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METHODOLOGY
FOR ESTIMATING SOVIET MILITARY EXPENDITURES

Office of Research and Reports
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FOREWORD

This report is one of several undertaken by this Office as part of an overall study of Soviet military expenditures. The orientation of the report is directed toward the methodology employed in estimating and analyzing these expenditures

The purpose of the report is to provide sufficient technical details to permit independent evaluation of the results and conclusions. These findings have appeared primarily as contributions to the 11-4 series of National Intelligence Estimates dealing with Soviet capabilities. An extensive presentation of the findings is yet to be published.

A series of reports more limited in scope is being prepared to provide more exhaustive treatments of specific topics. The following two reports in this series have already been published:

No appendixes on methodology and gaps in intelligence have been included in this report, because the report is primarily methodological.

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METHODOLOGY
FOR ESTIMATING SOVIET MILITARY EXPENDITURES*

I. Introduction

The studies of Soviet military expenditures referred to in this report began several years ago when it became apparent that a more comprehensive means of determining the economic implications of Soviet military activity was required. Meaningful aggregative data of Soviet origin were not available, necessitating some method of deriving suitable substitutes. Investigation indicated that a surprising amount of quantitative data either was directly available or was inferable from the context of programs. A system of accounts was evolved to encompass the pertinent Soviet activities in a manner that would best facilitate the employment of the data at hand and describe these activities in accordance with the various concepts with which these Soviet programs might be viewed meaningfully and profitably.

Section II of this report deals with general methodology and presents the system of accounts, its purpose, and its use. There follows a discussion of certain broad methodological problems primarily associated with pricing.

Section III presents the specific methodology employed to quantify, in monetary terms, each of the programs and activities represented by the accounts. The organization of the system of accounts is adhered to, and discussion of the method, problems, and techniques concerning the respective ruble and dollar values is included. Most of this discussion is found under subheadings for ruble values because ruble valuation is fundamental to the studies.

Finally, Appendix A of this report is devoted to the question of whether or not the Soviet military establishment pays the turnover tax; Appendix B, to the presentation of weighted ruble-dollar ratios; and Appendix C, to price indexes used to change both ruble and dollar price bases.

* The estimates and conclusions in this report represent the best judgment of this Office as of 1 May 1960.

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II. General Methodology

A. Framework

For the purposes of these reports the term Soviet military expenditures defined to comprise programs and activities that are comparable to those covered by US major national security expenditures -- that is, the military functions, including military assistance, of the Department of Defense and the entire program, military and civil, of the Atomic Energy Commission. Thus all of the functions usually associated with military establishments are included and, because of the need for comparability, the nonmilitary nuclear energy program as well. Inclusion of investment in the nuclear energy program is an exception. Otherwise, investment in armament plants and the like are specifically excluded.

Given this delineation of the scope of these reports, a system of accounts was derived that would accommodate both the desired end products and the available data. Any such system of accounts will be but one of many that might serve adequately, but as long as the requirements necessary to fulfill the objectives are met, a satisfactory product will result. These requirements are (1) adequacy to represent all those facets of Soviet military and related activity in the appropriate detail and format, (2) adaptability of the estimated military expenditures to reconciliation with Soviet budgetary and national accounts, and (3) sufficient detailing to provide combinations that facilitate comparison with US outlays in a manner that will minimize distortion.

1. System of Accounts

The system of accounts for military expenditures is presented in Table 1,* along with definitions of the accounts. As will be noted, the major categories I through V are conventional in nature and include those functions directly associated with a military establishment. Category VI (Other Programs and Activities) is a residual category and includes the nuclear energy program mentioned above, as well as two activities that have yet to be specifically incorporated into these reports, international transactions and stockpiling.

In short, these accounts represent programs and activities that go beyond what is usually ascribed to the term military. Technically this term has a relatively narrow and specific definition that refers to activities of the army, but more commonly it is used to indicate the activities of all the armed services. In spite of these problems, the term is used in this report: it is concise, denotes the general meaning intended, and has tacit acceptance through accepted usage.**

* Table 1 follows on p. 5.

** Another term, defense, is widely used in this context but has been rejected for purposes of this report for several reasons relating to the ambiguity of its use. The term is likely to be used as a seemingly all-inclusive sector of activity when used as an end-use category in national accounts, although when so used it is adjusted in accordance with standard Western practice in compiling such accounts. At times the term appears to represent no more than the activities of the US Department of Defense. As sometimes employed, the term is synonymous with major national security. There are also occasions when its use seems to be predicated on the desire to represent US philosophy about such activities, and in such instances the term is likely to be used to denote any broad grouping of pertinent activities. Finally, the USSR uses the term to denote its announced allocation to the Ministry of Defense. Although it is seemingly implicit in its title that this allocation covers all Soviet outlays of direct military significance, ^(Footnote continued on p. 4)

2. Flexibility in Coverage and Format

Examination of this system of accounts will indicate that it is capable of assimilating both US and Soviet data as they originate in published or other form. The structure of the Soviet system of accounts makes it a relatively simple matter to accommodate its entries to their respective counterparts in the derived system. 1/* Similarly, US data are reconcilable with this system: the major categories (those with Roman numerals) are very much like those now used by the US Department of Defense. 2/ There are, however, some appreciable differences with respect to specific accounts within these categories.

Thus flexibility, in the first instance, is nothing more than the ability of the system to incorporate the desired degree of detail, whether it is of the sort just enumerated or not. To achieve flexibility, subaccounts are in use, and further extension of the system in this direction is to be expected. It is important that extension of this kind should be possible without major changes in the system.

The system also is intended to provide a basis for assimilation of detail oriented to different levels of aggregation. It is intended to provide a similar flexibility with regard to presentation, and thus to format. In this vein the system of accounts is designed to be used in two ways. It may be used to categorize total expenditures according to the accounts: that is, each entry -- for example, aircraft -- would represent all the expenditures made by or for the Soviet military establishment for that activity. The system may also be used on a more limited basis, one that permits an entirely different orientation for categorization of the outlays associated with missions or functions, such as, air defense or strategic capabilities. Hence, in considering the Soviet air defense system as a separate entity, the outlays for major equipment would be under category II, the outlays for airfields under IV, personnel under I, and so on. In either case, therefore, the same accounts would be used, and most of them are likely to be applicable.

Similarly, the accounts may be employed to differentiate initial (investment) costs and operating costs regardless of whether total expenditures or those associated with a particular mission are at issue. When the accounts are used in this manner, most but not all are likely to be found necessary. For example, in delineating the cost to the Soviet government of establishing an operational long-range air force base, most of the accounts would have to be employed. There is little problem in viewing items under procurement and construction and even research and development as investment, but it should be noted that the initial training of personnel, as well as certain entries under operations and maintenance, may well be ascribed to investment.

Most of the accounts may also be applicable when considering the operating expenditures associated with such a program. In this instance, however, the appropriate accounts would more likely be limited, largely because there are entries for the maintenance of facilities and equipment under category III, Operations

Soviet use of the term does not conform to Western definitions in this respect.

Other terms are also in use, most notably that term with which these accounts seek comparability, major national security. This term, however, is awkward if only because of its length, and it has some of the same connotations as the word defense.

* For serially numbered source references, see Appendix D.

A System of Accounts for Military Expenditures

Categories and Accounts for Expenditure

Definition

I. Military personnel

Pay and allowances, subsistence, clothing, and miscellaneous items of supply for all militarized personnel on active duty and payments to retired career personnel.

A. Active regular service

Ground, naval, and air force career and conscript personnel on active duty. The components, such as pay and allowances, are considered separately for each service and for branches of the respective services.

1. Pay and allowances

Regular pay, for rank, position, and length of service; and allowances, such as those for food and quarters; special pay, such as that for location, language competence, and hazardous duty.

2. Subsistence (food)

Food served in or dispensed by military facilities. The different rations need to be considered.

3. Clothing

The basic issue only. Special clothing -- for example, flight gear -- is included under organizational equipment. Differentiation in issues for tank and grade need to be considered.

4. Miscellaneous

Soap, matches, and other miscellaneous items.

B. Militarized security

Elements of security forces that have military capability, such as, border troops.

1. Pay and allowances

See A, 1, above.

2. Subsistence (food)

See A, 2, above.

3. Clothing

See A, 3, above.

4. Miscellaneous

See A, 4, above.

C. Reservists

Persons with reserve status called to temporary active duty, such as summer training.

1. Pay and allowances

Compensation of reserve personnel. For Soviet reservists the term pay and allowances is not applicable; recompense comes from their normal place of employment.

2. Subsistence (food)

See A, 2, above.

3. Clothing

See A, 3, above.

4. Miscellaneous

See A, 4, above.

D. Retirees

Retired military career personnel.

1. Pensions

Payments received after retirement.

A System of Accounts for Military Expenditures
(Continued)

Categories and Accounts for Expenditure

Definition

II. Procurement

Equipment purchased primarily for operational use. Initial spares and replacement items are included; prototypes and other developmental models are excluded.

- A. Aircraft
- B. Armored combat vehicles

All combat and other aircraft purchased by the military establishment.

Tanks, assault guns, armored personnel carriers, armored scout cars, and hard-skinned amphibious vehicles.

- C. Artillery and other weapons

Artillery, including anti-aircraft artillery, rocket launchers, mortars, and small arms.

- D. Ammunition

All ammunition, including aerial bombs (conventional), mines, and torpedoes.

- E. Trucks

All soft-skinned vehicles.

- F. Naval vessels

All combat, transport, and auxiliary vessels of the naval establishment.

- G. Ground electronics

All noncommunications ground electronic equipment -- for example, ground radar and electronic countermeasures equipment -- that is not an integral part of other equipment and the electronic elements of ground communications equipment. All other electronic equipment is integrated with the respective weapons and equipment and their operating spare parts.

- H. Guided missiles

All ballistic and air breathing missiles, their ground guidance, and their support equipment.

- I. Organizational equipment

All other operational equipment, including that for maintenance, construction, general purposes, and special purposes.

III. Operations and maintenance

Outlays, other than those for military personnel, to operate and maintain military forces.

- A. Civilian personnel

All civilian employees of the military establishment. Most of these employees are engaged in operations and maintenance.

- 1. Pay and allowances
- 2. Subsistence (food)
- 3. Clothing
- 4. Miscellaneous

Salaries; wages; such emoluments as those for hardship posts; and such allowances as those for food, clothing, and quarters.

Where applicable, rations that are issued.

Where applicable and issued.

Where applicable and issued.

- B. Maintenance of facilities

Materials and supplies for the maintenance of items under IV, below.

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Table 1
A System of Accounts for Military Expenditures
(Continued)

Categories and Accounts for Expenditure	Definition
III. Operations and maintenance (continued)	
C. Petroleum products	All petroleum, oil, and lubricants purchased by the military forces.
D. Maintenance of equipment	Operating spare parts for equipment. (See II, above.)
E. Transportation	All outlays by or for the military establishment to transport men and materiel and for transportation charges that are not included in the prices of items purchased.
F. Medical care	Medical supplies. Expenditures for construction of medical facilities are included under IV, E, below; for medical personnel, under I, A, and A, above; for equipment, under II, I, above.
G. Printing and publishing	Outlays for printing, publishing, and purchasing such items as military manuals and texts.
H. Other	Outlays for such US activities as the promotion of rifle practice and such miscellaneous Soviet activities as the support of the All-Union Society for the Promotion of the Army, Aviation, and the Navy (Vsesoyuznoye Dobrovol'noye Obschestvo Sodeystviya Armii, Aviatsii, i Flotu --- DOSAAF).
IV. Facilities	
A. Facilities for operation of equipment	Facilities from which combat equipment is operated such as airfields and naval bases.
B. Facilities for maintenance of equipment	Facilities for the maintenance of combat and support equipment.
C. Facilities for personnel	Facilities for housing.
D. Fixed communications facilities	Permanent communications facilities, including wireline and all equipment other than electronic equipment. The electronic equipment is included under II, G, above.
E. Other facilities	Administration, storage, training, hospitals, mess, and similar facilities.
V. Research and development	All research and development, including development, test and evaluation, for militarily significant purposes.
VI. Other programs and activities	All other programs and activities deemed relevant.

A System of Accounts for Military Expenditures
(Continued)

Definition

Categories and Accounts for Expenditure

VI. Other programs and activities (continued)

A. International transactions

Those transactions and activities that have a direct bearing on the extent and burden of military expenditures and involve another country.

1. Trade

Transactions involving the international movement of military goods and services.

2. Occupation costs

Payments made by an occupied country to the occupier.

3. Reparations

Payments made as recompense for war damage.

B. Stockpiling

Outlays for stockpiling critical and strategic materials and for the expansion of the production of critical materials.

C. Nuclear energy

The entire outlay for nuclear energy programs, including those not of direct military significance.

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and Maintenance. Thus categories II and IV might not be necessary, * and categories V and VI are unlikely candidates for use under such circumstances.

3. Budgetary and National Accounts

When the estimates of military expenditure are to be reconciled with or incorporated into budgetary analysis or national accounts, there are various adjustments that need to be enforced.

The basic values of these studies are the annual expenditures of the USSR for designated or all military programs. To depict trends, these values are expressed in constant rubles -- prices for a base year are applied to physical measures over a period of time. Because these prices reflect productivity gains wherever feasible and appropriate, in certain instances the constant price basis is one of constant input prices.** Such prices are believed to reflect costs to the Soviet government and therefore to be representations of transfer prices.***

The constant price basis is not directly suitable for budgetary analysis that, perforce, is accomplished in terms of current prices. Hence the basic values of military expenditures must be converted by suitable price indexes instead of attempting to revalue each program, activity, commodity, and service in the prices appropriate to every year under consideration.

To the extent that input prices constitute a part of the underlying price basis, it is not suitable for national accounting where series are usually expressed in market prices. To obtain market prices, indexes of production have been applied to base-year values of the original series in these instances.

Other considerations besides price bases play a part. In the case of budgetary analysis, there is the question of the specific sources of funds, budgetary and otherwise, for the various military programs and activities. For national accounts, there is still the matter of conforming to the concepts and purposes of such accounts. Transfer payments must be removed, adjustments necessary to

* They might be used when the replacement of attrited items, for example, is treated as an operating expense.

** For a more extensive discussion of some of the aspects of price bases, see III, B, 1, a, p. 31, below.

*** In these reports, costs of production are not being measured except insofar as they are reflected in price. Naturally, cost information must be resorted to frequently, but conceptually it should represent no more than a means of attaining transfer prices. It is not meant that cost should be lightly dismissed. Some of the expenditures that are included are best and most often described in cost terms. Illustrative is overhead in the usual business sense. In and of itself, overhead for given military programs can be difficult to measure; it becomes more so when common overhead must be apportioned among several programs. Of course, overhead is but one of several costs that might require allocation among programs -- the joint product case -- requiring, in effect, application of concepts of cost accounting.

One need not, even in these instances, however, orient oneself to cost. Practically, however, it is almost unavoidable. For example, costs must be used at times to reflect price, and production functions are based on costs.

depict returns to the factors of production must be made, and categorization by end use and sector of origin is required.* For these studies, the removal of transfer payments involves no more than removing pension payments to retired career personnel. The depicting of returns to factors of production entails removal of indirect taxes. With regard to categorization by end use, investment must be distinguished. Somewhat more is required for categorization by sector of origin -- the military programs and activities must be allocated to industry, agriculture, construction, transportation, communication, trade, and services. Even outside the context of national accounting, there is need for allocation by sector of origin. One of the goals of the studies of Soviet military expenditures is to be able to assess the impact of the military programs and activities on specific sectors of industry.

4. International Comparisons

By definition the scope of military expenditures corresponds to that of US major national security expenditures. Hence any problems are most likely to revolve around detailed comparisons, particularly the obtaining of US or other Western expenditures in a manner that corresponds to the specific accounts used in these studies of Soviet expenditures.

B. Broader Methodological Considerations

1. Ruble Valuation

Reduced to its most fundamental form, the basic methodology underlying the estimation of Soviet military expenditures is price times quantity. That is, prices in rubles are applied to physical measures representing the goods and services procured and/or produced for the Soviet military effort. Obviously this methodology can rarely be used in this most simple manner and at times cannot be used at all.

Several general considerations of significance relate to the prices. Most of these considerations reduce essentially to the problem of whether or not the Soviet military establishment pays the turnover tax and to the problem of full cost pricing: that is, whether or not the prices paid by the Soviet Ministry of Defense or its agents represent the full cost, in the Western sense, of producing the goods and services purchased.**

a. Turnover Tax

The turnover tax is probably the only Soviet tax of importance with regard to military financing, and its impact is felt only in certain areas. As a rule, this tax is only applicable to consumer goods and not to producer goods. Hence the items for which it becomes significant in terms of the bill of goods and services appropriate to the Soviet Ministry of Defense are limited: food, clothing, and petroleum products.***

* Although other considerations exist, these are the common ones.

** The turnover tax is not completely divorced from the question of full cost. To the extent that turnover tax receipts are viewed as returns to a factor of production -- for example, land -- it is relevant.

*** The rates of the turnover tax for these items are sufficiently large as a percentage of wholesale and retail prices (generally from 30 to 50 percent) to warrant the designation insofar as they are an ingredient of price.

Although these taxes as estimated constitute a relatively small percentage of the total Soviet military outlays, an appreciable sum in absolute terms is at issue. The magnitude of these taxes assumes considerable importance in the context of over-all Soviet economics, specifically with reference to personnel costs and budgetary and national accounts.

The evidence as to whether or not the Ministry of Defense pays the turnover tax and to what extent is not conclusive in any ultimate sense.* It seems quite clear that the Ministry is paying this tax, but it cannot be judged whether or not payments are in full and paid wherever normally applicable. The evidence, however, justifies a working hypothesis that the standard rates of taxation are appropriate to military transactions.

b. Full Costs of Production

General Soviet policy in establishing industrial prices -- and the major pricing problem of concern here relates to major items of military hardware -- is well known. With the exception of rent and interest, the usual factors of cost, including profit, are included in the price base, although it is recognized that the depreciation allowances taken into account are unrealistically low, particularly from the point of view of obsolescence.

Whether or not this same general policy is applicable to major items of military equipment is not fully known. Two documents dealing with the Polish situation provide the only knowledge of this sort. Given the efforts of the USSR to mold the Satellites in its image, the same system may be pertinent within the USSR as well.

The first of these documents is a decree signed in 1955 by Marshal Rokossowski, who was then Minister of Defense of Poland. The decree deals with the pricing of special order goods produced under the aegis of the Ministry of Defense. ^{3/} The items of cost to be covered seem to center on the direct and easily measured inputs of labor and materials. Some slight consideration apparently is given to elements of overhead, and 3 percent of calculated costs is to be added in some instances for profit. There is, however, no indication as to the scope of this decree in terms of the items to which it pertains. It may only be speculated that its scope is indeed broad, because most military items are special-order goods in that they are contracted for on a job lot basis.

General confirmation is provided by source ^{4/}, which lists the elements of cost covered by the prices established for military items. This list is somewhat more inclusive with regard to overhead than the decree just cited and makes mention of depreciation allowances. The rate of profit (as a percentage of calculated costs) is stated to be 5 percent as opposed to the 3 percent previously noted.**

Of the numerous other factors that may influence the extent to which prices paid by the Soviet military establishment represent full cost of production, those most likely to be of concern are local taxes, subsidies, research and development, and the performance of certain industrial, agricultural, or commercial functions by the Ministry of Defense. In the matter of local taxes, all

* For a discussion of this evidence, see Appendix A.

** It is also of interest that this same source indicated that in cases where the Ministry of Defense provides the raw materials the profit margin is 10 percent.

that can be said at this juncture is that there is some reason to believe that enterprises may be excused from paying these taxes to the extent they are involved in production for military consumption. As a corollary, these enterprises then may be denied the right to include these taxes in the prices that they charge the military establishment.

Subsidies may take many forms but inevitably their existence means that special prices -- that is, lower prices than might otherwise be the case -- are in effect. If such subsidies do exist to any appreciable degree, one or both of two methods of subsidization are likely to be in practice: either (1) there is centralized reimbursement of the producer for such reductions as are granted to the Ministry of Defense and/or (2) the burden of price concessions is shifted, in whole or in part, to civilian production within the jurisdiction of the same producing unit (plant or factory) or perhaps within the same Council of the National Economy (Sovet Narodnogo Khozyaystva -- Sovnarkhoz); ministry, or other broad administrative echelon. The evidence so far accumulated on this matter suggests that such subsidization is not the usual practice but that there are circumstances in which it is operative.*

The costs of research and development might be expected in some circumstances to be included as an element of cost for purposes of price determination. Certainly these costs are so included in many areas of the Soviet economy. Whether or not they are included by the USSR with regard to military research and development, however, is not of consequence to these studies; the prices employed, by design and good fortune, appear to be exclusive of such costs.** Hence this aspect of cost is estimated as a distinct entity and is not reflected in the estimated outlays for such items as hardware; it is accounted for separately.***

Those savings in outlay that may be accruing to the Ministry of Defense because, for all practical purposes, it is engaged in industry and/or agriculture are a separate problem. As was true of subsidies, there is a dichotomy. One aspect of the problem relates to those possible instances in which the Ministry "owns" and/or operates plants, farms, and the like. Given rough equivalence in the efficiency of operation, the fact that "free" military personnel may be staffing these operations should lead to a lower marginal cost to the military establishment for the product. Only limited knowledge is available, however, as to the extent of such operations. Of some 200 million hectares in cultivation in the USSR, only 4 million hectares are estimated to belong to subsidiary farms. In view of the widespread practice by which industrial and other organizations have subsidiary farms, it is unlikely that the acreage farmed by military units accounts for a large enough share of the 4 million hectares to be significant in light of the food requirements of the Soviet Ministry of Defense. Hence it seems probable that agricultural operations are not likely to result in any appreciable, unaccounted-for advantage accruing to the Soviet Ministry of Defense.

* Scattered information on prices paid by military organizations for items of fairly general consumption indicates payment of standard prices. An occasional reference to special prices raises the likelihood of circumstances in which, in effect, there is subsidization. Several defectors indicate a widespread practice of subsidization of military items, but there is no confirmation. For a fuller discussion in the context of the turnover tax, see Appendix A.

** For a more complete discussion see III, E, p. 66, below.

*** See Category V, in Table 1, p. 5, above.

The other aspect of the problem relates to the processing facilities that may be organic to military units. For example, a given unit may have the facilities for slaughtering meat and could effect reductions in outlay, at least to the extent of its labor inputs. In such instances tax savings may also occur. Such a situation is possible because facilities of the nature indicated would permit purchase of less processed products, and the turnover tax is applied incrementally at the various stages of processing.

To date, it has not been possible to assess quantitatively whether or not the full costs of production to the Soviet economy are being reflected in the derived monetary valuations. To the extent, however, that the price information used is accurately based on the prices actually paid by or for the Ministry of Defense, the reasonable conclusion seems to be that the resulting estimates in terms of rubles are something less than the full cost in the Western sense.

2. Dollar Valuation

For international comparison the estimated Soviet expenditures are valued in US dollars. To do so, a simple concept has been chosen and adhered to that the outlays represent what would be required if the Soviet military programs were purchased in the US. The dollar values thus obtained do not reflect the "real cost" of military programs to the USSR, but they do represent a magnitude that may be compared in absolute terms with like US outlays.

Where fundamental incomparability of product exists, the situation is ameliorated by recourse to estimates of the cost in dollars of the Soviet item if it were to be produced in the US.

The basic method of valuation is the same as for ruble valuation: price times quantity. There are instances, however, in which direct application of dollar prices is not feasible, and the valuation is accomplished through the use of dollar-ruble ratios. Some of these ratios are based on price information that is directly applicable; others are ratios for broad categories of goods. Even in the latter instance, however, there is usually enough evidence to justify this procedure.

Two phenomena deserve special mention in connection with dollar valuation of the Soviet military effort. In the first instance, military goods and services are less expensive in relation to other goods and services in the Soviet economy compared with the relationship of military goods and services to other goods and services in the US economy.* Thus, when measuring intensity of effort in respective domestic currencies, that of the USSR appears relatively low and that of the US relatively large. The second phenomenon, one that perhaps more clearly illustrates the danger of measuring the intensity of the Soviet effort in dollars rather than rubles, concerns manpower. When Soviet manpower is priced in the US market, it is accorded US military wages** -- that is, what a man "costs" in the US. This amount of money represents a far greater demand on resources than does its ruble counterpart.

* These relationships in the respective countries say nothing about the relative efficiencies of the two countries in this area of production.

** Including allowances and payments in kind with regard to food and clothing.

3. Timing

There are two elements not yet discussed that also deserve general mention. Both relate to time, although in entirely different respects.

The first relates to the need to move monetary relationships or value to different price bases -- that is, expressing them in terms of prices of another time period. This need arises when the basic estimates of expenditure, which are in constant prices, must be expressed in current prices for budgetary analysis and when a new base year is chosen. To accomplish these conversions, price indexes are most often employed. Because of their general nature, these indexes represent a greater degree of uncertainty than do most of the elements that relate to price. This statement applies particularly to those indexes used for major items of military hardware and is equally applicable for the US and the USSR. Usually, general industrial indexes or indexes for materials and broad categories of equipment are all that are available. In a few instances, seemingly contradictory evidence is at hand and there is nothing available to permit positive resolution. Information on inputs and productivity, however, is sufficient to permit judgment as to the direction and, to a lesser degree, to the general magnitude of the changes.

The second element relates to the time leads or lags between production and procurement, for example, and the relationship between these leads and lags and financial practice. In these reports the problem is particularly pertinent with regard to procurement,* where production of major items of equipment is used. Fortunately, for many purposes the leads and lags do not introduce serious error. The one area in which they might introduce error of concern to these reports is analysis of specific Soviet budgetary allocations, where relatively minor displacements in time can be troublesome.

4. Estimates of Error

Such discussion naturally leads to the question of the error involved in this report in general. As may be expected, no objective mathematical or statistical computation of margins of error is possible. Resort must be had to subjective assessment.

It will be noted that, for the most part, estimates of the error have not been presented in the treatment of the various categories in this report. The discussions do give some basis for evaluation, to the extent that one may conclude that a given estimate is good, bad, or not evaluable. In fact, the impression left may be unduly harsh: the material bearing on means of refinement or improvement is somewhat idealized and reflects what would be desired, not what is necessarily required, for a basically sound estimate.

The errors of the various estimates vary considerably -- some may be well within 10 percent; others are considerably larger. Quantitative assessment has been largely limited, however, to the aggregated results. Total Soviet military expenditures have an estimated error of plus or minus 20 percent, with a probability of 90 percent.

* See III, B, p. 30, below.

III. Methodology for Specific Categories of Expenditure

A. Military Personnel*

1. Active Regular Service

a. Pay and Allowances

(1) Ruble Values

The procedure basic to estimating the bill for pay and allowances of Soviet military personnel is one of applying rather abundant information on military wages to detailed tables of organization. ** This procedure is used almost all types of units, including headquarters, for the Soviet air and ground forces. The sample priced in this fashion represents about 60 and 80 percent, respectively, of the total strength of these services. *** The estimate for the naval forces is determined by applying average rates for their counterparts in the other services. The available sampling of naval pay data confirms the validity of this procedure.

The ruble estimates thus obtained are probably somewhat conservative. This conclusion is based primarily on the high degree of reliability of the wage data on hand and the fact that certain allowances and special forms of pay, such as those for subsistence and for language competence, have not been included.

(2) Dollar Values

Dollar equivalents of these estimated ruble outlays are obtained by applying average US military wages to the corresponding Soviet manpower. † Differences in the composition of the forces are taken into consideration by selecting average US wages for a year in which the general composition of the forces of the two countries are believed to be most similar. †† Average rates of increase are applied to make these rates of compensation appropriate to the time period being considered. †††

It is recognized that the method of obtaining US dollar equivalents has certain shortcomings. In the first instance, adequate detailing of the US mix has not been accomplished. Second, the average rates of increase used to move base-year US military wages ‡ reflect the composition of the US armed forces at the time of changes in the pay structure rather than rates of increase

* For definitions of the various accounts, see Table 1, p. 5, above.

** For complete description of data and methodology, see source 5/.

*** For the ground forces, this approach is limited to a base year. Values for the other years are obtained by applying the average recompense for officers and for other personnel (obtained from the basic calculation) to their respective strengths, after allowing for the effects of changes in over-all strength and in tables of organization.

† In terms of 1955 relationships, \$3,400, including allowances. (Dollar values are given in US dollars throughout this report.)

†† In no year is comparability really satisfactory.

††† In 1952, there was an average increase of 4 percent 6/; in 1955, an increase of 11.9 percent 7/; and in 1958, 8 percent. 8/

‡ This procedure is used in order to minimize changes in composition of the armed forces.

known to be appropriate to the composition of the forces in the base year. In addition, for purposes of obtaining dollar equivalents, the composition of the Soviet armed forces is treated as if it has remained constant. Finally, there is some question of comparability with regard to the inclusiveness of the rates of remuneration in the two countries. As noted, certain Soviet allowances and other forms of recompense -- those for subsistence, those for some forms of hazardous duty, those for awards and bonuses, and several other rather minor ones -- are not incorporated in the construction of the Soviet pay bill. Some allowances, such as those for subsistence and clothing, are included, at least conceptually, with expenditures for other programs and activities. (See the discussion of subsistence, b, below, and clothing, c, below.) The aggregative data employed for pay and allowances, however, are all-inclusive. Relative comparability is achieved by reducing US outlays for pay and allowances by the estimated payments for subsistence and clothing and including those payments with other categories of expenditure.

The fact that US and Soviet allowances differ somewhat in definition is not relevant for most purposes. The primary purpose in wanting an expression of these outlays in both rubles and dollars is to be able to reflect the costs of certain types of manpower both in domestic terms and within the framework of the scarcity relationships existing in the other country. Hence, as long as the initial concept of pay and allowances is complete for both the US and the USSR, no violence is done to the accomplishment of the stated purpose. Furthermore, the differences in definition or scope are of little concern, in that quantitatively they are negligible compared with the major elements that are included in the pay bill and discussed in this report.

(3) Ruble-Dollar Ratios

A Soviet-weighted ruble-dollar ratio is immediately derivable by dividing the ruble value for pay and allowances by its dollar equivalent.* A US-weighted ratio may be obtained by estimating the pay and allowances of US military personnel in rubles. The value so obtained, divided by the actual dollar expenditures for this purpose, will yield the desired result.

(4) Further Considerations

With regard to ruble valuations the need for additional data is primarily a matter of the following:

- (a) Rank and position pay for officers with the rank of general of the army or higher;
- (b) Position pay for seagoing naval personnel of all ranks and grades; and
- (c) Position pay for those ground and air force slots where such pay is currently derived by extrapolation.

* This computation gives a ratio of 1.9 rubles to US \$1 in terms of 1955 relationships. The ratio would vary slightly over time, even in constant monetary terms, if only because of the effect of changes in the composition of forces.

Improving dollar calculations is largely a matter of incorporating more detail relating US pay and allowances, by rank and function, to the mix of the US armed forces.

b. Subsistence (Food)

(1) Ruble Values

The determination of the outlays for food by the Soviet Ministry of Defense for its military personnel is reduced to a rather simple formula that is believed to produce rather sound results. The procedure employed is the pricing of the basic Soviet military ration.*

A circular of the Quartermaster General of the Armed Forces of the USSR that was issued in 1949 provided the details of the basic ration. 9/ Other sources confirm that the prescribed ration is approximated in practice and that it has undergone little or no change. 10/ That circular is sufficiently detailed in that it includes "norms" for both quantity and quality, for the amounts of "foodstuff [to be] placed in kettle per man per day," and for the "wast [to be expected] in processing foodstuffs [before cooking]."

Table 2** presents this basic military ration in the USSR in terms of weekly requirements per capita. The prices applied to the specified quantities represent average annual Moscow prices for purchases at wholesale rates. Hence the turnover tax*** is included, but retail trading margins have been eliminated.

The resulting required outlays for a weekly ration per capita are converted to an annual outlay per capita which is, in turn, applied to the total regular service manpower on active duty. Clearly this method is not realistic, first, because it is known that there are several military rations, the one used being the least costly, † and, second, because officers and also re-enlistees receive a subsistence allowance reported as 200 rubles per month. †† One source indicated that officers eating at base mess facilities have to add 200 rubles per month to their allowance for this purpose ††† in order to meet the charges. This expense is personally borne, however, and thus is not a direct cost to the Ministry of Defense. It is of most importance that the Ministry of Defense is presumably bearing a subsistence cost of 2,400 rubles per year for each officer, whereas the

* Thus only current needs are taken into account. Reserves of food for the military establishment may be part of the Soviet stockpiling program and not an expenditure of the Ministry of Defense.

** Table 2 follows on p. 18.

*** For discussions of this tax, see II, B, 1, a, p. 10, above and Appendix A.

† Substantially so, according to one source, 11/ which cites a cost of 324 rubles per month per person for the universal military ration and 941 rubles per month per person for the ration issued to flying personnel. The cost of other military rations lies somewhere between these extremes.

†† Those stationed in East Germany, however, do not receive a monetary allowance but are issued their full ration, contributing nothing.

††† 12/. The amount has also been reported as one-half the cost of their rations. Something on the order of 200 rubles per month seems reasonable in view of the probable relationship between the cost of the basic ration and the cost of the ration probably received by officers.

Table 2
Cost of the Basic Military Ration in the USSR a/

Item	Net Ration (Grams per Week)	Waste (Percent of Gross Ration)	Gross Ration (Grams per Week)	Procurement Price b/ (1951 Rubles per Kilogram)	Cost of Ration (1951 Rubles per Week) c/
Meat	900	25	1,200	20.0	24.0
Fish	600	35	923	12.5	11.5
Fats (animal and vegetable)	350		350	25.2	8.8
Groats (including macaroni)	1,165		1,165	5.5	6.4
Flour	140		140	4.1	0.6
Potatoes	3,500	25	4,666	0.76	3.5
Vegetables	2,280	15	2,682	1.8	4.8
Condiments	20		20	12.8 d/	0.3
Bread	6,300		6,300	1.96	12.3
Sugar	250		250	11.4	2.8
Tea	7		7	132.4 e/	0.9
Salt	210		210	0.5 f/	0.1
Tobacco	70 g/		70	14.4 h/	1.0
Total					77.0

a. Unless otherwise indicated, physical quantities and wastage factors are based on a circular of the Soviet Quarter -
master General. 13/

b. Retail prices 14/ discounted by trading margins. 15/

c. For the price index used to represent these costs on other price bases, see Appendix C.

d. The price of condiments is assumed to approximate the price of canned goods.

e. Retail price.

f. The 1951 price is an estimate based on 1948 and 1953 prices.

g. The issue of tobacco apparently varies. The figure of 10 grams per day of cheap tobacco was obtained from two
reports. 16/

h. 17/

basic ration for enlisted men imposes a burden some 30 percent higher* on a capita basis.

Other considerations already discussed** may also affect the magnitude of the derived results: for example, military farming operations and military processing facilities. One facet of this problem not previously discussed may also have some bearing on the results: namely, the prices paid for those subsistence items procured locally by military units stationed outside of the USSR. In view of the number of these troops, however, and their apparent dependence on fairly substantial imports of foodstuffs from the USSR, 18/ it does not seem likely, even though local purchases may be made at favorable prices relative to those paid in the USSR, that any substantial error is likely to accrue from failing to account specifically for such local purchases by occupation forces.

In summary, the effects of these unaccounted for influences are counterbalancing, at least to some extent. At this time it is not possible to measure the relative significance of such practices as military farming and processing. It might be noted, however, that the present subjective evaluation of the ruble estimates of the Soviet subsistence bill is that they are reasonably accurate.

Moreover, no distortion is believed to be introduced through conversion to other price bases by means of indexes. The index employed reflects retail price movements,*** 19/ but in view of the relative stability of retail trading margins, the index should also be a reasonable representation of wholesale price movements. † Nor should it matter that this index is being applied to a sample somewhat less comprehensive in its coverage, for the composition of the sample is not believed to differ excessively from that underlying the index.

(2) Dollar Values

Dollar equivalents can be obtained on two entirely different bases: the outlay per capita for rations for the US armed forces, or the required outlay for the Soviet ration. In practice, only the former basis is in use. It is employed to reflect the outlays that would be necessary in the US to support Soviet

* Relative to ration costs during the period 1955-58. In 1951 prices the enlisted man's ration is 67 percent more costly if the costs borne by officers and by the Ministry of Defense have remained unchanged.

** See II, B, 1, b, p. 11, above.

*** The value of the index for 1955 (1951 = 100) is 78. For the full index, see Appendix C.

† Should the Soviet military establishment be procuring subsistence items at special prices or at relatively primary processing stages, the applicability of the cited index is subject to further question. Because special prices may or may not follow a pattern like that of wholesale and/or retail prices -- depending on the relationship between the former and latter, if any -- it is not possible to evaluate their effect. Something can be said, however, with regard to possible military purchases of foodstuffs at more primary stages because the military establishment possesses some processing facilities. In such instances the movement of prices is not likely to follow the pattern of wholesale prices but to come closer to agricultural procurement prices, which have followed an entirely different pattern. Thus the charges for handling and processing as well as elements of the turnover tax are bypassed.

(4) Further Considerations

The foregoing discussion illustrates, at least implicitly the type of data necessary for further refinement and an improved confidence level. Those aspects of the pricing problem discussed in the first section of the report pertain here (as they do to some extent throughout this report) at least with regard to more positive verification that some of the factors do not have a bearing on this subject. Then, too, there is the problem of the extent of the applicability of Moscow-based prices, particularly where there is a substantial amount of local procurement (whether it is internal or external to the USSR). Furthermore, it would be desirable if the other Soviet rations known to be in use were included in this calculation.

Dollar valuations, if greater effort is to be expended on counterpart costs, should be improved by recourse to such detail as the breakdown by rank and grade of those receiving allowances instead of rations and of those receiving rations in the US armed forces.

c. Clothing*

(1) Ruble Values

The estimates for individual clothing issues,

were derived in like fashion: a clothing issue priced by the item. There was some variation between the items of issue, however, as there were differences in the prices applied. Nevertheless, the resulting outlays per capita, as estimated, were surprisingly close. The estimate for 1953 was 3,720 1953 rubles; that from the report, 2,700 1951 rubles for 1951. On an annual basis, both sources cite, without further adjustment, 900 rubles per man. Accounting for this apparent anomaly is the assumed life of the clothing: 4 years, according to the report, and 3 years according to the report. With adjustment for repairs and changes in price, the report gave a prorated annual outlay per capita of 1,100 rubles in 1951. Presumably the estimate would also rise above the level of 900 rubles if the costs of repairs and maintenance were taken into account. Thus these two estimates, their differences notwithstanding, are roughly 1,000 1951 rubles per year. This figure has been embodied in the studies of military expenditures by this Office.**

There are, besides those problems already mentioned, a number of problems that are related to this subject and that warrant consideration. In formulating these estimates, it was found necessary in both the reports to rely on the Soviet retail price structure. In the report, scattered, published retail price data were applied to the items

* Excluding special clothing, such as flight gear, which is considered organizational equipment.

** It will be noted that the resulting estimate more realistically represents average annual outlays; the procedure employed is not responsive to the irregular expenditures that would be incurred, for example, by a major change in the basic clothing issue.

In order to convert this value to the monetary relationships of other years, the published Soviet retail price index for items other than food is used whenever it is available. Since 1954 this index has remained essentially stable. For the full index, see Appendix C.

of the issue, whereas in the report, prices paid by the Soviet military establishment in 1940 were used and a retail price index was applied to the results in order to achieve a 1951 price base.

In addition to the problem of prices, there are problems relating to the makeup and the applicability of the standard issue of clothing. It is apparent that two somewhat different issues of clothing lay behind the estimates contained in the reports. Even though the composition of the issue used in the report is based on information from 24/ the publication dates back to 1947, and some changes are known to have occurred since that time. 25/

Furthermore, the clothing issue is treated as being applicable for all ranks and grades. It is more likely that re-enlistees and officers receive an issue of higher quality. Such differences in quality, as well as differences in the composition of the issue, create another possible element of conservatism in this estimate.

(2) Dollar Values

Dollar valuation of Soviet expenditures for military clothing (regular issue) presents the same situation as pertained for subsistence, and for largely the same reasons. ** The same alternative means may be used, although efforts to date have been limited to a determination of US outlays per capita for clothing and application of the figure so determined to Soviet military personnel. Again, such a figure is obtained by a combination of the outlays specifically labeled as being for clothing and the allowances paid to officers and enlisted men for initial issues and maintenance. *** The same problems are applicable here too, among them the possible ambiguity of direct expenditures for clothing and the divergence in the composition (rank and grade structure) of the US and Soviet armed forces in any year.

(3) Ruble-Dollar Ratios

It follows from the preceding discussion of dollar valuation that the possible ruble-dollar ratios may also be on two bases. At this juncture, however, only one ratio may be derived, and that ratio is no more than the relationship between US expenditures per capita in dollars and like expenditures in the USSR in rubles. The ratio so obtained is 4.4 rubles to US \$1, in terms of 1955 relationships.

(4) Further Considerations

The requirements for data in this area are comprehensive. They range from price data and monetary allowances to the composition of the various issues of clothing.

* It is reassuring, however, that some more current information on prices paid by Soviet military organizations for items of clothing seems, in very broad terms, to affirm the general magnitude of the estimate presented above. In fact, if anything, there is a suggestion that the present estimate is conservative. However, little in the way of detailed analysis or evaluation of these data has been accomplished as yet.

** See b. (b), (2), p. 19, above.

*** A figure of \$200 per man per year has been employed in terms of 1955 relationships.

For ruble expressions of Soviet outlays for clothing the following is needed: (a) the current basic clothing issue and such changes in the issue as have occurred since 1947; (b) other issues and the respective recipients; (c) information on the prices paid by the Soviet military establishment and on how these prices have changed during 1948-60; and (d) any monetary allowances paid by the Soviet Ministry of Defense instead of, or as a supplement to, issues of clothing.

d. Miscellaneous

(1) Ruble Values

A miscellany of goods and services issued to military personnel either directly or indirectly is included in this category: toilet soap, laundry soap, matches, cigarette paper, razor blades, toothpaste, toothbrushes, pencils and paper, fuel for space heating and cooking, laundering of personal equipment, shoe and clothing repair, and utilities. Clearly, some of the items more properly are elements of operations and maintenance and will be so classified in the future.

The ruble value of the supplies included in this category is determined on a per capita basis and then converted to annual aggregates for the military establishment. Specifically, prices for the individual items are applied to the appropriate quantities of the specific goods and services. This basic computation has been accomplished in terms of 1951 rubles because the issue was originally estimated as being applicable to 1951, although it is believed that the issue has remained a reasonable representation of the situation since that time and is probably suitable for 2 or 3 years before. Its applicability in 1947-1948 is somewhat suspect, however, the issue probably being a bit too lavish for that period of reconstruction in the USSR.

When necessary to convert the estimates so obtained to price relationships of another year, the Soviet retail price index for items other than food has been applied. No attempt has been made as yet to obtain an index specifically applicable to this category, for two reasons. First, the outlays in question are sufficiently small, so that a gross distortion would be required before any noticeable difference in results would occur.* Hence a low priority was assigned such an undertaking. Second, it is frequently convenient to group these outlays with those for food and clothing.

(2) Dollar Values

Dollar equivalents of the ruble outlays determined for miscellaneous supplies are obtained by the application of a ruble-dollar ratio.** The resulting 1951 dollar values are converted to other price bases by means of an index measuring changes in US prices for items of consumption.

(3) Ruble-Dollar Ratios

In terms of 1951 relationships, the ruble-dollar ratio is 10 rubles per dollar. It may be considered a Soviet-weighted ratio in that the items incorporated in the calculations belong to the list presented above. Instead of the usual process of determining a ratio of this sort, however, those ratios available for individual items of this category are arrayed and the median value

* The index used does move in the right direction.

** See (3), below.

selected as representative of the group. The reason for proceeding in this fashion is strictly practical: the price data are not abundant enough to permit sufficient reflection of the estimated "basket" of items, and thus there seems to be little purpose in using a process that is more refined than the data and that would be slower in its application.

A US-weighted ratio cannot be calculated at this time and probably should await the realignment of this category.

(4) Further Considerations

The material necessary to improve this estimate of Soviet expenditures centers on prices. More prices known to be paid by their military establishment for the items in this category and the movement of these prices from 1947 to the present are required.

For the improvement of dollar equivalents and US-weighted ruble-dollar ratios, similar considerations apply. In addition, however, the counterpart US goods and services must be specified.

Because of the diverse nature of the items included in this category no one price index for Soviet or US prices will, in an ideal sense, be able to account adequately for price movements during a period of time. For such an accomplishment a series of suitable price indexes (one for each item) would be required. The magnitude -- in monetary terms or other terms -- of this category, however, is sufficiently small that the effort that would be required is not warranted.

2. Militarized Security

a. Pay and Allowances

(1) Ruble Values

Basically the procedure involved in determining the bill for pay and allowances for militarized security forces in the USSR is the same as that for the regular service arms. In practice an abbreviated version of that method, drawing heavily on the results for the Soviet army (ground forces), has been employed.*

A large part of the militarized security forces is organized in units comparable with those of the regular Soviet ground forces. These security forces comprise border, interior, signal, and convoy troops, and in the past have been estimated to account for 400,000 of a total estimated strength of 550,000. ** 26/ Application of average rates of pay for the army to these 400,000 troops*** thus accounted for the pay bill for most of the personnel involved but did not account most of the remuneration.

* See 1, a, p. 15, above.

** Estimates that are more current will be incorporated in future studies.

*** Apparently reliable information justifies this procedure. 27/ The similarity between regular ground force units and those to which these 400,000 troops belong is marked, both with regard to unit organization and pay and allowances.

The remaining 150,000 persons received two-thirds of t monetary recompense. These persons were militarized civil defense personn headquarters personnel, and those personnel engaged in such activities as espionage and counterespionage. It is because of the unusually high proportion of officers, including higher ranking officers,* that this group was so costly.

There is, however, a question relating to scope. The estimate included 100,000 KGB personnel engaged in intelligence activities. Of the some 8,000** are estimated to have been integrated with the Soviet army, nava and air forces. Of the remaining 92,000, a large but indeterminate number were engaged in activities that may not have belonged in this category. There is no doubt that they were an integral part of the Soviet military security effort, but obviously all such efforts should not have been included. Where the dividing line should have been in this case is not yet known, and further research into the functions of these other 92,000 personnel is necessary before a decision can be reached relative to their position in studies of military expenditures.

Moreover, the very constancy of these strength figures has created doubt. The decline of the economic function of the MVD, organizational changes affecting the subordination of units of the MVD and KGB, elimination of the MVD as a central organization, and the announced reductions in military manpower contribute to this doubt. Nevertheless, it seems reasonable that for about 1951 the strength figures may be considered fairly reliable.

(2) Dollar Values

As in the determination of ruble values, there is also relatively less difficulty in obtaining dollar values for the border, interior, signal, and convoy elements of the militarized security forces. For these units there is little reason not to apply the same dollar outlays per capita as used for the regular services, remembering the same limitations of the data.***

The situation is somewhat different for the remaining security personnel. Partly because of the difficulties in this area with regard to the comparability of functions in the US and in the USSR and partly because of a lack of specific data on mix, the same average dollar outlays per capita employed for the regular services have been applied. The problems in such a procedure may well be more apparent than real. For example, it is possible that comparable US ranks and grades should not be employed, because the purpose of obtaining dollar equivalents is to reflect what Soviet programs and activities would cost in the US, and the US might not devote the same resources (measured in this instance by the ranks and grades of personnel) to accomplishing a given task. Certainly the scarcity relationships and incentives differ in the two countries. † Where, of course, there is no comparability of function, only speculation is possible.

* Relative to the regular services.

** Estimate based on a sample of T/O information.

*** See 1, a, (2), p. 15, above.

† Again, many of the difficulties of this sort will be ameliorated when sufficient detail and flexibility permit consideration of programs and activities in the context of function or mission.

of the Soviet military establishment. Instead, while on such duty, these personnel receive one-half their usual wages or salaries from the civilian establishments that employ them.* 30/

Computation of the monetary income so disbursed is accomplished in the most feasible manner with the data on hand. Estimates of the total number of reservists, by year, are based on Soviet law and sizes of classes (the number of males born in any year). 31/ The legal commitments for service of each category of reservist are published, 32/ but the wide divergence between the law and practice must be established. 33/ This divergence occurs in two ways: not all of the reservists eligible for annual or other training are called, and those called do not always serve for the length of time specified. Because information sufficient to quantify these divergences has not been forthcoming, the method used, although not arbitrary, is no more than a subjective quantification. The resulting man-year estimates are equal to one-third amount that strict application of the legal requirements would have yielded.

Conversion of these man-year figures to estimated ruble outlays is accomplished by application of the average wage for workers and employees in the USSR.** The use of such an average, of course, invariably introduces problems. In addition to those discussed below with regard to this average wage, there are several which are peculiar to its use in this context. These problems center largely around the fact that the distribution of reservists by age, sex, education, and area of residence (urban or rural) probably differs from that for all workers and employees, although the net effect of these influences is moderated somewhat by counterbalancing.

(2) Dollar Values

Dollar valuations are gained in a manner very similar to that used for personnel on regular active duty in the armed forces. The average annual recompense per capita for service personnel in the US was applied to the number of man-year equivalents served by Soviet reservists.*** Disregarding the problems inherent in the application of averages, this process permits conservative reflection of the outlays that would be entailed were the US to support the Soviet reserve program.

(3) Ruble-Dollar Ratios

The only ruble-dollar ratio currently available is the relationship between the average wages used in rubles and in dollars. Conceivably some weighting system to account for differences in the composition of Soviet and US reserve forces might be developed, but the likelihood of doing so seems remote.

* Despite the incidence of the burden of these expenditures, they are included as part of the cost to the Soviet economy of an obvious and direct military program.

** For a discussion of this average wage, see C, 1, a, (1), p. 46, below.

*** For the average US rate of compensation, see 1, a, (2), p. 15, above.

(4) Further Considerations

As the preceding discussion illustrates, there are many facets of this problem on which additional information could be brought to bear. Resolution of most of these, however, would represent unwarranted refinement and would add little, if anything, of substantial import to the study of military expenditures. There is one sector, in particular, that does not fall within the scope of this last declaration: that dealing with the necessary underlying series of manpower. Here the detail is important and should be extensive enough to cover the number of reservists called for such duty as summer training; the duration of such training by group (by class of reservists and by rank and grade within the classes); the residence, rural or urban, of those called; and, if possible, the remuneration from civil employ received by the various groups.

b. Subsistence (Food)

The Soviet Ministry of Defense is presumed to bear the expense of feeding reservists on these abbreviated tours of duty. Accordingly, the calculated per capita cost of rations for the active regular service personnel has been extended to cover like expenditures for reservists.*

c. Clothing

No outlays for issues of clothing to reservists have been incorporated in these analyses of Soviet military expenditures. Admittedly it seems unrealistic that the Ministry of Defense bears no expense of this kind, but, given the number of reservists and their abbreviated tours of duty, it seems highly unlikely that they receive anything but the temporary use of used clothing. Thus the associated expenditures would be relatively slight.

d. Miscellaneous Supplies

As in the case of clothing, it seems quite likely that some small expenditure for miscellaneous supplies issued to reservists should be taken into account. No information permitting an independent judgment, however, is available.

4. Retirees

a. Pensions

(1) Ruble Values

The question of monetary payments to retired career military personnel** leads to a problem of scope, even though the group would appear to be clearly defined. Briefly the problem is to decide whether the results obtained are to be viewed as all-inclusive (that is, covering both regular service and militarized security personnel) or as representing retirement payments for regular service personnel only.

Budgetary analysis will be affected by the choice made. Pensions for regular service personnel are financed from the allocation to the

* See 1, b, p. 17, above.

** Those noncareer personnel receiving pensions for wartime disability and the like are specifically excluded. They are covered by social insurance.

Soviet Ministry of Defense; those for militarized security personnel are financed from the budgetary residual. The procedure followed to date has been to consider the estimated outlays for pension payments as financed from the allocation of the Ministry of Defense, and thus pension payments for militarized security personnel have actually not been taken into account.

Because the size of the Soviet armed forces, which are perennially larger than those of the US, cannot be reflected in Soviet retirement rolls in any precise fashion, a minimal estimate directly related to the number of US retirees has been accepted. It is reasoned that these larger Soviet forces, given their regulations, must be, and must have been retiring personnel eligible for pensions in at least the same numbers as the US. Hence the annual series of US retired personnel was smoothed (that is, a trend was fitted) and employed.

Soviet regulations prescribing the requisite time in grade for promotion, the time in service necessary for retirement, the duty warranting additional credit towards retirement, and the percentage of basic active duty pay to be received as retirement payments provide the basis for estimating an applicable average annual pension payment.* As a result of these factors the average rank at retirement is roughly equivalent to that of major,** and the average pension is 19,000 rubles.

(2) Dollar Values

A dollar value, equivalent to the ruble outlays for military pensioners, is derived by applying the average annual US payment to the number of retirees estimated as being on the Soviet rolls. The average US figure (in 1955 roughly \$2,500),^{34/} is hardly ideal, however, for it simply represents US outlays for military retirees divided by the number of retirees. It is clear, therefore, that the US figure represents an average retirement payment for retirees of all ranks and grades and does not in any conscious manner reflect a per capita dollar value known to be specifically appropriate to Soviet military retirement rolls. This value of \$2,500, it should be noted, apparently does reflect a considerable difference in the composition of the retirement rolls in the two countries that is, there are appreciably more enlisted personnel on the US rolls.

(3) Ruble-Dollar Ratios

The only ruble-dollar ratio available is no more than the relationship between the two per capita figures cited above: 7.4 rubles to US \$1 (in terms of 1955 relationships). Differences in weighting -- that is, the composition of the respective retirement rolls -- have not been taken into account.

It is of some interest that the relationship between expenditures per capita for pay and allowances in the two countries is markedly different from the relationship of expenditures for pensions: the former is about 2 rubles to US \$1, the latter 7 rubles to US \$1. The explanation of this divergence, however, is largely the dissimilarity in the composition of the active duty and retirement rolls in the two countries with regard to rank and grade, particularly the relatively small numbers of retired career enlisted personnel in the USSR.

* The more recent changes affecting these payments have not been taken into account. It is apparent that the changes are somewhat counterbalancing, but it is believed that their net effect will be to reduce the per capita payments as estimated in this report.

** Only Soviet officers and re-enlistees qualify as career personnel. In this analysis, re-enlistees are given only cursory consideration because of their small numbers relative to the number of officers.

(4) Further Considerations

In improving the estimates of retirement outlays, of primary importance is information that will permit direct determination of the number of Soviet retirees by rank and grade. Further refinements in other approaches to the problem are already possible, but until such time as the information on manpower that is basic to such a calculation can be viewed with a higher degree of confidence, there is no point in following other approaches.

b. Other Benefits

No estimate has been made of the costs associated with auxiliary benefits, such as certain tax exemptions, which accrue to Soviet retirees. The sum of such costs is most unlikely to be of sufficient magnitude to warrant the effort.

B. Procurement

The term procurement has a breadth of meaning sufficient to encompass the acquisition of everything from manpower to guided missiles and is occasionally used in such a context. In a general way the term is understood to refer to the acquisition of equipment -- combat, support, and organization -- as well as such items as rations and clothing. For purposes of this report, however, the term has been limited to those items that are sometimes referred to as major procurement -- that is, major equipment and organizational equipment and their initial spare parts,* as well as replacement items.**

The term major equipment refers to that equipment used for the direct accomplishment and support of the basic combat function of the unit; organizational equipment, to all the other equipment necessary to the general functioning and existence of the unit. In the discussion that follows, however, a precise alignment of major equipment and organizational equipment is not achieved. Rather, the several types of equipment are presented under headings denoting specific classes of equipment, such as aircraft and trucks. This procedure reflects the dual nature of so much of the equipment, both within specific units and among various units, and the effort still necessary to accomplish further delineation. Thus the account labeled organizational equipment is, in a sense, a residual.

Finally, it has not been possible to determine the actual Soviet schedule of procurement, as distinct from production, much less the scheduling of payments. In fact, then, the estimates represent the value of production. Furthermore, with regard to major items of military hardware (exclusive of transport aircraft, trucks, and similar items with a civil as well as a military use), the estimates represent the value of all production of the given items and not just that intended for the Soviet military forces. Thus production entering external trade channels or going to the Soviet militarized security forces (or still other internal consumers) is included in the figures presented in the studies of Soviet military expenditures as domestic military procurement. Because these other recipients of military hardware have, to date, accounted for only a relatively small share of the total, they may be ignored for many purposes but not with

* As opposed to operating spare parts, which are a factor in operation and maintenance. (See Section C, p. 46, below.) Initial or concurrent spare parts accompany delivery of the equipment and may be viewed, in large part, as those spare parts that fill the pipeline.

** See Table 1, p. 5, above.

regard to budgetary and national accounting analyses, where they may assume some significance.*

1. Aircraft

a. Ruble Values

Simply, these estimates are derived from production functions (in cost terms) and from physical series** of production (by plant) for each model of Soviet aircraft. The initial valuations are made in dollars and are then converted to a ruble basis.

The production function relates volume of production to cost, and one such function is adequate to describe the relationship for a given model of aircraft. In practice, however, it seems better, for purposes of calculation to employ several functions, each with the purpose of characterizing the cost-output relationship for a structural component (such as airframe, engines, or electronics) of an aircraft. Cumulatively such a combination of functions yields the same results as would the one. The subsidiary functions are of two kinds: those in which the cost per unit of output is regarded as constant and those in which the cost declines with successive production. Illustrative of the former are armaments, electronics, and propellers. The latter pertains to airframes, engines, and accessories.***

It has been established that a declining cost function, or "learning curve," describes productivity in the US aircraft industry. † The appropriate function is an exponential of the type $y = kx^{-n}$, which can be depicted as a straight line on log-log paper. This curve is fully defined by a point on the curve and its slope. When the slope is 90 percent, the function indicates that if the cost is C for unit x , for unit $2x$ the cost is $0.90 C$.

There is no need to represent this function, as was just done, in terms of unit cost; it may be expressed equally well in terms of cumulative average unit cost or total cost. All these curves are essentially straight lines when plotted on log-log paper and are alternative means of stating the same relationship. For computational purposes the total cost curve is used in the studies of military expenditures.

Available data indicate the existence of functions of this type for the Soviet aircraft industry. Voznesensky wrote in 1947: "The growth in labor productivity resulted in a reduction in labor expenditures per unit of output, especially in war industry. Labor expenditures in plants of the aircraft industry for the output of the Il-4 plane declined from 20,000 man-hours in 1941 to 12,500 man-hours in 1943; labor expenditure on the Il-2 plane fell corresponding from 9,500 to 5,900 man-hours; and labor expenditure on the PE-2 plane decreased

* For a brief discussion of such analyses, see II, A, 3, p. 9, above.

** The methodological concern of this discussion of procurement is confined largely to the valuation of the physical series provided primarily by the respective US services.

*** Additional components such as electronics may be described by functions of this type in the future. Those for which the "learning" process is most operative, however, are those already described by such functions.

† The functions herein presented describe cost as a function of output. For a more complete discussion of learning curves, see source 35/.

from 25, 300 to 13, 200 man-hours." 36/ Further corroboration came early in 1955,

Finally, a Soviet publication dated 1957 explicitly demonstrates that such functions of the costs of aircraft production are employed in the USSR. 37/

The information from 1955, together with data for the Li-2 (Cab), suggests that these Soviet functions are of the same order as those for US plants. It is, therefore, considered to be reasonable to use US learning curves as representative of those of the USSR. **

The dollar data incorporated in these functions are considered to be a reasonable representation of the appropriate costs of components of Soviet aircraft. They are based on estimates of what it would cost the US aircraft industry to produce the Soviet aircraft as they are built in the USSR or on the cost of counterpart US models where the aircraft are considered to be sufficiently alike.

Such cost data and the production functions already defined serve to provide (in conjunction, of course, with production of aircraft, by plant***) the means for calculating the dollar value of Soviet production. † Initial spare parts are included in these estimates but are calculated separately. The factors employed are based on US analogy. ‡ These factors vary with the type of aircraft and are related to production for each major component of an aircraft.

Implicit in the discussion of dollar valuation is the fact that sufficient data are not available to permit direct valuation in rubles. The available data, however, are of a nature that permits basing ruble valuation on opposite Soviet information. Such information is adequate for ascertaining a ruble-dollar ratio that is reasonably reliable.

** Use of US functions, however, does not imply that Soviet costs and productivity are the same as those in the US, but rather that the cost reductions that are a product of learning proceed at a similar rate. Differences in costs in the two countries are accounted for by the ruble-dollar ratios.

*** The productivity functions are applicable to production of a model at one plant, not to production at several plants or throughout the industry.

† The results so obtained have certain characteristics that are somewhat different from those frequently described in a value series. Although these series are in constant prices, which is a standard means of portraying growth, they are in what is herein termed input prices as contrasted to market prices. This situation follows from the productivity functions, which reflect the shifting pattern of inputs as measured in constant prices of the inputs -- for example, labor and materials. With the exception of the values obtained for the base year, the series described must for some purposes be converted to market prices in the base year. On such occasions a production index is derived and applied to the value in the base year obtained from the method just described.

From 1947 to March 1955, seven internal Soviet prices have been found: three for complete aircraft, one for an aircraft less its engine and three for engines. These data cover the Li-2 (Cab), the MIG-15 (Fagot), the VK-1 engine used in the MIG-15 and the Tu-14 (Bosun), and the VK-1A engine used in the MIG-17 (Fresco) and the Il-28 (Beagle). The quotations for the Li-2 and the VK-1 referred to interplant transfers, whereas the other prices referred to actual transfers to the military establishment.

The earlier quotation for the Li-2 (700,000 rubles),¹⁰ was assumed to have been based on production between 1 January 1947 and 1 July 1947. Cumulative production is estimated to have been 2,540 aircraft as of 1 January 1947 and 2,610 aircraft as of 1 July 1947. The average price for an almost identical US plane, the C-47, has been obtained for the corresponding units and adjusted downward to reflect the lesser provision of electronics on the Li-2. (The Li-2 is estimated to have 20 percent of the electronic equipment found on the C-47.^{38/}) In order to express both the US and the Soviet costs in 1947 prices, the cost of the C-47 has been moved by a price index* because the corresponding US units of production occurred before 1947. On this basis the average price of the 70 units of the C-47 referred to above in 1947 prices is estimated at \$116,000. The resulting ruble-dollar ratio is 6.0 rubles to US \$1.

A similar procedure is used in calculating a ruble-dollar ratio from the price of 741,000 rubles for an Li-2. The relevant changes in production and price are accounted for in the manner just described in the preceding paragraph. The corresponding price for a C-47 is \$136,000 in 1950 prices. The ratio, therefore, is 5.4 rubles to US \$1.

Comparable analysis for the MIG-15 required the estimate of a US manufacturer of what it would cost to produce this aircraft, using Soviet techniques, in the US. (There is no counterpart US model.) The available Soviet price is for aircraft produced at Komsomol'sk Airframe Plant No. 126, which started production of this aircraft in 1950 and is estimated to have produced about 50 units by 1 January 1951.** According to the US manufacturer's estimate an average price of \$163,000 in 1950 prices is applicable, which when compared with the Soviet price of 865,000 rubles yields a ratio of 5.3 to 1. Of course, if the ruble price pertained to a large or smaller number of units, the resulting ratio would have varied directly. For example, if the basis for this price was a series of 40 units, the ratio would be 4.3 rubles to US \$1.

In the case of the VK-1A engine, the ruble-dollar comparison can be made in a straightforward manner, in view of the fact that the data are directly comparable in terms of time and level of output. The price for the VK-1A engine, 320,500 rubles, was quoted. The J48-P-8 is the closest US equivalent. Both the Soviet and the US models were developed from the Rolls Royce Nene turbojet engine, and they are generally comparable in weight and thrust. The US engine was priced at \$58,700 in terms of 1954 prices. The ruble-dollar ratio, therefore, is 5.5 to 1.

* See the footnote on p. 34, below.

** Four other plants had been producing the MIG-15, thereby providing the basis for realistic assessment of costs for a new entrant into the field.

The several computations have yielded ratios ranging from possibly 4.3 rubles to US \$1 to 6.0 rubles to US \$1. It has been concluded that 5.5 rubles to US \$1 is a reasonable representation of the price relationship existing during this period. In view of the relatively small amount of electronic equipment and armaments on the aircraft for which internal Soviet price information is available, this ratio is considered to be appropriate for airframes, engines, and accessories.

This ratio has been modified only slightly in order to reflect the relationship between US and Soviet prices in 1955, which is estimated at 5 rubles to US \$1. The ratio is rounded to a single digit because, all things considered, it seems to be the best representation even though it means that the modification appears, in crude terms, to be the equivalent of taking account of the increase in US prices with no corresponding change in Soviet prices.* Several considerations are integral to this relatively small change: (1) most of the alternatives rounding to this value; (2) the constancy of the individual ratios during the period; (3) the offsetting effects of Soviet prices of labor and materials (labor is an appreciable input in production of aircraft); and (4) the rapid change in the product and the relative profusion of models that began in 1955.

As noted, this relationship is the means of obtaining the ruble valuation of Soviet production of airframes, engines, and accessories. The dollar values for electronics and armaments are translated into rubles by means of other ratios.**

Usually, when current monetary terms are required, no adjustment is made in the derived ruble values. The series, based on input prices, are considered to be the most adequate representation of transfer prices in both constant and current terms. As already noted, the input prices are in constant terms. In view of the upward trend of Soviet wages, the fact that the quantity of inputs varies, decreasing with increased production, is believed to introduce sufficiently compensating elements to represent the resulting values as being in current price terms as well.

b. Dollar Values and Ruble-Dollar Ratios

Dollar valuation and the ruble-dollar ratios are an integral part of the foregoing discussion of ruble values.

c. Further Considerations

The desirability of more Soviet price information, particularly for the more recent period, is clear. The other needs relate to more information about the learning process in the USSR, input prices, and the like. These requirements, however, can all be included under the need for price information, an area in which a relatively small amount of material helps a great deal to meet many of the goals of these studies.

* The price index for machinery and motive products is employed to reflect price changes for US aircraft. (See Appendix C.) The US wholesale price index, less farm products and processed foods, is now believed to be more appropriate and will be used in the future.

** See 3, p. 38, and 7, c, p. 42, below.

2. Armored Combat Vehicles

a. Ruble Values

Of the data available on prices of major equipment unique to Soviet ground forces, the greatest amount, and perhaps the most useful, relate to tanks. Specifically, three of the four pieces of price information apply to the T-34: 425,000 rubles in September 1941, 275,000 rubles in 1943, and 250,000 rubles in 1944. The first of the prices is a direct quotation ^{39/}; the second has been derived from the value of output at Plant No. 174 ^{40/} and the physical volume of output ^{1/}; the third has been calculated from a statement on relative costs of medium tanks in 1944 compared with 1943. ^{42/}

Obviously the cited prices are all reflections of experience during World War II. The period was one of rigidly controlled prices in the USSR, and thus the prices have been considered a reflection of the price levels in 1945.

With or without the preceding assumption, it is clear that the data indicate the existence of a declining cost function, or learning curve. Within the framework of the assumption, fitting the above data to an appropriate exponential yields a function with a slope of 90 percent.*

Application of the estimated production of the T-34 to this function would result in an appropriate series of values. The initial requirement, however, called for expenditures by the Soviet military establishment for this item in 1951 prices. To this end the posited 1945 prices were converted by means of a price index that was a weighted average of wage and armor steel plate price. At this stage, values were obtained from the curve.

The 1951 price relationships necessary for the initial endeavor in this sphere have been converted to a 1955 base for the current efforts. To do so, the industrial cost index presented in Appendix C is used. An extension of the price index employed to move 1945 prices (the weighted average of wage and armor plate price movements) has not been applied. In view of the necessity for the widespread application of the industrial cost index, it has been considered to be desirable to use this index for as large a sample as is feasible, unless its use would introduce some gross distortion.

For valuation of the T-54 the cost per ton of the T-34 has been adjusted upward to allow for the introduction of improved engines and fire control equipment. Because the T-54 is not completely different from the T-34, some transferability of learning from the T-34 has been assumed. Hence the initial unit of production of the T-54 is estimated to have a position on the productivity curve equivalent to the 7,500th unit of output of the T-34. Because of the estimated increases in cost for the T-54, however, this point lies above the corresponding point on the curve for the T-34.

Fundamental to the valuation of production of heavy tanks in the USSR is a statement that appeared in the Soviet press: "The cost of heavy tanks declined 53 percent during the war years and resulted in a saving of 2.5 billion rubles. The cost of producing a tank in August 1944 was 13.5 percent less

* US experience with a roughly comparable tank, the M-4, exhibited like gains in productivity.

** For a discussion of these functions see 1, a, p. 31, above.

than in 1943." 43/ A production function has been derived from this information* by applying a decreasing exponential function of the type used for the medium tank

The computation, when based on the over-all decline of 55 percent during the war years, yields a curve with a slope of 83 percent. The applicability of this curve is attested to by the fact that it describes a 12.7-percent decline in cost between 1943 and 1944, a reduction that compares closely with the 13.5 percent cited above. Given this curve, the remainder of the process for obtaining the relevant values is identical to that for the T-34.

The method employed to obtain similar values for self-propelled guns is less direct. No Soviet data on prices or costs are available. But, because the chassis of these weapons are the same as those for tanks, it was considered to be appropriate to apply the costs in rubles per ton for the tank of equivalent size to the weight of the respective self-propelled gun.

Finally, there remain for consideration armored personnel carriers, armored scout cars, artillery tractors, and amphibious vehicles. Prices for the armored personnel carriers and armored scout cars have been obtained by adding the costs (in 1951 rubles) of armor plate and the estimated amount of labor necessary for its fabrication and installation to the prices (also in 1951 rubles) of the respective basic truck chassis on which such vehicles are built. Conversion of the results to prices of other years has been achieved in the same fashion as for the tanks and self-propelled guns. It should be possible, however, to determine directly the prices for these vehicles for other years -- for example, 1955. The available information appears to be quite adequate for such a task.

Price or cost information for artillery tractors and amphibious vehicles is not to be had. In these cases, dollar prices for comparable US items have been obtained. These prices have been adjusted where necessary to allow for differences in specification and then converted to rubles with the ruble-dollar ratio for armored personnel carriers and armored scout cars.

An element of each of the programs discussed in this section is the expenditure for initial spare parts. Such expenditure has been added at a rate of 10 percent of the value of production, which represents a conservative application of analogous US information. In the case of equipment phased out of production during the period under study, ** a higher rate has been used during the last years of its production in order to provide an adequate supply of spare parts for the equipment remaining in service.

There are three aspects of the method just described which contain elements of inconsistency. Although not believed to introduce serious distortion of the results, the inconsistencies are worthy of consideration if only to highlight the likelihood of being able to eliminate them, at least in part, in the future. First, the Soviet prices used to value the major items discussed in this section (tanks and self-propelled guns) may be a mixture of price, cost, and perhaps an undefined value per vehicle. Nevertheless, this information has been treated as reflecting costs -- for example, the declining cost functions. Second, if aircraft prices may reasonably be supposed to have reacted differently from the prices of other industrial goods, it appears reasonable to suppose that

* And, of course, a price at a point in time, which was computed in the same general manner as that for the T-54.

** For example, the T-34/85 and the Su-100.

the prices of at least some of the items included in this group would behave in a manner similar to those of aircraft. There is, however, one rather important point: product changes are not so far-reaching in a given period of time for ground armaments as they are for aircraft. As stated above, an industrial index is employed to reflect price movements for armored combat vehicles, in contrast to what is done for aircraft. Third, the means of pricing the vehicles in this category vary in their degree of sophistication: for tanks and self-propelled guns, a declining cost function is used; for the other vehicles, productivity gains are not taken into account.

b. Dollar Values

The basic procedure for obtaining dollar equivalents is by direct application of dollar values. Ruble-dollar ratios, however, are often employed for a computational convenience.* In fact, in extending the estimates over time the procedure frequently has been reversed in that dollar values are converted to rubles.

c. Ruble-Dollar Ratios

The ruble-dollar ratios relevant to this category are all derived from unit prices for comparable items of equipment.

As was mentioned above, US experience with a tank (the M-4) which corresponds roughly to the T-34 indicated a productivity function like that derived for the T-34, thus tending to confirm at least the reasonableness of the cost function derived from Soviet data. From the respective US and Soviet data for these models it is possible to derive ruble-dollar ratios for the period of World War II that vary from 4.9 to 1 to 5.2 to 1, a narrow range. Fortunately there is information of a confirmatory nature as well. A US manufacturer estimated that it would cost some \$50,000 to produce the T-34 in this country.⁴⁴ The use of the ratios just cited results in a ruble value that conforms very closely with the appropriate ruble value on the derived cost function.

Unfortunately, these ratios are in terms of 1945 prices rather than in the originally required 1951 prices or the currently required 1955 prices. In order to obtain a ratio based on 1951 prices, the price of the T-34 in 1945 rubles was moved in the manner indicated in a, above; the 1945 price of the US M-4 was moved with a similar index (a weighted average of wages and the price of armor plate). The 1951 prices so determined were reduced to values per ton which, when placed in apposition, yielded a ruble-dollar ratio of 4.5 to 1. From this point, ratios reflecting 1955 prices have been determined by means of price indexes which have already been noted. The ratio that may be computed is 3.4 rubles to US \$1.**

* It would be more direct to speak of converting ruble values to dollars by means of dollar-ruble ratios rather than ruble-dollar ratios. Application of the latter means division rather than multiplication to obtain the desired results. The ruble-dollar format is employed throughout because of its widespread use.

** Of considerable interest is a recent statement by an "official" Soviet source. A. M. Alekseyev, Candidate of Economic Science and holder of a Stalin prize, stated in a public lecture in Moscow on the Seven Year Plan that the ratio for tanks was 3.5 rubles to US \$1.⁴⁵ From the context, and the date of his address it is assumed that the ratio is applicable to 1957. Conversion of the derived ratio based in 1955 (used in this study) to 1957 prices yields a ratio of 3 rubles to US \$1. Acceptance of the publicly stated ratio as the 1957 rate means, therefore, that the ruble valuations of these Soviet armored vehicles has been conservative and/or that the equivalent dollar valuation has been overstated somewhat. Limits of 15 percent to the respective understatement or overstatement are implied.

These ratios, which are based on the Soviet T-34 and the US M-4, are used for all tanks and self-propelled guns, a reasonable procedure in view of the comparabilities. The applicability of these ratios to the remaining armored combat vehicles also has been adjudged appropriate.

d. Further Considerations

Clearly, additional price information would be desirable and the more recent the vintage the better. Not only are specific prices, and costs, of the several items needed; but there is a real need for indexes that realistically portray the movement of prices, and costs, for these items of major equipment.

3. Artillery and Other Weapons

The information available on this subject is sparse and the methodology employed is brief. To obtain appropriate monetary valuations for artillery and other weapons, it is necessary to use counterpart US price data* and to convert the results so obtained by means of a ruble-dollar ratio.

Initially, costs in 1945 dollars were the basis of this calculation. These costs were converted to a 1951 base by means of an index** and then applied to the estimate of Soviet production of the various weapons. In this application, allowance was made for productivity gains. 46/ Fragmentary information suggested a 1951 ruble-dollar ratio of 6 to 1 which was used on a tentative basis to arrive at ruble valuations.

Current practice is only slightly different. Reductions in cost due to learning are no longer taken into account, because of the small gradient of the production functions for these weapons, and hence their, rather negligible effect on the results for these studies does not justify the requisite effort. In addition, another piece of price information (for the 57-mm antiaircraft gun) 47/ has led to direct modification of the ruble-dollar ratio expressed in 1955 price relationships. Instead of the ratio of 5 rubles to US \$1 that would be obtained by applying the Soviet index of industrial cost and the US indexes for metals and metal products and for machinery and motive products*** to the 1951 ruble-dollar ratio, a new tentative ratio of 4 to 1 has been established.

4. Ammunition

Estimates of the number of rounds of various types of ammunition (excluding conventional aerial bombs, mines, and torpedoes) produced by the USSR are converted to a tonnage basis. These tonnage figures are, in turn, valued by applying dollar prices per ton. Ruble values are then obtained through application of a ruble-dollar ratio, which, with 1951 as a base year, is 4.6 to 1. The information on Soviet prices*** used in arriving at this ratio is sufficiently sketchy, so that except for the fact that the ratio falls within the relatively narrow range found applicable for most of the ratios of concern, it probably would be discarded. At best it is viewed as tentative. The usual price indexes are applied to reflect the ratio in terms of 1955 price relationships: 4 rubles to US \$1.

* The US price data employed included allowances for initial spare parts. In general, such spare parts account for at least 10 percent of the basic price.

** See Appendix C.

*** For rifle and shotgun shells and for what appear to be mortar shells.

A production series for mines and torpedoes has also been derived through the application of US prices and their conversion to rubles by means of this ratio. Expenditures for conventional aerial bombs have been estimated in a similar manner.

5. Trucks

a. Ruble Values

Price data are available by model and year for a large percentage of the vehicles produced. 48/ The models used by the military establishment have been valued directly in 1951 rubles, including a factor of 30 percent (as related to production) for initial spare parts.* It is expected that in the future the same procedure will be followed with 1955 as the base year, but thus far price relationships have been obtained by means of the industrial cost index.† It is clear from the available prices for trucks that little distortion resulted from using this index.

b. Dollar Values

The weighted ruble-dollar ratio described below is applied to the ruble values in order to obtain equivalent dollar figures for 1951.*** When necessary, the US price index for motor vehicles 49/ is employed -- that is, when dollar values need to be determined for other years besides the base year.

c. Ruble-Dollar Ratios

The ruble-dollar ratio for 1951 is a weighted ratio based on the Soviet mix. Ratios for individual models are obtained by using the price of the closest US counterpart. The specific ratios that result are combined by using the values of production of the respective models as weights. The ratio so determined is 5.8 rubles to US \$1. In order to obtain a 1955 relationship, the aforementioned US and Soviet price indexes are applied to this ratio. Failure to use weights for the given year in each instance has introduced little error.

d. Further Considerations

Little information is required in this area insofar as the concern is for financial data. Some of the generally applicable questions (see the section on General Methodology), however, apply. † For example, (1) are the available prices those that are actually paid by the Soviet military establishment, and (2) what are the sources, budgetary or other, from which the military establishment receives funds for the purchase of this equipment?

* Based on US experience.

** See Appendix C.

*** The results obtained with this ratio are the same as those that would have been derived through the direct application of dollar prices.

† See II, p. 11, above.

6. Naval Vessels

a. Ruble Values

The valuation of Soviet naval shipbuilding* is a product of analogy with US experience. Given the basic estimates of construction by type of vessel and descriptions of the respective classes of vessels, the usual procedure has been to apply US costs (converted to rubles). **

Initially, US costs expressed in dollars are reduced to a tonnage basis -- that is, X dollars per ton for each of the appropriate classes of vessels. These factors in turn are applied to the estimated weights of Soviet vessels. Conversion to rubles is achieved with ruble-dollar ratios. ***

In an attempt to account for the actual transference of funds from the Soviet naval authorities or their agents to the shipbuilders, the construction cycle is considered. The completion of tonnage in place is thus computed on a monthly basis, and payments are deemed to occur in accord with this schedule. Although the process outlined undoubtedly represents an oversimplification, it probably provides a reasonable estimate. It is known that the Soviet system is to transfer funds to the shipyard with acceptance of various stages of construction and that there are apparently some 20-odd steps in the process.

b. Dollar Values

In view of the foregoing, the means of obtaining dollar valuations is already apparent. Dollar valuations are the first fundamental step in the process of estimating expenditures. There is, however, one facet of the process that has not been discussed. At times it has been necessary to move dollar values from one monetary base to another -- for example, from 1951 dollars to 1955 dollars or from 1955 to 1957 dollars. To accomplish this step, the following price index is applied 50/:

1950	100
1951	107
1952	114
1953	122
1954	130
1955	130
1956	138
1957	146

c. Ruble-Dollar Ratios

The paucity of data on prices and costs with regard to Soviet naval vessels precludes direct determination of such outlays in rubles. Hence some means of translating analogous dollar values into rubles is needed. Ruble-dollar ratios are the vehicle and those deemed appropriate have been derived in the manner described in the following paragraphs.

* In general, outlays for conversions have not been estimated. Thus an element of underestimation exists.

** Some direct ruble price information is also employed.

*** See c, below.

At first the relevant classes of US ships were represented by seven inputs: propulsion machinery, electronic equipment, armor and armament, power, shore spares,* other materials, and labor. The dollar costs for each of these inputs for each class of major vessel built by the USSR were converted to rubles with a series of ruble-dollar ratios. These are ratios derived from the general categories of goods and services into which each of the seven specified inputs fall.** This process yielded ratios of 5.6 to 1 for cruisers, 6.0 to 1 for destroyers, and 6.3 to 1 for submarines -- all in terms of 1951 prices.

In view of the problems inherent in the method employed, a single ratio of 6 rubles to US \$1 was used throughout for new construction. When expressing 1955 price relationships the Soviet investment cost index*** was used to deflate the ruble element of this ratio; US costs were, and are obtained directly. 51/ The ratio in terms of 1955 prices was 4.8 rubles to US \$1. It is of interest to note that the price information dealing with merchantmen was consistent, although only roughly, with this material. 52/

More recently, it has become feasible to use more widely the standard ship classification system of weight and cost of the US Navy. 53/ This classification system and procedures similar to those already described yielded the following ratios in terms of 1955 prices: 4.0 rubles to US \$1 for destroyers, 4.1 rubles to US \$1 for submarines, and 5.5 rubles to US \$1 for auxiliaries.

d. Further Considerations

Clearly the need here is for price and cost information applicable to Soviet naval vessels. Considerable information of this type is available for such nonmilitary vessels as cargo ships and tankers.

7. Ground Electronics

This account is the only one devoted exclusively to electronic equipment. In all other instances, such equipment constitutes (a) an integral part of a weapons system (for example, aircraft or guided missiles) or (b) only one element of a broad category of equipment (for example, the instance of organizational equipment). The methods employed in handling the various accounts, however, permit the separation of most of the electronic equipment, so that the extent of Soviet endeavors in this area may be assessed. †

* Spare parts procured for a particular ship, or class of ships, at the time of construction and stored on shore.

** In terms of 1951 prices these ratios are as follows: materials, 11 rubles to US \$1; propulsion machinery, 6 rubles to US \$1; electronic equipment, 9 rubles to US \$1; armor and armament, 5 rubles to US \$1; power, 15 rubles to US \$1; shore spare parts, 6 rubles to US \$1; and labor, 3.5 rubles to US \$1.

*** See Appendix C.

† Only recently this account has been extended to include a substantial amount of noncommunications and communications equipment that is not an integral part of other equipment. Previously, ground radar was the sole item included; other items of ground electronic equipment were presumed to be covered by the broad factors used in computing organizational equipment.

Noncommunications equipment encompasses ground radar, electronic countermeasures equipment, ground infrared equipment, navigational aids, proximity fuses, and electronic computers. Communications equipment comprises tactical communications equipment for the ground forces, electronic equipment used by the air defense system for communications, and the electronic elements of fixed communications equipment.

a. Ruble Values

Fundamental to estimation of the required outlays for ground radar, the dominant element of this account, is the estimated ground radar order of battle. In determining this order of battle, each of the Soviet regions for defense is considered separately. Reasonably accurate data are available on Soviet equipment for several areas. Such data are extended when necessary to those areas for which the information is less complete.

Production of radar for the Soviet early warning/ground-controlled intercept system is based on establishing the number of sets on sites. Production of ground fire-control radar is based on order of battle requirements and on Soviet production of new antiaircraft guns plus a 15-percent factor for the replacement of equipment. The necessary scheduling of production on an annual basis is related to a variety of factors, including the correlation between production and construction, respectively, of the equipment and facilities. Each type of radar is scheduled separately.

The projection period is handled in a similar manner. Estimates are made on the basis of probable Soviet requirements, in view of trends in the development of weapons. Each type of radar is accorded separate treatment.

With a time series of annual production by model, the last step is to determine the outlays required for the procurement of this equipment. The sparseness of the necessary information on ruble prices makes it necessary to use analogous US price data. Ruble values then are obtained by application of a ruble-dollar ratio.

Outlays for other noncommunications electronic equipment are computed in a similar manner in that the underlying physical series are often based on order-of-battle information or are related to ground radar. Other information, however, is also brought to bear for some items. Outlays for the electronic elements of ground communication equipment are also determined in a similar manner, except that information on links, transmitters, and receivers as well as requirements and order-of-battle information are employed.

b. Dollar Values

As previously noted, the basic process of monetization is performed in dollars.

c. Ruble-Dollar Ratios

The over-all ruble-dollar ratio for military electronic equipment is 6 rubles to US \$1 in 1955 prices. This ratio, which has been used throughout this report, is a weighted composite of several ratios derived for different types of equipment.

One of the components of this over-all ratio is the ratio for radar equipment, also 6 rubles to US \$1. A ruble price was synthesized for an assumed typical Soviet radar set from known prices of labor and materials, which were applied to the physical inputs used in manufacturing a similar set in the US. The relationship between the fabricated Soviet price and the US price, both in 1950 prices, yields a ratio of 8.7 rubles to US \$1. The rate reflecting 1955 prices is obtained by deflating the derived Soviet price in 1950 terms with an index of labor productivity for the former Ministry of the Radiotechnical Industry and an estimated price index for electron tubes, then comparing this price with a derived US price in 1955 terms.

d. Further Considerations

The need is for more information that directly indicates Soviet production and procurement of ground electronic equipment or, for that matter, of any major military electronic equipment. More Soviet price information -- enough, at least, to permit calculation of expenditures in rubles -- would be highly desirable.

8. Guided Missiles

Something of a departure from the normal procedure exists with regard to this account. The other accounts under Procurement are limited to the items of hardware specified, whereas in this case not only the missiles and the ground guidance* but also their support equipment (special and standard) are included. To some extent this departure with respect to support equipment is a matter of necessity; it has not been possible to differentiate suitably expenditures for support equipment for all missile systems.**

Moreover, the basic approach is somewhat different in that the outlays for entire missile systems are derived first. All costs, both of investment and of operational nature -- encompassing everything from personnel to missile -- are taken into account by means of the building block concept used in cost analysis of weapon systems. Reconciliation with the accounts presented in this report presents little difficulty.

a. Ruble Values

Other than for certain standard items of equipment, it is not possible to obtain ruble values directly. Therefore, most of the estimation is performed initially in dollars and then converted to rubles with the most appropriate of the available ruble-dollar ratios.

b. Dollar Values

Basic to the valuation of Soviet missile systems is data on US systems. US data on costs and outlays for counterpart systems are adjusted in accordance with observed or estimated characteristics of Soviet operational deployment, organization, equipment, hardness of sites, and dispersion. Each system is necessarily considered separately with the requisite values for the missiles, ground guidance, and special support equipment derived from production functions ("learning curves").***

The usual practice of including all equipment procured (or produced) under the accounts for Procurement is also followed here. Thus missiles used for training, replacement missiles, and those missiles in the pipeline are included, as are those estimated to be operational. Initial spare parts are similarly included.

* Ground guidance includes all guidance equipment except that in the missiles and comprises such items as radar, computers, and fire-control equipment. Guidance equipment for missiles that is installed in aircraft and ships is also included.

** In future estimates, differentiation of the costs of special and standard support equipment may be possible.

*** See 1, a, p. 31, above.

Not included in this account are certain elements of equipment for missile systems that are covered by other accounts. Most notable of these elements are nuclear warheads. The other elements are the pro rata share of the equipment for early warning and ground control intercept that is associated with defensive missile systems, the aircraft and naval vessels that carry and launch missiles (alterations to aircraft and ships and special equipment installed on them are taken into account), and developmental work. In this regard it might be noted too that in those instances in which equipment is inherited from earlier systems it is not recharged to subsequent systems except insofar as there are modifications.

c. Ruble-Dollar Ratios

For the items basic to this account -- missiles, guidance equipment, and special support equipment -- there is no direct Soviet price information. (For standard support equipment, the situation is somewhat different.**) Thus, in the interests of minimizing distortion, ruble values are obtained wherever feasible by applying ruble-dollar ratios to components of this equipment. Of most importance for this purpose are the ratio for airframes and engines and the ratio for electronic equipment.**

d. Further Considerations

The most pressing need with regard to determining the necessary outlays for Soviet missile programs is for price information known to be directly applicable. Production functions, the number of plants engaged in producing each major item or component, replacement factors, and a host of like and other items are pertinent. As an alternative or as a supplement to such information, aggregative data on Soviet expenditures for missile systems would serve well in that they would provide benchmarks for evaluation.

9. Organizational Equipment

The consideration given to the other accounts under Procurement cannot be extended to organizational equipment. In the first instance, this account does not easily lend itself to such treatment; it covers myriad items, everything from automotive equipment to mess equipment, from special clothing to tent pegs. Second, the available information relates to certain types of this equipment only and varies with the individual item, in some cases pertaining to the quantity of an item held by a particular unit, in other cases to the prices of the items, although not necessarily the same items for which quantitative data are available.

It has been decided, therefore, that the usual methodology would not be productive. Instead, US outlays for this category of equipment and their relationship to other outlays are used after being modified on the basis of the available data to reflect Soviet conditions.

a. Ruble Values

Once the appropriate relationship between outlays for organizational equipment and other outlays is determined, ruble valuation involves no more than the application of this factor to the "other outlays" estimated for the Soviet military establishment.

* For example, see 5, a, p. 39, above.

** See 1, a, p. 31, and 7, c, p. 42, above.

b. Dollar Values

Dollar valuation is accomplished by means of a ruble-dollar ratio.

c. Ruble-Dollar Ratios

The ruble-dollar ratio is derived from the several ratios computable for particular items of organizational equipment and from ratios available for other classes of equipment. This procedure results in a ratio of 4.9 rubles US \$1 in 1955 prices. Ratios in terms of prices of other years are obtained by applying a Soviet index of industrial cost and a US index of the prices of machine and motive products.

d. Further Considerations

It is unlikely that organizational equipment will ever be treated in the manner accorded most of the other categories: there are too many items. This abundance of items, however, does not mean that the more costly items cannot and should not be so treated. Nevertheless, significantly improved estimates for organizational equipment are likely to come from an entirely different approach.

To date, items of major equipment have been considered separately -- for example, the T-34 and the MIG-19. Consideration of the combat and supporting units that use this equipment has been limited to establishing Soviet requirements for the equipment or evaluating the estimated volume of the equipment. (Estimates relating to personnel and operation and maintenance are made to a great extent in the context of the relevant units.) The present trend, for several reasons, is toward increasing emphasis on the expenditure required to equip and maintain specific units and/or to provide given capabilities.

It is in just this direction that realistic consideration of organizational equipment lies -- that is, on the basis of Soviet practice and the manpower and major equipment assigned to a particular unit, certain organizational equipment must necessarily be an integral part of that unit's equipment and equipage. This approach will incorporate greater flexibility: (1) it will facilitate use of available Soviet data and, hence, direct estimation in Soviet terms; (2) where the preceding is not feasible, it will permit computations of outlays for specific items of equipment where such practice is reasonable; and (3) it still leaves room for resorting to factors based on analogous data but with more specific analogs than heretofore employed. This new approach should also contribute appreciably toward resolving definitional problems associated with distinguishing between major equipment and organizational equipment.

The type of information required for this kind of reestimation of organizational equipment should, of course, ideally be direct Soviet data. The data should cover operating and training procedures, use of equipment, the actual organizational equipment and its cost to the Soviet Ministry of Defense, repair and maintenance schedules, and information on the level at which such work is performed -- for example, in the particular unit or at a higher echelon. Some of this information -- in fact most of it -- is needed for other categories as well.

C. Operation and Maintenance

In this category are included those outlays associated with operating and maintaining the equipment and organization of the Soviet armed forces, excluding outlays for military personnel but including those for civilian personnel. * Each of the entries in this category covers a particular but broad class of commodity or service that has usually been subdivided. For example, under Maintenance of Equipment** are the operating spares for all types of equipment, major and organizational. The spare parts for items of major equipment are computed for each distinct model (usually as a function of order of battle), although common factors exist for certain related items (such as armored combat vehicles). This method, although generally adequate, has certain shortcomings. Available data tend to support the belief that these shortcomings may be overcome by accounting for the requisite outlays by type of unit -- that is, on a functional basis -- rather than by type of commodity or service purchased.

1. Civilian Employees

a. Pay and Allowances

(1) Ruble Values

Although civilians are integrated in the tables of organization of Soviet military units and some relevant data are available on organization and wages, it has not been feasible to attempt an estimate from such material. Instead the outlays for civilian employees of the Ministry of Defense are based on gross calculations.

It has been estimated that civilian employees number about 10 percent of military manpower. *** The available organizational material on the USSR and analogous information on the US† lend credence to this figure. Application of the average wage†† for workers and employees in the USSR yields the ruble outlay required by the Ministry of Defense for these personnel.

The problems inherent in the procedure just presented are obvious. (a) The estimates of civilian personnel depend on and vary with the number of military personnel and are more likely to reflect the situation adequately over a span of years rather than on an annual basis. (b) The wage rate employed is an average applicable to an extremely broad segment of the labor force. Although this procedure is likely to yield an accurate estimate of the wage bill, there is as yet no direct verification. The scattered and seemingly profuse wage data available for these employees, however, may provide a basis for evaluation and/or refinement.

* Outlays for military personnel are included in A, p. 15, above.

** See 4, p. 51, below.

*** Based on a sample of information on tables of organization. 54/

† The US does have a considerably higher proportion of civilian employees, but this higher proportion is caused partly by the different practices in the two countries.

†† In 1955, 8,600 rubles. (For an index reflecting the movement of these wages over time, see Appendix C.)

(2) Dollar Values

Dollar equivalents of the ruble expenditures for civilian employees are obtained in the same fashion as were the ruble outlays, except that the average dollar pay for civilian employees of the US Department of Defense is substituted for the average wage in rubles. * 55/

(3) Ruble-Dollar Ratios

The ruble-dollar ratio for any year is simply the ratio of the average ruble wage to the average dollar wage. In terms of 1955 relationships the resultant ratio is 2 rubles to US \$1 (8,600 rubles divided by \$4,300).

The ratio just described is, for all practical purposes, unweighted. If weighted ratios were to be obtained, it would be necessary to account for differences in the composition of the civilian labor forces employed by the armed services of the respective countries. This process also would entail wage data, by position, for both countries. It is questionable, however, whether any substantial improvement would result from such an exercise.

(4) Further Considerations

Primarily the data required relate to the size and composition as well as the specific pay of the civilian employees of the Soviet Ministry of Defense. A moderate quantity of this type of material for individual units or locations is available; a satisfactory extension of such data would permit the improvement already suggested.

* There is a problem related to obtaining dollar values that is not peculiar to this sector but rather pertains to the entire area of personnel. This problem involves the differing concepts in the US and the USSR as to the functions and responsibilities of the personnel, in this case the civilian employees of the military establishments. The method outlined for obtaining dollar values could lead to some distortion of the results if any or all of the following occur: functions performed in the US by civilian personnel being performed in the USSR by military and/or security personnel, US procedures in a given instance being more extensive and/or complex than those in the USSR, certain operations that are nonexistent in one country being practiced in the other, or any of the many other possibilities. Such distortion would follow because the procedure used applies a dollar rate for US civilian or military personnel that may not be applicable in the USSR for the function being considered. The situation is aggravated by the disparity in the two countries between the relative position of civilian and militarized personnel with regard to remuneration.

The broad framework under consideration, however, tends to reduce the disparities. Further broadening of the framework to include more aggregative sectors of military activity -- for example, all personnel, militarized and civilian -- would further reduce such disparities. If it were possible to consider all activities on a strictly functional basis without being confined by organizational bounds (military, civilian, and militarized security), a better dollar representation for the entire activity or just a phase of it -- for example, personnel -- could be obtained.

b. Subsistence (Food), Clothing, and Miscellaneous

It is known that some civilian employees of the Ministry of Defense receive income in such forms as food and quarters. The average wage however, is believed to be inclusive of such income whether received in kind or allowances.

2. Maintenance of Facilities

a. Ruble Values

Estimates of the outlays made by the USSR to maintain its military facilities are directly related to the outlays initially required to construct them. Annual maintenance outlays generally are determined at 5 percent of the value of the facilities.* This factor is no more than a representation of what is deemed generally to be appropriate for items of construction in view of Soviet conditions -- for example, the severe weather. The facilities included in this estimate are air installations; missile sites; naval bases; petroleum storage facilities; buildings of fixed installations for communications; barracks; hospitals and buildings for administration, storage, and other purposes.**

b. Dollar Values

Dollar equivalents are obtained by applying the ruble-dollar ratio for construction.***

c. Ruble-Dollar Ratios

A single ruble-dollar ratio of 6.4 rubles to US \$1 in terms of 1955 relationships is employed to obtain dollar equivalents. This ratio is designed to be applicable to the Soviet construction activity in general, but the little evidence available that deals directly with military construction suggests that it is reasonable for military construction as well. This ratio, however, is probably conservative for maintenance as defined -- that is, exclusive of labor because construction materials are relatively more costly in the USSR than in construction.

d. Further Considerations

Actual outlays and the prices paid by the Soviet Ministry of Defense for this type of activity and the maintenance schedules and/or planning factors used constitute the information for which there is the most pressing need

* It will be noted that this factor must be exclusive of the value of military and civilian labor of the Ministry of Defense in maintaining facilities. Personnel costs are considered separately. (See A, p. 15, above, and 1, p. 46, above.)

** See D, p. 58, below.

3. Petroleum Products*

a. Ruble Values

Most of the Soviet military consumption of petroleum products including that for operating and maintaining equipment, is represented by the estimates under this entry. Operating reserves, which are probably paid for the Ministry of Defense, and stockpiles, which are believed not to be paid for the ministry, are excluded. Expenditures for operating reserves are likely to nonrecurring -- that is, for a given type and quantity of equipment, once these reserves are on hand they need not be considered further as an element adding cost. As the composition and number of units change and/or new equipment is introduced, however, these reserves will change with regard to volume and product.

Estimates, in metric tons, are available for the consumption of the various petroleum products by each of the Soviet services.** These estimates are derived by applying factors computed for each type of equipment or category of personnel to estimates of the order of battle.***

The resulting consumption, in tons, is then apportioned to zones in the USSR and European Satellites in accordance with the geographic distribution of Soviet troops and equipment. The application of internal zonal wholesale prices† for the various petroleum products yields the ruble valuations of the expenditures required for this consumption. For the Soviet prices in 1955, see Table 3. †† Similar information is available in terms of prices on 1 July 1950. †

b. Dollar Values

Equivalent dollar valuations are obtained by applying a ruble-dollar ratio.

c. Ruble-Dollar Ratios

For simplicity and ease of handling, a single ratio of 13.4 rubles to US \$1, † in terms of 1955 relationships, is applied to the summation of the ruble valuations described above. Actually the ratios for consumption by naval and ground forces should be slightly higher, that for consumption by the air forces

* Expenditures for solid fuels and purchased electric power, which might ordinarily be expected to be represented as an element of Operation and Maintenance are partially covered under Miscellaneous Supplies for personnel. Such expenditures, in aggregate, are believed to be rather small.

** Published reports 56/ provide estimates for part of the historical period. These estimates have been projected to complete the requisite series.

*** No allowance is made for Air Force and Army requirements for petroleum products for such purposes as space heating and lighting; they are considered to be insignificant. Handling losses are taken into account for aviation fuel and lubricating oil.

† The turnover tax (see Appendix A) and transportation charges are included.

†† Table 3 follows on p. 50.

††† 1955 prices (1 July) are 23 percent lower than those of 1 July 1950.

‡ Based on Soviet weights to which ruble and dollar prices were applied.

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Table 3

Prices of Selected Petroleum Products in the USSR a/
1 July 1955

Product	Rubles per Metric Ton				
	Zone				
	I	II	III	IV	V
Automotive gasoline					
A-66	537	564	594	640	704
A-70	620	670	720	790	880
A-74	715	745	785	875	960
Aviation gasoline					
B 100/130	1,025	1,075	1,100	1,140	1,315
B 95/130	898	945	896	1,088	1,238
B 93/130	875	915	960	1,060	1,200
B 91/115	715	745	785	875	960
B 70					
Jet fuel					
T-1, TS-1, T-2	370	390	415	440	448
Light diesel fuel					
L	292	317	324	350	420
Z	312	337	344	370	440
DL	292	317	324	350	420
Lubricants					
Auto-tractor oil AK-15 (Avtol 18)	740	780	830	900	1,000
AK-10 (Avtol 10)	810	850	900	970	1,070
AKZ p-6 and p-10	1,060	1,100	1,150	1,220	1,320
Diesel oil D-11, Dp-8, Dp-11, Dp-14 (with additive AZN 11 Tsiatim-1, except for D-11)					
	908	972	1,032	1,088	1,188
Diesel oil Dp-8, Dp-11, Dp-14 (with additive Tsiatim-339)					
	1,028	1,272	1,332	1,388	1,488
Automobile transmission oil	332	368	416	490	590
Auto-tractor transmission oil					
Summer grade	300	340	385	460	560
Winter grade	332	368	414	490	590
Aviation lubricants					
Fleet mazut	1,000	1,040	1,100	1,170	1,280
	250	279	295	320	388

a. 57/

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slightly lower. These differences, however, amount to no more than several tenths of a ruble per dollar, hardly enough to introduce any distortion in the results. Future presentation, however, may well require differentiation not only among the armed services, but perhaps to the extent of separate treatment for each principal petroleum product. Such differentiation will present no problem.

d. Further Considerations

Price data are for the most part plentiful. The major problem is establishing whether the available Soviet prices truly represent the prices paid by their military establishment. The current belief is that they do -- that is, the Ministry of Defense pays the turnover tax. (See Appendix A.) A second problem and one of lesser concern, is the need for additional price information for years between major price changes. Adequate detail exists with regard to prices of 1 July 1950 and 1 July 1955; information on price movements in the interim period and since 1955 is sketchy. Because the biggest part of the studies of Soviet military expenditures are conducted in base year prices, not having detailed information for interim periods is not of great importance. For purposes of refined budgetary analysis, which is conducted in current terms, suitable information on price movements becomes essential.

4. Maintenance of Equipment

This category is confined primarily to the expenditures required for operating spare parts* for major and organizational equipment. Outlays for personnel, facilities, and other supplies, which contribute to the maintenance of equipment, are treated in other categories.

Operating spare parts generally are computed from factors reflecting US experience which, where possible, are adjusted in accordance with the limited knowledge of Soviet practice. These factors usually express the monetary relationship between the expenditures for operating spare parts and the value of the order of battle, both of which are referred to in this report in terms of constant, or base year, prices.

a. Ruble Values

(1) Aircraft

Originally, operating spare parts were computed by applying factors for major components of aircraft to the value of the active inventory. For example, airframes and accessories, 10 percent of the value of airframes and accessories; electronics, 10 percent of the value of electronics; and armament, 5 percent. (Spare engines and spare parts for engines are included with initial spare parts under Procurement.) These factors are lower than those that were applicable in the US but were chosen at the cited levels to eliminate the influence of the longer pipelines that the US must maintain and to reflect the more primitive support provided to Soviet units.

More recently the procedure for computing the estimates of expenditures for these spare parts has been changed. These estimates are now

* Operating spare parts are to be distinguished from initial spare parts. The latter accompany the original equipment when it is delivered to a unit or depot; the former are delivered subsequently. Initial spare parts are included under Procurement.

derived as a function of production with a 2-year lag. All operating spare parts in year X are estimated at 10 percent of the value of production in year X minus . This procedure reflects US experience and yields very similar results to those gained from the more laborious, earlier technique.

One piece of evidence supports the reasonableness of the estimates obtained with either of the techniques just described. A reliable source indicated that in an offer to Finland the USSR was asking 108 percent of the value of MIG-15's proffered for a 3-year supply of spare parts. The value of the initial and operating spare parts as computed in this report is about 30 percent lower for a 3-year period than the value reported by the source. In view of the dependence of Finland for these spare parts on a foreign source and the likelihood of Finland's not being able to realize the advantages of size that would accrue to the USSR, it seems fair to conclude that Finland would require a proportionately greater outlay for spare parts.

(2) Armored Combat Vehicles

Operating spare parts for tanks and other armored combat vehicles are computed at an annual rate of 5 percent of the value of this equipment in the active inventory.

(3) Artillery and Other Weapons

A series of factors that may be reduced to an average annual factor of about 10 percent of the value of the artillery and other weapons in the active inventory is used.

(4) Ammunition

No specific estimate relating to the maintenance of ammunition has been made. To the extent that maintenance costs, other than spare parts, are included in other categories, the understatement caused by not having an entry here is minimized.

(5) Trucks

The factor in use for operating spare parts for trucks is 15 percent of the value of the trucks that are with the troops. Fifteen percent has been the minimum factor for the US.

(6) Naval Vessels

The spare parts, materials, supplies, and equipment necessary for the ordinary operation and maintenance of naval vessels by the naval establishment and the requisite outlays for repair, overhaul, and alteration done for the naval establishment are covered by this entry. Annual factors, in rubles per ton for each major class of vessel, are applied to the order of battle. The factors represent US costs converted with a ruble-dollar ratio.*

(7) Ground Electronics

An annual factor of 15 percent of the active inventory is employed for noncommunications equipment.**

* See c, p. 53, below.

** For the factor for the electronic elements of communications equipment, see (9), p. 53, below.

(8) Guided Missiles

Operating spare parts and supplies for missiles and the ground guidance as well as for support equipment for missile programs are included under this entry.*

(9) Communications Equipment

Maintenance of the equipment is estimated at an annual rate of 12.5 percent** of the estimated initial cost to the military establishment. In addition, a factor of 3 percent of the value of this inventory is added for utilities. The cost to the military of leasing facilities from the Ministry of Communications is derived by estimating the channel kilometers of facilities leased and applying an average price per kilometer.***

(10) Organizational Equipment

The calculation of the spare parts necessary for the maintenance of organizational equipment is the same as that for the initial procurement of the equipment -- that is, the application of the ratio that these expenditures bear to other defense expenditures in the US, adjusted to reflect the proportionately smaller effort that the USSR is estimated to put forth in this area. Ground, air, and naval forces are handled separately. Estimated expenditures for spare parts for organizational equipment are conceptually complete with the exception of those that would pertain to that part of the Soviet naval establishment providing shore support for the seagoing units. Expenditures for such spare parts for the vessels are included in the calculation presented under the entry Naval Vessels.†

b. Dollar Values

Although the dollar valuations may be considered to have been derived by the application of ruble-dollar ratios, they are in most instances directly computed in dollars: the factors expressed as percentages are applied to dollar valuations of inventories (or procurement).

c. Ruble-Dollar Ratios

The ratios employed are the same as those either obtained from or derived for the estimation of the amounts expended on procurement.†† There are, however, two exceptions, both relating to naval vessels. The ratio for spare parts for naval vessels is an average of ratios applicable to industrial materials and products: in 1951 prices, 10 rubles to US \$1 and in 1955 prices, 8.2 rubles to US \$1. Reflecting differences in composition and proportion of inputs is the ratio for alterations, 4 rubles to US \$1 in 1955 prices.

d. Further Considerations

The primary need with regard to operating spare parts is for more Soviet information that is directly applicable. Ideally the planning factors used by their military establishment would be most useful. Information on the use of equipment and on maintenance practice, however, although further removed

* See B, 8, p. 43, above.

** A factor of 10 percent was used in the past.

*** This procedure for estimating the cost of leased facilities represents a change from that used in the past.

† See (6), p. 52, above.

†† See B, p. 30, above, D, 4, p. 63, below, and Appendix B.

from the derived results will -- if available in sufficient detail -- permit the construction of suitable factors or, at the least, should facilitate a more confident adjustment of US factors.

5. Transportation

a. Ruble Values

The scope of this category is limited to the explicit expenditures for transportation made by the Soviet military establishment. Hence transportation charges included in the prices of equipment and supplies, charges paid by troops out of personal funds, and those charges that might be imputed for transportation performed by the military establishment are excluded. These costs are, however, included under other headings: where the transportation charges are an element of price, they are reflected in the expenditures for the item*; where military vehicles, or other means provide transportation, the costs are included in accounts under Personnel and under Operation and Maintenance.** Travel and other costs of transportation paid for out of personal funds are not a cost to the Ministry of Defense.

The procedure employed to ascertain the magnitude of explicit expenditures for transportation is to determine the ton-kilometers and passenger-kilometers associated with the relevant movements of military freight and personnel and then to apply the rates appropriate to each class of goods and to passengers.

The estimates of ton-kilometers of movement necessary to supply Soviet forces in the USSR and in the European Satellites and the Chinese Communist and North Korean forces during the Korean War were derived by considering the tonnages originating at primary centers of production and depots in conjunction with the geographic distribution of the forces. Only rail transport was taken into account; some of the equipment capable of being delivered under its own power, such as aircraft, is estimated to be so delivered; water transport is believed to be negligible in moving military materiel and personnel; and truck and air transport are believed to be furnished largely by the armed forces themselves.

Passenger-kilometers are estimated in a similar manner. Cognizance is taken of the average length of haul associated with maneuvers, rotation, and leave, as well as with the withdrawal from Austria. For reasons similar to those cited regarding movement of military supplies and equipment, movement by rail is the sole means of transport for which expenditures are calculated.

Specifically the procedures just described are applied to major items of military hardware; food, clothing, and coal; and major redeployments. Clearly this list is not comprehensive; there are other items for which explicit payment for transportation is made by the military establishment. Indicative of these omitted items are engineering equipment, organizational equipment, construction material and equipment, and spare parts. To provide for such omissions, the estimate derived for those items that could be specifically included is increased by 10 percent.

* Of the prices used, only those for petroleum products include transportation charges.

** Only operating costs are included in these categories. To account for the full cost, it would be necessary to include the appropriate elements under Procurement and under Construction.

Because rates known to be applicable to military transport are not available and because of the possibility that the military establishment receives preferential rates, alternative means of estimating the explicit expenditures of the Soviet Ministry of Defense for transportation are undertaken. In the first instance, Soviet rates for the particular commodities at appropriate average lengths of haul are used, as are the lowest class of passenger rates for the movement of personnel. For those items of military equipment for which no rates are included in the Soviet tariff, 58/ the rates for such civilian goods as vehicles, machinery, chemicals, and tools are used. In the second instance, the rates for coal, which are comparatively low, are used instead of the specific commodity rates. Rates for coal, converted to a passenger-ton equivalent, are also used for personnel because of the widespread Soviet use of freight cars for the movement of troops.

The estimate of total expenditures for transportation based on the first schedule of rates is about twice that yielded by the second schedule. Because the first schedule is likely to have resulted in overstatement, if only because of Soviet practice with regard to the movement of personnel,* the best estimate of these expenditures is considered to lie between the two figures derived by the means just cited. The halfway point -- that is, the mean of the two figures -- has been selected as the most reasonable estimate.

The pricing procedure just described was employed after the base year of the estimating process was shifted to 1955. In the initial study of Soviet military expenditures, 1951 was the base year. No rate schedules comparable to those released after the revision of the Soviet tariff effective 1 July 1955 were available. Hence an average rate, in kopecks per kilometer, was applied. This rate was derived from over-all revenue figures in rubles and transportation data in ton-kilometers and passenger-kilometers.

b. Dollar Values

Dollar equivalents are obtained by application of a ruble-dollar ratio. Although sample US rates might be applied, it did not seem feasible to do so, because of the problems associated with obtaining equivalence in detail when making this ruble-dollar comparison. Furthermore, the relatively small expenditure (less than 1 billion rubles annually) associated with transportation hardly seemed to warrant the considerable additional effort that would be necessary.

c. Ruble-Dollar Ratios

The ruble-dollar ratio, as an expression of freight rates in terms of 1955 relationships, is 4.8 to 1. This ratio is derived by comparing unit revenues in the US with similar unit revenues in the USSR. In both instances the figures for unit revenue are obtained by dividing gross freight revenues by revenue ton-kilometers. For passengers a similar comparison produces a ratio of 5.15 to 1. Because the two ratios are similar and because considerably more weight attaches to freight, the passenger ratio has been disregarded.

* Charges for the transport of personnel are estimated to account for about one-third of all explicit transportation charges.

d. Further Considerations

With sufficient effort the explicit coverage included in this estimate could be extended to some of those items now accounted for within the added increment of 10 percent. There is no indication, however, that the required effort will yield commensurate returns, given that expenditures for transportation are estimated to be somewhat less than 1 billion 1955 rubles annually and that this figure is considered to be a good reflection of the appropriate order of magnitude.

There remains, however, essentially one unresolved problem: whether or not the Ministry of Defense receives preferential rates. If not, the use of rates for civilian goods of similar bulk and density does not introduce serious error.

6. Medical Care

This entry is limited to outlays for medical equipment and supplies. Outlays for hospitals (the buildings and major equipment) and their maintenance and for personal services, military and civilian, are included in other categories.

a. Ruble Values

There is not sufficient material on Soviet military medical care to make a direct estimate of the associated expenditures. Thus US analogs are employed as the means of estimation. With this indirect approach, there is no basis for refinement by service or arm of service.

Outlays by the US Department of Defense for medical equipment and supplies are reduced to a per capita basis. This figure is then reduced by roughly 20 percent in order to reflect the lower Soviet standards. After conversion of this new per capita outlay to rubles* by means of a ruble/dollar ratio, it is the factor by which total military strength is multiplied in order to derive the estimate of the requisite Soviet expenditures.

b. Dollar Values

The basic calculation is in dollars, in terms of 1951 prices. The results of this basic calculation are converted to other dollar bases by means of an index of wholesale prices of all commodities.

c. Ruble-Dollar Ratios

The ratio used to convert the per capita outlays to rubles represents the median of ratios for scattered items of medical supplies and equipment. In terms of 1955 relationships the ratio is 8 rubles to US \$1.

d. Further Considerations

Although direct information as to the type and cost of medical care with regard to supplies and equipment is perhaps the most desirable, there is other information that might serve well. Illustrative is the type of information available on Soviet military sanatoriums and hospitals, including a smattering

* The figure was originally computed in 1951 prices and then deflated with an index of industrial costs to 200 rubles in terms of 1955 prices.

that is indicative of expenditures. From such information, there should be a more refined version of the estimate herein described.

7. Printing and Publishing

An estimate of expenditures for printing and publishing by the Ministry of Defense is included solely because it is obvious that the Ministry supports a considerable effort for this purpose. Little of direct financial importance is known, information being limited primarily to the knowledge that a considerable number of military books and pamphlets are published and that there is a Soviet publishing house devoted to this end.

a. Ruble Values

On the basis of analogous US outlays a dollar figure is derived which by means of a ruble-dollar ratio is then converted to rubles. The estimate so obtained is submitted as no more than an indication of the order of magnitude for example, it is clear that expenditures for this purpose would fluctuate over a period of time, and the derived estimate does not.

b. Dollar Values

The dollar equivalents do not need derivation because the basic calculation is in dollars. These dollar values are also moved with an index of wholesale prices for all commodities.

c. Ruble-Dollar Ratios

In terms of 1955 price relationships the ratio is 6 rubles to US \$1. To obtain other price bases, a Soviet index of industrial costs and the previously mentioned US index are used.*

d. Further Considerations

Literally nothing of quantitative significance is known. Any information that is indicative of the volume of military publications or of the associated expenditure would lead to substantial improvement.

8. Other

The only Soviet military expenditures currently carried under this account are those for the All-Union Voluntary Society for the Promotion of the Army, Aviation, and Navy (Vsesoyuznoye Dobrovol'noye Obshchestvo Sodeystviya Armii, Aviatsii, i Flotu -- DOSAAF).

a. Ruble Values

Revenue raised through dues is obtained by applying the known assessment per member to the

* See Appendix C.

estimated number of members. The last component, local contributions, is estimated to account for less than 20 percent of the total, although such a figure represents only a best guess as to the volume of this known support of DOSAAF.

There are several limitations to the estimate resulting from the process just delineated. The information available is several years old and covers a limited period of time. Changes in the degree of participation and in the extent of financial support are bound to have occurred over time. Although the constant annual expenditure carried as the estimate for the entire span of years is not credible, there is reason to believe that it represents a reasonable order of magnitude.

b. Dollar Values

Dollar equivalents are obtained by applying a ruble-dollar ratio.

c. Ruble-Dollar Ratios

The ratio of 5 rubles to US \$1 in terms of 1955 relationships, is employed, representing no more than an estimate of the balance in the distribution of outlays between manpower and supplies. In effect, it is a compromise between the low ratio for manpower (about 2 to 1) and the considerably higher ratios for materials and supplies.

d. Further Considerations

It is clear from the discussion above that more information on the changes that have occurred with regard to the scope of activities of DOSAAF, as well as more comprehensive and current information on its financing, will improve at least the confidence with which this minor estimate might be viewed.

D. Facilities

In general, it has been necessary to estimate expenditures for Soviet military construction by making single, comprehensive calculations covering all construction of a given type, such as barracks or warehouses. With but three exceptions, it has not been possible to estimate the required expenditures for construction as it relates to specific military functions or activities. It is hoped, however, that these three exceptions indicate the direction of future estimates.

The first of the exceptions, air bases, includes most of the facilities to be found at such Soviet bases. The second is the construction associated with the Soviet guided missile program. Here too, the inclusion of facilities is comprehensive. The last exception is operational naval bases, which, although less inclusive than the first two, follow the same pattern.

The method of dealing with the exceptions, of relating the construction to the function of which it is a part, has the virtue of being more flexible and more complete, as well as, for many purposes, placing the outlays in a more meaningful context. Such a method does not preclude deriving total expenditures for construction or, for that matter, for a given class or type of construction.

In the discussion that follows it has not been possible to include all elements of Soviet military construction. In general, certain obvious facilities such as messhalls and maintenance shops are not covered, nor are utilities or

the frequently reported fences around all installations. These items are included at least in part and conceptually, in the expenditures for that construction treated along functional lines. As the three exceptions make clear, the least information is available for the purely ground force and logistic installations found in the USSR.

Because most of the estimates and the accounts are oriented to class type of construction, those for air bases, guided missiles, and naval bases cut across the lines of the several accounts. They appear under the first entry, however, it being the most appropriate.

1. Facilities for Operation of Equipment

a. Air Bases

(1) Ruble Values

Since the close of World War II, most of the Soviet construction of military air bases has been to provide for expanding jet forces. Because of the relatively small expenditure associated with other bases, the estimate has been limited to home bases of jet combat units and of Tu-4 units.

In general, provision has been made for all facilities but not for equipment. Runways, taxiways, hardstands, storage facilities for petroleum products, housing, personnel service buildings, administration and operations buildings, maintenance shops, and small ancillary buildings are accounted for specifically. Roadways, installation of utilities, and some miscellaneous items of construction are not specifically included but are covered by adding a factor of 10 percent of the cost of the other items.

The number and types of bases and their dates of initial operation are determined largely through information on the air order of battle. From tables of organization and equipment, information suitable for estimating the requisite base facilities is obtained. Several sources provided the specifications of the runways, taxiways, and parking areas. Information out of East Germany is the basis for the assumed size of storage facilities for petroleum products.

The number of these air bases is determined through 1955 in the fashion described above. In order to make provision for the following period, beginning with 1956, an estimate of the number of bases in 1963 has been valued in a manner consistent with that employed for the historical period. The additional increment of value compared with 1955, is then prorated over the intervening years, paying as much heed as possible to relevant considerations.

In most instances, Soviet data on prices and costs are available for direct application to the derived specifications. Such data for grading and preparing sites, for poured concrete, for square meters of various types of building are all available or derivable. (See Table 4 for a sampling of the prices and costs employed. *) Although many of the prices and costs employed are for civilian rather than military construction, suitable modification is not unduly hazardous. If any substantial error in pricing is present, it is probably due to positing that civilian labor is used for the construction. There is basis, however, for judging that the use of other labor is relatively minor.

* Table 4 follows on p. 60.

Table 4

Sampling of Prices Employed in Determining Expenditures
for Military Construction in the USSR
1 July 1955

Type of Construction	Price (Rubles per Square Meter) <u>a/</u>
Pavement at typical air bases	
8-inch concrete surface on 8-inch compacted sand, gravel, or other base	52
12-inch concrete surface on 12-inch compacted sand, gravel, or other base	72.5
Housing	
Family quarters	
Commissioned officers	1,480
Noncommissioned officers	1,260
Bachelor officers' quarters	
Barracks	870
Messhall	700
Administration and operations buildings	1,000
Maintenance shops	870
Hospital	35,000 <u>a/</u>

a. The figure shown for hospitals is given in terms of the cost of construction per bed.

The price basis employed is that of 1 July 1950. The application of an index value of 87* (1 July 1950 = 100) yields values in 1 July 1955 rubles.

(2) Dollar Values

Dollar equivalents of the ruble values are obtained by application of a ruble-dollar ratio.

(3) Ruble-Dollar Ratios

An over-all ratio for construction of 6.4 rubles to US \$1 in 1955 prices is employed. It is not feasible to derive and devise ratios specifically applicable to each type of military construction.

* For the price index of construction, see Appendix C.

(4) Further Considerations

The information still required is of two kinds -- that relating to specific facilities at given types of air bases and that reflecting the charges actually paid by the Soviet military establishment or its agents for this type of construction. In the first instance, the need is for more direct information on facilities and installations, primarily other than runways, taxiways, and hardstands. In the latter case, either direct information or information substantiating the applicability of prices with a civilian origin is needed.

Information on the source, budgetary or otherwise, of the funds used for the construction of these air bases should be obtained, although it is not specifically related to determining Soviet expenditures for air bases.

b. Guided Missile Construction

Construction expenditures for guided missile programs are an element of total expenditures for missile programs derived in the manner described in III, B, 8, p. 43, above. Briefly, the method is generally one of using analogous US information modified by available Soviet data. There are, however, two instances both relating to surface-to-air missile programs (the SA-1 and SA-2 programs) for which rough specifications of Soviet installations are available. In the general case, calculation is performed in US dollars for each program and for the key components thereof. Ruble values are then obtained by applying the general ruble-dollar ratio for construction used throughout this report -- 6.4 rubles to US \$1 in 1955 prices. For the indicated surface-to-air programs the estimates are made in terms of Soviet construction costs.

c. Naval Bases

(1) Ruble Values

This estimate is derived from data on a limited number of operating naval bases. The basic information listed the facilities at these bases. In the main, it is difficult to establish their scheduling, the actual period of the construction as well as the initial date of operation. In addition, there is no assurance that the listed facilities are all-inclusive. Nevertheless, a partial estimate is to be preferred to none.

Estimates of the required outlays are derived on the basis of known Soviet prices for construction materials, of costs for certain units of construction, and of prices for given types of equipment. Again, the pricing procedure is primarily one of adapting information on prices and costs for civil construction.

At the conclusion of this process the outlays for the entire period 1946-55 are prorated evenly on an annual basis. The amplitude of the fluctuations from year to year that resulted from the basic calculation hardly seemed worth maintaining. On the one hand, the ruble amounts are relatively small; on the other, the difficulties of scheduling preclude such implications of accuracy. For the years after 1955 the annual value obtained from smoothing the historical series is employed.

(2) Dollar Values and Ruble-Dollar Ratios

The over-all ratio for construction of 6.4 rubles to US \$1 in 1955 prices is employed.

(3) Further Considerations

The informational problem is typical: more information is needed on facilities, their dates of construction, and the prices paid by the Soviet military establishment.

2. Facilities for Maintenance of Equipment

No specific estimate of this type of facility has been made. To some extent, of course, repair shops and the like are included in the categories of construction discussed above. To a much more limited extent, however, maintenance equipment (the equipment in such shops) has been included. Most of it is covered, at least conceptually, by the estimate of organizational equipment.*

3. Facilities for Personnel

This category is defined to include housing facilities only. Hospital, mess, recreation, and other facilities for personnel, to the extent they are included, are treated in 5, p. 65, below.

a. Ruble Values

Fundamentally, a single factor is used to account for the resources devoted to housing military personnel. A Soviet source has stated that 4 square meters of barracks space is the per capita allotment for military personnel.** 60/ Where, however, personnel and their dependents are housed in air base facilities, there is differentiation for rank and family status, and quarters are provided accordingly. In this instance, too, allowance is made for those living off the base. The scheduling of the construction of this housing is done in accord with the development of the respective air bases and is considered to be an element of the third and final phase of the standard Soviet pattern.***

With regard to the remaining military personnel -- that is, all others housed in military base facilities throughout the USSR -- the problem of scheduling is handled in a different manner. An average strength for the period 1947-55 of 4 million men† times the allotted minimum space of 4 square meters per man yields an inventory requirement of 16 million square meters of housing, barracks style. In the early years of the period it was unlikely

* See B, 9, p. 44, above.

** A recently received publication indicates 2.5 to 4 square meters, 59/ representing the minimum and applying essentially to conscripts.

*** Standard Soviet practice seems to divide the construction of a permanent air base into three phases. During the first 2 years, runways, taxiways, and parking areas are built; in the third year, storage facilities for petroleum products; in the last 2 years, base installations, including permanent housing. Naturally, there is a degree of overlap among these phases.

† This figure of 4 million men is used only for estimating expenditures for military facilities that are computed as a function of manpower.

that permanent housing was available for all personnel, in view of the widespread destruction in western USSR during World War II and of reports of tents being used as base housing. It is assumed, therefore, that such an inventory of permanent housing did not exist until 1955.

For this basic housing, 10 percent of the value of the inventory as estimated for 1955 is taken to represent the annual expenditures for new construction and maintenance. In 1947, expenditures equal to 7-1/2 percent of the value of the inventory are estimated to have been allocated for replacement, 2-1/2 percent for maintenance. It is presumed that both types of expenditure converged over time on a limit of 5 percent of the values of the inventory, and that this limit is reached in 1955 and maintained during the remaining years covered by the estimate.

Clearly such an estimate must be in error for some years, it is believed that for a period of time the estimate is a conservative but reasonable order of magnitude for housing expenditures.

b. Dollar Values and Ruble-Dollar Ratios

The construction ratio of 6.4 rubles to US \$1 in 1955 prices applied to the ruble values to obtain dollar values.

c. Further Considerations

The major need is for direct information as to the space allotted personnel, by service, in accordance with rank and family status and on the scheduling of the construction of such facilities.

4. Fixed Communications Facilities*

This account embraces the major, military, fixed, ground-to-ground telecommunication facilities of the USSR, including wireline, microwave, and long-range radio. These facilities are defined as those of military command nets from divisional echelons and major naval headquarters up to the Ministry of Defense and those command nets from major headquarters to major military air bases, as well as the entire air defense system. Telecommunications equipment of lower echelons is largely mobile; hence it is included with organizational equipment. **

Specifically excluded are those nets and facilities associated with radar, jamming, communications intelligence, direction finding, monitoring, meteorological services, police functions, civil defense, guided missiles,

* After computation the value of the electronic components of these facilities is included with ground electronics (see B, 7, p. 41, above). In the future, this account may be placed under Procurement because it now comprises equipment almost exclusively.

Until recently these estimates were somewhat less comprehensive and included a heavy element of buildings and structures. Inclusion of such buildings and structures is now believed to be unrealistic. More information has become available, including price information. The price information permits direct valuation of the equipment in rubles rather than dollars as in the past. Finally, the base year for determining an initial inventory of these facilities was 1955, not 1959 as it is now.

** See B, 9, p. 44, above.

DOSAAF, the MVD-KGB, atomic energy, navigational aids, and, as noted above, mobile facilities, including the fixed ground stations with which the mobile units communicate. As in the case of mobile equipment, some of the facilities and nets excluded here are covered elsewhere in categories relating to other military programs.

a. Ruble Values

Within these definitional bounds the basic procedure is to establish the cost of reproduction, in constant ruble prices, of the inventory of the fixed communications facilities at a point in time and thereafter to determine the annual increments to this inventory both backwards and forwards in time. In general, the value of equipment is determined from Soviet prices.

The inventory valued is that estimated in existence in 1959. The Soviet order of battle, down to divisions, is located geographically in the appropriate military districts. Communications are then established among the various elements in accordance with their function in the military structure.

Within the chain of command the Ministry of Defense is linked to all military district headquarters, and military district headquarters are linked not only to their respective armies and corps but also to air and naval components within their respective areas. In addition, the Ministry has direct links to all field army and independent corps headquarters. Lateral communications also exist; military districts maintain contact with each other, as do other echelons within a district.

Detailed estimates of the facilities and equipment found at various communications centers are developed, and values applied to these components. Available information, including planning manuals, are sufficient to make this step possible.

Summing the value of the communication equipment at the various centers provides the estimated inventory for the base year. The base year inventory is projected back to 1955 and forward to 1965 by relating the growth of mainline communication equipment to the growth in production of military radio equipment. The annual expenditures for communications facilities are simply the differences between the values of the inventory in successive years.

b. Dollar Values

Dollar equivalents of the annual ruble expenditures are obtained by employing the ruble-dollar ratios cited below.

c. Ruble-Dollar Ratios

The ratio for communications equipment is about the same as that for radar and other electronic equipment, 6 rubles to US \$1.*

d. Further Considerations

More data on the actual equipment employed at the various echelons of the Soviet military network, the scheduling of installing these communications facilities, and the completeness of the coverage herewith included

* See B, 7, p. 41, above.

in terms of what it is intended to be would all add to a reduction in the margin error that now must be subjectively ascribed. As always, any actual outlay prices paid by the Soviet military establishment would be welcome additions.

5. Other Facilities

This last category of construction is a catchall intended to represent all military facilities not already specifically included. It falls somewhat short, however, and is limited to administration buildings, warehouses, hospitals, and petroleum storage facilities. To the extent that some of these have already been included, * they are treated here on a net basis. Because of the similarity in the means of building the estimates for three of the four items, they are all treated together.

a. Ruble Values

Annual expenditures for military administration buildings and warehouses are computed in the same way as those for barracks. The only variant is the price per square meter of structure. ** It is assumed that 1 square meter per man of each of these types of structure would satisfy the minimum requirements of the Soviet forces. For this purpose, a constant force level of 4 million men is posited for the period beginning with 1947. The requirement of 4 million square meters of each of these types of facility is estimated to have been fulfilled in 1955. Annual expenditures for new construction are the same function of the value of the base year inventory as is the case for barracks. **

Expenditures for hospitals are treated in similar fashion: a basic inventory in 1955 and the same converging series of outlays for replacement and maintenance. The sole difference is that the requirements for space per man are converted to the cost per bed, 35,000 rubles in 1955 prices. Soviet data on civilian hospitals serve as a guide for this value and also provide some indication as to the number of beds to be expected in military hospitals. It has been concluded that in 1955, when the inventory requirement was reached, the available beds were sufficient to accommodate 1 percent of the personnel of the forces. Again, the figure of 4 million men is used for this purpose as the representation of manpower.

Storage facilities for petroleum, oil, and lubricants are treated in a different manner. On the basis of information that the operating reserves of the Soviet Air Forces vary from 17 to 33 percent of annual requirements, 61/100 is posited that storage facilities with a capacity equal to 20 percent of annual consumption is the rule for all Soviet forces. Thus a basic inventory for 1947 is computed, and annual increments to this inventory are calculated as a direct function of the increases in consumption of petroleum products. The resulting series is then smoothed; that is, the average outlays during the periods 1947-50, 1951-55, and 1956 on are used as the annual values during the respective periods. Irregularities in the unsmoothed series are inconsistent with what was to be expected from other related developments. It is necessary to employ US prices for these facilities† and to convert the resulting values with the ruble-dollar ratio for construction.

* See D, 1, p. 59, above.

** In 1955 prices, 1,000 rubles per square meter for administration buildings and 580 rubles per square meter for warehouses.

*** See D, 3, p. 62, above.

† The minimum prices used for computing the storage capacity of air bases are employed.

In this instance, there is an element of double counting, so small it can be ignored, which stems from the inclusion of storage facilities for petroleum products in the calculations of expenditures for the construction of air bases and the all-inclusiveness of this method of computing storage facilities.

b. Dollar Values

Dollar equivalents are obtained in exactly the same fashion as for the facilities already discussed. Where direct valuation is in rubles, as in expenditures for administration buildings, warehouses, and hospitals, the ruble-dollar ratio for construction is applied. In the case of storage facilities for petroleum products, direct valuation is in dollars.

c. Ruble-Dollar Ratios

Once again the same ratio of 6.4 rubles to US \$1 in 1955 prices is employed.*

d. Further Considerations

The emphasis must be placed on the need for more specific information on the exact types and quantities of those facilities that the Soviet military establishment has and the rates of accretion during a period of time. Least is known about the facilities to be found at ground force and logistical installations in the USSR. As already noted, all facilities are not accounted for, and information which would permit extension of these estimates is desirable.

E. Research and Development

It is clear that the interest in research and development, insofar as this report is concerned, is confined to that research and development having a more or less direct bearing on Soviet military capabilities. The available data, however, preclude making a direct approach to estimating this particular aspect of Soviet research and development. Instead, it has been necessary to consider all such activity and only thereafter to estimate the military share.

1. Ruble Values

Although the USSR reveals sizable expenditures for science, not enough additional data are available to permit direct estimation of total expenditures for research and development. Therefore, analogy must be resorted to.

The rather regularly announced expenditures for "financing scientific research establishments," which are financed primarily from the budgetary allocation for social-cultural purposes, appear to correspond to what would ordinarily be termed research and development in the US.** The rest of the Soviet program,

* See D, 1, p. 59, above.

** Basic and applied research and its application to new uses up to the point of design and production engineering.

which is hereafter referred to as product development, is closely akin to the concept of development, test, and evaluation used by the US Department of Defense.

On the basis of this kind of division of expenditures for research and development in the US, specifically by the Department of Defense, a relationship has been derived that is used for the USSR. In recent years, expenditures of the US Department of Defense for development, test, and evaluation have been as great as those for research and development.* Because of the obvious emphasis on military research and development in the USSR and because product development in general would reasonably be expected to receive more emphasis in the USSR than in the US,** the use of a one-to-one relationship between product development and other research and development for the USSR appears justified but conservative. It is not possible to overcome the conservative relationship, however, because no means was available for determining how much greater product development should be or how such a relationship would vary over time. Hence the one-to-one relationship is adopted as the best to be had at this time.

Application of this relationship means that Soviet outlays for research and development are estimated at twice what were announced for "financing of research establishments." This procedure, within its limitations, is adequate for the period through 1957. In 1958, there was apparently a change in the scope of announced expenditures for research and development.*** No explanation can be documented, but the most reasonable hypothesis is that the economic reorganization that began in 1957 has included a considerable realignment in the subordination of the organizations engaged in research and development and that consequently some of the outlays for product development are now included in the announced allocation.

The procedure described so far encompasses the historical period but not the present and future. In arriving at estimates for the period beginning with 1958, personnel and wage data play an important part.

* Until the publication of the budget for 1960, expenditures for development, test, and evaluation were always included under procurement. In the budget for 1960, some of these expenditures have been combined with the expenditures for research and development under the entry Research, Development, Test, and Evaluation.

** It seems credible that because so much of what has been developed in the West is available to the USSR and because the USSR is generally behind the West there must be appreciable Soviet effort to adapt Western developments (that is, product development). This ability to progress, up to a point, without research should mean greater proportional emphasis on product development by the USSR.

*** Apparently the announced plan for expenditures in 1958 was on the old basis and actual expenditures on the new basis. This difference may account for the indicated excess of actual expenditures compared with the plan. It is possible, however, that the figures would still show an excess of actual expenditures if both were given on the same basis. It is of interest that simple extrapolation of the budgeted funds announced for the period 1950-57 yields a value for 1959 that is remarkably close to the announced planned allocation of 23 billion rubles.

The nature of the data on scientific manpower, including their relative plenty and precision, makes them the most useful in attempting the projection. The series of scientific manpower employed in research institutions* has been selected for this purpose because the best direct data on expenditures are the announced allocations for financing these institutions. For the period 1950-57 the expenditure per scientist can then be determined and applied to the number of these scientists estimated for each of the following years. In accordance with the procedures used for the historical period, the expenditures so derived are doubled in order to take account of product development.

Constant ruble values are used to express these expenditures. The expenditures per scientist are derived initially in current rubles; they are converted to constant rubles by apportioning them between wages and other outlays** and by applying a general index of wages 62/ and an index of industrial costs, *** respectively. In spite of obvious inadequacies the latter index is used to reflect changes in the prices of construction, equipment, and materials.

The resulting expenditures per scientist showed an annual average rate of increase of 2-1/2 percent in real terms over the period 1950-57. Although most of the increase took place during 1954-57, the average rate for the entire period is incorporated in the derivation of expenditures for 1958 and successive years.

Only a partial test of the reasonableness of the expenditures per scientist is available. These expenditures include wages for supporting personnel as well as for the scientists. Application of estimated annual wages for such personnel indicates that about one-half of the estimated outlays go for wages. During the Fifth Five Year Plan it is estimated that roughly 70 percent of the expenditures of the Academy of Sciences were so expended, but the Academy has the highest paid scientific personnel. In addition, the nature of the Academy's work in pure and applied research would be expected to result in proportionally lower outlays for equipment and materials compared with other organizations engaged in research and development. Furthermore, US outlays for research and development seem to be apportioned roughly 50-50 between wages and other categories of expenditure. Although normally the mere fact of comparability between the US and the USSR in such an instance would be sufficient to arouse suspicion of the results, the relatively superior position of Soviet scientists in their wage structure compared with that of US scientists is a strongly mitigating circumstance. Moreover, statistics recently published by the USSR, although subject to alternate interpretation, are seemingly confirmatory. These statistics indicate a general decline, in the proportion represented by wages, from about 60 percent in 1950 to about 50 percent in 1957. † 63/

The final step, that of determining what proportion of total Soviet expenditures for research and development is of military significance, is rudimentary. Although it is known in general terms that Soviet research and development is oriented toward military ends and/or toward programs of likely military significance, to a lesser extent toward investment in heavy industry, and to a

* Through 1957. Projections are based on estimates of more comprehensive groups of scientific personnel.

** The changing relationship of wages to other outlays has been considered.

*** See Appendix C.

† It should be noted that these published figures are in current rubles. In constant terms the changes would be magnified because wages have increased during the period, whereas other costs have, in general, declined.

relatively negligible degree toward consumption, it is not possible to estimate specifically the relative shares. It has been postulated, therefore, that two-thirds of the total Soviet effort is for military or related purposes, in view of the fact that about one-half of US outlays for research and development (including product development) are within the scope of the Department of Defense and the Atomic Energy Commission and that the US expends a considerable amount on research and development for consumer goods. This proportion appears reasonable, but to date no evidence to support or disprove it has been found.*

Because of the possibility of amortizing the cost of such research and development and recovering it in price, the question of double counting arises with regard to this account. Regardless of this possibility, an underlying term for price information was that such information be exclusive of the costs of research and development. Where US prices have been used, they were to be free of nonrecurring costs, and fortuitously the Soviet prices generally pertain to items that had been in production for more than 2 years,** that were being produced under license, or that were direct copies of Western products.

2. Dollar Values

In view of the limited amount of detail available, the dollar equivalent of Soviet expenditures in rubles for research and development is necessarily crude. As in all other instances in this report, dollar values conceptually represent the estimated outlays required to pay for the same programs and activities in the US. For research and development, as for military personnel, the principal expenditure is for manpower, not a commodity. Thus Soviet outlays for research and development when stated in dollars represent, in effect, what the manpower, materials, and the like used in the Soviet effort would cost in the US; it does not represent what the final products of Soviet research and development would cost. Nor does it represent the cost to the USSR in real resources. In spite of the preferred position of scientists in Soviet society, the US scientist commands far more in real terms, and thus the application of US wage scales to Soviet personnel merely represents what the number of scientists would "cost" in the US.

The dollar equivalents are obtained by applying the ruble-dollar ratio discussed immediately below.

* A declining proportion of the total of such expenditures was accounted for by the published breakdown 64/ of budgeted expenditures for financing scientific research establishments into wages and the like. In 1950, 57 percent of such expenditures were explained; in 1957, only 40 percent. Whether this failure to break down the residual is a reflection of sensitive Soviet programs is not known. In a sense, it seems to be too obvious a revelation for them to be making. Interestingly, the republic outlays are explained essentially in full; the unexplained expenditures involve disbursements from the union budget.

** The usual practice, where amortization of research and development cost exists, is for that cost to be recovered during the first 2 years of series production.

3. Ruble-Dollar Ratios

It is assumed that the apparently equal division of Soviet outlays for research and development (exclusive of product development) between wages and other items, is suitable for at least most of the period under study. With the use of this relationship, a ratio for manpower of 3 rubles to US \$1, and a ratio of other expenditures of between 6 and 10 rubles to US \$1, there are obtained over-a ratios of between 4 rubles and 5 rubles to US \$1 in 1955 terms. The upper limit of 5 rubles to US \$1 has been chosen largely because it is believed that the influence of product development would tend to raise the ratio.

Per capita outlays for scientists in the US and the USSR, when compared, present some interesting testimony. In 1953, US expenditures per scientist amounted to \$27,000 and Soviet expenditures to 110,000 rubles, a relationship of about 4 to 1. By 1955, Soviet outlays were increasing rapidly, as were those of the US, with the result that the relationship between ruble and dollar expenditures seemed to remain constant or perhaps to increase somewhat, to more than 4 to 1.

In spite of certain incomparabilities in the US and Soviet data, the per capita expenditures that are derived undoubtedly reflect an order of magnitude of reasonable proportions. Although ordinarily such comparison could not and should not be used to verify or to form the basis for a ruble-dollar ratio, in this instance, and given the apparent similarity in the use of the funds, it is not without relevance.

4. Further Considerations

It is not necessary to consider in detail the kind of information still necessary to improve considerably the estimates of Soviet research and development. In almost any aspect, additional information is needed -- for example, (a) Soviet expenditures for product development; (b) the number of each category of personnel employed in any phase of research and development; (c) outlays for wages, construction, equipment, and the like; (d) the distribution of funds with regard to research and development for military, industrial, and consumer purposes; and (e) more information on the financing of research and development.

F. Other Programs and Activities

This category is a residual that completes the system of accounts encompassing all the programs and activities of direct military significance that have not been enumerated above. Included in this category are programs and activities that, because of purpose and/or scope, go beyond the limits of being applicable solely and directly to the capability of the Soviet forces -- for example, the entire Soviet nuclear energy program. The development and production of weapons is of direct military significance; the balance of the program is not. The situation is similar with regard to another entry, International Transactions. Imports and exports of military end items, particularly new and modern equipment, are of direct significance; occupation costs are not. Transactions of the latter type, however, are important because they undoubtedly ease the economic burden of the USSR with respect to its military establishment.

1. International Transactions

The comprehensive heading International Transactions is employed to demonstrate the breadth and complexity of the problem usually referred to as military trade. The actual importing and exporting of military goods and services

is only one facet of the problem, in some ways the aspect that lends itself most easily to solution; the burden on the producing country and the extent of that burden with regard to the armaments industry of the producing country may be ascribed with relative ease. Beyond this point, trade in military goods presents the same complexities -- for example, suitable valuation -- as do other Soviet trade transactions, as well as occupation costs and reparations.

With regard to the receipt of occupation costs, there may be nothing tangible with which to start except the nominal monetary value of such payments. These receipts may be sufficient, for example, to cover the operating expenditures of Soviet troops in the country making the payments. The USSR, however, may defer expenditure of the receipts. What is more important is that these receipts may not be spent for items necessary for the support of Soviet forces. In such case, the USSR would be directly bearing the burden of providing the supplies for these forces but, in an over-all economic sense, may be receiving still greater returns.

Discussion of this kind can be extended at great length. All of the associated problems, however, do not seriously affect the subject of immediate interest, which is the actual annual expenditures of the USSR for military programs and activities. To the extent the USSR is not consuming its domestic production of armaments and is importing armaments and supplies from other sources, there should be an accounting.

These problems assume greater importance for purposes of national accounting but are not of serious consequence, because the volume of these transactions relative to the Soviet national product, or even in relation to all balance of payments transactions, is not inordinately large. In the area of budgetary analysis the importance of international transactions is a function of Soviet financial practice. Fortunately, Soviet practice is believed to be of a nature that tends to minimize such transactions -- that is, it is believed that revenues obtained from occupation costs and from trade in military items accrue to the Soviet budget as general revenue and are not unbudgeted revenues at the disposal of the Ministry of Defense. If this be the case, what might be substantial financial resources need not be sought and accounted for.

a. Trade

This heading is defined to cover all transactions between the USSR and other countries that involve the movement of military goods. No differentiation because of the methods employed to finance the transactions, the terms of the transactions, and the like is of relevance. Hence, for example, those East German products consumed by the Soviet occupation forces are imports by the USSR; those Soviet products consumed by the occupation forces in East Germany are domestic (Soviet) consumption. Those payments of occupation costs that are not spent in East Germany for items of military supply but for other purposes are outside the purview of this discussion. The primary interest is in the requisite expenditures for Soviet military consumption, regardless of whether the goods are of Soviet or foreign origin. When the goods are of foreign origin, of course, the timing of Soviet payments for them, as opposed to receipt of them, is necessary information.

In spite of Soviet Bloc announcements indicating that reparation terminated several years ago, such payments would still bear on the broader issues of significance with regard to the historical period and, therefore, to budgetary analysis.

2. Stockpiling

This category is provided because it is an account* under US expenditures for major national security. Hence, for purposes of comparing US and Soviet expenditures, allowance must be made for this category.

The category is defined to cover primarily expenditures for stockpiling critical and strategic materials and for the expansion of the production of critical materials, items for which it has not been possible to make counterpart estimates for the USSR. Hence, when comparisons between US and Soviet outlays are made, US expenditures for these activities are deleted. In view of the fact that the scope of these reports on Soviet military expenditures is limited to activities of direct military significance, omission of this category is of no concern. In the broader context of the full economic burden that the Soviet military effort imposes on the economy, this category needs to be included.

3. Nuclear Energy

There are no data available that directly indicate the magnitude or composition of the expenditures for the Soviet nuclear energy program. Therefore, bills of materials have been developed for building and operating feed material plants, gaseous diffusion cascades, reactors, and other nuclear facilities required to produce the amounts of uranium and fissionable materials that the USSR is estimated to have produced. These bills of materials are based on what is known or can be inferred about Soviet plants and nuclear technology. US analogy is used only to fill the gaps left by incomplete knowledge of the Soviet program.**

a. Ruble Values

The ruble values are determined either by pricing quantities of materials directly in rubles with prices available in Soviet catalogs or by converting dollar costs into ruble costs through the use of appropriate ruble-dollar ratios. The resulting estimates of Soviet expenditures for nuclear energy must be considered first approximations. These estimates are believed, however, to approximate reasonably the magnitude of the Soviet effort. It is believed that the cumulative estimates are more accurate than the estimates for individual years and that the estimates for the later years are more accurate than those for the earlier years.

b. Dollar Values

Dollar values are obtained directly. The dollar prices used are not based on estimates of cost of the same volume of production of fissionable materials in the US as is attributed to the USSR but rather are based on Soviet technology to the extent possible.

* Usually referred to as Stockpiling and Defense Production Expansion.

** Estimates of Soviet expenditure for nuclear energy that were incorporated in past studies of military expenditures were based largely on analogy with such US expenditures.

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APPENDIX A

TURNOVER TAX AND THE SOVIET MINISTRY OF DEFENSE

1. General

Under the existing Soviet policy of extreme secrecy regarding the financing of activities related to national security, specific statements of policy with regard to the payment of the turnover tax by the Ministry of Defense or its agents have not been available since World War II. Statements for previous years, however, coupled with information on recent purchasing operations, permit some discussion of the problem.

Before World War II, Soviet policy regarding payment of the turnover tax by their military establishment was not constant. In 1930 the armed forces were exempted by government order from the payment of this tax. 65/ This exemption was revoked effective 1 October 1931, and military purchases were again subject to payment of the turnover tax. 66/ During World War II the policy, as it pertained to the output of the principal armament-producing industries, was modified by the Council of Soviet Commissars in Order No. 139, 9 February 1943. This order released the Peoples Commissariats of Defense, Armaments, Aviation Industry, Shipbuilding, and Tank Industry from payment into the budget of turnover taxes accruing from the sale of their output. 67/ Thus military procurement of hard goods became an explicit exemption. There is no evidence that this policy has since changed, and the turnover tax on military hard goods is not at issue.*

The military procurement of consumer types of goods (principally food and clothing) and petroleum products apparently continued to be taxed. A handbook on turnover tax rates on food products, published by the Finance Commissariat in 1944, contains instructions to charge the turnover tax on products of the meat industry (livestock, meat, meat products, and food fats) "which supply the needs of the Peoples Commissariats of Defense, the Navy, and the troops of the NKVD of the USSR" according to specific zonal prices. All other goods were to be taxed at the price of the zone to which they were taken. 68/ Furthermore, it may be argued, as it was in one study of this problem, 69/ that the turnover tax was necessarily collected during the war years. Receipts from this form of taxation were viewed against the increased proportions of the taxable output allotted to the armed forces (grain products, meat products, cotton fabrics, and leather shoes). It was pointed out that turnover tax receipts did not decline to the extent that might have been expected had the armed forces been exempted from the tax.

Since World War II, financial laws and regulations have not been available. A Soviet textbook authorized by the Ministry of Finance for use in tekhnikums teaching finance, however, deals extensively with the turnover tax as a source of state income. 70/ In discussing the nature of turnover taxes on a number of the products that are of direct concern to a study of military purchases, A. K. Suchkov specifically identifies sales to "extra-market" consumers (the Ministry of the Armed Forces, the Ministry of the Navy, and the Ministry of Internal Affairs). 71/ In the discussion that follows, the material from this source is presented by categories

* In general, producer goods are exempt from the turnover tax, which is almost exclusively a tax on consumption.

representing relevant and significant military purchases and examined in the light of available intelligence information. *

2. Food

Suchkov identifies the principal sectors, including "extra-market" consumers, to which grain is allocated by the central organization for grain procurement (ZAGOTZERNO) and states that the grain is sold to all consumers at uniform wholesale prices including taxes. 74/

Several _____ tend to confirm that, where regular supply channels are used, the standard procedures and prices, including turnover taxes, are employed.

In discussing the operation of the grain procurement organization in the USSR, a Soviet writer lists untaxed turnover as deliveries to state commissions for sorting, to state reserves, to the internal distribution system of the procurement organization, for sowing and seed loans, for export, and for distribution as prizes and payments in kind to agricultural workers. 78/

Two recent Soviet books provide general support for this earlier text. One indicates that the turnover tax is levied on clothing for the Ministry of Defense, MVD, and KGB, but it is not clear as to whether or not the rates are the same as those on goods sold in retail trade. 72/ The other states that these ministries pay wholesale prices, including the turnover tax, for grain products. 73/

The Suchkov book makes another reference to the military in discussing the application and administration of turnover taxes with respect to fruits and vegetables. Suchkov states that all products of this group, in contrast to virtually all of the remaining trade of the food industry, are exempt from taxation on sales to regions of the far north and to military units. 80/ It is not completely clear as to whether the exemption applies to all military units or only to military units in the far north.

3. Clothing

In discussing taxation of the output of light industry in the USSR, Suchkov again makes reference to the goods supplied to "extra-market" consumers. 85/ Dealing with textiles, knit goods, and footwear, he indicates that these consumers can be supplied from factories, from the shipping bases of the industry, and from the trading bases of the industry. In each case the supplier of the goods is subject to the turnover tax.

Information regarding actual transactions between the military establishment and its suppliers is meager.

a wholesale price of

135 rubles for overalls of a given specification, plus 0.5 percent for packing and crating, had been established by a protocol with the Ministry of Defense. 86/ A price of 135 rubles would indicate that the turnover tax is included inasmuch as the retail prices for overalls in state and cooperative stores in 1957 ranged from 136 to 168 rubles per pair, depending on size and design. Because the official Soviet index of clothing prices shows a decline of only 4 percent between 1953 and 1957, the prices in 1953 should not have been significantly different. The turnover tax on items of this kind ranged from 55 to 64 percent of wholesale prices, including the turnover tax, in 1955. 87/ In view of the similarity between the wholesale price to the military and the retail prices cited, particularly in view of the level of the turnover tax, it would appear that the price to the Ministry of Defense included this tax.

whether list prices or protocols are used, there appears to be adherence to prices at least on the wholesale level, including the turnover tax.

4. Petroleum Products

Since 1944, turnover taxes have been applied to petroleum products at a specific rate per ton and, according to Suchkov, are applied at the wholesale level. In addition, however, petroleum products are subject to a budgetary surcharge, which Suchkov states is applicable only to the sale of petroleum products through the trading network. Sales to the "extra-market" consumers, he comments, are exempt from this surcharge but not from the turnover tax. 89/

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Furthermore, it is evident that delays in plan fulfillment cause a curtailment of turnover tax receipts, there working hardship on the administrative organs of the localities that are dependent upon a percentage of these taxes as income.

A quartermaster officer who served during the war described the procurement of food, particularly meat. He maintained that meat is acquired at the hoof at a price reflecting cost to the procurement agencies and is slaughtered by the military for its own use and for the creation of reserves.

However, that the military deals on a regular basis with meat combines and with the Chief Directorate of Cold Storage Plants and Wholesale Trade in Meat and Butter, organizations that process and distribute the meat, respectively. Moreover, the former quartermaster officer weakened his own argument by making an exaggerated statement with respect to the quantities of meat purchased by the military and stated that if taxes were paid, the cost would be many times more than the defense expenditures announced for the maintenance of the armed forces. This is simply not the case. On the basis of the meat content of the military ration, the amount at issue in the extreme would be on the order of 2 billion rubles annually, whereas the announced expenditures are on the order of 100 billion rubles.

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Finally, there is a report from a Soviet [redacted] ho was an engineer [redacted] and who cited examples of comparable military, industrial, and retail prices for a number of commodities during 1951-52. 97/ The indicated relationships between these prices are roughly in the order of 1 to 5 to 10. [redacted] had access to price lists governing the Soviet Navy's accounting with suppliers, and the prices cited were those that he remembered. The reason for his access to military price information [redacted] s not indicated, and it should be noted that the information was recalled from memory more than 5 years after his access to it.

What reliance to place on these [redacted] reports cannot be determined. With the exception of the last one, the information gained relates to rather turbulent times in the USSR -- just before, during, and immediately following World War II. It is entirely possible that military procurement of consumer types of items during the war was of necessity many times on an ad hoc basis and without any great attempt on the part of the government to exercise rigid fiscal control. It is also possible that even now there exist fiscal practices which provide for special preferential prices, including carefully hidden tax exemptions or rebates, for military purchases.

On the basis of the information available, however, it seems probable that the turnover tax is collected on taxable commodities supplied to the military establishment through normal channels and that after 1950 these normal channels became the more important sources for military procurement.

APPENDIX B

WEIGHTED RUBLE-DOLLAR RATIOS

The ruble-dollar ratios presented throughout this report are essentially un-weighted -- that is, each ratio represents no more than the relationship between a dollar price and a ruble price for a given commodity or service. Weighting was to be accomplished at a later stage. In some cases, however, it was necessary to deviate from this practice, but even so the resulting ratios can rarely be considered to be weighted.

In Table 5 the ratios used have been listed for the categories of the System of Accounts, * along with the estimated expenditures for each category in 1955. These Soviet expenditures are employed as weights and should be viewed as no more than means of demonstrating aggregate ratios. The ratios so computed are shown for each major category and for the total. Were dollar equivalents to be obtained by applying aggregated ratios, the ratios based on Soviet weights should be employed. The dollar equivalents are intended to represent what the Soviet military program would cost on the US.

In Table 6** the same ratios are aligned with US expenditures for the same year. It was necessary to use broader categories than those employed in Table 5 if comparability were to be achieved. To the extent that the individual ratios are not un-weighted and that elements of Soviet weighting have crept in, this exercise is somewhat awry. The fact that the US-weighted and the Soviet-weighted ratios for total military expenditures have almost exactly the same value should not be given undue significance.

Table 5

Construction of Soviet-Weighted Dollar-Ruble Ratios
1955

<u>Categories and Accounts for Expenditure a/****</u>	<u>Individual Ratios (Dollars per Ruble)</u>	<u>Weights b/ (Billion Rubles)</u>	<u>Weighted Ratios (Dollars per Ruble)</u>
I. Military personnel			0.31
A. Active regular service			0.35
1. Pay and allowances	0.53	26.1	
2. Subsistence (food)	0.13	17.8	
3. Clothing	0.23	4.4	
4. Miscellaneous supplies	0.19	1.1	

* Shown as dollar-ruble ratios, the reciprocal of the values shown up to this point. With ruble weights, such inversion of the ruble-dollar ratios was necessary unless, of course, the weights were divided by the ratios rather than multiplied.

** Table 6 follows on p. 84.

*** Footnotes for Table 5 follow on p. 83.

Table 5

Construction of Soviet Weighted Dollar-Ruble Ratios

1955

(Continued)

Categories and Accounts for Expenditure ^{a/}	Individual Ratios (Dollars per Ruble)	Weights b/ (Billion Rubles)	Weighted Ratios (Dollars per Ruble)
I. Military personnel (Continued)			
B. Militarized security			0.23
1. Pay and allowances	0.27	5.4	
2. Subsistence (food)	0.13	1.7	
3. Clothing	0.23	0.5	
4. Miscellaneous supplies	0.19	0.1	
C. Reservists			0.34
1. Pay and allowances	0.50	2.2	
2. Subsistence (food)	0.13	1.6	
D. Retirees			
1. Pensions	0.14	2.9	
II. Operation and maintenance			0.24
A. Civilian personnel	0.50	4.5	
B. Maintenance of facilities	0.16	2.1	
C. Petroleum products	0.07	3.3	
D. Maintenance of equipment			0.22
1. Aircraft	0.20	1.5	
2. Armored combat vehicles	0.29	0.3	
3. Weapons	0.25	0.4	
4. Ammunition	0.22		
5. Trucks	0.21	1.3	
6. Naval vessels			
a. Alterations	0.25	1.0	
b. Spare parts	0.12	0.6	
7. Ground radar	0.17	0.9	
8. Guided missiles	0.19	0.1	
9. Organizational equipment	0.20	2.3	
E. Transportation	0.21	0.6	
F. Medical care	0.12	1.0	
G. Printing and publishing	0.17	0.3	
H. DOSAAF	0.20	0.5	

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Table 5
Construction of Soviet-Weighted Dollar-Ruble Ratios
1955
(Continued)

Categories and Accounts for Expenditure <u>a/</u>	Individual Ratios (Dollars per Ruble)	Weights <u>b/</u> (Billion Rubles)	Weighted Ratios (Dollars per Ruble)
III. Procurement			0.2
A. Aircraft	0.20	20.7	
B. Armored combat vehicles	0.29	2.9	
C. Artillery and other weapons	0.25	2.2	
D. Ammunition	0.22	3.9	
E. Trucks	0.21	1.3	
F. Naval vessels	0.21	9.5	
G. Ground radar and communications equipment	0.17	2.2	
H. Guided missiles	0.19	2.9	
I. Organizational equipment	0.20	1.9	
IV. Facilities			0.16
A. Facilities for operation of equipment	0.16	4.0 <u>c/</u>	
B. Facilities for maintenance of equipment	0.16		
C. Facilities for personnel	0.16		
D. Fixed communications facilities			
1. Equipment	0.17	0.1	
2. Construction	0.16	0.6	
E. Other facilities	0.16		
V. Research and development	0.20	15.5	0.20
VI. Other programs and activities			0.12
C. Nuclear energy	0.12	10.0	
Total		<u>162.2</u>	0.24

a. The numbering and lettering of the categories and accounts are those of Table p. 5, above.

b. 98/.

c. Applies to all facilities except for fixed communications facilities.

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Table 6
Construction of US-Weighted Ruble-Dollar Ratios
1955

<u>Categories and Accounts for Expenditures ^{a/}</u>	<u>Individual Ratios (Rubles per Dollar)</u>	<u>Weights ^{b/} (Billion Dollars)</u>	<u>Weighted Ratios (Rubles per Dollar)</u>
I. Military personnel			2.6
A. Active regular service			2.4
1. Pay and allowances	1.9	9.1 ^{c/}	
2. Subsistence (food)	7.8	0.7 ^{d/}	
3. Clothing	4.4	0.3 ^{e/}	
C. Reservists	2.3 ^{e/}	0.3 ^{f/}	
D. Retirees	7.4	0.4	
II. Operation and maintenance	3.5	8.3	3.5 ^{g/}
III. Procurement		^{h/}	5.0
A. Aircraft	5.1	8.0	
B. Armored combat vehicles	3.4	0.7	
C. Artillery and other weapons	4.0	-0.1	
D. Ammunition	4.6	0.8	
E. Trucks	4.8	0.3	
F. Naval vessels	4.8	1.0	
G. Radar and communications equipment	6.0	0.6	
H. Guided missiles and associated equipment	5.4	0.6	
I. Organizational equipment	4.9	0.9	
IV. Facilities	6.4	1.6	6.4
V. Research and development	5.0	1.8 ^{h/}	5.0
VI. Other programs and activities			8.0
C. Nuclear energy	8.0	1.4 ^{i/}	
Total		<u>37.1 ^{j/}</u>	4.1

a. The numbering and lettering of the categories and accounts are those of Table 1, p. 5, above. To a certain extent a higher level of aggregation is needed than in Table 5, p. 81, above, because of problems of comparability. Therefore, certain of the accounts have been omitted.

b. 99%. The weights are the US military expenditures for the fiscal year 1955.

c. Including all allowances except those included under obligations for clothing.

d. These expenditures vary from the figures used to compute average outlays per man and hence from the ruble-dollar ratios, because the latter were adjusted to account for outlays included under allowances.

e. Composite ratio for pay and allowances and subsistence, using US weights.

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- f. Expenditures for personnel only; other expenditures are included under the appropriate accounts.
 - g. Composite ratio based on ratios for civilian personnel and for all other items using US weights.
 - h. Outlays for developmental work are included in the various categories of equipment, inasmuch as these outlays could not be separated in all instances. Thus these categories include funds that, in the derivation of Soviet-weighted ratios, are under research and development. The similarity of the applicable ratios precludes any serious distortion in the results.
 - i. Excluding outlays for research and development, which are located in Category V.
 - j. Excluding outlays for production equipment and facilities, military assistance, and stockpiling and expansion of defense production. Total for the weights for categories and accounts for expenditures has been rounded.

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APPENDIX C

US AND SOVIET PRICE INDEXES
FOR ANALYSIS OF SOVIET MILITARY EXPENDITURES

The indexes for analysis of Soviet military expenditures presented in this appendix are those that have been in general use to permit the movement from one price basis to another. They do not, however, represent all of the price relationships employed with regard to the movement of either US or Soviet prices. Most of these other relationships have already been presented in the text; those which have not are few and represent, for the most part, relationships between only two and, occasionally, three years. Such limited information is usually employed in shifting the bases of ruble-dollar ratios. In addition, it is occasionally necessary to construct a composite index, for the same purpose, from the indexes presented in this appendix and from others (for example, the dollar expression for the Soviet nuclear energy program and for research and development).

1. Indexes Employed to Account for Soviet Price Changes

a. Military Pay and Allowances

Basic pay scales have remained essentially unchanged since early 1947, with the exception of those for some enlisted positions.

b. Subsistence (Food)*

<u>Year</u>	<u>Index</u>
1947	188
1948	188
1949	178
1950	144
1951	128
1952	118
1953	104
1954	100
1955	100
1956	101
1957	101
1958	101

* Soviet index of state retail food prices for 1950-56. 100/ There are available announced values for 1947, 1948, and 1958 and a new estimate for 1949 that differ from the above. They are 260, 203, 104, and 183, respectively. 101/

c. Clothing and Miscellaneous Items of Personal Supply*

<u>Year</u>	<u>Index</u>
1947	145
1948	145
1949	142
1950	123
1951	117
1952	116
1953	108
1954	100
1955	100
1956	99
1957	99
1958	99

d. Civilian Wages**

<u>Year</u>	<u>Index</u>
1947	83
1948	87
1949	88
1950	88
1951	91
1952	93
1953	95
1954	97
1955	100
1956	103
1957	108
1958	112

e. Construction***

<u>Year</u>	<u>Index</u>
1947	135
1948	135
1949	135
1950	121

* Soviet index of retail prices of products from 1950-56. 102/ Announced values for 1947 and 1948 are available, as is a new estimate for 1949. These values are 188, 152, and 137, respectively. 103/

** Average monetary wages of wage and salary earners. 104/

*** Cost of construction; 1949-56, from a Soviet statistical handbook. 105/

e. Construction (Continued)

<u>Year</u>	<u>Index</u>
1951	113
1952	108
1953	108
1954	106
1955	100
1956	99
1957	99
1958	99

f. Industrial Cost*

<u>Year</u>	<u>Index</u>
1947	130
1948	127
1949	151
1950	131
1951	122
1952	112
1953	106
1954	102
1955	100
1956	97
1957	97
1958	97

2. Indexes Employed to Account for US Price Changes

a. Major National Security**

<u>Year</u>	<u>Index</u>
1947	71
1948	73
1949	77
1950	78
1951	85

* Basically the index reflects changes in cost of comparable industrial production as derived from published Soviet statistics. 106/ Given their basis, these figures do not represent a price index in the usual sense. Nevertheless, they have been used because they appeared to be the best available reflection of wholesale prices of machinery. A derived index of wholesale prices of machinery that is now available closely approximates these values. Use of a wholesale price index would be desirable and probably will be substituted at a later date.

** Derived from source 107/.

a. Major National Security (Continued)

<u>Year</u>	<u>Index</u>
1952	86
1953	85
1954	87
1955	90
1956	94
1957	100

b. Machinery and Motive Products*

<u>Year</u>	<u>Index</u>
1947	63
1948	69
1949	73
1950	74
1951	81
1952	83
1953	84
1954	85
1955	88
1956	94
1957	100

c. Utilities**

<u>Year</u>	<u>Index</u>
1947	78
1948	91
1949	87
1950	88
1951	91
1952	91
1953	93
1954	92
1955	92
1956	95
1957	100

* 108/. Used for many of the hard goods.

** Index for fuel, power, and lighting materials. 109/

d. Other Personnel Costs*

<u>Year</u>	<u>Index</u>
1947	99
1948	102
1949	95
1950	96
1951	104
1952	100
1953	99
1954	98
1955	98
1956	100
1957	100

e. Food**

<u>Year</u>	<u>Index</u>
1947	101
1948	109
1949	96
1950	100
1951	114
1952	110
1953	103
1954	102
1955	97
1956	97
1957	100

f. Civilian Wages***

<u>Year</u>	<u>Index</u>
1947	60
1948	65
1949	68
1950	70
1951	76
1952	80
1953	85

* Clothing and miscellaneous supplies for personnel. The index used is a composite of indexes for apparel and footwear, 110/ weighted 10 to 1.

** Composite of indexes for farm products and for processed foods, weighted equally. 111/

*** Average hourly earnings, excluding overtime, for all manufacturing industries. 112/

f. Civilian Wages (Continued)

<u>Year</u>	<u>Index</u>
1954	88
1955	91
1956	95
1957	100

g. Medical Care, Printing, and Publishing*

<u>Year</u>	<u>Index</u>
1947	82
1948	89
1949	84
1950	88
1951	98
1952	95
1953	94
1954	94
1955	94
1956	97
1957	100

* Index of wholesale prices for all commodities. 113/

APPENDIX D

SOURCE REFERENCES

Evaluations, following the classification entry and designated "Eval.," have the following significance:

<u>Source of Information</u>	<u>Information</u>
Doc. - Documentary	1 - Confirmed by other sources
A - Completely reliable	2 - Probably true
B - Usually reliable	3 - Possibly true
C - Fairly reliable	4 - Doubtful
D - Not usually reliable	5 - Probably false
E - Not reliable	6 - Cannot be judged
F - Cannot be judged	

Evaluations not otherwise designated are those appearing on the cited document; those designated "RR" are by the author of this report. No "RR" evaluation is given when the author agrees with the evaluation on the cited document.

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