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NATO Standardization and Technology Transfer

VOLUME I – EXECUTIVE SUMMARY

by

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Prepared for:

European/NATO Directorate
Office of the Assistant Secretaty of Defense
for International Security Affairs

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Short Title: Technology Transfer

Contractor: General Research Corporation
Contract Project Director: Robert A. Gessert
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This study reviews current literature dealing with the problem of technology transfer; reassesses the importance of technology transfer to NATO standardization; evaluates lessons learned about technology transfer in the cases of Roland II, Sidewinder and Sparrow, and the F-16; and examines current US governmental policies, regulations, and procedures for controlling and releasing militarily significant

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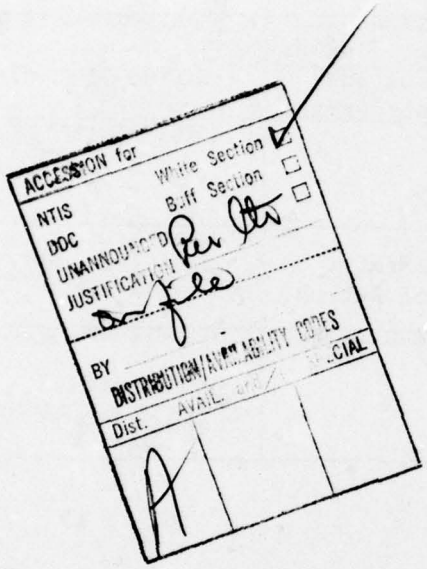
technology. Conclusions and recommendations for US technology transfer policy affecting NATO standardization are presented.



PREFACE

NATO standardization and technology transfer have been two subjects of widespread and increasing interest in the US defense community since about 1975. Both bear a direct relation to improving the US and NATO conventional posture vis a vis the Soviet Union and the Warsaw Pact. The US and NATO have counted on technological superiority in fielded systems - particularly in Central Europe - to help offset some of the advantages of Pact numerical superiority in deployed forces.

A major study by a Task Force of the Defense Science Board brought concern with export policies affecting technology into sharp focus in early 1976. Though that Task Force dealt principally with commercial transfer to the Soviet Union and other communist states, it seemed to augur tighter controls on militarily significant technology in general as it warned of imminent erosion of the West's technological lead. Following completion of its earlier examination of NATO standardization and licensing policy, including related industrial and technological matters, the General Research Corporation (GRC) was requested by the Office of the Assistant Secretary of Defense for International Security Affairs (OASD/ISA) to undertake this examination of the convergence of these two subjects.

GRC, and its subcontractor and consultant for this report express their appreciation to the government officials and representatives of US industry who gave freely of their time, particularly for the case studies examined. Special appreciation is expressed to Major General Richard C. Bowman, Director, European and NATO Affairs; to Colonel

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The views and judgments expressed in this report are those of the authors and do not necessarily reflect the views of ISA or any person interviewed in the performance of the study.

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EXECUTIVE SUMMARY*

INTRODUCTION

Purpose and Scope

The purpose of this study is to review and assess problems of technology transfer in relation to NATO standardization and interoperability; to examine the criteria, policies, procedures, and mechanisms that have governed the transfer and control of technology; and to recommend modifications in those that can facilitate the controlled release of US technology to achieve greater NATO standardization subject to the constraints of US national security and industrial competitiveness.

Background

Standardization of weapons and equipment among the allied forces of NATO, especially in the central region, is now widely recognized as highly desirable, if not essential, to the improvement of the conventional leg of NATO's triad of capabilities at a cost that is affordable. The payoff for standardizing weapons and equipment is expected to be in improved allied force effectiveness and, hopefully, in more efficient and economic use of collective resources. All the principal NATO countries are now engaged in efforts to find ways to achieve greater NATO standardization, or at least interoperability, without sacrificing other national interests, including their domestic industrial interests.

*Headings in this Summary are keyed to the Chapters in the Main Report (Volume II). All reference documentation is supplied in the Main Report.

By whatever means greater standardization is achieved— by common procurement from a single source, by co-production of a commonly-selected development, or by co-development leading to co-production — weapons technology is transferred from one country to another within the alliance. Thus, one of the potential costs of standardization is some loss of control of sensitive technology. This may have repercussions for the competitive position of national industries in international markets as well as repercussions for national security if strategically significant technologies are involved and the chances for their dissemination beyond what is intended are increased.

The US defense-industrial community has become increasingly concerned in recent years about the erosion of the technological lead the West has traditionally enjoyed vis a vis the Soviet Union and its allies. This lead has been counted on to help off-set the quantitative imbalance between the forces and equipment of the Warsaw Pact states and of NATO. One of the ways this lead appears to have been eroded is by the transfer of US and European-developed technologies to the Soviet Union and its allies for explicitly civil programs. Another is by the diffusion of militarily-applied technologies in the fielded weapons and equipments of the US and its NATO allies and in the sales of such items to third world countries. Both suggest tighter controls on the transfer of any technology that has a militarily significant application and in which the US enjoys a strong competitive position.

Discussion

In the late fifties, beginning with President Eisenhower's offer to NATO in December 1957, the US committed itself to a policy of sharing US technology with its European NATO partners. The success of this policy in achieving important goals partly contributed to de-standardization as European industries and consortia have developed and produced systems that are competitive with US technology and designs. These include collaborative projects such as the British-French Jaguar ground attack/ trainer jet and the Lynx, Gazelle, and Puma helicopters; the German-French Alpha-Jet trainer/ground attack aircraft and the Roland surface-

to-air missile system; and the British-German-Italian Multiple Role Combat Aircraft (MRCA). Other examples include the Harrier VSTOL aircraft, the HOT and MILAN antitank weapons, the EXOCET and OTOMAT antiship missiles, and the Rapier and Crotale surface-to-air missiles. While not all of these match US technology, it is clear that European technology has become competitive with US technology in some areas.

A significant US technological lead vis-a-vis Europe continues to exist in several key areas that are important to civil as well as military projects. These include areas such as electronic warfare equipment, propulsion systems and fuels, advanced guidance systems, and solid state devices. In most of these areas, the US technological lead is militarily and strategically significant in relation to the communist countries, and widespread dispersion would be contrary to US security interests. In some areas, the technologies in question also have large-scale or important commercial applications, and dispersion might be unfair or disadvantageous to US developers who have invested heavily in R&D. In either military or commercial applications, it is generally the design and manufacturing know-how of the key technologies and not the textbook theory or principles that provide the principal advantages.

Problems associated with the transfer of technology, including design and manufacturing know-how, have not gone unnoticed in NATO. A Working Group on Industrial Property (AC/94) under the NATO Conference of National Armaments Directors (CNAD) published in November 1976 a comparative study on "Military Equipment and Industrial Property Legislation" among the NATO countries. The AC/94 working group was assigned the mission in December 1976 of conducting a follow-on study of licensing policies and intellectual property rights in NATO standardization projects. The NATO Industrial Advisory Group (NIAG), formed in 1968, has developed procedures for the free exchange of ideas under constraints of safeguarding national security and industrial privacy, a "moral code on the free exchange of ideas," and guidance for the standardization of protective clauses in industrial property rights.

Despite such studies, agreements and guidance, many problems exist in facilitating the free exchange of ideas that involve the design of high technology systems and components and the manufacturing know-how to produce them efficiently and competitively. There currently is no clear policy guidance for US contractors who want to cooperate or collaborate or share technology with European contractors in weapons development. Major obstacles exist, which are too much for contractors to overcome alone without strong government backing, for forming collaborative arrangements with Europeans. If NATO standardization/interoperability is to be achieved by greater use of co-production or co-development arrangements with European allies, there is an urgent need for reviewing, revising, and consolidating US criteria, policies, procedures, and mechanisms for affecting release of critical technology without jeopardy to US national security and US industry.

TECHNOLOGY TRANSFER IN PERSPECTIVE

General

A study by a Task Force of the Defense Science Board in early 1976 (the Bucy Report) brought into sharp focus within the defense and defense-related industrial communities a critical question of the relation of technology to US foreign policy and defense goals. That study was concerned specifically with the export of US technology and its impact on the maintenance of US technological superiority vis a vis the Soviet Union in areas of significance to national security. At the time the Report was issued, the US had had three years of experience in increased scientific and technical cooperation with the Soviet Union under a series of eleven agreements initiated at the Nixon-Brezhnev summit of May 1972. These, together with increased trade and commercial technology transfer programs, had begun to raise serious concerns that the US was eroding its technological superiority without a material improvement in the political-military environment. The Bucy Report sounded a somber warning on this score and urged immediate steps to tighten control on the export of US technology.

Prior to the Bucy Report, the Congress had held hearings on US-USSR advanced technology transfer in December 1973, on detente in general in May-July 1974, and on US-USSR cooperative agreements in science and technology in 1975. In January 1975, the General Accounting Office had also released a report on the progress in the US-USSR cooperative science programs. Shortly after issuance of the Bucy Report, hearings were held again in April and May of 1976 on export licensing of advanced technology. In May of 1977 the Subcommittee on International Security and Scientific Affairs of the House Committee on International Relations published a comprehensive review of technology transfer and scientific cooperation between the US and the Soviet Union prepared by the Congressional Research Service of the Library of Congress.

Such studies, reports and reviews led, in late May 1977, to the inclusion in the International Security Assistance Act of 1977 of a provision for a one-year, Executive Branch study of technology transfers.

The Bucy Report and other recent literature on the export control of technology has been widely interpreted as portending a generally more restrictive US policy on technology transfer that could have severe implications for allied cooperation in defense development and production and, thus, on NATO standardization.

Meanings of Technology Transfer

The general literature on technology transfer in the 1970s contains three rather distinct but related meanings of the term "technology transfer." These are:

a. Intra-US transfer to other uses and agencies, including state and local governments and the private sector, of technologies developed at taxpayer expense under US government sponsorship or within federal laboratories.

b. Export or import of commercial technologies developed within the US or abroad either under government sponsorship or by private technological-industrial sectors.

c. The transfer of arms-related technologies under programs of arms sales and military assistance, and under programs of defense cooperation including military trade and co-production or co-development of weapons and equipment.

In view of heavy expenditure on and performance of R&D by the federal government, the federal laboratories and the National Science Foundation have sponsored programs of technology transfer to assure greater utilization and secondary applications of federally-funded technology. One outgrowth of such concern for greater utilization of federally funded technology is a NATO-wide conference on technology transfer in Lisbon, 7-11 November 1977, with tri-service US support. Of most direct relevance to this study are the second and third meanings of technology transfer, that is, export (or import) of technology — either for intended commercial applications or for intended military applications.

Commercial Technology Transfer. US policy on the export of technology for commercial and civil applications has developed in three general contexts: aid to developing countries, trade with friends and allies in the industralized world, and detente with the Soviet Union and other communist states.

Primarily as an instrument of aid and, in the longer run, to enhance trade and other foreign policy goals, the US, along with other industrially developed countries, has sought to transfer relevant and absorbable technologies to developing countries. With respect to allied or friendly industrialized democracies, the US has generally also fostered commercial technology transfer in furtherance of US goals.

US policies of technology transfer to the Soviet Union and other communist states have been more cautious and, even under detente in the 1970s, have sought to restrict such transfers to commercial or civil technologies and have excluded military products and associated technologies, as represented on the US Munitions List. US allies in NATO and Japan have similarly agreed through the informal Coordinating Committee (COCOM), consisting of all of NATO less Iceland plus Japan, to limit

exports of products and technologies to the Soviet Union and other communist states to items that have no military or strategic significance or potential. There appear to be two principal difficulties with such policies. First, many if not most advanced product technologies with significant military applications are inherently dual-purpose, capable of either commercial or military applications. Second, the manufacturing technologies (know-how) associated with specific product technologies are inherently more difficult to control once they have been transferred. Thus in both regards, end-use agreements or limitations and patent and copyright safeguards, which are counted on heavily in US export policy with allied trading partners to protect the interests and rights of transferors of technology, are of little avail in controlling technology transfers to the Soviet Union.

Arms-Related Technology Transfer. The export or transfer of arms-related US technology has inevitably taken place in the large-scale programs for direct arms transfer or sales by which the US has sought to strengthen and support the military capabilities of allies and other friendly states. As the Bucy Report aptly notes, however, the sale of end products is one of the least effective mechanisms of transferring the critical technologies that go into the design and production of the end products. "Reverse engineering," especially of sophisticated, high technology systems is an exceedingly difficult process and is rarely successful without active accompanying mechanisms of transfer.

Technology is much more readily transferred when direct arms sales are accompanied by training, logistic support, and technical assistance for operation and maintenance of the arms that are transferred. The transfer of sophisticated, high-performance equipment to developing countries like Iran and Saudi Arabia has required this assistance to develop an infrastructure for use of the equipment and arms supplied. Arms technology is most directly transferred when licensed production or co-production arrangements are entered into as a vehicle for arms sales and military assistance.

While, in general, arms transfers and related technology transfers to allies and other friends is seen by the US to be a primary requirement of US security, they are also used to support or provide leverage for other foreign policy goals, including: creating interdependencies with recipient states, offsetting US oil importing accounts, and providing markets for high-cost arms and related technologies to reduce unit costs. NATO allies — especially Britain and France and to a lesser extent West Germany — with substantial, high investment armaments industries have similar incentives for arms transfers and related technology transfers. In the aerospace industries in particular where, for example, Britain and France require substantial export to utilize their present investment and to sustain employment, the US and its NATO allies are in competition for transfers to third world countries.

The technological character and magnitude of US arms transfers to the third world has been of increasing concern to the US Congress and this concern has been reflected in the new arms transfer policies formulated by the Carter Administration and in the creation of an interagency Arms Export Control Board under the chairmanship of the Under Secretary of State for Security Assistance. Besides defining arms transfers as an "exceptional foreign policy implement" the use of which rather than the denial of which must be justified, two features of the new policies are especially significant for the transfer of arms technology. These are the principles that the US will not be the first to introduce into a region "newly-developed, advanced weapons systems which would create a new or significantly high combat capability," and that sales or co-production of US-designed weapons would be prohibited "until they are operationally deployed with US forces."

Which Aspects of Technology are Transferable?

A useful distinction can be drawn between technology as process (know-how) and technology as product (know-what).

Technology as Process. Activities covered by the concept of technology as process include:

a. pure research
b. applied research
c. designing
d. developing
e. testing and evaluating
f. planning and managing
g. manufacturing
   - fabricating of components
   - assembling
h. quality control
i. distribution
j. support and maintenance
k. operating or employing (i.e., using)

Such activities all fall within the definition of technology as "knowledge rationally applied." They suggest the range of purposeful activities or processes frequently referred to as the "know-how" necessary to bring a complex system into being, from concept to a fielded end product. They are frequently referred to collectively as "design and manufacturing know-how," as in the Bucy Report.

Export of technology as process may be accomplished by direct foreign investment that is accompanied by the transfer of people — i.e., key teams of entrepreneurs, managers, and skilled workers — together with employment and training of local personnel.

Such methods of transfer are highly effective. A major variant on direct foreign investment is the creation of a multinational corporation or a joint venture between two or more transferors who are also transferees. In the absence of direct foreign investment, training of local personnel may also be accomplished under a contractually agreed program of technical assistance.

In the area of allied cooperation in defense development and production, multinational corporations, joint ventures, and consortia — with varying degrees of government participation and ownership in particular

industries — have clearly been dominant patterns for transferring and sharing technology within NATO Europe.

Technology as Product. Things covered by the concept of technology as product include:

a. basic principles
b. applications concepts
c. specifications and requirements
d. models and prototypes
e. test and evaluation equipment
f. test and performance data
g. technical design data
h. production plans
i. manufacturing plant and equipment
j. support plant and equipment
k. maintenance plant and equipment
l. end products

This list includes a mixture of documentation and physical objects under the rubric "things." All are intermediary or end products of some aspect of technology as process; they are what is made by know-how. They record or embody know-how and could thus be thought of a "know-what."

Any aspect of technology as product is capable of transfer by sale and purchase, whether in the form of documentation or physical objects. The sale of physical objects generally implies a relatively unrestricted transfer of ownership from the seller to the purchaser. Unless specifically negotiated as a condition of sale, about the only restriction on the transfer of ownership is an assumed obligation not to copy or reproduce any patented or copyrighted aspects of the object purchased. As noted earlier, without specific design information, documentation and technical data, copying or reproducing would be an exceedingly difficult process anyway. Sale of technical design data and documentation is by far the more effective way of transferring technological know-what than sale of physical products.

Within a domestic economy, there is normally only one consumer for military products. Among other things, with respect to technology development and transfer, this has generally required that the government become an important element as producer as well as consumer. The government becomes the principal risk taker and supporter of R&D, especially for advanced technology systems where development costs run high and the risks of not developing a usable product may also be high. In the US, to assure producibility and performance at affordable costs, development contracts are commonly competed among two or more industrial suppliers. Moreover, the potential at least to compete production contracts is also used as a device to assure production at the best price (or least cost). For these reasons, as well as for specific national security reasons, the government becomes either the sole owner of the technology it pays for (documentation as well as objects) or it assures that it has complete and royalty-free rights to all necessary technical data. Where specific classified data and equipment are involved, the government also controls all transfers of these on the basis of industrial security regulations and strategic disclosure policies and procedures.

Mechanisms of Transfer

Mechanisms for Transferring Know-How. There are four principal types of mechanisms for transferring technology as process: (1) direct foreign investment, (2) joint ventures, (3) contracted technical assistance, and (4) information exchanges.

Direct foreign investment is the most effective mechanism for transfer of general technology in one industrial sector to a country in which that sector is underdeveloped. Joint ventures are particularly effective in transferring technology that is specific to particular firms since they generally require close industrial collaboration. Contracted technical assistance under a co-production agreement is the most direct and effective mechanism for transferring technology that is specific to a particular system. Within any given industrial sector, the international transfer of technology among several countries commonly takes place by

a mix of these types of mechanisms and general information exchanges. The mix and degree of employment of all the types of mechanisms is as important as the existence of any one type. Within the context of NATO standardization joint ventures and technical assistance agreements seem clearly to be the most important types of mechanisms for technology transfer of know-how.

Mechanisms for Transferring Know-What. As with technology as process, there are four principal mechanisms for transfer of technology as product: (1) turnkey factories, (2) processing and manufacturing equipment, (3) end products, and (4) technical data and documentation.

Turnkey factory contracts, and to a lesser extent, supply of particular processing and manufacturing equipment are generally accompanied by extensive manufacturing know-how along with the physical objects transferred. Technical data and documentation provide direct access to design information which may or may not yield design know-how depending on the degree of sophistication of the substantive technology involved and the extent of any technical assistance that may accompany the transfer.

In the context of NATO standardization, the principal mechanisms for technology transfer are the sale and purchase of end products with operating and maintaining provisions, or the sale and purchase of technical data through licensing arrangements, or the sharing and co-ownership of technical data through joint ventures in development.

Identification of Critical Technologies

The Mutual Security Act of 1954 as amended provides for export control of military end products, their components and parts, and any technical data associated with them. These have been enumerated in nineteen categories of articles "designated as arms, ammunition, and implements of war" that constitute the US Munitions List. Such categories are characterized by types of military uses and do not provide a systematic basis for identification of key types of substantive technologies.

The Bucy Report strongly recommended that DOD take the lead in establishing new criteria, policies, and procedures for screening and controlling all exports of technology whether for direct military or for ostensibly commercial purposes on the basis of substantive categories of technologies. Such criteria, policies, and procedures should:

- focus on design and manufacturing technologies,
- emphasize the more active mechanisms of transfer, and
- identify strategic technologies.

These principles are reflected in the Report's specification of three "actions" that should constitute the center of implementation of the Task Force's recommendations. These are:

1. The Department of Defense should identify principal technologies that require export control.
2. The administration of export control regulations should emphasize the scrutiny and control of the more active mechanisms of technology transfer.
3. A comprehensive study of active mechanisms for transferring technology that are beyond the normal scrutiny of export control administration should be made by the Department of Defense and recommendations developed for monitoring and controlling them.

The Implementation Study Program that was undertaken by DDR&E on the basis of the Bucy Report concentrated its initial efforts on the identification of the principal technologies that require export control. Four broad criteria were postulated for determining whether a substantive type of technology is strategically significant to the US, warranting tighter export controls. These criteria are: (1) whether the US currently enjoys a competitive (leading) position with respect to the technology; (2) whether the technology is critical to US military systems; (3) what the military status of the technology is; and (4) what the transfer capability is vis a vis the Soviet Union. Qualitative rankings of high, medium, and low were defined for each criteria to provide an initial

basis for screening. A preliminary screening of technologies, coordinated by Battelle Columbus Laboratories and Science Applications, Inc., produced a candidate list of twenty technologies that could be identified as strategically significant.

The new study of technology transfer required by the Security Assistance Act of 1977 will engage more resources and further refine such identification of critical technologies and criteria, policies, and procedures for export control of them. Although tighter controls are likely to be directed primarily at exports to the Soviet Union, other communist countries, and third world countries, European NATO partners will watch this process with keen interest for at least two reasons. First, one intended outcome of this process will be proposed revisions of the list of embargoed commodities for the COCOM countries, which include Japan and all of NATO except Iceland. Second, tighter export control policies and procedures for technology transfer may have some unintended effects and implications for NATO standardization.

TECHNOLOGY TRANSFER IN NATO: THE INDUSTRIAL-POLITICAL CONTEXT

General

The goal of NATO standardization, which President Carter embraced for his Administration, has been proclaimed with varying intensity by every US administration since NATO was formed and increasingly enshrined in US legislation since 1974. On the European side of the Atlantic, every principal NATO member government (except France) and the three principal forums for intra-European cooperation on defense matters — the Western European Union (WEU), Eurogroup, and the independent European Programme Group (EPG) — have also asserted the necessity of achieving greater standardization and affirmed their commitment to that goal.

However, a list of current major programs — F-16, AWACS, XM-1/Leopard 2 and Roland — illustrates the problem of the gap between goal and implementation. The first two are products of the high technology US aerospace industries that compete with and threaten to overwhelm

European aerospace industries and make many Europeans suspicious that standardization is a Trojan horse for US industrial dominance. The tank selection is complicated by strong national predispositions concerning armor requirements and tactics as well as by intense competition in automotive industrial capabilities and seems to confirm the inability of the two most industrialized NATO partners to reconcile military interests with competitive industrial interests. The Roland case is unique in representing US adoption of a product of European missile and electronic industries, but is marred by widespread belief (however inaccurate) that US industry and the US Army have "Americanized" the European technology and design and thus de-standardized it.

Dominant Themes

Two themes have dominated most public and official discussions of NATO standardization in recent years and have become part of the standard rhetoric - especially in Europe. These are the themes of the "two-way street" between Europe and America and of "rationalization" of European armaments policies and industrial capabilities. It would be hard to exaggerate the political importance of these two themes.

On both sides of the Atlantic, the name of Thomas Callaghan is most prominently associated with the theme of the "two-way street." In his writings, the theme means a growing balancing of trade between Europe and North America in military systems, eventuating in a "common market" in military trade. Many Europeans are skeptical about the "two-way street" of balanced military trade though few openly criticize the slogan. Privately, many Europeans acknowledge that a common market in defense may be neither feasible nor desirable from either an American or a European point of view, but the slogan has become vital to any discussion of acceptance of European or American designs.

Europeans lay far more pragmatic stress on the second dominant theme: rationalization of European armaments policies and industrial capabilities. When Europeans have seemed slow to embrace US policy initiatives on NATO standardization — such as the US proposal in mid-1975

to create a permanent committee on standardization to report directly to the North Atlantic Council (NAC), — it has been largely because they fear that in a NATO-wide context individual European states might play their short-term, intra-European competitive interests off against one another in separate dealings with the United States (or have their intramural interests so played). It has become commonplace to argue that Europe must "get itself together" before a better balance can be struck across the Atlantic on cooperation in military development, production, and procurement. This theme runs throughout meetings of the WEU and Eurogroup and was a major reason for the creation of the EPG since neither WEU (without Norway and Denmark, for example) nor Eurogroup (without France) provided an adequate framework for representing all West European interests.

Whether there is much more hope that the rhetoric of the requisite European rationalization will be realized than that the "two-way street" will be realized is open to question. During the past two decades, a great deal of rationalization of European industry has already taken place as individual companies have been consolidated into national industries and several key forms of international cooperation have evolved for collaborative research and development and co-production.

European Industrial Interests, Issues and Capabilities

Alliance-wide, the driving motivations for the current interest in standardization in NATO are: (1) to improve the combat effectiveness of NATO forces by enabling interoperability and cross-servicing of weapons and equipment across national lines; (2) to economize in the allocation of collective resources by eliminating duplicative research and development and dual logistics and support systems; and (3) to achieve economies of scale and improve returns on investments and reduce unit costs through larger or longer production runs for an alliance-wide market.

Rationalization within Europe of armaments policies and capabilities represents an attempt to integrate a portion both of the market and of the technological-industrial base for armaments. For all intra-European

collaborations, thus, the critical issues for negotiation are (1) work (or employment) sharing; (2) technology sharing in research and development; and (3) market sharing. Such collaborations are typically carried out only after a common military requirement has been identified and sources have been selected to carry the project through from conceptual design to production with the expectation that commitments will be maintained on the negotiated issues. This is in marked contrast to the US procurement philosophy which generally fosters competitive research and development through the prototype development phase and, even when selection is made, at least theoretically requires the possibility of other or second source production and procurement.

To American industry — with its philosophical emphasis on free enterprise, competition among alternative developers and producers, and government "control" by formal regulations and standards (as opposed to ownership or collaborative negotiation) — the European pattern of governmental-industrial cooperation seems "foreign." On the one hand, it is alleged to contribute to long-term inefficiencies, particularly in the use of capital resources, low productivity rates in comparison to US industry, and inconsistently applied standards of quality and configuration control. However, consolidations and international collaborations have dramatically contributed to overall European development capability and probably to efficiency and productivity by building on the well-capitalized industries of the principal European partners. Particularly in the high technology areas, British and French collaboration has led to the Lynx, Gazelle, and Puma helicopters and the Martel ASM as well as the Jaguar ground attack/trainer jet; French and German collaboration to the HOT and MILAN antitank weapons and the Kormoran air-to-air missile as well as to Alpha Jet and Roland; French and Italian collaboration to the OTOMAT SS naval missile and the air-to-surface Albatros. Many of these systems are clearly competitive with US designs on a systems performance basis.

European technological capabilities that could be competitive with US designs are not restricted, however, to international collaborations

or consortia. As examples: (1) the British, French, and Germans all have impressive national capabilities in the design and development of tanks and other armored fighting vehicles as well as guns; (2) the Belgians are noted for small arms designs; and (3) the Dutch are noted for electronics as well as some aircraft and shipbuilding designs.

The Search for a Political Framework

In a comprehensive and impressive study for the International Institute for Strategic Studies (IISS), on "Weapons Procurement in Europe," Roger Facer outlines the "range of choice" that Europeans face in defense production and procurement. He summarizes Europe's dilemma by asserting that "taken as a whole, Europe has neither a market for defence equipment comparable with that of the United States nor an industry anything like as large" and, further, that "no European country is self-sufficient in defence equipment, whether in industrial or market terms." In another study for IISS, David Heyhoe, another British civil servant in the Ministry of Defence, takes a hard look at the new independent European Programme Group (EPG) to assess its prospects for becoming the framework for rationalizing European armaments policies and technological-industrial capabilities. After examining the delicate political relationships among the EPG, NATO's Conference of National Armaments Directors (CNAD), the Eurogroup, and the WEU, Heyhoe asserts that "the EGP is a logical, but not a necessary, development from the events which preceded it." With some despair about protracted and sensitive political negotiations, but with cautious optimism about yet one more try to find the right political framework, Heyhoe prudently concludes that "it is important that Atlantic co-operation should not be made to wait upon the achievement of European co-operation. ....The two levels of co-operation...need to progress hand in hand."

Alternative Forms of Trans-Atlantic Procurement

The present trends toward industrial collaboration on ad hoc armaments projects within Europe, the search for a political framework for rationalization of European armaments policies and capabilities, and

the trans-Atlantic dialogue on NATO standardization — all place great pressure on the United States to select more European designs or European-developed systems for its forces. At present the Franco-German Roland air defense missile, the British Harrier VSTOL aircraft, the Belgian MAG-58 machine gun, and potentially a German or a British 120mm gun for the XM-1 carry only very limited hopes of satisfying Europe's desire (or demand) for a "two-way street" in armaments selection.

Despite the commitment of the US Executive and Legislative branches to NATO standardization and potentially greater US selection of European designed and developed weapons systems, the obstacles to such selection are formidable. At least the Service and Congress will generally require that a European candidate system be shown to be clearly superior to an existing (or even foreseeable) American alternative. Furthermore, US industry and labor will be highly sensitive to dislocations that may be implied or required by a US selection of a European system. Meanwhile, the "traffic" in US designs flowing to Europe has shifted dramatically from direct sales to offset production. Licensed production to European firms has also declined somewhat. Those European industries capable of producing whole US sytems have shown more reluctance to do so in favor of supporting their own research and development by producing European designs. With direct sales to Europe declining, the US is not likely to undertake major purchases from Europe. Competitive US armaments industries would be reluctant to accept offset co-production arrangements if the US adopts European designs; they would prefer licensed production arrangements as an entry fee into trans-Atlantic collaboration or a new product line. This raises the question of whether selection of current European designs should also be evaluated as a basis for eventual trans-Atlantic co-development — a pattern presently more in evidence in the civil field than in the military field, and a pattern that could greatly affect the long-term future of rationalization within Europe and between Europe and America.

Implications for Technology Transfer

At a WEU Symposium in Paris in March 1977, on European armaments policy, the Warsaw Pact military threat to Western Europe was almost matched by the putative US industrial threat as the justification that gives urgency to a coordination of European armaments policies. Besides rationalization of European defense industries in the senses discussed above, assuring their advanced technological capability and status appears paramount to most Europeans. Therefore, sensitivities are acute to problems in the transfer and protection of technology. From their point of view, European NATO partners have sought to achieve something approaching technological parity with the US as part of the two-way street. This faces Europeans with a serious dilemma: on the one hand, they desire access to the latest, most advanced American technological developments (e.g., precision guided munitions and guidance for cruise missiles); on the other hand, they resist US technological domination and prefer to maximize incentives to stimulate and sustain an indigenous technology.

A recent report on NATO standardization by the Congressional Research Service of the Library of Congress sharply delineated three major approaches to achieving greater standardization across the Atlantic: (1) agreed common procurement, preferably from single sources (the Callaghan approach); (2) co-development against agreed requirements with pooling of R&D resources (the intra-European approach); and (3) common selection and procurement of independently or competitively undertaken developments, facilitated by licensed production or offset co-production (purportedly, the preferred DOD approach). Each of these approaches has advantages and disadvantages. It is unlikely that any one could or should be attempted across the full range of country and NATO requirements. Agreed common procurement from a single source requires the least direct technology transfer. In particular, design and manufacturing technology is hardly transferred at all, except insofar as end product transfer is accompanied by extensive operating and maintenance support. Co-development requires technology sharing or pooling almost more than "transfer" as such. That

is, it represents a deliberate effort to combine resources, including design and manufacturing technology and know-how, and to forego competition in specific technological areas. Common procurement on both sides of the Atlantic is most likely to involve licensed production or offset co-production arrangements in the foreseeable future.

CURRENT EXPERIENCE IN TECHNOLOGY TRANSFER WITHIN NATO

General

An earlier GRC report to OASD/ISA on NATO standardization and licensing policy presented an overview of US experience in licensing within NATO. That overview identified technology transfer as a problem requiring attention and policy accommodation to facilitate allied co-operation in defense production as well as R&D. The present study more closely examined Roland II, Sidewinder (AIM-9L) and Sparrow (AIM-7F) air-to-air missile systems, and the F-16 as case studies in technology transfer. Appendixes A, B, and C of the Main Report present details of these case studies.

The Roland Case

As the major current program of technology transfer from Europe to the US, Roland is especially important as a case study. Early in the program, reports and rumors in the press and in the defense communities of both Europe and the US alleged that the US Army had Americanized Roland and thus de-standardized it or even made it non-interoperable with the French and German systems. Both the Project Office and the US licensees have attempted to dispel such reports and rumors and are prepared to document their case, but allegations persist.

The Roland program of technology transfer was complicated both politically and technically by the sequence of events leading to the US selection of Roland. The US laid down no clear guidelines as to what it would require in a licensing arrangement between the European developer and an American producer in licensed production of a European system.

Instead US companies were encouraged to seek licensing arrangements on their own with European developers of Rapier, Crotale and Roland in advance of competitive selection. In retrospect, industry participants believe it would have been best if DOD had provided clear guidelines of its requirements while the Project Office believes that it would have been best to negotiate a Memorandum of Understanding between governments before the industries began to negotiate their license agreements. It is this sequence of events that has served the F-16 program so well. In the Roland case, however, the US government did not have an opportunity to examine the license until the competition was already in process. As a result, the Project Office feels that the US government's interests in such questions as third-country sales and second-source procurement were not adequately covered, resulting in the need for extensive subsequent amendments to the license.

Of particular concern to Euromissile was the amendment required by the US to provide for second source production, which raised the specter of very broad-scale dissemination of the technical data package. European companies were obviously just as concerned about the loss of proprietary data through technology transfer as their American counterparts and are wary of US industry, if only because of its vast size and competitive capabilities. They fear that the release of proprietary data is tantamount to creating a competitive giant in the world marketplace.

In the original Roland agreement, as in almost all cases, there was also an underestimate of the amount of technical assistance that would be required in early phases of the technology transfer. Both Hughes and Boeing failed to take adequate account of the amount of support and assistance they would need from the various European contractors on the program to acquire, translate and interpret the total data package when it became available.

At present Roland II includes built-in and automatic test features, but these are not as extensive as found in US systems currently in development. US user experience in the field may lead to demands for changes in this area. Moreover, unless the US is willing to accept

a closer relationship between factory maintenance and repair and field units, some of the identity of design mandated by Congress may necessarily be lost because of differences between Europe and the US in concepts for reliability and maintenance. The current concern of US developers and users with reliability and maintainability is the product of many bitter post World War II lessons. These lessons have been learned not only in training bases in CONUS, but in combat far from producer support. European nations cannot be expected to have the same approach to these aspects of weapons developments as the US, but it is equally difficult for the US to forego US concepts of reliability and maintenance whose need has been so graphically demonstrated.

The Roland experience demonstrates rather clearly that the US government must in some way take a more aggressive role in the licensing process than it has in the past. Leaving it solely to industry to make licensing arrangements is not in the best interest of the government because of the likelihood that aggressive industrial enterprises will achieve sole source positions. These may result in increased procurement costs for items for which the government could just as easily have obtained a direct license. This course of action requires a certain basic level of expertise on the part of government negotiators and an aggressive program for licensing and exploitation of licenses.

The Sidewinder and Sparrow Case

Raytheon, the prime US contractor for these two systems, has a long history of licensed production of its tactical missiles in Europe and is one of the most experienced firms in the United States in matters of co-production, co-development, and future avenues to standardization.

Raytheon points out that in the United States the government typically acquires rights to the data package on a weapon system so that, if it desires, it can procure the weapon readily from a second source in open price competition. As a result, if the data package is provided to a foreign government or contractor, as part of a licensed production program, the supporting services expected of US industry are likely to be

rather limited. However, this will be true only in the case of a foreign licensee who has sufficient technical competence to assimilate the material in the data package, but who will still require assistance for the transfer of manufacturing know-how.

Nonetheless, Raytheon argues that industry often is not involved early enough in government-to-government negotiations that ultimately lead to company-to-company licenses for weapons production. There are a number of companies, like Raytheon, which have long prior experience and great continuity of senior personnel in the negotiation of international licenses and collaboration. In those cases, industry believes it is able to provide valuable support to the government during the MOU negotiations to develop agreements best suited to the interests of both government and industry.

In contrast to American experience, European governments and industries almost always work closely together from the outset of a weapons development program. This relationship is true also in negotiations for licensed production of a US design, which can put the US developer or producer—and even the government—at a disadvantage. In Raytheon's view, US industry should play an early and more prominent role in negotiations setting the terms for licensing of US designs for production in Europe.

With specific regard to technology transfer, Raytheon believes that government and industry must work very closely together to decide what the impact will be for technology transfer in any given program. Government must, with industry's inputs, decide which basic technologies should or should not be transferred to each country, based on the interests of national security and national policy. Industry is usually in the best position to judge what its overseas counterparts can do and to know how easily foreign industry can develop the design or manufacturing expertise involved in a particular program. Thus, experienced US companies should have a strong voice in making decisions about the transfer of technologies they have participated in developing.

The F-16 Case

At the declaratory level, the principal objective of the F-16 co-production program is the achievement of greater standardization within the NATO alliance. Certainly this is, in fact, an important objective of the program which even the most cynical of European critics would recognize as genuine. On the other hand, there are also some other important motivations which have had at least as much effect, below the declaratory level, in promulgating the effort. As in the Roland case, a long evolutionary process, requiring the integration of many different factors, has been necessary.

The F-16 co-production program can, in a sense, be viewed as an anachronism. It is the outcome of a set of interests, within the smaller European NATO countries, that began to crystallize in the late 1960s and will probably not be repeated. Furthermore, the F-16 project is, to some extent, an echo of the F-104 co-production program. Many of the same divisions of industrial labor of the F-104 program — especially in terms of division of airframe subsections, can be found once again in the F-16 project. The fact that it is so much more complicated now to negotiate such a project than it was in the early 1960s, when the F-104 consortium was being put together, cannot be attributed solely to the fact that the F-16 involves US co-production whereas the F-104 did not. There is also a strong implication that European partners, even when the major industries of Germany and Italy are excluded, have become much tougher and are no longer willing to be regarded simply as subcontractor job shops for US industry. If the F-16 program included the principal aerospace industries in Britain, France, and West Germany, a number of more difficult issues would have emerged, especially with regard to greater sharing of technology in airframe, engine, and radar co-production.

Consequently, it would be very difficult to hold up the F-16 co-production program as a model of future NATO standardization efforts. It is unique; and, in fact, the hypothesis could be put forth that any major trans-Atlantic collaborative program will be unique, deriving from a particular set of circumstances that gives it force beyond the simple goal of standardization.

One strength of the F-16 program, in the early negotiating phase, was that the federal government itself took the primary negotiating role with European governments. The international negotiating process began before a final selection of the prime contractor had been made in the United States. Consequently, the burden of preliminary negotiation of the terms of the Memorandum of Understanding fell on the Office of the Secretary of Defense and the Aeronautical Systems Division of the US Air Force. This fact not only gave credibility to the program; it permitted a flexibility in the early negotiating that can come only from the high levels of government. By the time General Dynamics entered the scene, the most important basic guidelines had been laid down.

Another major strength of the program is the ability of the SPO at Wright Field to integrate senior national representatives of the four European partners, on a fully participatory basis. In further support of this full participation, the US Air Force has made it a firm policy to be as open as possible in the disclosure of technical information and engineering choices. Furthermore, the sensitivity of the business managers within the SPO to classical European concerns over employment stability and the privacy of financial data have also aided in keeping the program on schedule.

In spite of the openness that characterizes the F-16 SPO, some important efforts have been made to withhold technology in critical areas. It could probably be demonstrated that Westinghouse has withheld some critical technologies in the radar system, especially in view of the rather low level of some of the work that is being performed by the European partners. In the case of the engine, Appendix C makes clear that blade technology, especially with regard to the casting of superalloys, has been carefully withheld from the consortium partners. The F-16 engine co-producers, none of which is primarily in the engine business, have readily accepted such constraints. A stronger argument for technological sharing might have been put forward if major partners such as Rolls and SNECMA had been involved.

There is a considerable risk of underestimating the true cost of the collaborative program in any situation where the contractor must make his proposal before he has full knowledge of the European co-producer, his method of operating, and the amount of technical data that will actually be available at the outset of the program. This appears to have been a contributing factor to the underestimating of costs both in the F-16 and Roland programs. One solution, frequently mentioned, would be the negotiation of licenses taking place from government to government, permitting resolution of technical and manufacturing issues within government before going out for competitive bidding on a much tighter set of specifications — in other words putting a governmental buffer between the industries of the participating countries. It seems likely, however, that these same objectives could be achieved by strengthening the MOU.

Implications for the Two-Way Street

The two-way street concept implies that technology transfer, as well as trade, will flow both ways. In attempting to learn from the technology transfer that has taken place one is handicapped in that there has been relatively little flow from Europe to the US. Also, even in cases where it has occurred the US buyers of the European product would argue that it has not been new technology or industrial know-how that has been transferred, but applications of existing technology which was available both in Europe and the US. Also, these technology importers would argue that there were only certain segments or portions of the technology applications of imported systems that were useful and these did not usually include, among other things, production management expertise, quality control techniques, value engineering, and built-in test and maintenance equipment and procedures. To make up for any deficiencies in these areas and to establish an American production base it is further contended that changes had to be made in European designs, and that these changes have been erroneously labeled unnecessary American "gold plating" or "Americanization" of European designs.

With respect to the flow of technology to Europe, which has been extensive, the US typically exported not only basic technology but also

the complete complex of industrial know-how that characterizes contemporary US production methods. There was little "Europeanizing" of the designs, apparently because European industry had little to add in these areas and because it recognized the utility of US production methods and was anxious to gain experience with them wherever possible. In addition, as the case studies show, US exporters often had the leverage to retain configuration control and continue to manufacture key parts of the systems exported which would have made "Europeanization" of American designs very difficult.

With respect to US industry, although there has been concern over fostering European competition, there is little doubt that US firms use US-to-Europe technology export to make industrial connections with the European market and in a broad sense to penetrate that market. Hawk, NADGE, Sidewinder, or Sparrow have greatly assisted US industrial penetration of world markets. The US competition for such programs is intense.

The US government has found itself over the past two decades in an excellent position to export US defense technology. It owned data packages which were relatively easy to transfer and had access to industrial corporations which were both willing and competent agents in their transfer. It could deal with problems of configuration control, third nation sales and royalties from a position of great strength. There is little doubt that what trans-Atlantic NATO standardization has been accomplished during these two decades has been largely due to US strengths in this regard.

US industry is not entirely happy with this situation. US industry believes that the government, in negotiating MOUs or licensing agreements within NATO, has largely deprived itself of the experience which US industry has gained and ignored legitimate industry goals. As a result, a more Europeanized approach using selected industrial cooperatives as instruments of the government is sometimes recommended by US industry.

Principal Findings

The Window Problem. The opportunities for two-way technology transfer and major standardization activities occur infrequently and depend on the conjunction (on both sides) of military requirements, political will, perceived industrial advantage, and a suitable product. If two or three major standardization programs are successfully established in the 1977-1987 period, they will represent a significant achievement.

The Sequence Problem. Governments must move in advance of industries in the negotiating process, and the MOUs must be very detailed in matters of technology transfer, performance characteristics, manufacturing and delivery schedules, as well as the more routine matters of work sharing and orders. On the other hand, industry should have a role in deciding on technology transfer matters; this will increasingly require that companies on either side of the Atlantic know intimately the capabilities of proposed partners on the other side.

The SPO as Buffer. In programs of US origin, the SPO has been indispensable; and the incorporation of senior Europeans into the US SPO management is one of the most effective practices developed to date in terms of aiding communications, facilitating technology transfer, and reducing frictions. A similar practice should be developed in collaborative programs of European origin.

Jobs and Budgets. As noted in the previous GRC study the United States must be sensitive to European concerns about employment. In the early negotiating phase, jobs are probably the paramount, even if unacknowledged, issue — especially in Britain and France. In the post-MOU phase, as the F-16 and Roland cases suggest, conformity with the budget becomes a key issue and cost overruns create extreme political hazards for a program. Consequently, the accurate estimation of program costs is critical, and the case studies suggest that US industry has failed so far to take into account the "collaboration factor" so familiar to European industry.

European Productivity and the Cost Differential. European partners will need a growing amount of latitude on production cost, due to their lower capitalization per worker, more relaxed work schedules, higher social charges, and shorter production runs. The United States can help by insisting on the concentration of work in major, well-capitalized facilities rather than fringe industries. Even so, over the life of a single program, the higher US production rates will permit learning curve benefits that may increase the cost differential.

Role of Government. Many of the issues raised in the case studies are concerned with the role of the US government in technology transfer. In the case of technology transfer to the US, there is the question as to whether the government or industry should obtain licenses for European developed equipment. On the one hand there are the arguments that if the government buys the license, European industrial organizations will be reluctant to sell. This reluctance is based on two fears: first that the government will not aggressively exploit its license as private industry would do; second that in its production source selection the government will necessarily compromise the licensor's data package.

In the case of technology transferred from the US, US industry representatives expressed reservations concerning the strong role that government now takes. It is argued that the government might achieve a smoother transfer and obtain greater benefits if industry were a more active partner in negotiating.

Importance of Government Rights in Data. One of the critical administrative factors that has facilitated US transfer of technology to Europe is that in domestic development contracts the US generally acquires full rights in technical data and requires a complete data package that would enable it to compete a production contract. European governments typically acquire only foreground rights directly associated with a development and do not require a complete technical data package and do not compete production contracts. Movement of European procurement regulations toward the American pattern would materially ease the two-way transfer of technology.

CURRENT POLICIES, REGULATIONS, AND PROCEDURES FOR RELEASING AND CONTROLLING TECHNOLOGY

General

The foregoing chapters show that there has been an increasing tension in US policy between fostering technology transfer and restricting technology transfer. Technology transfer has been fostered in broad commercial areas as part of a policy predisposition toward free trade and worldwide economic development. On the other hand, advanced technology in particular has been regarded as an important strategic asset, and certain commodities and data embodying such technology have been subject to export controls of varying stringency for particular countries since at least 1940.

There is a more urgent need to assure that the Soviet Union and its allies do not gain easy access to Western technology that is militarily significant while at the same time assuring that technology can be transferred smoothly enough among NATO allies to facilitate achieving timely standardization and interoperability at the best technological level available. US interests in NATO standardization and interoperability need to be taken into account in the current reexamination and reassessment of export (and import) controls on technology transfer that are called for by the Congress and by the Bucy Report.

Export Legislation and Regulations

Two primary pieces of legislation provide the statutory and regulatory framework for US control of exports by non-governmental entities. These are the Export Administration Act of 1969 as amended, and the Mutual Security Act of 1954 as amended.

The Department of Commerce, through its Office of Export Administration in the Bureau of East-West Trade, exercises control responsibilities and functions under the former for virtually all exports from the United States, except munitions. Under the Mutual Security Act of 1954 as amended, the Department of State is responsible for control of all exports

of munitions by non-governmental entities.* Responsibilities and functions are exercised by the Office of Munitions Control in the Bureau of Politico-Military Affairs.

Other Acts, such as the Arms Export Control Act of 1976 and the International Security Assistance Act of 1977, provide the legislative framework for governmental transfers of arms and arms-related assistance and data. The Defense Security Assistance Agency is the executive agency for the Department of Defense in establishing and supervising DOD programs of sales and assistance under such Acts in coordination with the Under Secretary of State for Security Assistance, who has primary Executive Branch policy responsibility.

The primary device by which control is exercised over exports by non-governmental entities is the granting or denial of a license to export (that is, governmental approval to export the item in question). The fundamental purpose of requiring a formal license to export, granted either by the Office of Munitions Control or by the Office of Export Administration, is to safeguard national security. A secondary purpose in both cases is to support specific foreign policy goals that may not be directly and clearly related to national security - e.g., general or specific embargoes over exports to specific countries in support of a United Nations resolution or in support of US policies concerning human rights. A third purpose of export control reflected in the Commodity Control List, is to protect the domestic economy from excessive drain of certain scarce resources.

Restricting Technology Transfer

General criteria for controlling exports of strategically significant technologies, such as advocated by the Bucy Report, are at least theoretically in effect in the policies that govern approval or denial of applications to the Office of Export Administration for exports to communist countries. The Bucy Report and its follow-on argue basically for a more specific definition and discrimination of what substantive types of technologies are strategically significant, an enlarged DOD

*Imports of munitions as well as virtually all other imports are controlled by the Department of the Treasury, US Customs Service.

role in such definition and discrimination with industrial participation, clarification and improvement of operational criteria and policies, and improved procedures for processing applications and applying improved criteria.

Fostering Technology Transfer

US policies in support of NATO standardization and interoperability, which have progressed rapidly in the past three years, imply positive steps to facilitate technology transfer within NATO at many levels from information exchanges on military requirements to co-production agreements for developed systems — that is, at all stages of the defense systems acquisition process. The recent DOD Directive 2010.6 on standardization and interoperability issued in March 1977 specifically requires that "DOD Components will include NATO standardization and interoperability goals as fundamental considerations in their development and procurement programs for both major and minor equipment items...." Another key element of this policy provides specifically that: DOD research and development (R&D) activities will pursue a mutually cooperative and beneficial policy regarding exchange of information with NATO partners in accordance with DOD Directive 3100.3. This policy is intended to foster an early mutual exchange of technological information leading to development and adoption of standardized or interoperable weapon systems and equipment by NATO countries. This policy will be exercised within the framework of approved guidelines for assessing the impact of weapons technology transfer on US national security objectives. Bilateral agreements should be completed in those cases where required under DOD Directive 5230.1 to establish a legal basis for classified exchange, including added substantive technical arrangements to cover individual sophisticated advanced weapons and technology.

In addition to the responsibilities assigned at the OSD level to monitor, assist and coordinate NATO standardization and interoperability policy, the Directive establishes that, inter alia, the Military Departments shall be responsible for:

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In coordination with ODDR&E encouraging early contacts between US development activities and NATO Allies' development organizations to consider reciprocal and mutually beneficial exchange of technology, cooperative or interdependent R&D programs, and appropriate licensed production arrangements to permit possible adoption of each other's systems.

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Determining disclosability of sensitive information under the Department's cognizance as established in the National Disclosure Policy, advising OSD(ISA) in cases where Allied proposals for participation in cooperative programs are rejected on grounds of unacceptable technology transfer.

Implementation

The success or failure of technology transfer policies and responsibilities affecting NATO standardization and interoperability will depend heavily on the Military Departments and their relations with US industry. It is in the Military Departments' materiel development and procurement communities and, in particular, their specific Project or Program Offices that specific technology transfer and disclosure positions will first be formulated and where they will be carried out. DOD policy elements (particularly ISA and DDR&E) will need to establish detailed interaction with and monitorship of technology transfer and disclosure positions formulated at this level as well as to provide overall policy guidance. Also, technology transfer and disclosure positions and justifications should be made a significant part of the fundamental consideration of NATO standardization and interoperability goals in the defense system acquisition process, and statements concerning technology transfer should be required in all Decision Coordinating Papers.

PRINCIPAL CONCLUSIONS AND RECOMMENDATIONS

The Defense Science Board Task Force report on export control of US technology (Bucy Report) and the Executive Branch study of technology transfers required by the International Security Assistance Act of 1977 portend tighter export controls that could impact on NATO standardization and interoperability policies. Despite the fact that these studies of technology transfer were stimulated by and are addressed primarily to problems of technology transfer vis a vis the Soviet Union and other communist states, there is widespread uncertainty in industry as to how new policies, criteria, and procedures of export control of US technology will affect the course of allied cooperation in defense development and production. There is an important need for clarification at the highest DOD levels of the relation between NATO standardization and the growing concern to control the export of US technology. It is recommended that, to assist in this clarification, the Office of the Assistant Secretary of Defense for International Security Affairs maintain an active role as advocate of NATO standardization in both the Bucy Report Implementation Study Program and the inter-agency Executive Branch study directed by the Congress.

New US arms transfers policies combined with the growing concern to control the export of US technology have created further uncertainties about prospects for trans-Atlantic cooperation in weapons development and production by means of licensed production and co-development. European concerns about maintaining and utilizing high-cost investments in advanced-technology industries complicate this problem. US policy needs to be especially sensitive to this issue and to seek ways to foster rationalization of European industrial capabilities and to be prepared either to purchase more systems directly from Europe to achieve standardization or to accept interoperability with European designs as an acceptable alternative.

Any means of accomplishing NATO standardization and interoperability (through common and standard technical requirements, through direct purchase, through co-development, through co-production) necessarily involves the transfer of technology either directly or indirectly. The issue of technology transfer and NATO standardization and interoperability is therefore a NATO-wide issue and not solely a US issue. Because Europeans cannot be unaware of or insensitive to US concerns with the control of advanced technology, it is especially important to solicit European views on the identification of those substantive technological areas that are most important to NATO vis a vis the Warsaw Pact and on the best means to provide for technological sharing and development in these areas across the Atlantic. The US should suggest to NATO that NATO undertake a review of technology transfer policies in parallel with current US Executive Branch studies of this subject. Both the NIAG and the AC/94 working group on protection of intellectual property could contribute materially to such a NATO study.

The case studies of technology transfer in current programs of NATO standardization showed that there exist substantial asymmetries in European and American procurement philosophies and government/industry relations that create technical and administrative difficulties for efficient technology transfer, especially from Europe to the US. The principal findings from these case studies (pp 29,30) indicate some of the measures that could be taken in NATO and on either side of the Atlantic to reduce these asymmetries and to facilitate a two-way street in technology transfer. Three principles that can be adopted immediately are:

(a) Negotiate additional general Memorandums of Understanding (MOU) like the US-UK MOU of 24 September 1975 to provide for greater bi-lateral or multilateral cooperation in research, development, production and procurement and

harmonization of weapons acquisition processes.

(b) Negotiate MOUs prior to any licensing arrangements between industries to assure that license agreements satisfy procurement philosophies and regulations of the governments involved and reduce frictions that might arise from requirements to renegotiate.

(c) Establish a NATO Systems Project Office with authority for configuration control for any licensed production or co-production project.

DOD Directive 2010.6 of 11 March 1977 has established clear DOD policies and responsibilities for NATO standardization and interoperability. The success or failure of US technology transfer policies and responsibilities affecting NATO standardization and interoperability will depend heavily on the Military Departments and their relations with US industry.

This key DOD Directive should be widely disseminated in the US defense-industrial community and its provisions with respect to technology transfer strictly adhered to. The substance of the Directive should also be made known to NATO allies, and their Ministries of Defense should be invited to prepare similar directives for their materiel development and procurement agencies.