

The United States Arms Transfer Process
and Policy: A Systems Dynamics Approach*

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by

Thomas D. Clark, Jr., Air Force Institute of Technology

This paper deals with the structure of the system of arms transfers by the United States to the rest of the world. Arms transfers play a significant role in the political, economic, and military affairs of most countries. Because of the diversity of opinion about the necessity for transfers and their true effect, a single policy concerning arms movement has been impossible to devise. This research is the first step in providing a model that can be used to study the effects of transfers and to evaluate policy concerning arms movement.

Arms transfers include all defense articles and services provided by the United States (U.S.) to foreign countries, foreign private firms, and international organizations. All arms transfers are subject to the Foreign Assistance Act of 1961, as amended, and the Arms Export Control Act of 1967, as amended (1:2), and must be in the national interest of the United States. Arms transfers can be classified as:

1. Grant Aid (GA), under which the U.S. Government (USG) gives defense articles and services to selected foreign countries with no reimbursement (1:8).
2. Military Export Sales (MES), which comprise:
 - a. Foreign Military Sales (FMS), under which the USG sells defense articles and services to foreign customers (1:7).

*This research has evolved over two years at the Air Force Institute of Technology. This paper is drawn largely from the masters thesis of Squadron Leader Douglas C. Chipman of the Royal Australian Air Force and Capt John T. Cunningham of the U.S. Air Force.

b. Commercial Sales, under which U.S. private firms sell defense articles and services directly to foreign customers without involving government-to-government agreements (1:3).

Since World War II, the control of arms transfers has been a major instrument of U.S. foreign policy. By either approving transfers of arms or withholding arms, the United States government has to some extent influenced the balance of power in many regions of the world. From the early 1960's onward, the major portion of arms transfers has comprised FMS, all of which, with the exception of some special restraints in Latin American and Africa, the President and Congress have been inclined to approve (2:17). Since 1974, the volume of sales has mushroomed into a multibillion-dollar export industry for the U.S. Although only a small portion (about 4 percent) of overall U.S. exports, deliveries under FMS (the most significant part of MES) amounted to approximately \$7 billion in FY 1977 (3:5-13, 1:4). Sales approved in the same period totaled about \$11 billion (3:1).

In spite of the benefits which the arms transfer market has created for the U.S. defense industry, the volume of arms sales has reached a level sufficient to generate political concern.

The virtually unrestrained spread of conventional weaponry threatens stability in every region of the world. Total arms sales in recent years have risen to over \$20 billion, and the U.S. accounts for more than one-half of this amount ...Because of the threat to world peace embodied in this spiralling arms traffic; and because of the special responsibilities we bear as the largest arms seller, I believe that the U.S. must take steps to restrain its arms transfers [4].

As a result of this political concern, ceilings on the dollar volume of FMS to non-allied countries were introduced in 1977.

Although the conduct of export sales is controlled by several Acts of

Congress and by various executive directives, and although it now involves many export dollars,

There is presently no single, formally established means for policy control of all programs for the transfers of U.S.-origin defense articles and defense services. Transfers under Foreign Military Sales (FMS) procedures are controlled through an informal system of direct coordination between Defense and State and ACDA [Arms Control and Disarmament Agency], with State making the final decision on the proposed sale [2:44].

The purpose of this study was to enhance conceptual understanding of the arms transfer system and to study that system's behavior in reaction to various changes in U.S. arms transfer policy. The vehicle of study is a dynamic policy model that illustrates the interrelationships among arms transfer policy, national security, foreign relations, and economic conditions. The study employs a System Dynamics approach.

The first step in constructing a model of the arms transfer system was to bound the system in terms of the research problem and objective. Because of the impact of arms transfer policy upon U.S. national security, foreign relations, and economic conditions was the issue at hand, sectors representing these areas were included.

The inherent behavior of this system, as depicted in Figure 1, is that as the U.S. political machinery makes decisions about arms transfers, national security, foreign relations, and the U.S. national economy all are affected. These effects can, in turn, influence each of the other sectors, including the U.S. political machinery's inclination to approve arms transfers.

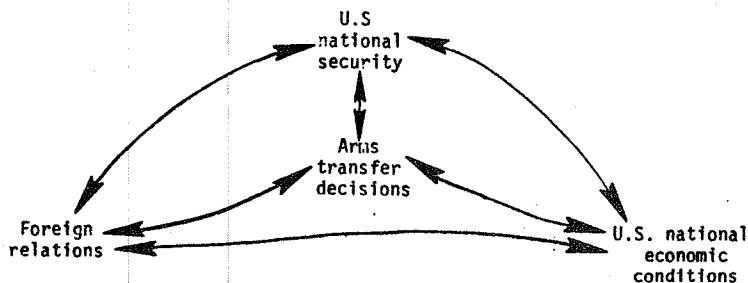


Fig. 1 Initial System Sector Design

This overall concept guided development of a ten sector model that deals with the flows of material, information, orders and U.S. dollars. Example runs have been completed with various sectors of the model although extensive experimentation has not been completed. The current work with the model involves verification of sector structures with some limited analysis when it appears benefit from several sample runs could accrue.

The detailed structure of the model is shown in a longer paper to be presented at the 1981 Systems Dynamics Conference. The presentation will focus upon the mathematical structure of the model and will illustrate preliminary results obtained with the model.

References

1. U.S. Department of Defense. Military Assistance and Sales Manual. DOD 5105.38-M. Washington: Government Printing Office, 1977.
2. U.S. Department of State. Report to the Congress on Arms Transfer Policy Pursuant to Sections 202(b) and 218 of the International Security Assistance and Arms Export Control Act of 1976. Washington: Government Printing Office, 1979.
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Introduction

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Implementation procedures for FMS have grown out of the management structure for Grant Aid, and consequently responsibility is divided mainly among the three military departments.

A report issued by the Senate Committee on Foreign Relations in 1977 identified a number of problems which existed within the arms transfer system:

- its essentially ad hoc and fragmented character;
- the multiplicity of decision channels;
- the lack of a single document or coherent series of documents on policies, planning, and procedures;
- difficulty in controlling all significant decision points; and
- inadequate intra-agency planning [2:45].

Criticisms of the arms transfer system have been raised in numerous studies and reports by members of both the government and the military. "The diversity of opinion about arms transfers makes it impossible to devise a concise statement of the problem that will satisfy everyone [2:41]." Those people critical of arms transfers have cited problems such as:

- lack of appropriate Congressional control;
- creation of regional arms races;
- creation of a "merchants of death" image for the U.S.; and
- depletion of U.S. forces' inventories to meet sales needs.

On the other hand, those in favor of MES have argued:

- strong allies and friends will reduce the likelihood of U.S. involvement in foreign conflicts;
- lower cost of certain U.S. weapons, minimizing cost of defense to taxpayers;
- keeps weapons production lines open when weapons are not being produced for U.S. military; and
- it [FMS] [is] a source of influence with customer countries [5:63].

With this number of opposing effects of arms transfers, it is clear that the interpretation of arms transfer policy can depend on individual or agency viewpoint. This is symptomatic of the lack of a systems approach;

in other words, each individual or agency perceives only a portion of the total arms transfer system and is prone to describe the policy control problem in correspondingly narrow terms. Given this situation, the purpose of this study was to enhance conceptual understanding of the arms transfer system and to study that system's behavior in reaction to various changes in U.S. arms transfer policy. The vehicle of study is a dynamic policy model that illustrates the interrelationships among arms transfer policy, national security, foreign relations, and economic conditions. The study employs a system dynamics approach (6:13).

The first step in constructing a model of the arms transfer system was to bound the system in terms of the research problem and objective. Because of the impact of arms transfer policy upon U.S. national security, foreign relations, and economic conditions was the issue at hand, sectors representing these areas were included.

The inherent behavior of this system, as depicted in Figure 1, is that as the U.S. political machinery makes decisions about arms transfers, national security, foreign relations, and the U.S. national economy all are affected. These effects can, in turn, influence each of the other sectors, including the U.S. political machinery's inclination to approve arms transfers.

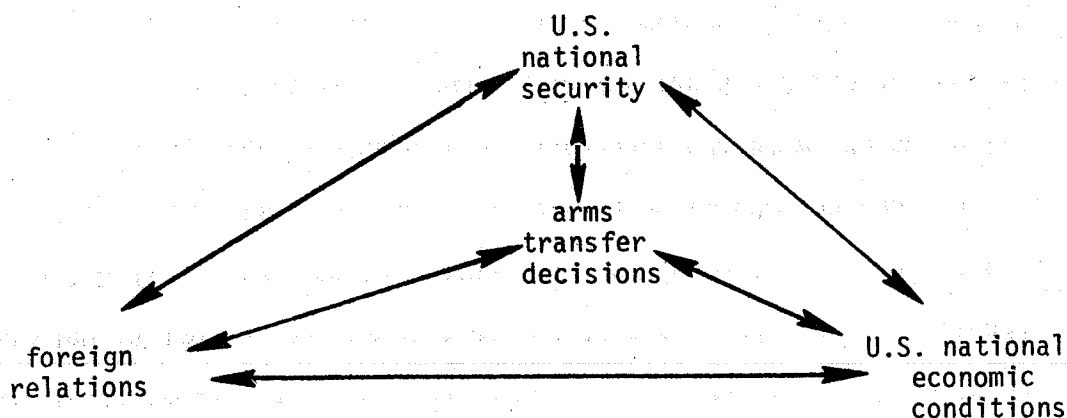


Fig. 1. Initial System Sector Diagram

From the initial system sector diagram, the arms transfer system was broken into smaller sectors to form an expanded system sector diagram (see Figure 2). This process facilitated closer study of specific relationships without the confounding influence of numerous variables which appeared later in the model construction process.

The expanded system sector diagram illustrates the major areas in the model and the general relationships between them. The character of these relationships is such that some process within each sector is stimulated by at least one output from one or more other sectors. The results of all stimulations to a sector cause at least one new output to be generated by it.

More specifically, the relationships between the sectors were defined in terms of flows in material, information, orders, or U.S. dollars. For the purposes of the Expanded System Sector Diagram, the relationships between sectors were not more narrowly defined. In the diagram, relationships were drawn differently, according to their nature. For example, the U.S. Military Resource Planning Sector perceives a level of threat to the U.S. after examining, among other things, military resources in the U.S. and the Rest of the World (ROW). This perceived threat is passed on to the U.S. Political Sector, often with requests for additional or new weapons systems. The U.S. Political Sector, after considering many factors, including indices from the U.S. Economic Sector, may authorize orders for new arms production in the U.S.

The ROW Military Resources Planning Sector also considers military resources in the U.S. and ROW when determining threat levels and arms requirements. The ROW Politico-Economic Sector can then authorize new arms production in ROW or send requests for arms to the U.S. If these requests are approved by the U.S. Political Sector, additional orders for arms production

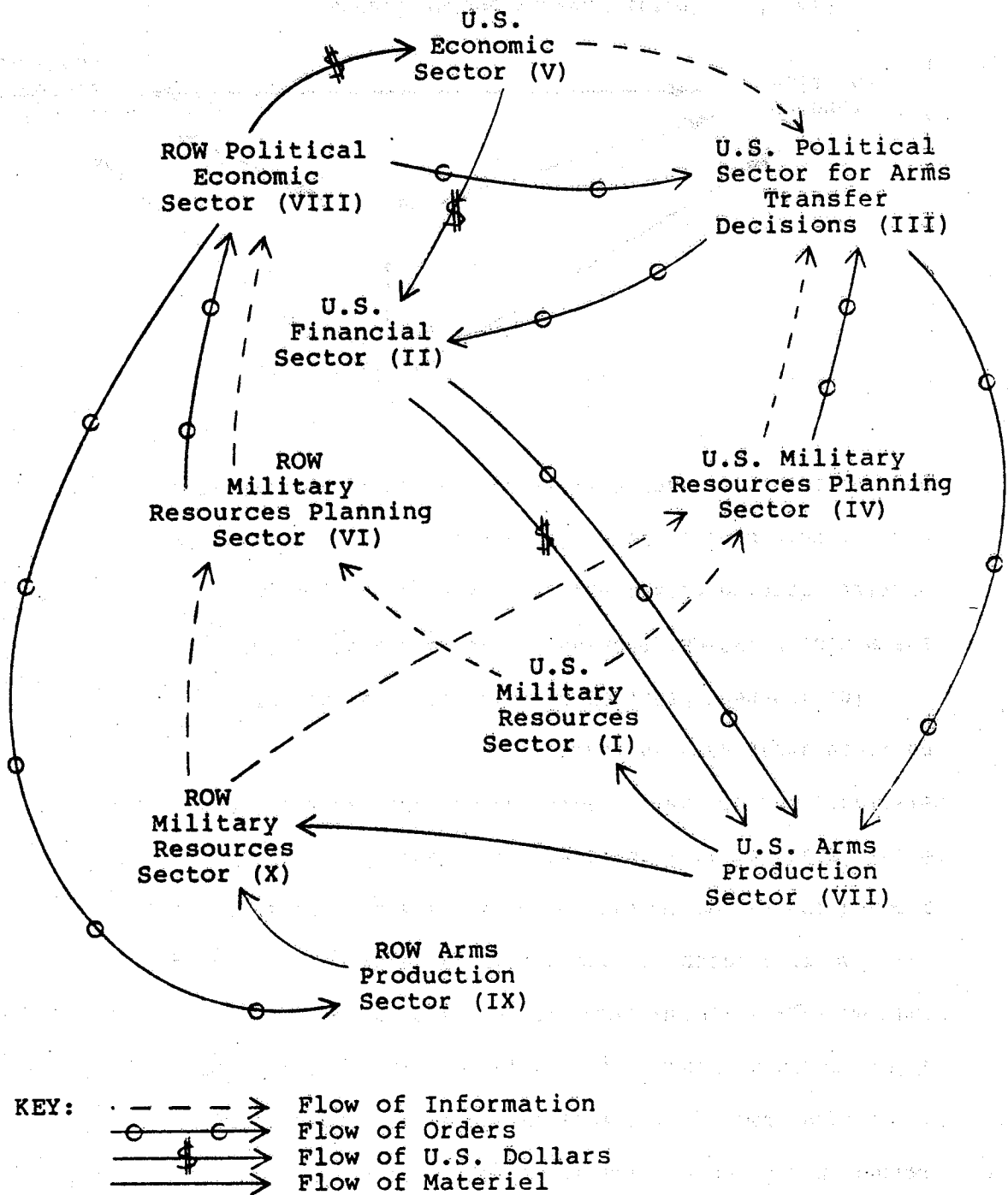


Fig. 2. Expanded System Sector Diagram

are passed to the U.S. Arms Production Sector through the U.S. Financial Sector. Arms produced will then flow to the U.S. and ROW military resource sectors respectively. Payments for arms produced in the U.S. for ROW are represented by a dollar flow between the ROW Politico-Economic Sector and the U.S. Economic Sector.

Although ROW is conceptually represented in the diagram as a single entity, all interpretations associated with ROW were arrayed in the fully developed model by country and by weapons' characteristics. The U.S. equivalent of the ROW Politico-Economic Sector has been broken out into the U.S. Economic Sector and the U.S. Political Sector to provide better visibility to the USG processes, which are the primary concern of this study.

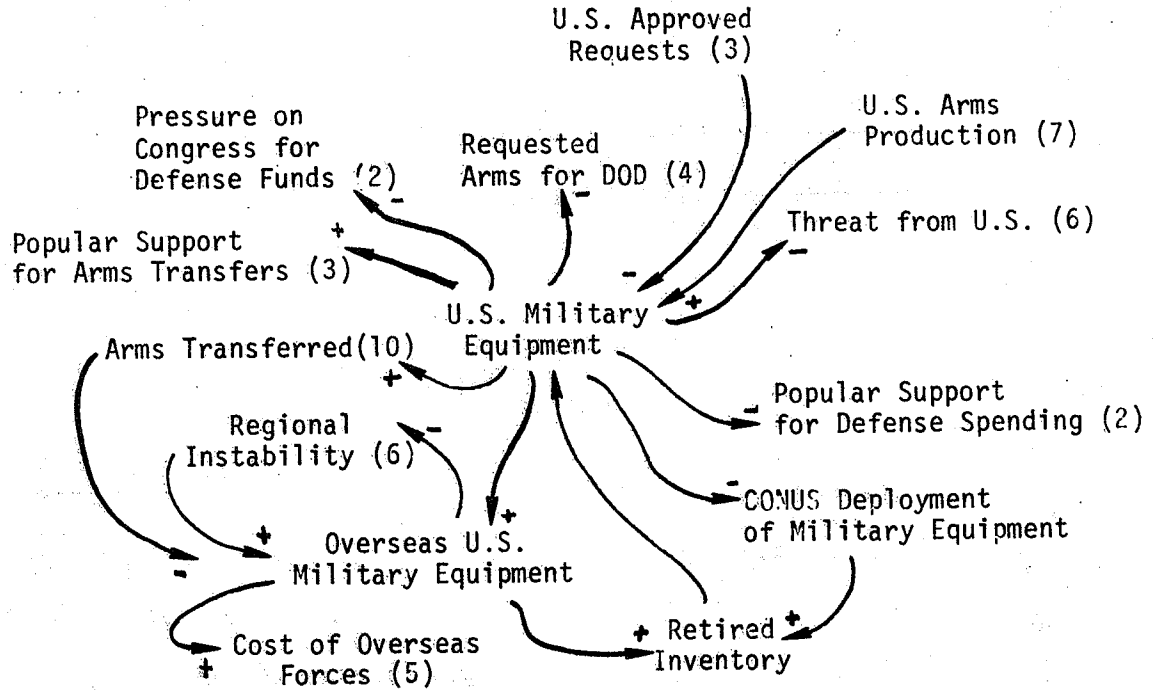
The remainder of the completed paper deals with specific influence diagrams for the ten sectors of the model, specification of the model, computerization and experimentation. The model has not been fully implemented because of computer constraints. The detailed work with it is continuing.

Conceptual Structure of the Model

An extension review was conducted prior to development of initial causal diagrams for the system. Initial diagrams were used to conduct interviews with managers in the State and Defense Departments. Policy advisors in the White House, and congressional and staff members. The diagrams presented in this section of the paper are the results of the review and interview process. Each sector of the ten sector model will

be shown and very briefly discussed.

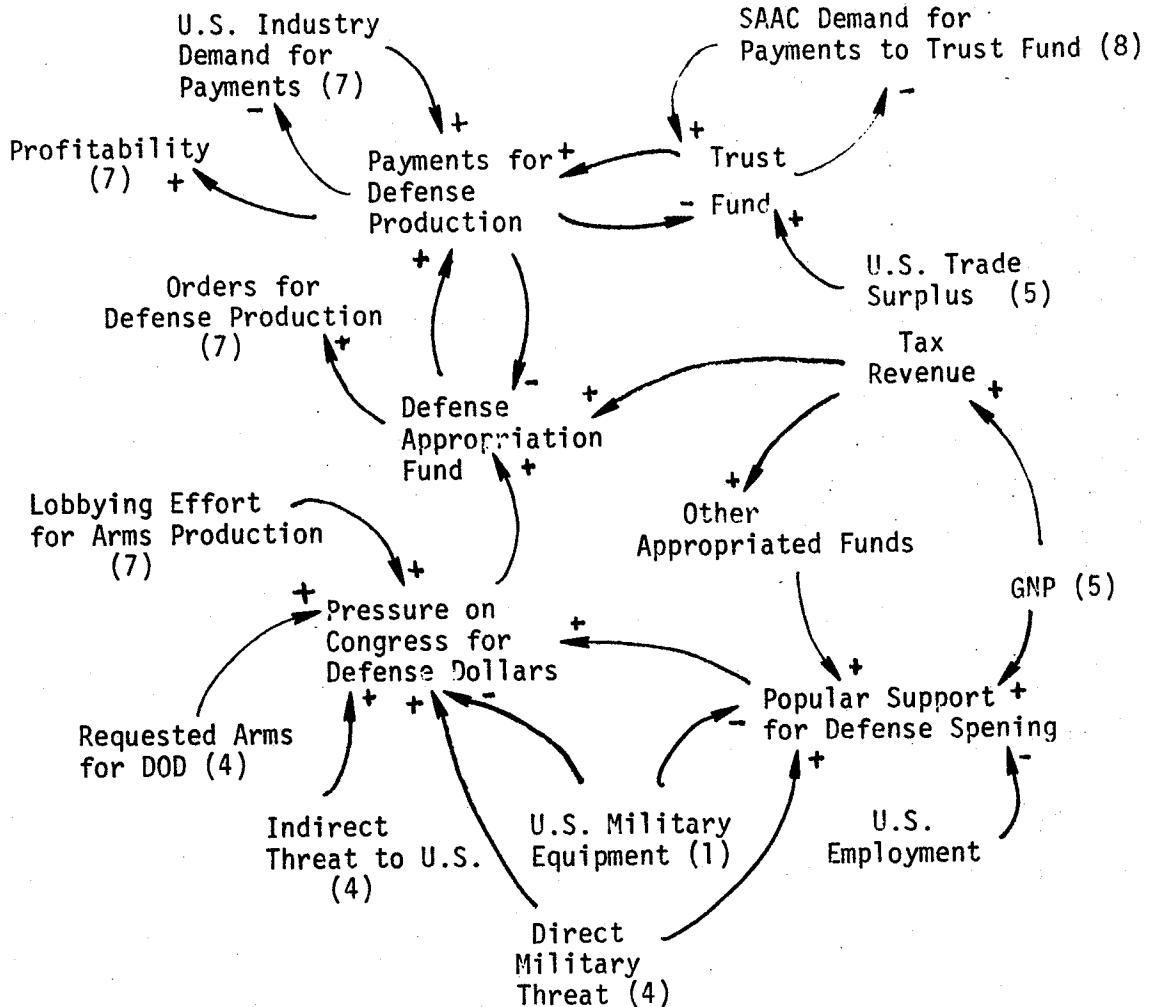
1. U.S. Military Resources Sector:



U.S. military equipment is the central variable in this sector. It is partially regulated by Retired Inventory through the Overseas Deployment of U.S. military equipment as well as through CONUS deployment. Overseas deployments affect the cost of maintaining forces overseas in a positive manner, and they can be used by the U.S. government to some extent to balance regional instability in the world (shown by a negative loop). A positive or re-inforcing loop is created between U.S. military equipment, Arms Transferred, Overseas Deployment of U.S. military equipment and retired inventory because the U.S. will transfer arms to some countries so they will be less dependent on the U.S. for military assistance in times of crisis (3). U.S. military equipment is also influenced by U.S. Approved Requests and U.S. Arms Production from Sectors 3 and 4 respectively. It in turn influences Popular Support for Arms Transfers (3), Pressure on Congress for

Defense Dollars (2), Requested Arms for DOD (4), Popular Support for Defense Spending (2) and ROW Perceived Threat from U.S. (6).

2. U.S. Financial Sector:



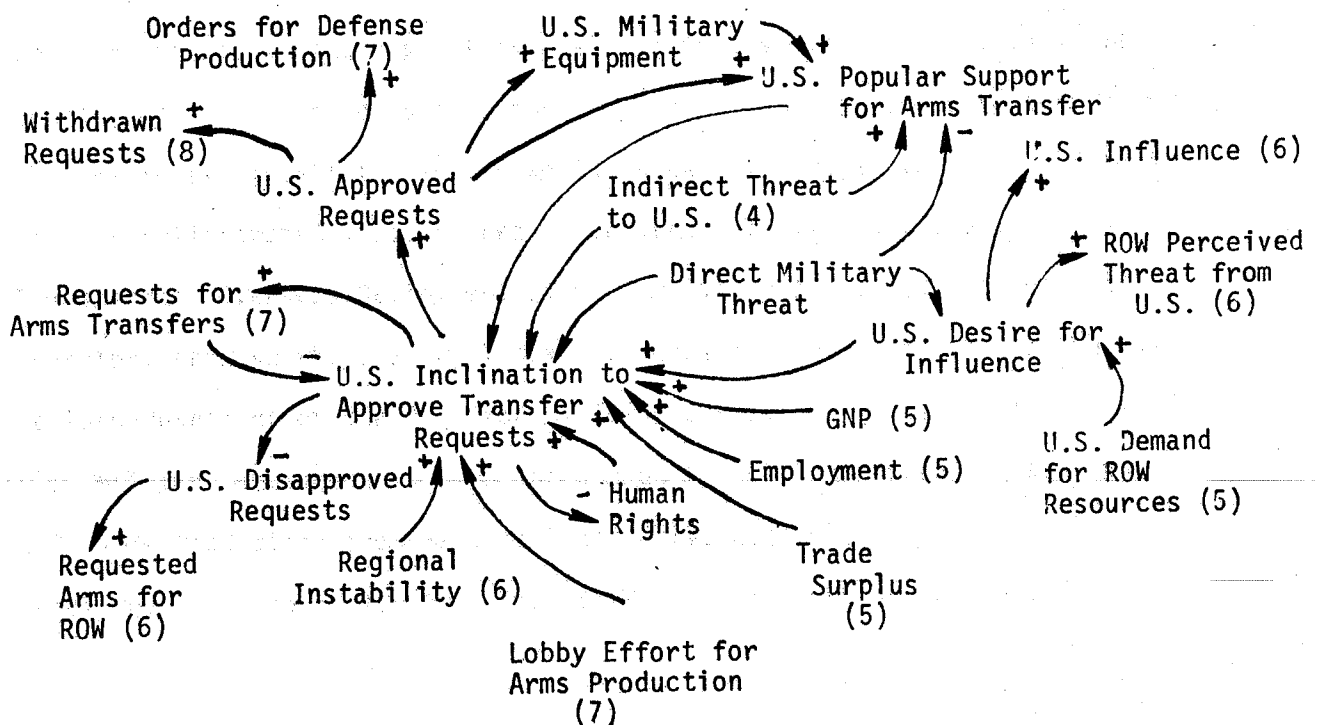
The U.S. Financial Sector contains most of the policy structure for relevant U.S. financial decisions. The source of funds for the U.S. defense system is the Defense Appropriation Fund which receives its dollars as a result of Congressional action. The pressure on the Congress to increase defense appropriations is a complex blend of political, economic and military factors. Those considered significant to the arms transfer system are depicted in the causal diagram and include Popular Support for Defense

Spending, Requested Arms for DOD, threat (direct and indirect) to the U.S., U.S. Military Equipment and the Lobbying Effort for Arms Production.

The dollars which eventually find themselves in the Defense Appropriation Fund originated from Tax Revenue and are, therefore, a function of Gross National Product as well as Pressure on Congress for Defense Dollars. Competing for the Tax Revenue are Other Appropriated Funds which, in turn influence Popular Support for Defense Spending. This completes a negative loop and depicts how the demands for other appropriations prevent the Congress from spending all of the Tax Revenue on defense.

For the purposes of this system all of Defense Appropriation Fund is disbursed as Payments for Defense Production. The fund is, of course, much larger than that used in this system. Also acting to satisfy U.S. Industry Demand for Payments are payments for arms produced for overseas countries. These are metered out to the industry by the government through the Trust Fund. The Trust Fund receives its dollars from customer countries through a variable defined as U.S. Trade Surplus. All payments combine to contribute to the profitability of the defense industry.

3. U.S. Political Sector for Arms Transfers Decisions:



Another sector which is influenced by Congressional action is the U.S. Political Sector for Arms Transfer Decision. In this sector, the Congress monitors arms transfer decisions made by the executive and is, by way of legislation, able to influence those decisions. This entire process is represented by the variable U.S. Inclination to Approve Arms Transfer Requests. Although conceptually defined as one variable, the U.S. Inclination to Approve Arms Transfer Requests is sensitive to many inputs, most of which are required to be considered by law or presidential directive. One of the most significant inputs is the United States' desire for increased influence with the prospective customer. A number of the people interviewed for this work indicated that the importance of bilateral relations between the U.S. and the country requesting arms transfer was in fact the single most important factor to the U.S. government when considering whether or not to disapprove a sales request.

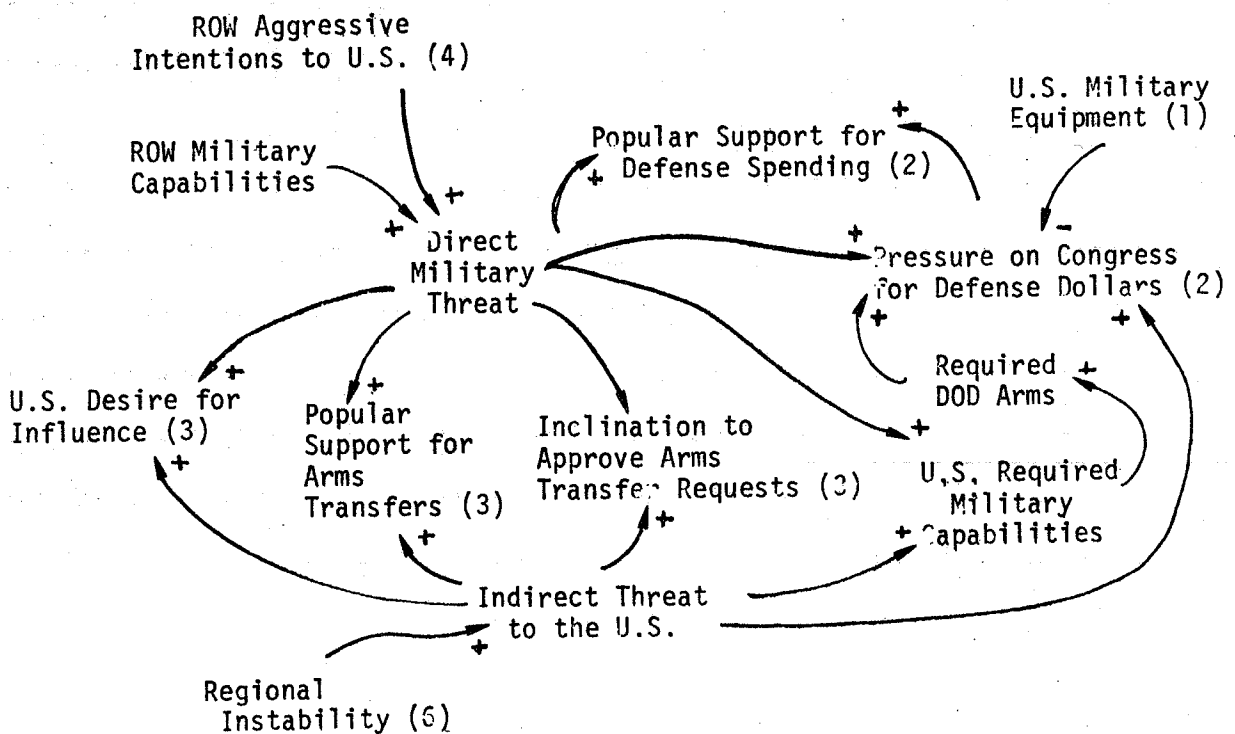
The Arms Export Control Act, as amended, requires that arms transfers would not be approved unless, among other things, the transfer will strengthen the security of the U.S. (8:Sec 102). To ensure that this happens, information about threat to the U.S. (direct and indirect) and regional instability needs to be studied by decision makers. Other factors influencing arms transfer decisions include the standard of human rights maintained by the prospective customer, the Lobbying Effort for Arms Production and U.S. Popular Support for Arms Transfers. U.S. Approved Requests, U.S. Popular Support for Arms Transfers and U.S. Inclination to Approve Arms Transfers combine to form a negative loop, depicting the U.S. public's growing dislike for transferring arms as more are transferred. This illustrates the increasing pressure which can be applied by that part of the public which sees the U.S. in the "Merchants of Death" role when arms are sold overseas.

Three factors which do not appear to play a direct role in arms transfer decisions but which pervade the system are U.S. Gross National Product, U.S. Employment, particularly in the defense industry, and the U.S. balance of trade. The rationale for including these variables is that while they do not play a significant part in arms transfer decisions from day to day, they could become quite important if they reach extreme values.

The U.S. Desire for Influence is defined to be a function of perceived threat to the U.S. and the United States' demand for external resources. This desire, in turn, affects the actual U.S. influence in a country and can be related to a country's perceived threat from the U.S. Requests for arms transfers which are denied by the political machinery remain in the system and are returned to the requesting country for reassignment.

One of the most important inputs to this sector is information about threats to the United States. Sector 4, the U.S. Military Resource Planning Sector, considers those factors which can combine to threaten the U.S. for the purpose of defining direct and indirect threat to U.S.

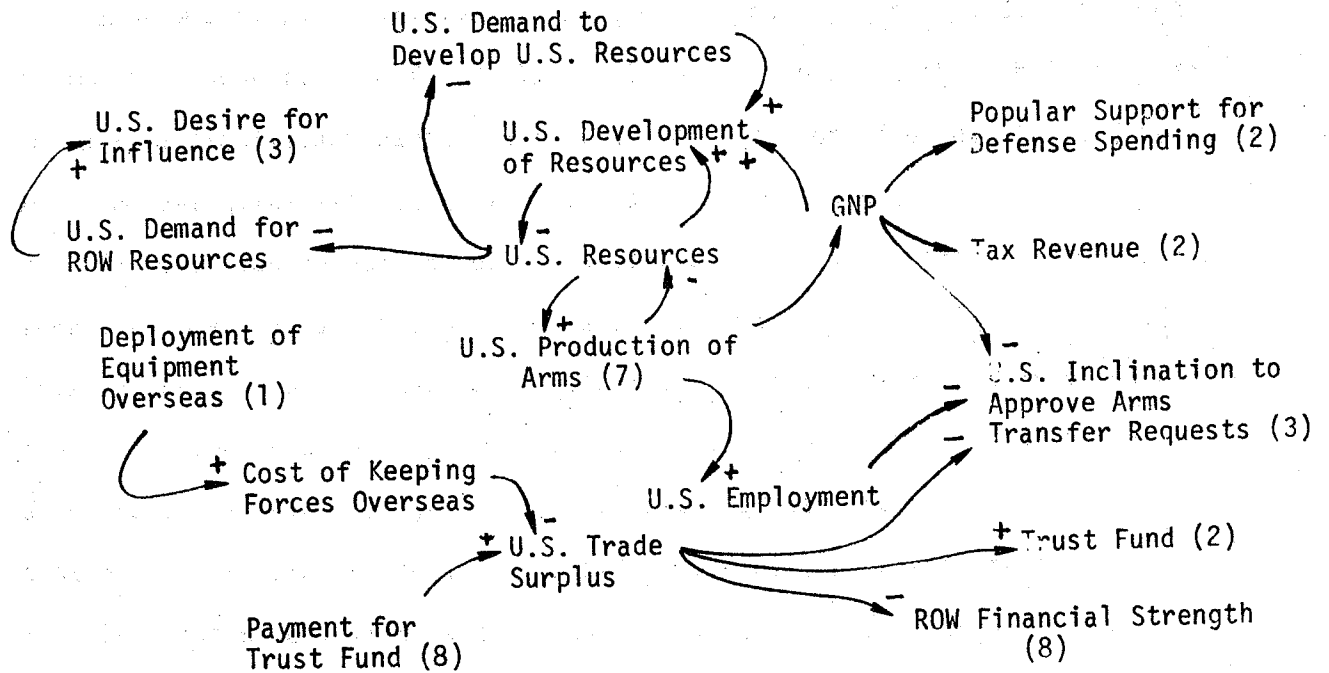
4. U.S. Military Resources Planning Sector:



Direct Military Threat is a combination of military capabilities inherent in equipment and aggressive intentions toward the U.S. by a country or group of countries. It implies a risk of overt attack on U.S. property. The degree of direct threat felt by the people of the U.S. will influence United States' required capabilities, U.S. desire for influence, particularly with friendly countries and the popular support for defense spending. These influences, in turn, increase the pressure on Congress for defense dollars. An indirect threat to the U.S. is more subtle than a direct military threat and can involve U.S. interests in foreign countries being jeopardized. In this sense, the possibility of being unable to import crude oil as a result of unrest in an area might constitute an indirect military threat to the U.S. In other words, all threats against the U.S. which are not direct and which might require military intervention are compounded in the variable, Indirect Threat to U.S. This indirect threat is taken as a function of regional instability.

Although an indirect threat may not be as visible as a direct threat, the process by which it results in increased Pressure on Congress for Defense Dollars is, for the purposes of this study, the same. The effect of direct military threat on the arms transfer system is, however, different from that of an indirect threat. In the general sense, as the direct threat to the U.S. increases, it would be more likely to concentrate on devoting defense production toward enhancing inherent military capabilities. On the other hand, as indirect threat is perceived to increase, the U.S. is more likely to transfer arms to friendly countries in the region concerned to reduce the magnitude of possible U.S. military involvement. For example, the U.S. increased arms transfers to South Korea partly to reduce the U.S. commitment there.

5. U.S. Economic Sector:



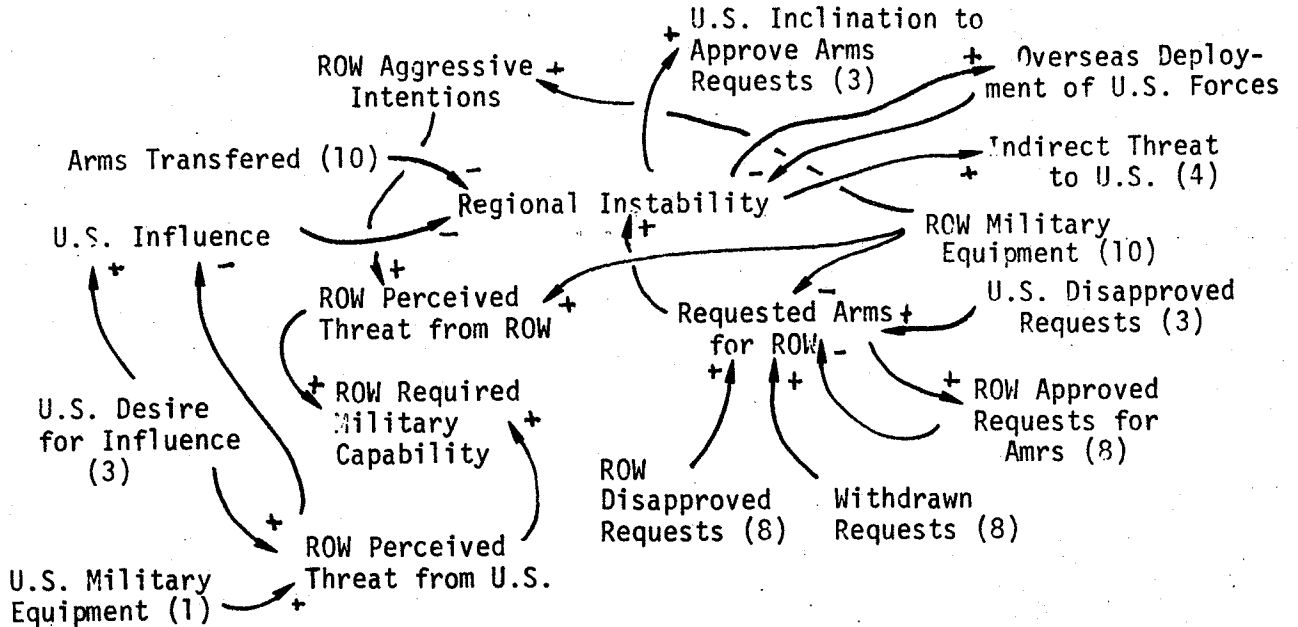
While the U.S. economy is not thought to play an important part in arms transfer decisions, the ability of U.S. industry to produce arms is quite important. If the rate of growth in GNP is high, U.S. employment stable, and the balance of trade close to zero, then the economy can be considered healthy. Under these conditions, the arms industry can expand its capacity, develop new weapons systems, and plan its production smoothly.

If conditions departed significantly from the norm, arms transfer decisions may be more influenced by economic events through changing lobby group activity, pressure on the Congress and through popular support for arms production and arms transfers.

Arms transfer decisions do have some effect on the economy. Arms production contributes in a positive way to GNP and employment while arms transfers have enhanced the U.S. Trade Surplus position. Also in this sector and detracting from the trade position to some extent is the Cost of Maintaining Forces Overseas. The U.S. economy, therefore, is considered to have

a small but important impact on the arms transfer system which, through a feed-back process influences the economy.

6. ROW Military Resources Planning Sector:

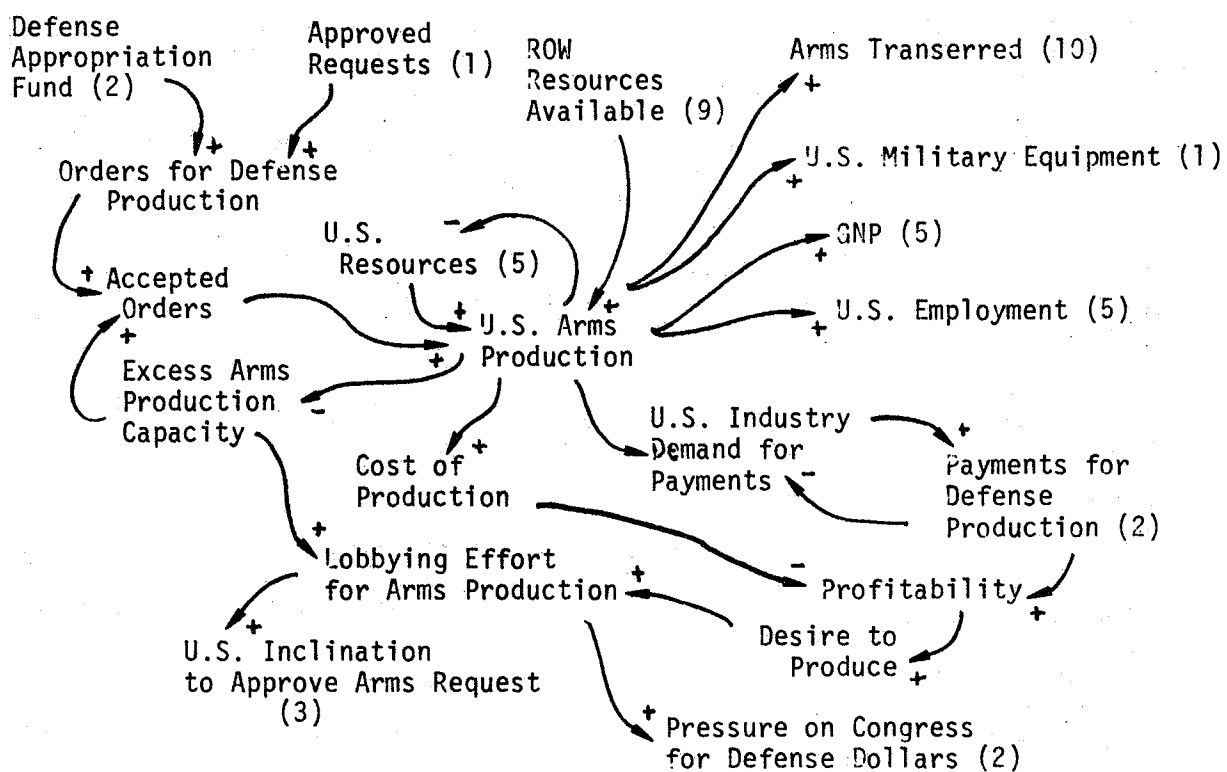


From a very high view-point, the process for foreign countries to plan for, request and authorize arms procurement is essentially the same as for the U.S. A military planning sector assesses the threat, determines requirements, and then asks the government for resources. This sector describes the general process for determining military requirements.

The threat felt by a foreign country is influenced by both the perceived hostile intentions and the military capabilities of its neighbors. An examination of the threat results in a country being able to determine what military forces it needs. This required force is compared to existing forces and excess requirements are then ordered. The aggregate of requested arms in a particular region is used as a measure of that region's instability. Regional instability impacts the U.S. Inclination to Approve Arms Transfer

Requests, willingness to deploy forces overseas and assessment of indirect threat. Also depicted in the diagram is a country's perceived threat from the U.S. This variable is shown separately because an active U.S. desire for influence with a foreign country might be seen by that country as a threat to its international position. Once the requirements are determined, orders are passed to the respective governments for consideration.

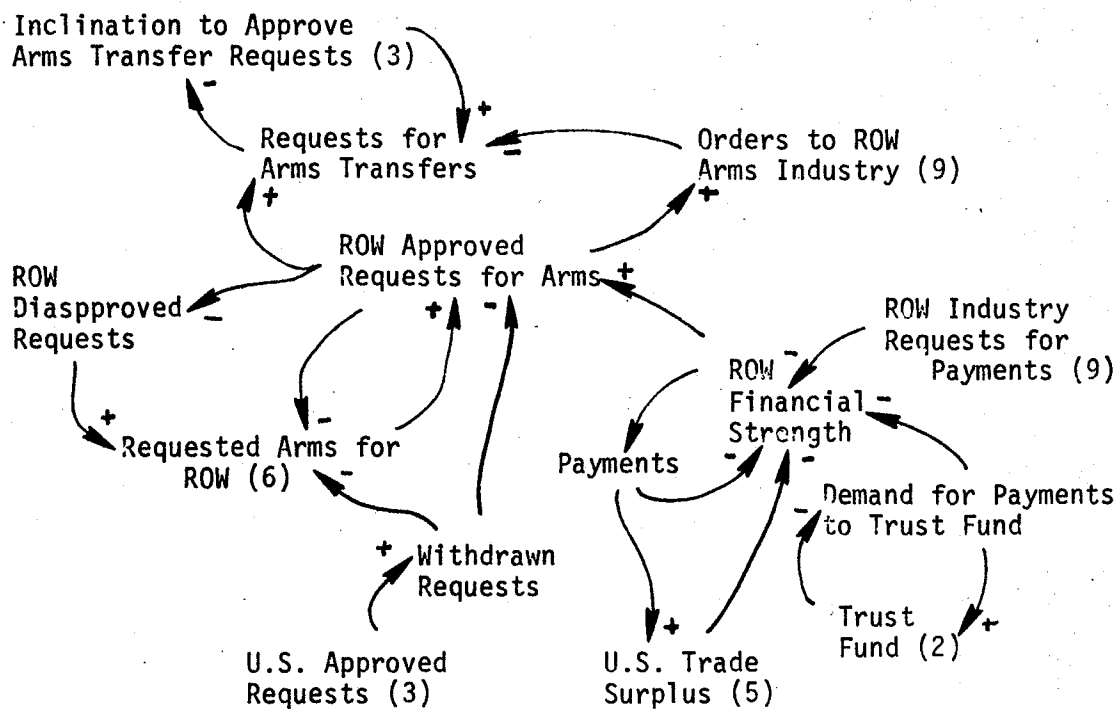
7. U.S. Arms Production Sector:



The final sector of the model concerned mainly with the United States is the U.S. Arms Production Sector. Orders for Defense Production are received from DOD when money has been made available from the Defense Appropriation Fund or from the Trust Fund. Orders accepted by the defense industry result in the production of arms for the U.S. and foreign customers.

Arms production depletes resources obtained from the U.S. and from the rest of the world and utilizes U.S. production capacity. An excess production capacity coupled with a profitable position results in increased lobby activity by the arms industry in the Congress for increased orders from home and abroad. As pointed out previously, the production of arms contributes in a positive way towards GNP and U.S. Employment.

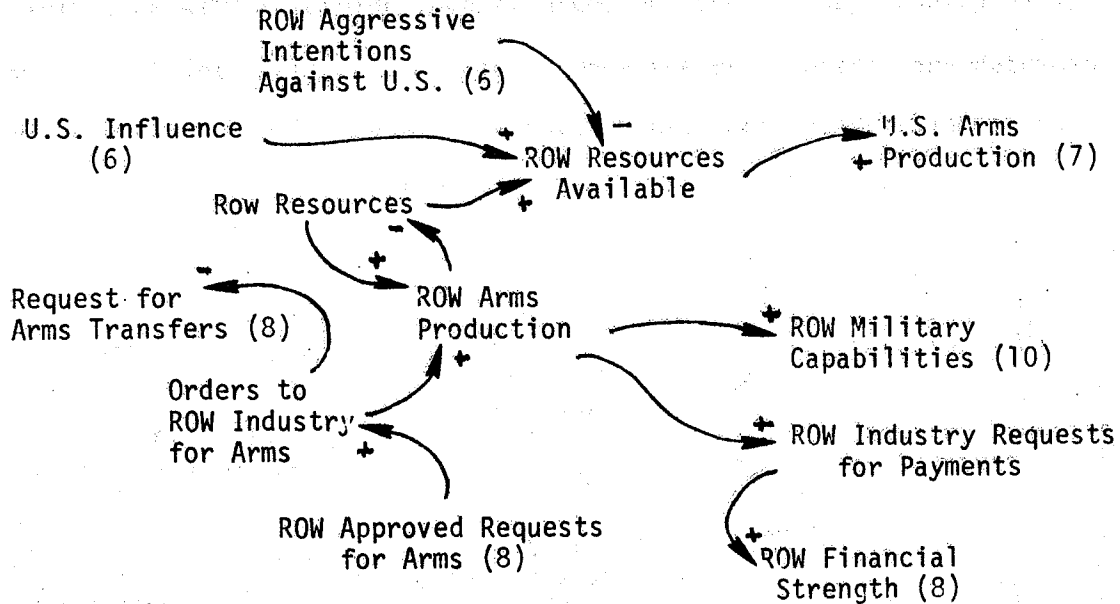
8. ROW Politico - Economic Sector:



The part of a foreign country responsible for making arms procurement decisions (usually the government) needs to be cognizant of a number of factors. For the functioning of this model they have been defined as the military requests themselves and the country's financial strength. The U.S. arms transfer system is then sensitive to how a country's authorized acquisitions are divided between the U.S. as requests for arms transfers from the U.S. and orders placed to industry in the rest of the world. Payments for

production in turn influence the financial strength of the country .

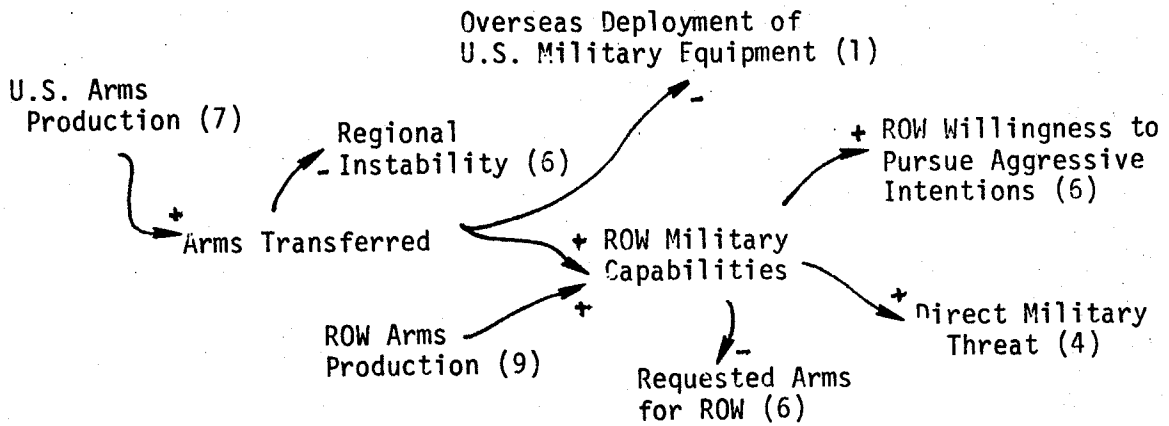
9. ROW Arms Production Sector (9):



Orders received by the ROW Arms Production Sector for arms production are assumed to result in unconstrained arms production. This is because any country with sufficient resources can generally obtain arms from somewhere in the world, even if the U.S. declines to sell. Payments to the industry for arms deplete ROW Financial Strength while they increase ROW Military Capabilities.

As arms are produced by the arms industry, resources are depleted and this in turn reduces the total resources available in the world. Available resources are sensitive to some extent to U.S. influence as well, both for their development and depletion.

10. ROW Military Resources Sector:



This sector demonstrates how arms from U.S. Production Sector contribute to Arms Transferred. Arms Transferred combined with ROW Arms Production to produce the total increase in ROW Military Capabilities. Transferred arms generally reduce the Overseas Deployment of U.S. Military Equipment and Regional Instability. An increase in ROW Military Capabilities on the other hand increases the overall threat to the U.S. and ROW's willingness to pursue aggressive intentions. It also depletes the number of requested arms for countries concerned. The ten variables in the ten sectors of the model presented have been operationalized and flow diagrams of the sector structures developed. Full exposition of the model flow diagrams and mathematical structure of the model is beyond the scope of this paper. One sector, however, will be addressed fully and its equations solved using DYNAMO to illustrate how the model is used in research.

Model Operation

The flow diagram for sector 1, U.S. Military Resources Sector, is shown in Figure 3. The structure in this sector embodies the fundamental philosophy of the model. The world is made up of thirteen representative

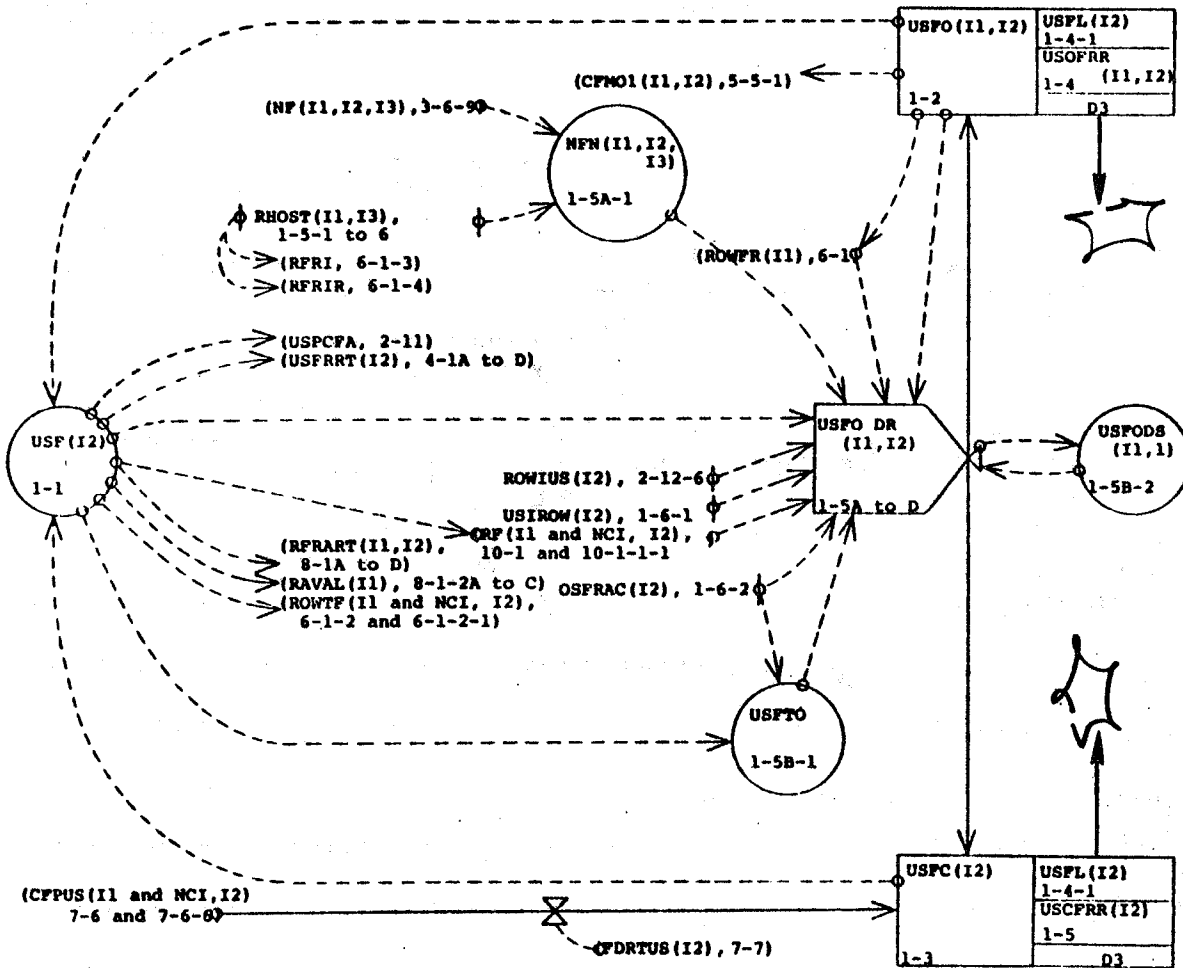


Fig. 3. Flow Diagram, Sector I

countries. For example, there is a European country representing all of the North Atlantic Treaty Organization members, an East Asian country representing Japan and Korea, and continuing until typical areas of the world are represented. The I1 index represents these countries. The second major principle involves the categorization of arms from nuclear weapons to "dated" (pre-1960) conventional weapons. There are four such categories represented by the I2 index.

The two basic levels shown are U.S. Forces Overseas (USFO), using both the I1 and I2 structure, and U.S. Forces Conus (USFC), using the I2 index and representing forces based in the continental U.S. These levels are controlled by a force deployment rate (USFODR) which is dependent upon the world situation, a country's requirements, and U.S. policy. The inputs that control movement of U.S. forces come from the various other sectors of the model. For this paper, these inputs were treated as exogenous to Sector I to demonstrate how the variables respond. Runs were first produced with the exogenous levels set to zero to demonstrate initial stability. All levels remained at initial values during this test.

The results of Figures 4 and 5 show how the variables respond to changing deployment policy. As the amount of force requests received increases, U.S. Forces are drawn down. This is not uncharacteristic of the result observed during the 1973 Arab-Israeli conflict. The U.S. heavily supported Israel at the expense of some U.S. force capability. In the second case, the variables are controlled to show response to fluctuating requests. These typical outputs illustrate how the model may be used to evaluate sales and deployment policy.

Summary and Conclusions

The major focus of this paper has been discussion of the structure of the Foreign Military Sales System. The discussion illustrates the power of system dynamics as a conceptual tool to form a theory of system structure and to formulate a set of hypotheses about system behavior. Application of the iterative process of conceptualization, analysis, testing, and reconceptualization has sharpened understanding of the system to this point. Research and the testing of policy alternatives are continuing.

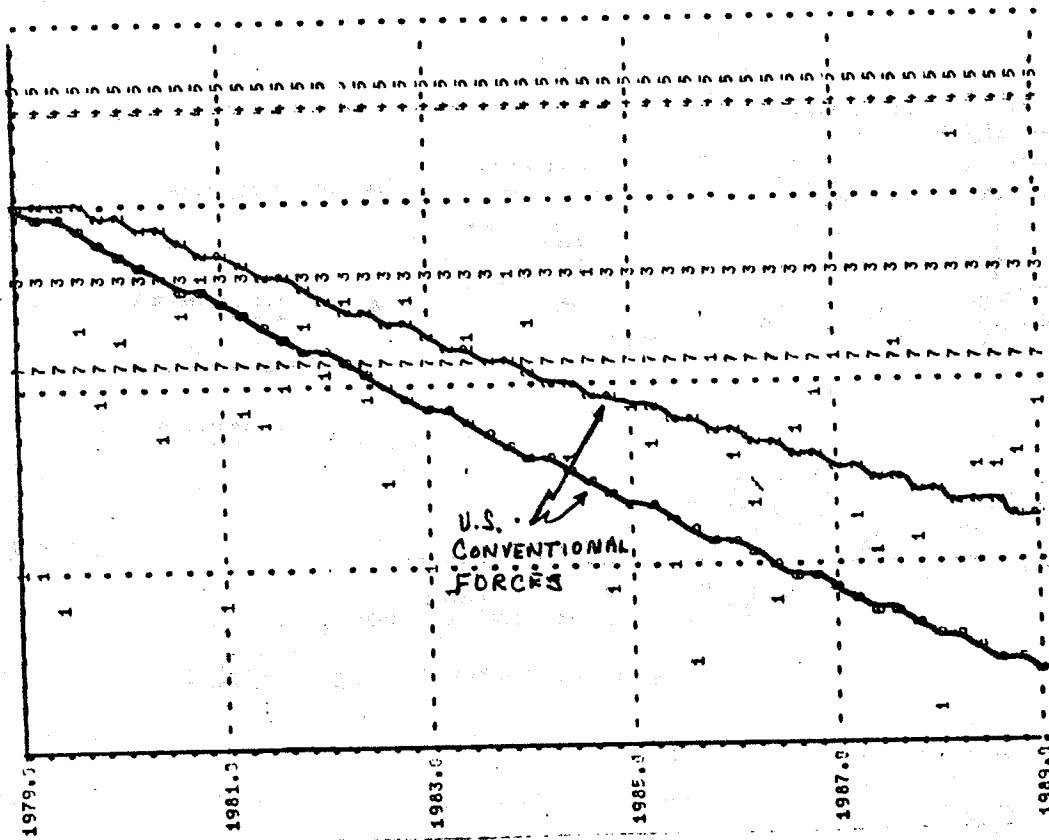


Fig. 4. Increased Support of FMS from U.S. Stocks

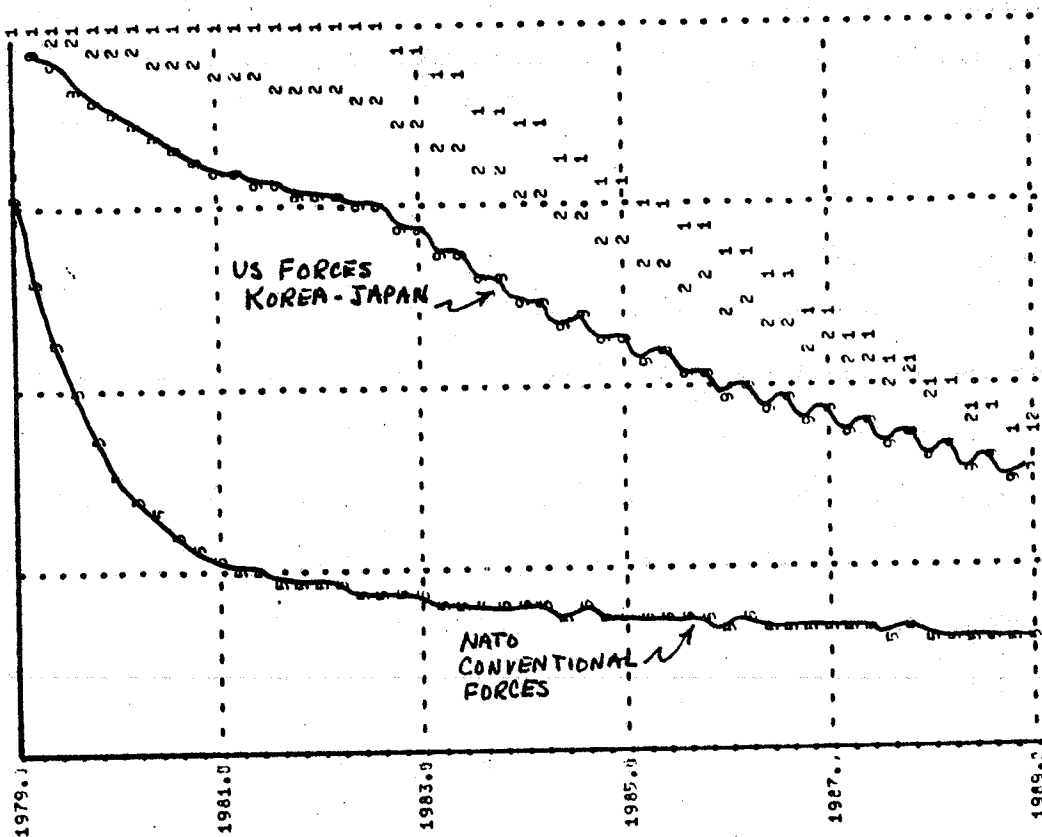


Fig. 5. Fluctuating Requests of Foreign Governments for U.S. Support

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