS4 would substantially ease the short-term cash flow problem of financing AWACS procurement. Although the effects of OS4 on employment and technology transfer would be indirect, they need not be negligible.

In principle, access by NATO countries to subsidized capital from the United States, to ease the financial burden of buying AWACS, would make it possible for the European countries to increase their investment in domestic R&D, as well as release funds for government or non-government purposes that in turn could be used to increase employment at home. The effects of OS4 on alliance political sensitivities would be mixed. The Germans and Dutch might, for example, find this form of assistance welcome, as would the United Kingdom, although other members of the alliance might feel it left unfulfilled their interests in achieving a more equitable "partnership" within the alliance.

Mixed Strategy (OS5)

It should be possible to formulate an offset strategy to facilitate NATO AWACS procurement by combining the more attractive features of each of the other offset strategies. Table 10 illustrates such a mixed strategy.

Table 10

OFFSET STRATEGY 5: MIXED OFFSETS

(In $ million)

1.	Internal offsets (based on Boeing's lower bound estimates focused on ICO, engines, communications)	315
2.	External military offsets	300
3.	External nonmilitary offsets	172
4.	Financial transfers	
5.	Export "feedback"	213[a]
	Total	1000

SOURCE: Sections III-V.

[a]Calculated as: $(1185 - 315) \times 0.18 = 213$.

In terms of the six criteria, our judgment is that OS5, the mixed strategy, performs as well as, or better than, any of the other strategies, with the possible exception that its impact on alliance politics is perhaps somewhat less clear than that of some of the other strategies--e.g., OS2, military offsets. As noted earlier, this overall assessment leaves out the intensity of the several effects, compared with the other strategies. For example, the employment effect of OS5 in certain defense industries in NATO countries would be less under OS5 than under OS1, the internal offset strategy, although perhaps greater in other industries because of the external military component of OS5 that is absent from OS1.

CONCLUSIONS

Table 11 summarizes the preceding discussion of the five alternatives, as well as our qualitative evaluation of how they perform with respect to the six criteria (i.e., employment, technology transfer,

Table 11

SUMMARY EVALUATION OF OFFSET STRATEGIES[a]

Evaluation Criteria[b]	OS1 (Internal)	OS2 (External Military)	OS3 (External Nonmilitary)	OS4 (Financial Transfers)	OS5 (Mixed)
Employment	1	1	1	2	1
Technological transfer	1-2	1-2	1-2	2	1-2
Balance of payments	1-2	1	1	1	1
Efficient resource use[c]	3	1-2	1	1	1
Alliance political considerations	1-2	1	1-2	2	1-2
Implementation (time and complexity)	3	1	3	1	1

[a]1 = positive effects; 2 = neutral or small effects; 3 = negative effects.

[b]The relative importance to be assigned to each criterion is likely to vary for different decisionmakers, agencies, countries, and points of view. Moreover, such differences can affect the choice among alternatives. For example, if principal emphasis were assigned to efficiency of resource use, OS3 would dominate OS2, while if implementation considerations were emphasized, the choice between the two would likely be reversed.

[c]Delivered price of AWACS in Europe.

balance of payments, efficiency, politics, and implementation) and the rating scale described earlier. If we make the convenient (and questionable) assumption that each criterion has equal weight, and further assume that the numerical rating scale can be treated cardinally, we can sum vertically for each of the columns of Table 11 to arrive at a general comparison among the alternatives.

OS2, external military offsets, and OS5, the mixed strategy, emerge as the most promising among the alternatives. OS1, internal offsets, seems to be the least preferred among the five alternatives.[1] Although OS3, the external *non*military offset strategy, has much to recommend it on five of the six criteria, it would be likely to entail serious implementation difficulties in part because jurisdictional responsibility

[1]Clearly, this result is sensitive to the target level of $1 billion offsets that we assumed at the outset.

for the matters embraced by OS3 is fragmented within the U.S. and other NATO governments. Nevertheless, an administration willing to surmount these difficulties might find OS3 a bold and attractive option to pursue, having potentially broad significance in economic as well as political and military relationships within the alliance.

Implementation of OS2 would plainly require extensive further analysis of European weapons systems, along lines previously discussed and going well beyond what we have attempted in this study. It would also require a deliberate and persuasive diplomatic effort to convince the participating countries that at least part of the motivation and the scale of U.S. military purchases from the other NATO countries is tied to AWACS procurement.

Implementation of OS5, the mixed strategy, should proceed by using the most efficient among the various types of internal offsets in combination with the most promising candidates for military offsets. This should be accomplished in conjunction with some movement toward liberalizing government procurement of nonmilitary goods and services and, to the extent necessary, loans to the participating NATO countries. OS5 offers the greatest opportunity for appealing to the diverse objectives of the NATO countries. In effect, it is a strategy that provides something for everybody.

As pointed out earlier, the AWACS offset issue relates to several larger and longer term alliance issues that are high on the priority list for NATO and U.S. consideration in forthcoming months and years. These larger issues include standardization and rationalization of NATO forces and equipment, the "two-way street," and the perennial problem of burden sharing within the alliance. It is therefore important that the choice of an offset strategy be consistent with and, indeed, conducive to the salutary evolution of U.S. policy on these larger issues.

At some risk of oversimplification, it can be said that the positions within NATO concerning these larger issues seem to divide into two sides: (1) a "*protectionist*" position, which construes the "two-way street" and the move toward standardization and rationalization in ways that would assure a *guaranteed and equal flow* of procurement

between the United States and its other NATO partners;[1] and (2) a "*competitive*" position which, while striving to attain agreed positions on NATO-wide military requirements and more open bidding and competition among potential suppliers, leaves open the question of exactly how the balance in the two-way flows will work out.

While both positions consider a "two-way street," one position would assure that there is a guarantee of equivalent traffic in both directions. The opposing position, the competitive position, would make sure that barriers are removed to traffic on both sides of the street, but would leave open the intensity of traffic in each direction. According to the competitive position, resolution of the "traffic" question would be left to the functioning of competitive forces, and the relative efficiency among alliance members in responding to the competition.

Opposition to the competitive positions is based on several considerations. One argument is that European defense industry is too small and fragmented to compete effectively against U.S. firms in the development and production of any major weapons systems. In addition to the so-called technology gap separating American firms from potential European competition, it is argued that the size of U.S. defense procurement--quite apart from NATO's collective demands--permits larger production runs for American producers resulting in lower unit costs and decisive competitive advantages for the Americans in any price competition within NATO itself. Further, it is argued that "winner-take-all" price competition would place "losing" countries in a position of dependency in resupply that would be politically unacceptable to them. And, finally, domestic economic and political constraints in the various NATO countries (e.g., industrial unemployment, politically powerful trade unions, industry lobbies, and their legislative supporters) may make governments unwilling, and perhaps unable, to allow market competition to determine

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[1] In defining protectionism, the *guarantee* feature is more critical than the *equality* of flows. In this context, protectionism means that military imports must comprise X percent of military exports, where the *extent* of protection is measured by the amount by which X exceeds the proportion that would result under an open and competitive defense market.

defense production outcomes. The latter argument, of course, is not without support in the United States as well as in other NATO countries.

This is not the place to go into a detailed examination of these arguments, nor of counterarguments and possible hedges and compromises that can be devised to meet them. Clear reflections of these views are conveyed by some of the discussions involving the Eurogroup, and its communication of June 1975 to the Secretary of Defense.

Although the subject is plainly one that requires separate and more detailed study, it seems to us that the resolution of this set of issues should be handled in ways that make it *less likely* that issues like the AWACS offsets issue will arise in the future. In an important sense, the notion of specific offsets tied to a specific new system procurement is itself a reflection of the protectionist view described above. In effect, offsets imply that the functioning of the competitive process would be altered, and supplanted by an explicit tying of some form of bartered production, or quid pro quo, in exchange for the specific military procurement under consideration.

To avoid this problem in the future, we suggest several specific and major changes in NATO policies and procedures:

- An effort through NATO to arrive at something analogous to the five-year defense plan (FYDP) in the Defense Department: a statement of agreed plans and military requirments on a NATO-wide basis over a substantial period of five years or longer.
- Competitive bidding within NATO as a whole, both on R&D related to the FYDP, and subsequently on procurement when contracts are evenually let. Government subsidies, reflecting national priorities and presumed externalities relating to particular technological fields, would affect the functioning of the competitive bidding, both with respect to R&D and eventual procurement. However, the contracting decision by NATO members would be based on price and quality, once these subsidies were applied by the respective governments and hence were reflected in company bids.

- o A collective effort on the part of NATO countries to reduce their respective trade barriers, not only the Buy America or buy domestic restrictions prevailing in each country, but other tariff and nontariff barriers to commercial procurement within NATO as a whole.
- o Encouragement of licensing arrangements on a standby basis by foreign military suppliers to protect individual countries from an unwanted degree of external dependence on those suppliers (see Sec. IV).[1]

All of these issues plainly warrant more study than we have been able to give them in this report, but in conclusion we should emphasize one point that provides a link between the AWACS offset problem and these larger NATO issues. In moving from OS1, the pure internal offset

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[1]There are some points in common between the proposals made in this study and those advanced by Thomas A. Callaghan, Jr. (see his *U.S.-European Cooperation in Military and Civil Technology*, Georgetown University Center for Strategic and International Studies, Washington, D.C., rev. ed., September 1975, and "A Common Market for Atlantic Defense," *Survival*, May/June 1975). For example, both approaches favor standardization and rationalization of NATO forces and systems, cooperation in R&D and defense production within the alliance, reduction and removal of government procurement restrictions, and the development of a NATO Common Market for defense production.

But there are also some important differences between what we are suggesting and the Callaghan proposals. For example, Callaghan emphasizes "dollar matching," by which he means that the United States should "match every dollar Europe spent in the United States with a dollar spent in Europe" (see *U.S.-European Cooperation*, op. cit., pp. 108, 111, 119). Callaghan also observes that, while "the need for competition should be stated, . . . care should be taken not to insist on it at an early date" (ibid., p. 116). These and other points in his report are advocated on grounds of political necessity. They convey a different flavor from that which we are advancing in this study. From the standpoint of incentives and dynamic effects, these aspects of the Callaghan report would likely have decidedly perverse consequences for the efficiency of NATO defense technology and production by protecting high-cost producers and countries. Dollar-for-dollar matching, or even "one-for-two" matching is exactly like an *ad valorem* import quota, and is essentially protectionist. It is interesting that it is argued such quotas are needed because otherwise European countries could not compete with U.S. defense production; yet, at the same time, some in the U.S. defense community, both inside and outside government, express fears of European competition.

strategy, to the other strategies, especially OS3--but also OS5, the mixed strategy--what we are advocating is essentially a movement away from the protectionist view, and instead a move in the direction of a competitive interpretation of the "two-way street." Indeed, the protectionist direction seems to us to lead toward standardization that is likely to be costly and inefficient; in other words, to standardization *without* rationalization.

Appendix A

MISCELLANEOUS DATA ON SELECTED EUROPEAN-DEVELOPED WEAPONS

Table A.1 contains additional information on several of the weapons discussed in Sec. IV.

Table A.1

MISCELLANEOUS DATA ON SELECTED EUROPEAN-DEVELOPED WEAPONS

Weapon	Country of Origin	Manufacturer	General Description	Estimated Unit Cost ($ million)	Assumed Size of "Reasonable" U.S. Buy	Estimated Offset Potential ($ Million)	Comparable U.S. Equipment and Cost	Comments
Land Warfare								
Leopard II	FRG	Krauss-Maffei AG	Main battle tank	1.0	3,300	3,300	XM-1, $600k to $2 million	In development. Seventeen prototypes built
Americanized Leopard	FRG	Krauss-Maffei AG	Reduced cost version of Leopard II	0.8	3,300	2,640		In development
Armbrust	FRG	MBB	Man-portable, shoulder-fired, expendable anti-tank weapon with a 300 m range	0.0004	50,000	20	LAW	Three being sent to the U.S. for evaluation
Milan	FRG/France	Euromissile	Man-portable, shoulder-fired, anti-tank weapon with 2000 m range	0.008	50,000	400	Dragon ($8700) has 1000 m range vs Milan's 2000 m. TOW ($4500) has 3000 m range vs HOT's 4000 m	In production. Tested in the U.S. (Ft. Ord) with good results in October 1974.
HOT	FRG/France	Euromissile	Man-portable, wire-guided spin-stabilized anti-tank missile, launches primarily from aircraft and helicopters. Max. range = 4 km.	0.01	50,000	500		The TOW unit cost represents a production run of 50,000 units. HOT is in production
Gazelle SA341	France	Aérospatiale	Light armed utility helicopter	0.345	96	33	Advanced Scout Helicopter (proposed)	In production. Operational One version carries the HOT missile.
BO115	FRG	MBB	Light armed utility helicopter	1.3	96	125		In advanced development
Ag 129	Italy	Agusta	Light armed utility helicopter	1.3	96	125		In advanced development
FH 70	FRG/UK/Italy	Widely distributed among contractors in FRG, UK, and Italy	Towed 155 mm howitzer	0.4-0.46	1,600	640-740	M114A1 ($90.6k) and XM198 ($126k)	In development. Production scheduled to start in mid-1976.
SP 70	FRG/UK/Italy		Self-propelled 155 mm howitzer	0.6-1.2	800	480-960	M109A1 ($245k)	Trials scheduled to start in mid-1976.
Flakpanzer Gepard	FRG	Krauss-Maffei	Twin-35 mm anti-aircraft guns on a tracked vehicle	1.6-2.4	400	640-960	None	Production to begin "shortly."
Naval Warfare								
SIRCS	U.S.	DNA	A conceptual integrated ship defense system, including detection, identification, tracking, weapons management, etc.	5-50	300	1,000	DNA	In conceptual stage. Could use European-developed components (e.g., Catulle, Sea Wolf, a Marine Rolland II)
2nd Generation ASM	NATO	DNA	Advanced anti-ship missile	0.25	500-1000	125-250	None	Feasibility studies
Sea Skua	UK	BAC	Helicopter-launched anti-ship missile.	0.12	1,000	120	Harpoon ($500k) is much larger and more capable	Trials started.
Project 7511	UK	Marconi Space and Defence Systems Ltd.	Lightweight torpedo for use on surface ships or by helicopters or other aircraft.	0.24	4,000	960	Improved MK 46	Trials to start soon. IOC possible in late 1979.
Maritime Harrier	UK	Hawker Siddeley	A navalized version of Harrier	5-6	100	500-600	None	In mock-up and system definition stage.
Air Warfare								
Advanced Harrier	US/UK	McDonnel Douglas (~60%) Hawker Siddeley (~40%)	A VTOL attack aircraft being developed from the AV-8A	4.5-5	300	540-600	None	In development
Hawk T. Mk. 1	UK	Hawker Siddeley	Jet trainer/light attack aircraft	2.3	200	460	Rockwell International T-2C ($1.34 million)	In flight test. IOC October 1976.
Alpha Jet	France/FRG	Dassault-Brequet/ Dornier	Jet trainer/light attack aircraft	2.3	200	460		Deliveries to begin October 1976.
M.B.339	Italy	Aermacchi	Jet trainer/light attack aircraft	2.3	200	460		Developed from the Aermacchi M.B. 326
Matra 550 "Magic"	France	Engins Matra	Air-to-air "dog fight" missile	0.045	5,000	225	AGILE and CLAW (proposals)	Production began in 1974
SRAAM	UK	Hawker Siddeley	Air-to-air "dog fight" missile	0.043	5,000	215		In advanced development. No production plans yet.
Jumbo	FRG	MBB	Rocket-powered stand-off missile with inertial midcourse and TV terminal guidance. 18-40 km range. Can be launched from high or low altitude	0.034	4,000	136	None	In development

Appendix B
IDENTIFICATION OF EXTERNAL NONMILITARY OFFSETS

This appendix supplements Sec. V and presents the analysis used to identify external nonmilitary offset candidates.

RELATIVE COSTS AND TOTAL EXPORTS

The methods used to calculate relative costs and total exports were briefly described in Sec. IV. United Nations data list 34 different product categories, by the Standard Industrial Classification (SIC) code. These 34 areas include most basic industries for developed nations. The data, obtained by the UN in response to a questionnaire on general industrial statistics, cover several levels of aggregation and include both cost (in local currency) and volume of gross output. We used data at the three-digit level of aggregation: for example, SIC 210 coal mining, 321 textiles, 351 industrial chemicals, and so forth. The complete list of product categories is shown in Table B.1; data are for 1963 and the 1967-1971 time period. We used the five-year period 1967-1971 to plot trends and relative costs.

We took the prices, at the three-digit level, and adjusted each year's prices for 1967-1971 from the local currency to U.S. dollars using the International Monetary Fund parity rates. There is no output at the three-digit level, so we aggregated the six-digit data to an equivalent three-digit level for each year. These data were entered into a computer program and annual price relatives were constructed. Unit prices, for each country and commodity, were obtained by dividing the total cost by the total output, in consistent output terms. We constructed a series of price relatives (price of country X/U.S. price) for 16 of the 34 three-digit SIC categories. Price relatives could not be computed for those categories where the quantity data were so heterogeneous as to make any price calculation meaningless. A typical member of this series (transport equipment) of 16 tables is presented in Table B.2.

The OECD data used a somewhat different classification system, the

Table B.1

UN DATA PRODUCT CATEGORIES

SIC Code	
210	Coal mining
220	Petroleum and gas
230	Metal ore mining
290	Other mining
311/2	Food products
313	Beverages
314	Tobacco
321	Textiles
322	Wearing apparel
323	Leather and products
324	Footwear
331	Wood products
332	Furniture and fixtures
341	Paper and products
342	Printing, publishing
351	Industrial chemicals
352	Other chemical products
353	Petroleum refineries
354	Petroleum, coal products
355	Rubber products
356	Plastic products, NEC
361	Pottery, china, etc.
362	Glass and products
369	Nonmetal products, NEC
371	Iron and steel
372	Nonferrous metals
381	Metal products
382	Machinery, NEC
383	Electrical machinery
384	Transport equipment
385	Professional goods
390	Other industries
410	Electricity, gas, steam
420	Water works and supply

Standard International Trade Classification (SITC). Table B.3 lists the OECD commodity groupings.

Although the OECD data had quantity information (as well as cost information), the United States and Canada did not report these values. Therefore, for the OECD we show only the increase in value of exports for each NATO AWACS country from 1970 to 1972 and the total value of

Table B.2

TYPICAL TABLE OF PRICE RELATIVES[a]

SIC CODE NO.: 384 UN DATA PRODUCT GROUP: Transport Equipment					
Country	1967	1968	1969	1970	1971
United States	1.0000	1.0000	1.0000	1.0000	1.0000
Federal Republic of Germany	0.3855	0.3659	0.3550	0.4009	0.4745
France	0.4564	0.4786	0.4136	0.3520	0.4202
United Kingdom	0.6	0.5939	0.0	0.6216	0.0
Canada	0.7811	0.7809	0.6992	0.6756	0.7846
Netherlands	0.0	0.0	0.0	0.0	0.0
Norway	0.0	0.0	0.0	0.0	0.0

SOURCE: United Nations, *Growth of World Industry*, 1972 ed.

[a]Price of Country X/Price of U.S.

exports by these countries in 1972. For comparison purposes, the total value of their exports to the United States in 1972 is also shown. The data were obtained for many countries and cover all goods imported by or exported from the countries concerned. Values of the goods are in U.S. dollars in the year listed; they were converted from local currency to U.S. dollars using International Monetary Fund parity rates. The results of the OECD survey show total exports of the OECD countries to the world, and to almost all the trading nations. Table B.4 displays exports of selected products for six NATO AWACS countries. The quantity data were very sparse (at the two-digit level) for several countries, one of which was the United States. As a result, we were unable to derive unit cost estimates from the OECD data to compare with those derived from the UN data.

Because of the serious deficiencies of both the UN and OECD data, any interpretation of these tables must be made with caution. First, the data are aggregated and not homogeneous. For example, at a three-digit level in the UN data, the category of industrial chemicals (SIC 351) contains 53 different chemicals, in various quantities, for each country. Since the quantity data are determined from the six-digit

Table B.3

OECD COMMODITY GROUPING

(Two-digit level)

SITC Code	Commodity Group
00	Live animals
01	Meat and meat preparations
02	Dairy products and eggs
03	Fish and fish preparations
04	Cereals and cereal preparations
05	Fruits and vegetables
06	Sugar, sugar preparations, and honey
07	Coffee, tea, cocoa, spices, and manufactures thereof
08	Feeding stuff for animals (not including unmilled cereals)
09	Miscellaneous food preparations
11	Beverages
12	Tobacco and tobacco manufactures
21	Hides, skins, and fur skins, undressed
22	Oil-seeds, oil nuts, and oil kernels
23	Crude rubber (including synthetic and reclaimed)
24	Wood, lumber, and cork
25	Pulp and waste paper
26	Textile fibers (not manufactured into yarn, thread, or fabrics) and their waste
27	Crude fertilizers and crude minerals (excluding coal, petroleum, and precious stones)
28	Metalliferous ores and metal scrap
29	Crude animal and vegetable materials, n.e.s.
32	Coal, coke, and briquettes
33	Petroleum and petroleum products
34	Gas, natural and manufactured
35	Electric energy
41	Animal oil and fats
42	Fixed vegetable oils and fats
43	Animal and vegetable oils and fats processed, and waxes of animal or vegetable origin
51	Chemical elements and compounds
52	Mineral tar and crude chemicals from coal, petroleum, and natural gas
53	Dyeing, tanning, and coloring materials
54	Medicinal and pharmaceutical products
55	Essential oils and perfume materials; toilet, polishing, and cleansing preparations
56	Fertilizers, manufactured
57	Explosives and pyrotechnic products
58	Plastic materials, regenerated cellulose, and artificial resins
59	Chemical materials and products, n.e.s.
61	Leather, leather manufactures, n.e.s., and dressed fur skins
62	Rubber manufactures, n.e.s.
63	Wood and cork manufactures (excluding furniture)
64	Paper, paperboard, and manufactures thereof
65	Textile yarn, fabrics, made-up articles, and related products
66	Nonmetallic mineral manufactures, n.e.s.
67	Iron and steel
68	Nonferrous metals
69	Manufactures of metal, n.e.s.
71	Machinery, other than electric
72	Electric machinery, apparatus, and appliances
73	Transport equipment
81	Sanitary, plumping, heating, and lighting fixtures and fittings
82	Furniture
83	Travel goods, handbags, and similar articles
84	Clothing
85	Footwear
86	Professional, scientific and controlling instruments; photographic and optical goods, watches, and clocks
89	Miscellaneous manufactured articles, n.e.s.
91	Postal packages not classified according to kind
93	Special transactions not classified according to kind
94	Animals, n.e.s., including zoo animals, dogs, and cats
95	Firearms of war and ammunition thereof
96	Coin other than gold, not being legal tender

Table B.4

TOTAL EXPORTS FROM SELECTED NATO COUNTRIES TO THE WORLD AND THE UNITED STATES, 1972, AND CHANGE IN EXPORTS FOR SELECTED PRODUCTS, 1970-1972

(In $ U.S. million)

Code	Description	Change in Exports - 1970-1972						1972 Total Exports (World)	1972 Total Exports to U.S.
		FRG	France	UK	Canada	Nether-lands	Norway		
01	Meat and meat preparations	20	129	72	14	207	1	1,611	146
02	Dairy products and eggs	174	149	21	-3	191	9	1,698	29
04	Cereals and cereal preparations	-20	556	4	341	47	0	3,171	65
05	Fruit and vegetables	47	117	8	2	163	1	1,399	63
11	Beverages	39	354	126	31	15	1	1,935	676
12	Tobacco and tobacco manufactures	9	12	24	3	58	0	387	8
24	Wood, lumber, and cork	8	31	1	505	6	6	1,464	1,079
25	Pulp and waste paper	6	-1	-2	57	-1	-9	1,012	484
26	Textile fibers	72	121	39	3	18	5	1,090	45
28	Metalliferous ores and metal scrap	-21	-5	9	-76	-14	9	2,122	460
32	Coal, coke, and briquettes	120	-7	-28	81	9	1	1,121	20
33	Petroleum and petroleum products	82	152	125	481	594	39	4,201	1,190
51	Chemical elements and compounds	313	132	131	14	305	14	3,914	392
53	Dyeing, tanning, and coloring materials	230	50	69	3	34	3	1,329	73
54	Medicinal and pharmaceutical products	138	74	117	7	59	2	1,633	67
55	Essential oils and perfume materials	70	96	33	1	29	3	897	50
58	Plastic materials, regenerated cellulose, and artificial resins	391	148	96	10	216	9	2,949	99
59	Chemical materials and products	154	84	66	2	82	2	1,690	86
62	Rubber manufactures	134	131	19	6	31	2	1,209	182
64	Paper, paperboard, and manufactures	170	89	40	137	84	11	2,989	1,074
65	Textile yarn, fabrics, made-up articles, related products	521	280	126	26	260	12	5,454	385
66	Nonmetallic mineral manufactures	204	157	607	36	69	9	3,243	488
67	Iron and steel	475	221	108	-13	276	42	7,110	1,160
68	Nonferrous metals	89	42	26	-208	78	52	4,257	1,177
69	Manufactures of metal	325	148	101	35	108	23	3,502	321
71	Machinery, other than electric	2,931	890	1,194	376	359	54	21,800	2,930
72	Electric machinery, apparatus, and appliances	1,081	414	264	-39	361	69	9,179	735
73	Transport equipment	2,398	1,376	657	1,201	428	252	21,227	6,865
84	Clothing	226	355	66	20	99	4	2,232	190
86	Professional, scientific and controlling instruments; photo and optical goods, watches, and clocks	302	121	183	26	152	4	2,899	334
89	Miscellaneous manufactured articles	350	282	282	32	121	17	3,973	625

SOURCE: OECD, *Trade by Commodities*, 1970, 1972 eds. Dollars converted from national currencies by OECD using IMF parity rates, or average of annual range of flexible rates.

code (individual chemicals, such as sulphuric acid, etc.), it is immediately apparent that the *composition* of the items and cost will be different for each country, thus making comparisons tenuous and difficult. Another problem is that *quality* differences are going to affect the unit cost comparisons. In the case of transport equipment (SIC 384), the number of automobilies reported is independent of the type and quality; thus Volkswagens are counted as equivalent to Mercedes-Benz and Rolls Royce cars. Finally, there is the problem of the accuracy and usefulness of the data reported. Of the 34 three-digit SIC codes, approximately half had such a broad range of categories as to be useless, and in the OECD data, the United States did not report the quantity of its imports, precluding price comparisons.

THE BUY AMERICA ACT AND THE IMPORTANCE OF TARIFFS

We now turn to the analysis used to measure the importance of the Buy America Act and also present the effective rate of protection for 351 industry groups in the 1967 input-output tables.

Richardson performed a detailed analysis of the Buy America Act using the 1963 input/output tables together with data on actual government imports by eight broad commodity classes.[1] The actual and hypothetical government imports and the eight estimated discrimination coefficients are presented in Table B.5.[2]

In his study, Richardson emphasizes the responses of the private sector to the government's discrimination against imports. Firms in the private sector using those commodities that are being discriminated against by the government will find lower import prices and higher domestic prices. Thus, there will be a tendency to substitute imports for domestic purchases, which will mitigate the distortions created by

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[1] J. D. Richardson, "The Subsidy Aspect of a 'Buy America' Policy in Government Purchasing," in United States Congress, Joint Economic Committee, *The Economics of Federal Subsidy Programs*, Government Printing Office, Washington, D.C., 1972.

[2] See ibid., App. C., for the method used to calculate the discrimination coefficients. Richardson notes that these coefficients have a slight upward bias.

Table B.5

ACTUAL AND HYPOTHETICAL GOVERNMENT IMPORTS, M_a AND M_h, AND DISCRIMINATION COEFFICIENTS, α, 1963

(In $ million)

Commodity Class	M_a	M_h	α
Ordnance	2.0	40	0.95
Nondurables	0.3	6	0.95
Lumber, wood, stone, etc.	0.1	2	0.95
Metal products	1.0	5	0.80
Nonelectric machinery	6.0	19.8	0.70
Electric machinery	25.0	82.5	0.70
Transport equipment	25.0	42.5	0.40
Instruments, miscellaneous	1.0	20.0	0.95
Total	60.4	217.8	

the government's discriminatory practices. The quantitative importance of this compensating effect, of course, is difficult to measure. Furthermore, its significance will vary among commodities. Richardson's contribution lies in his recognition that such a force exists and tends to counteract the desired results (reduced imports) of the Buy America Act.

We repeated Richardson's calculations for the 1967 input/output tables, obtaining our data on actual government imports for the eight commodity classes directly from the Commerce Department. Table B.6 displays the results. Total actual government imports were $167 million, whereas hypothetical imports were $799 million, the ratio of M_a/M_h being approximately 0.21. This implies that the weighted discrimination coefficient $\bar{\alpha}$ is 0.79.

To assess the importance of tariffs in restricting imports to the United States, Ozello calculated the effective rate of protection for 351 industry groups in the 1967 input/output tables. He used roughly the same methods as Baldwin (see Table 5, Sec. V, above). The effective rate of protection is "the maximum percentage increase in the value added by primary resources during production that is made possible by trade distorting policies . . . For example, assume that under free trade conditions the per-unit cost of intermediate products is

Table B.6

ACTUAL AND HYPOTHETICAL GOVERNMENT IMPORTS, M_a AND M_h, AND DISCRIMINATION COEFFICIENTS, α, 1967

(In $ million)

Commodity Class	M_a	M_h	α
Ordnance	24	137	0.8347
Nondurables	11	122	0.9099
Lumber, wood, stone, etc.	1	7.2	0.8607
Metal products	4	40	0.8994
Nonelectric machinery	8	58	0.8629
Electric machinery	20	226	0.9115
Transport equipment	92	156	0.4246
Instruments, miscellaneous	7	53	0.8665
Total	167	799	

$0.50 on a final product that sells for $1.00. If these prices are fixed in the free international market, a 10 percent duty on the final product will increase its price to $1.10 but will not affect the price of the intermediate inputs. Therefore, value added in the manufacturing process will increase from $0.50 to $0.60, or by 20 percent. The effective rate of protection is consequently 20 percent while the nominal rate remains at 10 percent."[1] The effective rate of protection and the average tariff are presented in Table B.7 for selected industry groups, which have been aggregated into the eight broad commodity classes used in Tables B.5 and B.6.

[1]Robert E. Baldwin, *Nontariff Distortions of International Trade*, The Brookings Institution, Washington, D.C., 1970, pp. 150-151.

Table B.7

AVERAGE TARIFF AND EFFECTIVE RATE OF PROTECTION (ERP), 1973 FOR SELECTED SIX-DIGIT INPUT/OUTPUT SECTOR, 1967

Corresponding Class	I/O Sector	Average Tariff	ERP[a]
Ordnance	Small arms	0.08	0.09
	Small arms ammunition	0.05	0.05
Nondurables	Cheese	0.10	0.09
	Canned fruits, and vegetables	0.14	0.18
	Wines, brandy	0.11	0.09
	Distilled liquor	0.10	0.06
	Cigarettes	0.25	0.31
	Broadwoven fabrics	0.19	0.26
	Lace goods	0.26	0.38
	Apparel	0.24	0.31
	Fabricated textiles, NEC	0.15	0.17
	Converted paper	0.08	0.11
	Industrial chemicals	0.08	0.09
	Chemicals, NEC	0.10	0.13
	Plastics, resins	0.11	0.15
	Organic fibers	0.11	0.12
	Drugs	0.06	0.06
	Shoes, except rubber	0.09	0.11
Lumber, wood, stone, etc.	Veneer and plywood	0.11	0.17
	Wood products, NEC	0.07	0.10
	Glass products	0.11	0.13
	Ceramic tile	0.20	0.25
	Vitreous plumbing	0.13	0.15
	Vitreous china	0.31	0.36
	Nonmetallic minerals	0.07	0.07
Metal products	Blast furnace and steel	0.06	0.07
	Aluminum rolling	0.07	0.13
	Aluminum castings	0.08	0.11
	Cutlery	0.17	0.21
	Fabricated metal products	0.08	0.09
Nonelectric machinery	Steam engines	0.07	0.09
	Machinery cutting tools	0.07	0.07
	Special dies and tools	0.16	0.19
	Textile machinery	0.07	0.08
	Industrial furnaces	0.06	0.07
Electric machinery	Electrical measuring instruments	0.08	0.09
	Electrical apparatus, NEC	0.07	0.08
	Lighting	0.12	0.16
	Primary batteries	0.08	0.09
	Electrical equipment, NEC	0.09	0.11
Transport equipment	Truck trailers	0.08	0.09
	Shipbuilding	0.08	0.10
	Railroad and streetcars	0.07	0.09
	Trailer coaches	0.07	0.09
	Transport equipment	0.08	0.09
Instruments, miscellaneous	Engineering instruments	0.07	0.06
	Surgical instruments	0.12	0.15
	Watches and clocks	0.19	0.26
	Jewelry, precious metal	0.12	0.19
	Miscellaneous products, NEC	0.09	0.11

[a]Based on the Corden estimate--M. W. Corden, "The Calculation of the Cost of Protection," *Econ. Rec.*, April 1957, pp. 29-51. These estimates differ substantially from the aggregate ERP estimates presented in Table 5, Sec. V, for two reasons: (1) The estimates by Ozello in this table are based on the 1967 input-output table, whereas those of Baldwin (Table 5) use the 1958 input/output table. (2) The categories in this table were chosen because they exhibited high ERPs; therefore, they are biased estimates of the 1972 aggregate ERPs that correspond to those of Table 5.