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**FOREIGN MILITARY SALES: A
METHODOLOGY FOR RECOUPMENT OF
NONRECURRING COSTS ON SALES OF
ARMY AVIATION SYSTEMS**

Frank A. Blackshear

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**U.S. ARMY AVIATION SYSTEMS COMMAND
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I. ABSTRACT

This research paper presents a functional treatment of the existing Department of Defense (DOD) and U.S. Army Aviation Systems Command (USAAVSCOM) pricing policies, criteria, procedures, and methodology for assessing appropriate charges on products or technology sales to non-U.S. Government customers. The criteria established herein applies to United States defense contractors when selling products and technology developed with DOD appropriations/funds to a foreign government; and is also applicable to international organizations, foreign commercial firms, or domestic organizations. This paper does not apply to Military Assistance or Grant Aid Programs; also, surplus or excess Government property is subject to contingencies beyond the scope of this paper.

II. INTRODUCTION.

This study deals with a fundamental approach, within prescribed Department of Defense policy, for systematically capturing the essential elements for insuring that a purchasing customer pays a fair price for the DOD nonrecurring investments in the manufacture of the products and/or for development of the related technology.

While there is a broad regulatory environment for control and policy administration for recovery of nonrecurring, government investments, situations which are unique to aviation system management are neither representatively available nor sufficiently specific for the functional analyst who is responsible for carrying out tasks. It is highly probable that other Army National Inventory Control Points (NICPs) are experiencing similar implementation problems of this same nature. Expectations are that this treatise might serve as a model for more effective implementation of this investigative concept of recovery.

III. PURPOSE.

The International Security Assistance and Arms Export Control Act of 1976 [1] is explicitly authoritative with its pronouncement that a mutually fair and appropriate amount of funds expended be recovered for any nonrecurring costs of research, development, and production of both major and non-major defense equipments.

This paper will point out in a simplified, yet essential, fashion several minimum steps that may be followed to satisfy this vital issue.

IV. SCOPE AND APPLICABILITY.

In conformity with DOD policy, recovery requirements apply to those Army aviation systems products and technologies for which investment costs are equal to or exceed the dollar threshold definitions below [2]

With respect to aviation products and technology, nonrecurring research, development, test and evaluation (RDT&E) costs of \$5 million or more to develop aviation systems related products and technology. The determination of RDT&E costs shall be based upon the current and predecessor models of an item or equipment.

With respect to aviation systems products, non-recurring production costs of \$5 million or more.

With respect to aviation systems products and technology, special customer nonrecurring costs under a Foreign Military Sale of \$5 million or more.

The costs to be applied against the above thresholds shall normally be determined based upon the system fly-away cost of the end item. However, should the end item contain one or more components which singularly meets these thresholds, recoupment will be made on both end item and component sales.

When the Army Aviation Systems Command wishes to assess a charge for investment cost that does not meet the previously mentioned threshold levels, a request for such assessment shall be processed as a deviation to DODD 2140.2 [2].

These procedures apply to United States defense contractors when selling products and technology developed by DOD funds.

The procedures contained herein do not apply to sales of excess property when accountability has been transferred to property disposal activities.

V. BACKGROUND.

Starting in 1975, the U.S. Congress, the Comptroller of the Army (COA), Headquarters, U.S. Army Aviation Materiel Development and Readiness Command (DARCOM), and the U.S. Army Aviation Systems Command (AVSCOM) embarked on an intensified program to establish and implement a solid, precise and equitable Pricing Policy for sales of materiel and services to the non-DOD customer, particularly the foreign customer - Foreign Military Sales (FMS). A major source which characterizes this continued emphasis on FMS Pricing Policy is, Report to Congress, by the Comptroller General of the United States, subject: Foreign Military Sales---A Growing Concern, dated 1 June 1976.^[3] An outstanding revelation from the Comptroller General's investigation was the dramatic increase in volume of U.S. Foreign Military Sales. For example, the report reveals that in FY 1967, foreign sales were about \$1 billion; and in FY 1975, sales grew to almost \$10 billion.

On 30 June 1976, the 94th Congress of the United States enacted Public Law 94-329^[1], a significant policy revision to the Foreign Assistance Act of 1961 and the Foreign Military Sales Act. A highly significant promulgation of the "new law" amended the manner in which recoupment surcharges would be recovered from foreign sales of U.S. products and technology.

In January 1977, the Department of Defense issued a stalwart directive ^[2] designed for strict conformity with the Congressional edict. On 16 March 1977, by Headquarters, Department of the Army

guidance, HQ DARCOM, Office of the Comptroller in conjunction with HQ DARCOM, U.S. Army International Logistics Command (Washington Field Office), issued to Major Subordinate Commands (MSCs), implementing instructions [4] relating to the establishment and recoupment of nonrecurring costs on sales of U.S. Government's products. In that instruction, functional responsibilities for the recovery of non-recurring RDTE and Production costs were assigned as follows:

"The Comptroller is responsible for establishing the policy, policy approval and for insuring that the policy is being carried out"[4]

"The International Logistics Directorate is responsible for confirming the amount of the assessment, the forwarding of the assessment, if applicable, to higher headquarters for approval, and other related operational matters." [4]

The Office of the Comptroller, Cost Analysis Division, formally issued the DARCOM directed instruction to responsible AVSCOM Command elements on 22 March 1977. In an Command-wide implementation meeting, convened and chaired by the Director of International Logistics on 29 March 1977, the machinery was geared to respond in an expeditious and accurate manner to the DARCOM requirement.

Numerous constraining factors prevented attainment of progress toward satisfying this recoupment recovery task. Among the prevailing implementation hardships was the new method of arriving at the proposed recovery surcharge. Previously, the recovery assessment traditionally had been made to the foreign customer by computing and applying a parametrically derived numerical factor to historical RDTE and Production investments. The new methodology is altogether different.

Second, the dollar threshold levels for imposing the surcharge were drastically reduced. This meant that data records identifying these lower threshold costs were neither available nor readily accessible. Third, Command Staff elements, Project/Product Managers and Weapon Systems Managers, who previously were not accustomed to the detail required to support this new methodology, were necessarily in need of additional guidance to fulfill the time-constrained tasks demanded of them.

In a letter signed by the AVSCOM Chief of Staff [5] originating in the Office of the Comptroller, Cost Analysis Division, additional and more specific directions were disseminated to the responsible elements in order to support the higher headquarters requirements. Then, on 26 April 1977, the Directorate of International Logistics, with Comptroller coordination, transmitted the first of a recurring report to HQ DARCOM which addresses the AVSCOM recoupment surcharge rates for major and non-major aviation systems and components.

By Charter of the AVSCOM Commanding General [6], the International Logistic's Steering Group was commissioned. Its purpose is to provide a high level managerial focal point for defining and solving problems related to International Logistic's Programs. The Group membership is below:

- Director of International Logistics (Chairman)
- Director of Materiel Management
- Director of Maintenance
- Director of Management Information Systems
- Director of Product Assurance
- Deputy Director of Procurement and Production
- Comptroller
- Judge Advocate

Finally, at the first meeting of the Steering Group, a prime agenda item, among many, was the need for concise, explicit, and workable methodology (procedural, technical, and strategic) for dealing with the aggregate problem nonrecurring investment recovery for foreign sales. The Office of the Comptroller, Cost Analysis Division, has assumed the lead role in this gigantic scheme of International Logistics support.

VI. POLICY.

The new Arms Export Control Act of 1976 [1] significantly expands provisions for recovery of nonrecurring RDT&E and production costs for foreign sales. The legislation says, in highlight fashion, that letters of offer for the sale of defense articles or defense services that are issued shall include a proportionate amount (dollars) for any nonrecurring cost of research, development, and production of major defense equipment.

Department of Defense Directive, DODD 2140.2 [2] stipulates: When the established dollar thresholds (See Scope and Applicability) are met, each DOD component or defense contractor (in a direct sale) submitting a sales offer to a customer shall include in the offering price, an appropriate charge for DOD investment costs unless a deviation has been approved. Stratifying this broad rule, the DOD further proclaims:

A. In the case of product sales, RDT&E and nonrecurring production costs will be prorated as pools against total estimated quantities of the sale model, past and projected. Such costs shall be applied on a proportionate basis to recover the equitable portion applicable to the sale.

B. In the case of technology sales, the amount of the charge will be the fair market price of the technology for the individual customer. Because of the factors to be considered, the fair market price of a technology may be different for different customers. In the case of sale of technology to a domestic organization, this price will be the lower of either (1) a proportionate share of the Department of Defense investment cost identified to the development of the technical data computed in the

manner set forth in A., above, or (2) a fair market price for the technical data based on demand or the potential monetary return on investment. For sales of technology to foreign customers, this price will be the greater of these two alternatives. The foregoing domestic pricing criterion will only be applied if the prospective purchaser agrees that, in the event the technical data are transferred from the prospective purchaser to a foreign recipient prior to it becoming generally available, the domestic purchaser will provide further payment to the government on the basis of the foreign pricing criterion.

C. In the case of product sales, if the dollar threshold is met for either nonrecurring RDT&E or production costs, recoupment for both categories of investment costs will be charged.

D. DOD RDT&E technology and production contracts shall provide for an obligation on the part of the contractor to pay to the DOD Component the amounts required by this Directive in the event of the contractor's direct sale of products or technology that fall within the guidelines of this Directive. This obligation shall also include flow-down requirements for qualifying subcontractor tiers. In joint Government/direct sales of a product or technology, the contractor will be required to include in his price, and to collect, the nonrecurring costs associated with the direct sale portion of the customer's purchase.

E. The full amount of "special" RDT&E and nonrecurring production costs shall be paid by the customer. A pro rata share of these costs subsequently may be credited to the customer. However, such credits shall not be granted after eight years have elapsed since original customer acceptance of the DD Form 1513.

F. In determining the amount of DOD charges for product or technology sales, consideration may also be given to non-monetary returns which are advantageous to national security, foreign policy, and the public interest. If such consideration is justified, DOD Components shall request a deviation for the difference between the amount that would be due under A., B., C., or D., and the amount actually planned to be recouped. With respect to FMS of major defense equipment however, exceptions can be requested only for particular sales that would significantly advance United States Government interests in North Atlantic Treaty Organization standardization or foreign procurements in the United States under co-production arrangements.

G. In the event of a direct sale, domestic or foreign, the contractor shall provide the Government with a complete release for any liability which might result from the contractor's use of Government data, tooling, test equipment, or facilities.

H. Once a charge has been established for a particular product, the charge for sales of that product shall not be changed except by direction of the Secretary of Defense.

The Comptroller is responsible for establishing the policy, approving policy and for insuring that the policy is being carried out.

The Director of International Logistics is responsible for confirming the amount of the assessment and the forwarding of the assessment, if applicable, to higher headquarters for approval, and other related operational matters.

Headquarters, US Army Materiel Development and Readiness Command (DARCOM) supplements certain provisions of the DOD directive by the following stipulations. See Reference [4] :

Surcharges/rates, when developed, will be included in the unit price of materiel for all commercial contracts, direct and domestic sales, and sales agreements (DD Form 1513) released to the customer and dated after 4 March 1977, pending approval of prescribed surcharges/rates by the Defense Security Assistance Agency (DSAA).

RDTE costs will, wherever possible, be identified with a specific model of equipment and pro rata determination made accordingly. If this is not feasible, then an RDTE cost pool will be established consisting of costs (both historical and projected) associated with both the predecessor and the current models of the equipment and a pro rata determination would then be made using production quantities of both the same predecessor and current models of equipment.

Any new items that meet the required thresholds of Major Defense Equipment (MDE), (i.e., \$50 million RDTE or \$200 million total production costs) must be submitted to HQ DARCOM, International Logistics Command, as each end item or component qualifies as MDE. These items will be submitted to DA/DSAA for approval as candidate items for inclusion in the MDE list.

The designated list of MDE should be updated quarterly and forwarded to HQDA not later than 31 March, 30 June, 30 September, and 31 December, each year.

Non-major defense items and components meeting the established thresholds will be updated annually in December and forwarded to HQDA.

HQ, USAAVSCOM has supplemented the recoupment policy along more functional and operational lines. Highlights of the USAAVSCOM recovery policy are below. See Reference [5]:

Project/Product and/or Weapon Systems Managers will accumulate the required data based upon directions

contained in HQ DARCOM instructions [4]. Additionally, these managers will notify the Directorate for International Logistics of new items that meet the criteria for recoupment and any changes which occur beyond the prescribed "significant" threshold.

Systems Managers controlling the investment appropriations will identify the items for which recoupment charges are applicable. They will also be responsible for the engine associated with their system. If the engine is peculiar to more than one system, the principal user will be responsible for maintaining the data (e.g., UH-1 WSM: responsible for T-53 series engine).

The Directorate for Procurement and Production and the Office of the Comptroller, Program Budget Division, will provide pertinent data available in their files.

The Directorate for International Logistics will confirm the amount of assessment, collate and forward the Command's assessment to higher headquarters for approval. The Office of the Comptroller will review the final data compilation prior to transmittal.

VII. METHODOLOGY.

A. The General Approach. The first and foremost order of any well defined methodology or procedure is to study the relevant system and to develop a well defined statement of the problem under consideration. Necessarily, this rule includes determining such things as the appropriate objectives, the constraints on what can be done, interrelationships between the area (system) to be studied and other areas of the organization, the possible alternative courses of action, and time limits for making a decision. Therefore, this phase of the methodology should be executed with considerable care. Then, the initial formulation should be continuously re-examined in the light of new insights obtained during the later stages.

B. An Optimal Approach. In this business of collecting, formulating and collating nonrecurring RDT&E and nonrecurring investment cost, the ideal methodology is a well defined collection of historical or actual cost data. Appendix B, Research and Development Cost Matrix, and Appendix C, Investment Nonrecurring Cost Matrix, represent one recommended means by which to advance the problem solution. Precisely where and how the elements of these matrices are filled requires examination of large volumes of records while at the same time associating varying degrees of confidences in the sources from which these data are extracted. Some suggested data retrieval sources, recognized by the Command as authoritative, are shown at Appendix F.

Once the matrices are confidently filled with data, the HQ DARCOM directed arithmetic scheme should be followed to arrive at a representative surcharge for recovery. For continuity, this scheme is presented here in step-wise fashion. See Appendix G:

Step 1. Name the system or component in the first appropriate column titled, Weapon System and Component.

Step 2. Record the total RDT&E cost from the matrix in Appendix B, or from some other self-designed record in the column heading, RDTE.

Step 3. Record the total nonrecurring Investment cost from the matrix in Appendix C, or from some other self-designed record, in the column heading, Production.

Step 4. Add the two values from Steps 1 and 2 and record this sum in the column heading, Total.

Step 5. In the next columns under Production Quantity, record under each sub-heading (Army, Marines, Navy, Air Force, FMS/Direct), the number of units produced (including units expected to be produced) for each military department, FMS/Direct sale.

Step 6. Add those quantities and record under, Total.

Step 7. To find the Recommended Pro Rata Unit Charge for RDTE, divide the RDTE cost defined by Step 2 by the total number of units.

Step 8. To find the Recommended Pro Rata Unit Charge for Production, divide the Production cost defined by Step 3 by the total number of units.

Step 9. Add the two quantities computed in Steps 7 and 8 to arrive at the total.

The same general procedural steps may be followed whether the problem under consideration involves a Major Defense Equipment or a Non-Major Defense Equipment. Some examples of aviation products which may qualify for recoupment under the DOD definition are listed in Appendix H.

It is recognized that the problem of establishing some common base year within the context of this entire cost accumulation exercise is of extreme importance and necessary for an accurate cost structure. That is, the purchasing power of the dollar spent in 1968 for an RDTE program is different from that dollar value spent in 1970 or any other fiscal period. However, at this writing, the consensus prevailing at HQ DARCOM (both from the policy and operations experts) is that no attempt should be made at this time to establish such common year dollar adjustments. If fiscal adjustments are to be made, that action will be taken at Department of the Army levels.

One final thought on this attempt to arrive at an optimal solution. It is difficult to extract a "right" answer from the "wrong" data. The strength, indeed, in this rather simple methodology is grounded in the accuracy and precision of the data collection phases.

C. An Estimating Alternative. Situations are fairly common in the management of aircraft systems whereby historical cost records, because of age and other omissions, become obscure, sparse, and even lost. This condition necessarily constraints the implementation of the methodology discussed above. Realizing that these conditions are real, HQ DARCOM [4]

authorizes an alternative of estimating RDTE and nonrecurring investment cost if, indeed, the approach is "reasonable." For example, if the cost records are available for only a portion of the development period, total cost may be extrapolated from known data. The algebraic approach recommended by HQ DARCOM is the concept of proportionality. With rather elementary and well grounded in assumption, the concept is recognized as a sound mathematical principle. Since this concept is a higher headquarters recommendation, its use is presented here with an example. By definition, a proportion is a statement of equalities of two ratios. In notation form, the proportion may be expressed as,

$$a:b = c:d,$$

and is read, "a is to b as c is to d." "a" and "d" are called the extremes; "b" and "c" are called the means.

Another form of the equation is,

$$\frac{a}{b} = \frac{c}{d},$$

and, indeed, this is its most common form.

The "DARCOM Rule" for estimating says that if RDTE nonrecurring investment costs records are available for only a portion of the development period, total costs may be extrapolated from known data. For example, if \$45 million was identified as actual expenditures for a four (4) year portion of a system which had a seven (7) year development period for RDTE, the remaining three (3) years may be computed as:

X, an unknown \$ value, is to 7 years of development cost, as \$45M is to 4 years of development cost. Or,

$$\frac{X}{\$45M} = \frac{7 \text{ yrs}}{4 \text{ yrs}}$$

Then, carrying out the arithmetic,

$$4X = (\$45\text{M})(7)$$

$$X = 315 \div 4$$

$$X = \$78.75\text{M}$$

From this simple extrapolatory technique, several limitations to this scheme are doubtlessly obvious to the reader which reduces the scheme to one of sub-optimality. The most obvious weakness in the scheme is the implied assumption that all RDTE costs behave as a linear function. This assumption indeed is not collectively exhaustive. Secondly, and much more complex, in treatment, is the danger of judiciously applying any technique for extrapolatory purposes to a point estimate, a condition which this problem situation fits. Other limitations are left to the observations of the reader.

Nonetheless, in the absence of a more definitive data base, the "DARCOM Rule" permits this type of methodology for establishing a recovery cost base.

Production quantities (units) under this line of approach are to include past production, current known production, and projected production for the years shown in the Five Year Defense Plan (FYDP) [7]. If actual production quantity records are not available, use may be made of the extrapolation scheme illustrated above.

D. Other Estimating Considerations. The further one is removed from the suggested optimal approach to computing recovery cost, the less reliable the estimating techniques become. Then too, the complex essence

of Army aviation systems is not, in most cases, conducive to standardized scientific postulation. There are, nonetheless, some classical mathematical methodologies which provide rather composite and precise solutions to estimating the costs under consideration. Not one of these approaches, standing alone, will solve the problem at hand. At most, they are aids in the universal approach.

Among these methodologies, the most popular in application and theory is the Cost Estimating Relationship (CER). Essentially, this statistical concept explains, to some degree of confidence, the relationship of a dependent variable (cost) to one or most independent (cost) driving variables. The expression may be represented by any of several functions, e.g., linear, power, exponential, hyperbolic.

Another cost estimating technique is the Learning or Experience Curve. Essentially, Learning Curve Theory, and its associated mathematics, postulates that each time the total quantity of units produced is doubled, the hours or cost to produce the last unit of this doubled quantity will be reduced by a constant percentage. Beware, the learning curve is very difficult to extrapolate or forecast.

Other techniques may be found in disciplines such as Bayesian Statistics, Mathematical Statistics, Operations Research and Correlation and Regression Analysis.

While these scientific approaches are mentioned here as viable alternatives to cost estimating, details beyond which are mentioned are outside the scope of this report.

VIII. SUMMARY AND CONCLUSION.

The implementation of a scheme for recovery of nonrecurring RDT&E and Investment cost of Army aviation products and technology involves several steps. Essential to establishing a sound and equitable surcharge is, first, understanding the policy which governs the process. Next is the recognition that each aircraft system, by its complexity - engineering, mission, cost - has a distinct stand-alone uniqueness. For that reason, problem definition must be structured with that facet in mind. Then, the methodology presented here, at most, is a guide to a more refined solution, dependent upon the resourcefulness of the concerned analyst; the caveats are many.

Finally, by its very nature, costing methodology requires considerable ingenuity and innovation. So, it is impossible to write down any standard procedure that should always be followed when the recommended optimum approach weakens or fails. Rather, the discussion throughout this report may be viewed as a model that roughly represents how successful selected cost topics may be approached.

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APPENDIX A

GLOSSARY, GENERAL

- A. A cost pool represents the total cost to be distributed across the specific number of units.
- B. Direct sale means a commercial sale to a customer by a defense contractor of products, technology, materiel, services, and/or development or production techniques which were originally developed, improved or produced using DOD appropriation/funds.
- C. Domestic organization means any U.S. nongovernmental organization or private commercial firm.
- D. Fair price of technology is a price negotiated between a buyer and seller when each has full knowledge of all pertinent information. It assumes that the monetary return to the seller(s) is primarily determined by the buyer(s) need for the technology and the potential market for product(s) produced from the technology. Thus, there are three factors which must be determined: (1) the costs incurred by DOD in developing the technical data being considered for sale, (2) the costs which would be incurred by the buyer(s) in independently developing the technical data, and (3) the estimated dollar value of product(s) which will be produced by the buyer(s) upon transfer of the technology. One of the common methods used by defense contractors in direct sales for obtaining a fair price for technology is a license agreement under which the licensee agrees to pay a fixed dollar amount plus a percentage of the sales price of product(s) which incorporate the technology.
- E. Flyaway cost is the total Aircraft Procurement Army (APA) costs of the investment recurring and nonrecurring cost categories for the production of major system equipment.
- F. Foreign Military Sales (FMS) means a sale of defense articles and services to a foreign government or international organization under authority of the Arms Export Control Act.
- G. Government sale means a sale of articles and/or services to customers by any DOD Component under authority of appropriate legislative acts.

- H. Major defense equipment means any item of significant combat equipment on the United States Munitions List having a non-recurring research and development cost of more than \$50 million or a total production cost of more than \$200 million.
- I. Model is the generic term applied to a basic item and all modifications to that item. The model can generally be identified by a basic alpha-numeric designation such as a ship hull series, an equipment or system series, an airframe series, or a vehicle series. Recoupment within a model series is identified by determining total nonrecurring investment (RDT&E or production, as appropriate) applicable to that model series and dividing by the total number of units of the model series estimated to be produced for DOD requirements, FMS, and direct sales.
- J. Nonrecurring production costs are those one-time costs incurred in support of previous production of the model specified and those costs specifically incurred in support of the total projected production run from which delivery is to be made which would normally be expended against a production run. These non-recurring costs include such costs as preproduction, special tooling, special test equipment, production engineering, product improvement, destructive testing, and pilot model production, testing and evaluation. They do not include costs of Government property or facilities for which rental or asset use charges will be assessed in accordance with DOD Instruction 2140.1.
- K. Nonrecurring research, development, test and evaluation (RDT&E) costs are those costs funded by an RDT&E appropriation to develop or improve the product or technology under consideration. This includes costs of any engineering change proposal initiated prior to date of the contract with the customer, as well as projections of such costs, to the extent additional effort applicable to the sale model or technology is necessary or planned. It does not include costs funded by either Procurement or Operations and Maintenance appropriations to improve the product. The costs of such improvements are recurring costs and will be recovered in accordance with DOD Instruction 2140.1.
- L. Pro rata recovery of nonrecurring costs means distribution of a cost pool to a specific number of units which benefit from the investment so that a DOD Component will recover from a customer a fair share of the investment in the product being sold.

- M. Royalty fee is the term used in assessing a technology charge when DOD sells to a foreign government or international organization a U.S. Government production technical data package for use in the manufacture of defense articles outside the United States under provisions of the Arms Export Control Act. DOD Instruction 2140.1 contains specific instructions for computing royalty fees.
- N. "Special" RDT&E and nonrecurring production costs are those incurred at the request of, or for the benefit of, the customer in developing a special feature or unique requirement. These costs must be paid by the customer as they are incurred.
- O. Technology means information of any kind that can be used or adapted for use in the design, production, manufacture, utilization or reconstruction of articles or materiel. The data may take a tangible form, such as a scale model, prototype, blueprint, or an operating manual, or may take an intangible form such as technical advice.

APPENDIX B

Investment Nonrecurring Cost---Matrix
Elements and Definitions

MINIMUM COST PRESENTATION
SYSTEM XYZ
RESEARCH AND DEVELOPMENT COST MATRIX
(CONSTANT FY DOLLARS, THOUSANDS)

ROW	PRIME APPROPRIATION	SYSTEM STRUCTURE									
		COST ELEMENT	AIRFRAME (1)	POWER PLANT (2)	COMMUNICATIONS, NAVIGATION/GUIDANCE (3)	FIRE CONTROL (4)	ARMAMENT (5)	AMMUNITION (6)	PECULIAR SUPPORT EQUIPMENT (7)	COMMON SUPPORT EQUIPMENT (8)	* (9)
1	---	RESEARCH AND DEVELOPMENT									
2	RDTE	DEVELOPMENT ENGINEERING									
3	RDTE	PRODUCIBILITY ENGINEERING & PLANNING									
4	RDTE	TOOLING									
5	RDTE	PROTOTYPE MANUFACTURING									
6	RDTE	DATA									
7	RDTE	SYSTEM TEST AND EVALUATION									
8	RD/OM	SYSTEM/PROJECT MANAGEMENT									
9	RD/OM	TRAINING									
10	RD/MC	FACILITIES									
11	RDTE	OTHER									
											TOTAL (11)

NOTE: *Use for a specific hardware component/subsystem of high management interest not captured elsewhere.

MINIMUM COST PRESENTATION

SYSTEM XYZ

*RESEARCH AND DEVELOPMENT COST DEFINITIONS

1. ROW (1), RESEARCH AND DEVELOPMENT COST: The term, "R&D Cost," is defined, in general, to be the sum of all costs resulting from applied research, engineering design, analysis, development, test, evaluation and managing development efforts related to a specific materiel system. The term R&D cost includes:

a. All costs to the Government, defined as contractor costs plus in-house costs, of products and services necessary to bring a specific materiel system from concept to serial production.

b. All costs to the Government of developing the specific capability, irrespective of how such costs are funded, i.e., irrespective of which appropriations (RDTE, MPA, MCA or OMA) are cited, and irrespective of which organization within the Army has responsibility.

2. ROW (2), DEVELOPMENT ENGINEERING: This element includes the costs incurred during study, analysis, design, development, evaluation, testing, and redesign for the Work Breakdown Structure (WBS) component(s) during the system development effort. It includes the design effort of preparing specifications, engineering drawings, parts lists, wiring diagrams, test planning and scheduling, analysis of test results, data reduction, report preparations and establishment of reliability, maintainability and quality assurance control requirements. It also includes the cost of raw and semifabricated material plus purchased parts consumed in the performance of component engineering effort. Included also are engineering test equipment such as oscilloscopes, transducers, recorders, radio transmitters, converters, discriminators, receivers, and other equipment required to accomplish the engineering function for the specified WBS element. Excluded from this element is the engineering effort (Producibility Engineering, and Planning) to insure producibility of the item or system prior to quantity procurement.

3. ROW (3), PRODUCIBILITY ENGINEERING AND PLANNING (PEP): This element includes cost incurred in assuring the producibility of the developmental weapon system, item, or component. PEP involves the engineering tasks necessary to insure timely, efficient and economic production of essential material and is primarily software in nature. PEP includes efforts related to development of the Technical Data Package (TDP), Quality Assurance (QA) plans, and special production processes to assess producibility. Also included are development of unique processes essential to the design and manufacture of the materiel and

details of performance ratings, dimensional and tolerance data, manufacturing assembly, sequences, schematics, mechanical and electrical connections, physical characteristics including form, fit and finishes, inspection test and evaluation requirements, calibration information, and quality control procedures.

4. ROW (4), TOOLING: This element includes the planning, design, fabrication, assembly, installation, modification, maintenance and rework of all tools, inspection equipment, and test equipment supporting the development of a specified WBS component. It includes that time expended in determination of tool, inspection, and test equipment requirements; planning of fabrication and testing operations; maintenance of tool records; scheduling and control of all tool orders; and programing and preparation of tapes for all numerically controlled machine tools used in development of a WBS component. It includes the cost of new material used in the fabrication, assembly, installation, modification, maintenance and rework of dies, jigs, fixtures, inspection equipment, handling equipment, work platforms, and test equipment used to develop each WBS component, as well as tools normally purchased in final form or which require negligible effort to assemble.

5. ROW (5), PROTOTYPE MANUFACTURING (INCLUDING SPARES): This element contains the cost of fabrication, processing, subassembly, final assembly, reworking modification, and installation of parts and equipment, power plants, boosters, electronic equipment, explosives, and other items (including Government furnished equipment) and the proving of such equipment and instruments for the specified WBS prototype element. This includes the construction of piece parts from raw materials, the cutting, forming, stretching, and blanking operations performed on material to make individual parts. It includes bench assemblies of all minor and major assemblies, mating or joining of primary sections, installation of special and general equipment, instruments and accessories performed after the mating, and all other preparation and/or processing and pre-flight and production service operations. Also included are the raw and semifabricated material plus purchased parts used in the manufacture of the specified WBS prototype item. The cost of prototype spare assemblies and parts are also included within this element.

6. ROW (6), DATA: This element includes the cost of preparation, revision, and reproduction of drawings, specifications, parts lists, test plans, testing procedures, draft manuals and other documentation which is produced in support of project management, engineering, tooling fabrication, and testing functions. Relative to a contract, this element includes cost of all deliverable data listed on a DD Form 1423, i.e., such effort as can be reduced or eliminated with reductions or elimination of the listed requirements. If the data are Government peculiar, include the efforts of acquiring, writing, assembling, reproduction, etc. If the data are not Government peculiar, but are identical to that used

by the contractor except in a different format, include cost of such efforts as reproduction, packaging, shipping, and, if necessary, re-formatting.

7. ROW (7), SYSTEM TEST AND EVALUATION: This element contains cost of only system-related development and operational test activities (DT/OT I&II), including cost of specially fabricated hardware to obtain or validate engineering data on the performance of the system. This element also includes cost of the detailed planning, conduct, support, data reduction, and reports from such testing, as well as hardware items which are consumed or planned to be consumed in the conduct of such operations as well as cost of all effort associated with the design and production of models, specimen, fixtures, and instrumentation in support of the test program. The actual test article(s) (i.e., functionally configured systems) are excluded from this element; they were included in the prototype manufacturing element. Testing which can be associated with a subsystem (e.g., aircraft engine) are included in the cost of that subsystem, rather than this system oriented cost element.

8. ROW (8), SYSTEM/PROJECT MANAGEMENT: This element includes cost of the technical and business management effort expended by both the Government and contractor(s) in the process of developing an integrated system. It contains cost for planning, directing, and controlling the definition, development, and production/testing of the prototype system/project and assuring that planning is accomplished by organizations responsible for the complementary functions of logistics and maintenance support, personnel training, operational testing, activation, or deployment of a system. This is a services cost element for the total system and is not to be confused with management effort that can be specifically associated with subsystem hardware elements; the cost of which is included in the cost of that subsystem/element.

9. ROW (9), TRAINING SERVICES AND EQUIPMENT: This element includes costs of services, devices, accessories, aids, equipment, facilities, and parts used to facilitate instructions through which personnel acquire sufficient concepts, skills, and aptitudes to operate and maintain the system with maximum efficiency. This element includes cost of effort associated with the design, development, and production of prototype training equipment, and the execution of training services. It includes the costs of training initial service test crews and maintenance personnel, including TDY of Government personnel, involved in DT/OT I and II.

10. ROW (10), FACILITIES: This element includes costs of any new building, conversion or expansion of facilities or sites, and the acquisition of real estate for development and testing of the system. It includes any construction cost for modification and testing of systems already in the Army inventory if necessary to the furtherance of the R&D program.

11. ROW (11), OTHER: Any R&D cost not included in the previous elements will be included here and completely identified as to kind and type, i.e., prime contractor general and administrative expenses and profit may be included in this category, if the data base does not account for it elsewhere. Also costs of any engineering change proposals initiated prior to the date of the contract with the customer, as well as projections of such costs, to the extent that additional effort applicable to the sale model or technology is necessary or planned not otherwise included in the price.

*Source: Department of the Army (DA) Pamphlet No. 11-2, Research and Development Cost Guide for Army Materiel Systems, May 1976.

APPENDIX C

Investment Nonrecurring Cost---Matrix
Elements and Definitions

INVESTMENT NON-RECURRING COST MATRIX
(CONSTANT FY DOLLARS, THOUSANDS)

[illegible]

NOTE: *Use for a specific hardware component/subsystem of high management interest not captured elsewhere.

MINIMUM COST PRESENTATION

SYSTEM XYZ

*NONRECURRING INVESTMENT COST DEFINITIONS

1. INVESTMENT COST. The term "investment cost" is defined, in general, to be the sum of all costs resulting from the production and introduction of the materiel system into the Army's operational inventory. The term "investment cost" includes:

a. All costs to the Government, defined as contractor costs plus in-house costs, of products and services necessary to transform the results of R&D into a fully operational system consisting of the hardware, training, and support activities necessary to initiate operations.

b. Costs of both a nonrecurring, i.e., costs which are required to establish a production capability, and recurring nature, i.e., costs which occur repeatedly during production and delivery to user organizations.

c. Costs of all production products and related services, irrespective of how such costs are funded, i.e., irrespective of which appropriations (APA, MPA, OMA, MCA) are cited, and irrespective of which organization within the Army has responsibility.

d. All costs resulting from production and introduction into operational inventory irrespective of how allocated among Unit Equipment (UE), Maintenance Float (MF) and Training Usage classifications.

2. ROW (1), NONRECURRING INVESTMENT: This cost element includes the necessary engineering and capitalization (plant facilities, tools, test equipment) to achieve initially the total production capability for the materiel system.

3. ROW (2), INITIAL PRODUCTION FACILITIES (IPF): Examples are initial hard tooling and production line set-up to support low rate and full scale production of the system, cost of fabrication, assembly, and installation of tools (including modification and rework of R&D tools for production purposes), dies, templates, patterns, form block manufacture, jigs, fixtures, master forms, inspection equipment, handling equipment, load bars, work platforms (including installation of utilities thereon), and test equipment (such as checkers and analyzers) to support the manufacture of the specified system and initial and duplicate set of tools necessary to reach full rate production plus

modification of Low Rate Initial Production (LRIP) tooling for full scale production. This element also includes maintenance of tool records, establishment of make-or-buy and manufacturing plans on nonrecurring tools and equipment, scheduling and control of tools orders, and programming and preparation of tapes for numerically controlled machine equipment.

4. ROW (4), INDUSTRIAL FACILITIES/PRODUCTION BASE SUPPORT (PBS): This element contains cost of construction, conversion, or expansion of facilities for production, inventory, or maintenance required to accomplish the program. Industrial Facilities cost may be identified with either or both the contractor and in-house effort. It may be identified with the total system or with specific components of the total system, such as the engine. The budget element most generally identified with Industrial Facilities is commonly called Production Base Support (PBS) (reference AR 700-90).

5. ROW (5), OTHER NONRECURRING: All Investment costs not included in the above elements. For example, disposal costs and lay away costs of Government-owned production equipment should be included here if a cost to the system. Include such costs as product improvement, preproduction, special tooling, special test equipment, production engineering, destructive testing and pilot model production. Cost included here should be completely identified as to kind and type.

NOTE: Disposal Costs. Disposal of hardware, including production and test equipment, is one time cost, and it is logically related to the acquisition of the item, even though it may be far removed in time. If disposal costs are addressed at all in a life cycle cost estimate, they should be mentioned (together with a discussion of residual value) in the investment phase.

*Source: Department of the Army (DA) Pamphlet No. 11-3, Investment Cost Guide for Army Materiel Systems, April 1976.

APPENDIX D
System Structure Cost Definitions

MINIMUM COST PRESENTATION
SYSTEM XYZ
*SYSTEM STRUCTURE COST DEFINITIONS

1. AIRCRAFT SYSTEM. Aircraft system refers to the complex of equipment, software, services, and facilities required to produce the capability of employing the air vehicle designed for flight in the atmosphere.
2. COLUMN (1), AIRFRAME: This column refers to the assembled structural and aerodynamic components of the air vehicle that support the engines and other subsystems essential to a particular mission. This element includes all efforts relating to the integration and assembly of all equipments into the airframe to provide an air vehicle as a whole. It includes all equipment inherent to and inseparable from the assembled structure, dynamic systems, rotor group, transmission, and other equipment homogeneous to the airframe. All effort directly related to the other elements is excluded.
3. COLUMN (2), POWER PLANT: This column refers to the installed engines which provide power/thrust to propel the aircraft through all phases of powered flight. This element includes the engine as a power unit within itself, of reciprocating or turbo type suitable for integration with the airframe.
4. COLUMN (3), COMMUNICATIONS, NAVIGATION/GUIDANCE: This column refers to those equipments installed in the air vehicle for communication and identification purposes, and/or to perform the navigation/guidance function.
5. COLUMN (4), FIRE CONTROL: This column refers to that equipment installed in the air vehicle which provides the intelligence necessary for ordnance delivery.
6. COLUMN (5), ARMAMENT: This column refers to that equipment installed in or on the air vehicle to provide the firepower functions. If the aircraft system has ordnance delivery equipment or auxiliary armament/ordnance delivery equipment the costs for those items will be included in this category and the column label annotated (i.e., by use of an *) to indicate that additional items have been included.

7. COLUMN (6), AMMUNITION: This column refers to the ordnance materiels that produce the destructive effects of the aircraft system. Ammunition to be costed with the aircraft system normally will be the increase in the Authorized Acquisition Objective (AAO) resulting from the introduction of the system into the Army inventory.

8. COLUMN (7), PECULIAR SUPPORT EQUIPMENT: This column refers to those equipments required to maintain and care for the Aircraft System while not directly engaged in the performance of its mission, and which have application peculiar to the aircraft system being analyzed.

9. COLUMN (8), COMMON SUPPORT EQUIPMENT: This column refers to the equipment required to maintain and care for the aircraft system while not directly engaged in the performance of its mission, and which are presently in the DOD inventory. It includes the acquisition of additional quantities of these equipments if caused by the introduction of the aircraft system being analyzed.

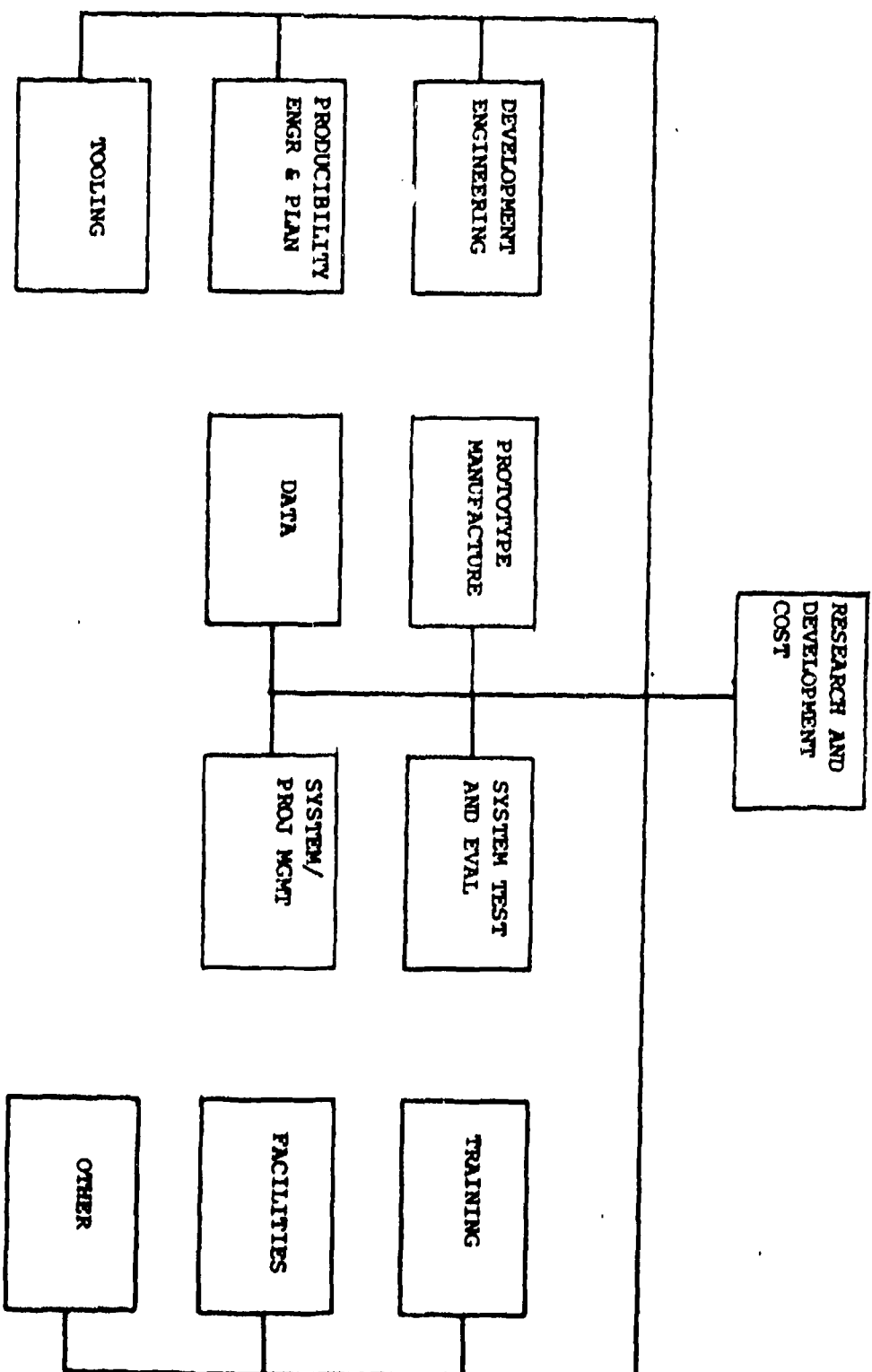
10. COLUMN (9), TO BE SPECIFIED: This column is reserved for use to highlight a subsystem of high management interest that would otherwise be submerged in one of the above hardware categories (columns).

11. COLUMN (10), OTHER: This column refers to that equipment required by the aircraft system but not elsewhere classified or which cannot be subdivided into the other major categories (columns).

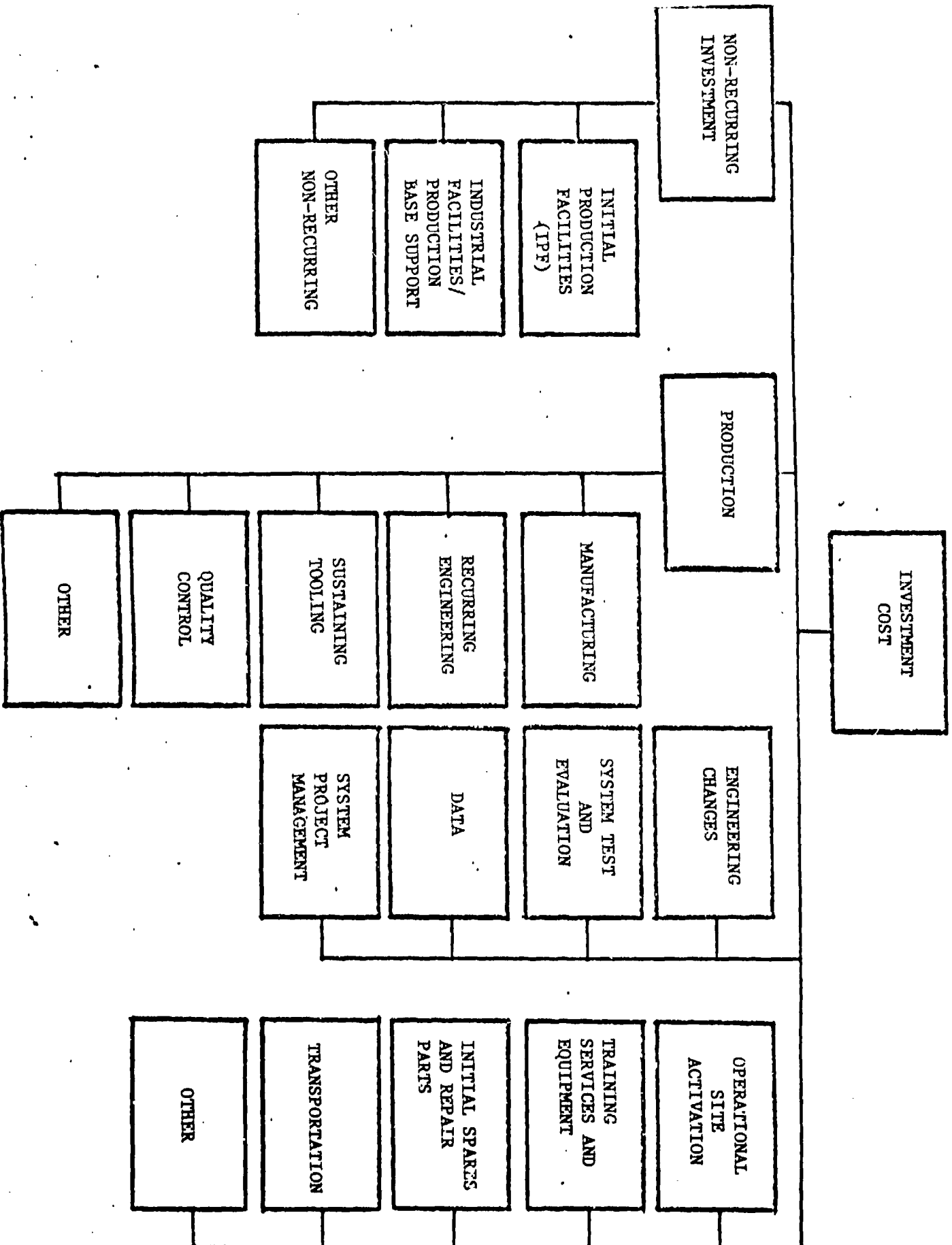
*Source: Department of the Army (DA) Pamphlet No. 11-2, Research and Development Cost Guide for Army Materiel Systems, May 1976.

APPENDIX E
Schematic Structures

RESEARCH AND DEVELOPMENT COST ELEMENTS
SCHEMATIC STRUCTURE



INVESTMENT COST ELEMENTS SCHEMATIC STRUCTURE



APPENDIX F

TYPICAL DATA RETRIEVAL SOURCES

- I. Contracts
- II. Cost Performance Report (CPR)
- III. Selected Acquisition Report (SAR)
- IV. Review and Command Assessment of Projects (RECAP)
- V. Cost Schedule Status Report (C/SSR)
- VI. Contract Funds Status Report (CFSR)
- VII. Cost Schedule Control System (C/SCSC)
- VIII. Contractor Cost Data Report (CCDR)
 - A. Cost Data Summary Report, DD Form 1921
 - B. Functional Cost Hour Report, DD Form 1921-1
 - C. Progress Curve Report, DD Form 1921-2
 - D. Plant-Wide Data Report, DD Form 1921-3
- IX. Cost and Operational Effectiveness Analysis (COEA) Studies
- X. Five Year Defense Plan (FYDP)

APPENDIX G

Hardware Components---Potential Qualifiers

A. Airframe.

1. Fuselage
2. Wings (Fixed Wing Aircraft)
3. Landing Gear and Wheels
4. Power Plant
5. Rotor Systems
6. Transmission Systems
7. Drive Systems
8. Hydraulic Systems
9. Instruments
10. Electrical System
11. Fuel Systems
12. Flight Control Systems
13. Furnishings
14. Cargo or Personnel Handling Systems
15. Auxiliary Power Unit
16. Avionics
17. Reconnaissance Equipment
18. Utility Systems

B. Power Plant.

1. Engine
2. Compressor
3. Combustor
4. Turbine
5. Gear Box
6. Lubrication System
7. Fuel Control System
8. Power Turbine Governor

C. Other Propulsion.

1. Propellers
2. Controls

D. Communications.

1. Intercom
2. Radio System
3. Data Link
4. Control Units

E. Navigation/Guidance.

1. Radar
2. Directional Radio
3. Radar Altimeter
4. Doppler Compass
5. Computer

F. Fire Control.

1. Radar/Sensors
2. Navigation and Air Data System
3. Displays/Scopes/Sights

G. Penetration Aids.

1. Ferret and Search Receivers
2. Warning Devices
3. Electronic Countermeasures
4. Infrared Jammers
5. Infrared Decoys
6. Terrain Following Radar

H. Reconnaissance Equipment.

1. Photographic and Electronic Equipment
2. Infrared/Sensors
3. Search Receivers

I. Automatic Flight Control.

J. Central Integrated Checkout.

K. Armament.

L. Weapon Delivery Equipment.

M. Aircraft Survivability Equipment.

APPENDIX H

RECAPITULATION OF NONRECURRING COST ON SALES OF MAJOR AND NON-MAJOR DEFENSE EQUIPMENT

(Hypothetical Sample)

Weapon System or Component	Nonrecurring Cost \$ Thousands			Production Quantity					Recommended Pro Rata Unit Charge		
	RDT&E	*Prod	Total	Army	Navy	Air Force	MAP/PJS Direct	Total	RDT&E	*Prod	Total
UH-1H (Airframe)	260,400	50,300	310,700	575	169	-	1500	2544	102.4	19.8	122.2
UH-1H (Engine)	36,390	75,600	111,990	1630	300	-	2700	4630	7.9	16.3	24.2
Main Rotor Blade	9,500	5,000	14,500	1000	200	-	1600	2800	3.4	1.8	5.2

Note: *Production.

Remarks: Costs presented in constant FY 1973 dollars.