24604

MEMORANDUM

NATIONAL SECURITY COUNCIL

~~CONFIDENTIAL~~

ACTION
January 26, 1971

MEMORANDUM FOR DR. KISSINGER

FROM: K. Wayne Smith KWS

SUBJECT: New Assessment of US/USSR RDT&E

Attached (Tab A) is a memorandum to Dr. Foster, DDR&E, responding to the paper forwarded by his office concerning a net assessment of US/USSR RDT&E in terms of technological lead analysis. My comments on the DDR&E paper were forwarded to you previously (Tab B). The memorandum to Dr. Foster has been prepared in accordance with your comments as noted (Tab B).

RECOMMENDATION

I recommend that you sign the memorandum at Tab A.

No further action needed. Per KWS 2/17/71

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THE WHITE HOUSE

WASHINGTON

CONFIDENTIAL

MEMORANDUM FOR

THE DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING

SUBJECT: Net Assessment of US/USSR RDT&E

I have read with interest the paper by the Acting Deputy Director of Defense Research and Engineering concerning a net assessment of the relative positions of U.S. and Soviet military RDT&E. The paper contributes, particularly in the concept of technological lead it develops, to the difficult task of understanding the national security implications of U.S. and Soviet RDT&E efforts. The strategic importance of technological lead is clear in terms of the initiatives it gives us for options to deploy new weapons systems, the hedge provided against technological surprise ("Sputniks") and the economies implicit in a secure position of technological leadership. I recognize that the net assessment analytical technique -- as presented in the paper -- is still in the development stage, and it would be premature to employ this initial analysis as a basis for U.S. RDT&E funding programs. Below are some areas that I believe might be considered in refining the net assessment methodology and its applications.

The current state-of-the-art in making meaningful comparisons of aggregate levels of RDT&E spending needs considerably more development. Implicit ruble-dollar exchange rates have not been established with adequate precision for policy-making purposes. We would not want to impute to the Soviets our economic and RDT&E systems, charge them our costs, and then assume that we have derived a reasonably accurate picture of "relative effective effort" expressed in spending. This concern leads me to question the reliability of the proportionality the paper claims to discover

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between technological lead and RDT&E spending levels. Refinement of the comparative costing technique would give us greater confidence in determining the relationships between RDT&E spending and technological lead.

The concept of technological lead itself tends to become less meaningful at each successively higher level of weapon system aggregation. The problem of determining technologically comparable weapons is difficult enough to estimate, especially since comprehensive technical intelligence is so hard to obtain. But the building of categorical systems leads (e.g., "strategic offense," "tactical") becomes more worrisome as the types of weapons aggregated become more dissimilar.

-- What is the meaning of a "tactical" technological lead that includes such disparate items as guns, missiles, tanks, aircraft and rifles?

-- What is the relationship between years of technological lead and relative force capabilities?

-- Can we differentiate required technological leads by program category or weapon system?

In applying the results of technological lead analysis we should not be too hasty to conclude that the only way to rectify adverse balances is to spend more money on RDT&E. Dollars are only one factor, albeit an important one, in gaining technological leadership. The effectiveness of RDT&E resource utilization has an important impact on advancing our technological position. We should also consider ways to reduce the need for some magnitudes of technological lead and ways to accelerate our RDT&E process.

-- Can the need for technological lead be reduced by better technical intelligence efforts?

-- Can we develop a less costly and more efficient RDT&E management organization and a shorter RDT&E cycle?

-- To what extent can we achieve better military capabilities by investing in less sophisticated quantity rather than more expensive quality?

Perhaps the most valuable use of a refined analytical technique for assessing technological lead will be in assisting us to construct a long-term rational RDT&E strategy about which we can program our spending. This strategy should focus on required military capabilities in the future rather than postulated RDT&E spending goals relative to the Soviets' projected funding patterns.

-- What are our alternative RDT&E funding strategies? What are the cost, benefit, and risk trade-offs?

-- What program structure of technological leads do we need?

-- Can we be more discriminating in the selection of RDT&E projects to identify those which really will advance national security?

I appreciate receiving the net assessment paper. It represents an advance in our analytical methodology. In due time I believe that the refined technique will be helpful to our policy-making and defense programming efforts.

Henry A. Kissinger

24604

MEMORANDUM

NATIONAL SECURITY COUNCIL

SECRET

ACTION
December 23, 1970

MEMORANDUM FOR DR. KISSINGER

FROM: K. Wayne Smith

SUBJECT: Net Assessment of U.S. Soviet RDT&E

to for action. Pls note HAK comments.

Bob Pursley has sent me an interesting paper (Tab A) by the Acting Director of the Office of Defense Research and Engineering (DDR&E) giving a net assessment of the relative positions of U.S. and Soviet military research, development, test and evaluation (RDT&E). DDR&E's assessment is developed in terms of:

-- Technological lead

-- Funding patterns

-- Trends which could change technological leads in 1972-1976.

-- National security implications of U.S. RDT&E funding strategy.

The DDR&E paper is important because it represents a novel analytical technique which may be seized upon to justify our spending billions more to close a forecast "technological gap."

This memorandum summarizes and critiques the DDR&E paper. Our analysis indicates the need for considerably more study before we allow ourselves to embark on an expensive crash program to close the "technology gap."

DDR&E's Major Findings Are:

-- In 1968, the U.S. had an overall military RDT&E technological lead of about two years across the board.

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-- In 1968, U.S. and Soviet military RDT&E "efforts" were approximately equal in terms of estimated spending.

-- Since 1968, U.S. spending has declined while the Soviet expenditure has increased at relative rates which, if continued, will reduce overall U.S. technological lead to zero or minus 2-3 years by 1976 (depending on possible alternative Soviet efforts versus the U.S. RDT&E spending program reflected in current fiscal guidance).

-- To minimize the effects of these trends and regain about a two year lead, the U.S. will have to spend at least $12.5 - $13.7 billion annually from 1972 through 1976-78, and $10.5 billion a year thereafter.

-- U.S. RDT&E funding patterns must change to concentrate on avoiding surprise in "sputnik" areas and incorporate selective "recovery plans" to regain leads.

The paper's basic argument for buying a technological lead is that it is essential to national security because:

-- The state of development technology determines our options to produce military hardware systems.

-- The range and choice of developmental "options to produce" determine the weapons and capabilities that will be available five years hence, and thus strongly influence our future strategy and defense posture.

-- Technological leads are necessary now to have superior force capabilities in the future.

The U.S. Needs Technological Leads to Avoid Surprise

-- Soviet RDT&E is closely guarded. We usually do not know what weapons they are developing until 2-3 years after they start.

-- U.S. RDT&E largely takes place in the open, giving the Soviets current knowledge of our state-of-the-art and early warning of our weapon developments. They can begin to develop countermeasures, and can enjoy the economies of copying our technology.

-- Technological lead enables our intelligence analysts to understand oservations of Soviet phenomena, interpret development and project trends. We can assess the threat more accurately insofar as we understand our own more advanced technology and from this vantage point look backward on the Soviets.

-- We need technological lead to compensate for the advantages inherent in a closed (Soviet) versus open (U.S.) society in RDT&E, and thus avoid technological surprise, i.e., "sputniks."

Technological Lead is Economical

-- The leader inherently has a larger technological base plus the "commanding heights," from which he can:

(1) Exercise more choice and initiative as to future weapon systems. The leader is free to choose the weapons to support his strategy. The follower is driven to close gaps and has less choice of strategy.

(2) Time initiatives more flexibly and still keep ahead of the enemy. The leader can spend more deliberately over time, and has more flexibility to vary spending without endangering security.

(3) Develop "sputniks" relative to the enemy's technology, thereby increasing lead and strategic advantage.

-- The technological leader has less need to invest in hedges against enemy surprises because of his advanced position and better understanding of enemy technological capabilities and limitations.

-- The leader avoids crash catch-up programs which are inherently less efficient and more expensive. The follower's smaller and less advanced technological base means that his incremental advances are shorter and more projects are needed within a given time frame to close a particular gap.

The Net Assessment of Technological Lead Methodology

-- Based upon observation of the initial appearance of comparable military systems, technological lead is established (e.g., the U.S. POLARIS submarine appeared five years before the comparable Soviet YANKEE-class submarine, thus a five year U.S. lead).

-- Weapon systems are categorized (e.g., strategic offensive, tactical, intelligence systems) and ~~a general lead by~~ category established. (e.g., in 1968 the U.S. had a three year general lead in strategic offense systems, one to two years in tactical systems, three years in intelligence.)

-- An overall "weighted average" technological lead is determined with weighting based on proportional funding levels for each category of systems relative to the others. (e.g., in 1968 the U.S. had a 1.6 to 2.3 year overall technological lead in military RDT&E. The range is due to uncertainties in the data and excludes "civil" space programs.)

-- Change in lead is noted over time and this establishes the percentage of additional "effective effort" made. (e.g., the U.S. gained between 0.6 and 1.8 years technological lead over the Soviets between 1960 and 1968, an additional U.S. relative "effective effort" of 10%-20% greater than the Soviets.)

-- U.S. and Soviet RDT&E funding levels are plotted and related to overall technological lead times. It is noted that Soviet spending, estimated in dollars, was about 10%-20% less than U.S. spending in 1960-1968.

-- Therefore, technological lead is gained by greater relative effort, and effort is proportional to spending, i.e., dollars buy technological leadership, Q.E.D. These are the major analytical concepts of the DDR&E analysis.

Since 1968, the Soviets have been spending both absolutely more and an increasing proportion of their GNP on RDT&E than the U.S. Meanwhile, the U.S. has been declining in its annual RDT&E spending both absolutely and as a proportion of GNP. Thus, despite our current technological leads, the Soviets already have the initiative and will take the lead in the very near future. The "technological gap" of the mid-70s is forming now.

Effects of Alternative Future Soviet RDT&E Funding Strategies versus Assumed U.S. Spending:

-- U.S. is assumed to ~~follow~~ current fiscal guidance in 1972-1976, i.e., about $7-5-$8 billion a year in military RDT&E spending.

-- If the current Soviet trend is projected straight out, assuming steady GNP increase of 5% and an increasing fraction of GNP devoted to RDT&E (the current trend), the Soviets will have a technological lead of two to four years in all categories of weapon systems by 1976.

-- If the Soviets peg future RDT&E increases to 3% of GNP (as at present) they will have a technological lead of one to three years in all areas by 1976.

-- If the Soviets spend $10.5 billion a year, they will zero out all U.S. technological leads by 1976. This is called the Soviet "base line" case.

-- The Soviets need less technological lead than the U.S. because they have less need to hedge against surprises from our open society. They are ahead just by zeroing out our leads. (This leads to a familiar dichotomy in U.S. military thought -- superiority or defeat.)

Proposed U.S. Responses versus Soviet "Baseline" Strategy

-- Spend $13.7 billion annually until 1976, and $10.5 billion thereafter, to regain the 1968 level of technological lead (two years) by 1976. (Alternatively, spend $12.5 billion annually to regain 1968 lead levels by 1978) This is $5-$6 billion more annually than presently planned.

-- Restructure RDT&E programs to emphasize avoidance of surprise, minimize the maximum risks, hedge against "sputniks." (We don't know what "sputniks" the Soviets are working on, but an imaginative scientist can think up a long exotic shopping list which will cost the requisite billions to pursue. DDR&E has suggested ten programs as a start.)

Critique

Do we really need technological lead? If so, how much? In what areas, programs?

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-- The advantages of technological lead are valid, but how much lead is enough? Is parity an acceptable risk? The DDR&E paper has accepted the 1968 U.S. technological lead levels uncritically as the desired objective. There is no analysis of the cost or rationality of those historical lead positions. The alleged Golden Age of technological lead goes unassayed. What kind of technological leads are required by our national security interests?

-- What are the cost-benefit-risk relationships of alternative levels of lead, lag, and parity?

-- How do alternative RDT&E programs relate to advancing our national security in terms of force capabilities? Surely, the composition of RDT&E is at least as important as the total amount of spending.

Comparing aggregate levels of RDT&E spending is a faulty measure of relative effort, both quantitatively and qualitatively.

-- Realistic sectorial ruble-dollar inferred exchange rates have not been established with precision. Jim Schlesinger has pointed out that these rates vary considerably within the overall Soviet defense budget, and that RDT&E is apparently the least comparatively efficient sector ($2.2/ruble).

-- Spending rates do not disclose the relative costs and efficiencies of the different internal factor price relationships, RDT&E organizations and management styles associated with the two very different competing economic structures. The labor and machinery factor inputs to R&D vary substantially between the U.S. and Soviet economies, and we have no reliable way of pricing Soviet factors in dollar equivalents nor in establishing the productivity of the Soviet factor mix. Furthermore, Soviet accounting is an enigma which we have yet to solve intelligently.

-- Evaluating Soviet RDT&E spending in U.S. dollars, which the CIA and DDR&E do, tends to result in overvaluation of the externally produced goods (Soviet). We impute to the Soviets all of our RDT&E system and economic structure, which they manifestly do not have, and charge them the costs. When the imputed spending exceeds ours, we assume that the Soviets are doing more and better than we, and a "technology gap" is "discovered" (or invented?).

No Objection to Declassification in Full 2013/08/02 : LOC-HAK-12-1-3-3

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-- Thus, the proportionality DDR&E asserts between "effective effort" or technological lead and RDT&E spending is probably not nearly as direct as implied. If the disparity between U.S.-Soviet spending is greater than "measured" gains in technological lead (e.g., 20% more spending results in only 10% gain in lead), diminishing returns could be inferred. Spending more on RDT&E, either by the U.S. or the Soviets, may not result in proportionate increases in technological lead (or "gap" closing). (That we are enjoying increasing returns to scale is not evident from our consistent history of cost overruns.)

-- If Soviet RDT&E spending is more nearly proportionate to their technological lead gains, then the U.S. should look more closely to learn the secrets of the possibly greater Soviet RDT&E efficiency rather than simply spend more and perpetuate our own relative inefficiencies.

Even if the Soviets are spending more, in real terms, for RDT&E than we are, it does not necessarily follow that their output will result in relatively better military capabilities or increased strategic advantage.

But this is gambling

-- How much Soviet spending is wasted on abortive systems or those which fail to advance technological lead relative to their U.S. competitors? By analogy, we spent $1.5 billion on the nuclear aircraft programs and undoubtedly gained several years in technological lead in a system that was still useless the day it was cancelled. We spent $15 billion on SAGE to develop an automated air defense system that works like a sieve. The Soviets opted instead for a redundant air defense system based on manual radars and communications. Does the "technological lead" in the decrepit SAGE system give us a better air defense capability over the clumsy Soviets? A new Soviet weapon may be better than its predecessor but may not represent an advance upon the technology of concurrent and competitive U.S. weapons. The SS-8 improved upon the SS-7 but gained nothing on the Titan technologically. The technology race may be like Alice's "caucus race." Defense R&D spending should focus upon improving our relative capability, not on comparative technology *per se*.

-- Even if a weapon is technically superior to the opponent's, it does not follow that a better combat capability results. Operational, countermeasure and quantitative factors also impact combat capability. Do 300 SS-9's offer a better strategic capability than 1000 Minutemen? Does a mix of 1440 Soviet SS-9s, SS-11s, and SS-13s give a better strategic capability than a mix of 1650 Minuteman and Polaris? Why do the Soviets build T62 tanks instead of MBT-70s? (They do not lack the technology.) Are 100 MBT-70s better in a firefight than 300 technically "inferior" T62s? These questions seem more relevant than the temporal technological leads of different weapons.

[illegible handwritten marginal note]

Technological lead comparisons are dubious in themselves and confidence diminishes at each successively higher level of aggregation.

-- Technological "lead" is based on our estimate of what we would have to do to develop the counterpart of a Soviet weapon or vice versa. Again, we impute our whole approach to R&D and production to the Soviets. But the Soviets do not build weapons like we do (MIG 21 vs F4). Measuring technological lead is about as "scientific" as caliphering craniums to determine IQs.

-- Technological leads, as defined by the date comparable items are first observed, are biased by non-technological factors. Observed products are the result of the timing of the decision to produce plus the efficiency and lead time of the production process itself. These decisions are influenced by political and economic factors that necessarily post-date the technical option to produce point. Can we factor out decision-making and tooling-up time lags to establish more accurate technological options to produce points? (Should we factor out the tooling-up process?) DDR&E's technological lead measurements are based on historically observed phenomena, and "estimates" of intrinsic technology -- in which we may tend to fix upon the worst case.

-- How accurate and meaningful are categorical aggregates (e.g., "strategic offense") and overall national technological lead time? We are increasingly adding and averaging apples and oranges. What is the meaning of a "tactical" technological lead that includes guns, missiles, tanks, aircraft, rifles, etc.? How helpful is such information in determining what specific weapons to develop, when and how many?

-- What is the net effect of cross-comparing countermeasure technological leads? How meaningful is a two year lead in strategic offensive systems if the opponent has a two year lead in strategic defensive defensive systems?

-- Weighting technological leads by proportional spending on categories of systems obscures relative sectorial efficiencies, tends to equate technology with money and may confuse quantity with quality.

-- We need to compare relative capabilities, not quantitative inputs and historical time differentials in outputs.

How much of a given technological lead is attributable to the quality, quantity and scope of basic and applied research?

-- We should differentiate spending to expand the technological base from spending to develop a particular application. Which is the strategically more productive factor? What are the interrelationships between research and development with regard to funding allocations? What are the trade-offs? How should we allocate between the two types of R&D spending? Rather than spend more on R&D indiscriminately, perhaps we could make some gains by re-allocating between R-&-D.

Can the need for technological lead be reduced by better technical intelligence effort?

-- If the Soviets' closed society generates a requirement for us to buy technological lead, perhaps we could reduce the need for lead, at less cost, by better intelligence efforts instead of spending more on RDT&E. What are the trade-offs?

Can we develop a more efficient and shorter RDT&E cycle, at less cost, rather than perpetuate the status quo on a larger and more expensive scale? (The DDR&E paper implicitly assumes not.) The faults of U.S. RDT&E are well-known and costly:

-- Over-specification (gold-plating, multi-purposing, customizing, pushing the state-of-the-art, ignoring on-the-shelf components, countering the worst possible threat, not trading-off design criteria).

-- Competition, duplication of effort and the not-invented-here syndrome.

-- Over-organization into multiple layers of R&D bureaucracy that smothers creative R&D in too much paperwork and beats to death good new ideas in a bureaucratic gauntlet of too many nay-sayers. Why is it that a small French aircraft company can turn out a high performance aircraft prototype every two years using 25 engineers, 50 draftsmen and 100 workers while we can't even write a proposal for a new fighter with less than 1500 engineers? To add insult to injury (self-inflicted), the Israelis say their $1.2 million Mirages are a match for the MIG-21 while our $3 million first line fighter is an adequate bomber.

(5) This anything

(6) But why take ... all this sounds like a brief why we don't need more R+D

(7) Too much essentially irrelevant

(8) All of this just proves we need to improve performance But would also say that R&D to stay ahead

-- Proliferation of small-scale efforts (something new for everybody) and reluctance to invest in fewer but more expensive and vulnerable -- politically and budgetarily) large-scale ~~programs. The~~ big programs are apt to be studied, starved, stretched and sliced to death as a nostrum for seemingly endemic cost overruns. Why not try to cut unit costs with more realistic specifications, simpler systems, better planning and good management? The technical disasters and 100%-300% gold plate of such programs as the F-111, Cheyenne, MBT-70, C-5, Typhoon, E-2A, Shillelagh, Falcon and Sparrow raise the nagging suspicion that at least a few of our allegedly inadequate R&D billions have not been accomplishing the job as efficiently and as effectively as possible.

-- A more streamlined and responsive RDT&E management organization and process might get us more output, quicker and at less cost.

What ought to be our RDT&E strategy in terms of (1) goals, (2) technological lead, (3) program structure, and (4) funding? (DDR&E's paper assumes uncritically that the 1968 leads should be our goal at whatever the cost and ignores strategic goals and program mix.)

-- What are our alternative RDT&E strategies?

-- What program structure of technological leads do we need? What RDT&E programs really will advance national security?

-- Can we differentiate required technological leads by program category or weapon system? What are the cost, benefit, and risk trade-offs?

-- To what extent can we achieve better military capability by investing in less sophisticated quantity rather than in more expensive quality? Our penchant for the superlative leads to such high-strung weapons that enormous and expensive maintenance and supporting structures are needed to keep the weapons operational. The tungsten-coated SR-71 absorbs 300 maintenance manhours for each flying hour. The F-104 regularly depletes the German air force pilot inventory. Meanwhile, the MIG-21 manages Mach 2 with 1/32 inch tolerances on engine turbine blades -- a supersonic windmill that Egyptians can fly.

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Summary of Critique

-- DDR&E has an interesting and possibly valuable argument. It is worth study. We need to be able to evaluate relative RDT&E efforts. Refinements in the comparisons are needed and should be explored to obtain a more accurate view of technological lead.

-- We need to examine means to reduce the requirements and costs of lead (e.g., better and earlier intelligence about Soviet RDT&E, and better management of U.S. RDT&E). We don't have only the choice of buying more lead; it may be well to invest in ways that would permit requiring less lead.

-- We need better analysis to determine what ought to be our technological lead position, overall and by category (the latter may be more important to national security since it has the stronger strategic implications), i.e., an RDT&E strategy.

-- We need to know the incremental costs and trade-offs between and within alternative RDT&E funding strategies.

My conclusion is that DDR&E has produced an interesting study, but
the significance of the results are difficult to assess. Basically, the
problem is that its evaluation is based on a comparison between
financing of R&D in the U.S. and USSR derived from a comparison of states
of military weaponry in the two countries both crude arts despite the
psuedo-quatification. This means that we are comparing quantities and not
capabilities. As you know, the President has said that we should emphasize
military capabilities, not force levels. This is a good case in point. Just
because the Soviets may be spending more money on R&D than we are, it
does not mean that their military capabilities will necessarily exceed ours.

What we should be evaluating is whether the expensive programs which we
now have are really contributing to our military capabilities so that we
will not be behind in the future. Perhaps the time is right for a NSSM on
our RDT&E program, exploring the issues raised by DDR&E and our
analysis. At least, DDR&E should answer the questions we have raised
before launching a campaign for billions more to close the technology "gap."

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RECOMMENDATION

__________ Prepare a NSSM.

✓ Assuming you do not want a NSSM, I recommend that you send a memorandum to Dr. Foster expressing your interest and raising the questions we have asked above.

__________ Alternatively, I could send a memorandum to Pursley expressing our interest in the DDR&E paper and introduce the issues surfaced by our analysis.

__________ Other

But put in the right perspective

Not as an argument for getting more money rather as device to assure better utilization of resources in own right.

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OFFICE OF THE SECRETARY OF DEFENSE
WASHINGTON, D.C. 20301

November 12, 1970

MEMORANDUM FOR: Dr. Wayne Smith, National Security Council Staff

SUBJECT: Comparative US/USSR Research and Development

The DDR&E staff has put together some materials on the relative postures of US and USSR research and development. You may find the attached compendium of interest. John Foster or Eb Rechtin would be happy, of course, to amplify or explain any portions of the materials on which you might like added detail.

Robert E. Pursley
Brigadier General, USAF
Military Assistant

Attachment

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OFFICE OF THE DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING
WASHINGTON, D. C. 20301

R&E #70-4262
Cy 7 of 35 Cys
18 September 1970

MEMORANDUM FOR THE DIRECTOR, DEFENSE RESEARCH AND ENGINEERING

SUBJECT: A Net Assessment of US/USSR RDT&E

The attached assessment was prepared based on the work of the ODDR&E Net Technical Assessment Group under Dr. N. F. Wikner. The basic rationale was developed following many discussions during the past three months with the Assistant Secretaries of the Services for Research & Development and their staffs; the Chiefs of Research & Development of the Services; the Deputy Directors of ODDR&E and their staffs; members of the Defense Science Board; members of the President's Science Advisory Committee; the Technical Staff of the Central Intelligence Agency and members of the Defense Intelligence Agency. However, this assessment represents my appreciation of the situation, not their official positions or views.

If there are new elements in this assessment they are: (1) the virtual elimination of the "economic uncertainty factor" in the USSR budget as a factor in such assessments, and (2) the relation of budget amounts in dollars to technical leads in years.

E. Rechtin

E. Rechtin
Acting Principal Deputy Director

Encl.

R&E #70-4262A
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A NET ASSESSMENT OF THE OVERALL MILITARY RESEARCH, DEVELOPMENT, TEST & EVALUATION (RDT&E) EFFORTS OF THE UNITED STATES AND THE SOVIET UNION

I. PURPOSES OF THIS ASSESSMENT

- Establish the relative military RDT&E positions of US & USSR
- Relate relative RDT&E positions to funding patterns
- Identify trends which could change the relative RDT&E positions in the 1972-1976 period
- Indicate implications of U.S. RDT&E funding strategies to national security
- Provide a basis for judgment of adequate levels of U.S. military RDT&E

II. THE PURPOSES OF RDT&E

- Develop military technologies and systems for possible production and deployment
- Definition and significance of technological lead; U.S. policy 1950-1970

III. A TECHNOLOGICAL LEAD COMPARISON OF US AND USSR MILITARY SYSTEMS, 1960-1968

- A comparison of specific systems
- A comparison by major categories
- Uncertainties in the comparisons

- Assumption: Lead is increased by greater relative effort
- Limitations of the assumption

IV. THE RELATIONSHIP OF EFFORT AND FUNDING

- Assumption: Effort is proportional to funding
- Limitations in the assumption
- US & USSR RDT&E Funding 1950-1970
- Budget plans as indicators of intended effort; US & USSR plans for 1972-1976. (What can USSR afford?)
- Uncertainties

V. POSSIBLE TECHNOLOGICAL LEAD POSITIONS IN 1976

- As dependent on USSR budgets and US fiscal guidance
- A possible Soviet strategy
- Possible "Sputnik" areas

VI. IMPLICATIONS FOR U.S. MILITARY RDT&E STRATEGIES

- Assumption: U.S. military FY 1972 RDT&E budget will not exceed fiscal guidance
- Importance of close watch on Soviet military RDT&E and its budgets; i.e., RDT&E initiative passing to Soviets.
- Avoidance of surprise vs overall excellence in U.S. RDT&E strategies
- "Recovery Plan" Budget Implications

VII. SUMMARY AND CONCLUSIONS

A NET ASSESSMENT OF THE OVERALL MILITARY RESEARCH, DEVELOPMENT, TEST & EVALUATION (RDT&E) EFFORTS OF THE UNITED STATES AND THE SOVIET UNION

I. PURPOSES OF THIS ASSESSMENT

The purposes of this assessment are to:

- Establish the relative military RDT&E positions of the United States and the Soviet Union accurately enough for overall planning purposes.

- Relate the relative RDT&E positions to past funding patterns in order that future budget plans can be used to help predict future positions.

- Identify budget trends which could change the relative RDT&E positions in the 1972-1976 period.

- Indicate implications of U.S. RDT&E funding strategies to national security

- Provide a basis for judgment of adequate levels of U.S. military RDT&E

II. THE PURPOSES OF MILITARY RDT&E

The principal purpose of military RDT&E is to develop military technologies and systems for possible production and deployment. The availability of better technologies and systems for production will not, of itself, increase the military capability to affect the outcome of battles and wars. The systems must be produced, the men trained, tactics developed, and the forces deployed and effectively used. But without RDT&E, many subsequent force capabilities are precluded.

The United States has been faced for the last two decades with potential adversaries who are numerically superior and whose closed societies make it difficult to determine the intent and status of their weapon system developments. Seldom have we known the characteristics of their systems before they are in conspicuous testing or deployed in service, by which time it is very late to initiate RDT&E in response. Under these conditions, it has been the policy of the United States to develop and produce technologically superior military systems for its armed forces.

Figure 1 shows a convenient way of visualizing how technologies advance with time and how comparisons can be made between two development programs. Figure 1 is a typical illustration of a plot of the performance characteristic of weapons system, such as the speed of an aircraft or the kill probability per dollar of a missile, plotted at the year when the system first became available for production. There are several reasons why this assessment uses the year when the technology is available for production rather than, for example, the year when it is first conceived, when it is first demonstrated as feasible in a laboratory test, or when it reaches final deployment. The "option to produce point" looks at the output or results of RDT&E. These results may or may not be produced, depending upon the national security situation at the time, but they are available if needed. Also, this particular point in the development is the first reasonably reliable point at which we can observe Soviet developments. Earlier phases of the developments are almost completely hidden from us. Unfortunately, the "option to produce point" may be three to five years from the initiation of a new development; consequently, a significant technological lead can be built up by the Soviets in a new field before we first observe it.

To return to Figure 1, as further RDT&E is accomplished, higher values of the technology become available at later times. Connecting these technology/time points together results in the time history of the technology. Plotting the histories of two competing programs permits an easy comparison. Figure 1 shows two comparable development programs of two countries, 1 and 2, with number 2 being initially at a lower technological level but increasing to catch up. The simpliest comparison, applicable to all such plots, is to use the common feature of "technology lead", the time interval by which one development program leads the other in a critical performance or cost characteristic.

Figure 2 illustrates one way that technology lead affects production and deployment timing and costs. In this illustration, a decision by Country 1 is made to produce the technology of its program (lower left corner of the chart), resulting in a weapon system which follows curve (a). (The slight upward slope of curve (a) is due to continuing minor improvements normal in a system under production and deployment.) The weapons system, in this illustration, is regarded as "obsolescent" when its technology equals that of Country 2, at which time Country 1 initiates a new weapons system production (line b). Of course, Country 1 could wait somewhat longer, but in any case it has the initiative. On the other hand, Country 2, in order to minimize the obsolesence of its weapons system (they are obsolescent before they are built), tries to stay closer to its technology line, with the result that more systems must be produced with increased costs in production tooling, logistics, training, etc. This "scramble" tends to be characteristic of any program which is behind and responding to initiatives taken by the leader; it has been observed in both U.S. and Soviet programs which were behind.*

Technological lead thus gives a country several advantages:

(1) If converted into deployed weapons, it may determine the outcome of the battle, increase confidence in the favorable outcome of the war, or increase the deterrent effect of our defense posture.

(2) It may be used to offset enemy secrecy, not only in operational

* The "scramble" is an uncontrolled version of an otherwise common programmatic decision in certain lines of development: to take smaller more frequent steps, rather than larger steps less frequently. The significant difference is in the initiative or control of the steps -- in one case voluntary and in the other, not.

situation, but also in the earliest design and developments of new weapons systems; one is ready for one's adversary.

(3) Technological lead gives a country the initiative in weapons system acquisition, resulting in better planning, control of the obsolesence factors, and a minimum number of crash developments.

Generally speaking, US policy has been to favor the longest lead times in strategic offense and intelligence and settle for the shortest lead times in tactical systems and strategic defense systems. Research and technology leading to weapons systems in each of these categories should, of course, have comparable or longer lead times than the weapons themselves. Or, stating it in a different way, if the research and technology base is too weak to provide a good head start, picking up lead in development and engineering by crash programs will be both difficult and expensive if not impossible.

In a very real sense, then, the numerous and complex purposes of RDT&E can be reduced to:

The primary purpose of RDT&E is to produce technological lead in critical weapon system technologies and systems.

III. A TECHNOLOGICAL LEAD COMPARISON OF US AND USSR MILITARY SYSTEMS, 1960-1968

Tables 1 A and 1 B give a listing of comparable US and USSR weapon systems with their comparable first production (or occasionally IOC) dates and technological leads. For example, in strategic offense, the Atlas and the SS-6 appeared at approximately the same time in 1960 and were roughly comparable weapon systems. Both systems were "soft", launched in the open, and used roughly comparable guidance systems. The detailed designs were different in structures, staging, and the use of radio guidance, but the end weapon effectiveness was approximately the same. Therefore, the United States is shown as having a zero technological lead in 1960, when the Atlas and SS-6 existed. By 1964, the technologies had advanced to the Titan II and SS-7 Class, but the Titan II had much more advanced technologies, by approximately three years, than the SS-7. Tables 1 A and 1 B show several other characteristics of technological lead. First, there are numerous systems which can be compared. Second, lead in a particular category, such as strategic offense, can change over the years. Third, both the US and the USSR have some weapon systems which the other country does not have, undoubtedly due to the asymmetry in the national security situation of the two countries. Fourth, some weapon systems become obsolete because of political considerations or decisions to abandon a particular line of development, and consequently the technological lead enjoyed by that weapon system is no longer applicable. This is the case for the B-47, cruise missile submarine, and IRBMs for the United States.

The technological lead numbers in Table 1 were produced based upon intelligence data, discussions with specialists in each of the fields, and the subjective judgments of members of the Office of Defense Research and Engineering. The subjective judgments were used when the data was incomplete or controversial; however, disagreements when they occurred were seldom larger than plus or minus 1 year.

Technological lead information, such as given in Table 1, can be grouped into a few main categories which can then be followed through the years. Table 2 is a listing of the categories of the technological lead in years for three times in the past: 1960, 1964 and 1968. Again, the technological leads are uncertain to about a year and there is some debate about the long term trends. A good example of this is the tactical category in which the 1960-1964-1968 pattern can either be 2-2-2 or 3-2-1. The former pattern shows the US holding even whereas the latter pattern shows a steady erosion. Strategic offense shows additional uncertainty in 1960 because the US and Soviet technologies were different and, as can be remembered from Table 1, many of those technologies later were dropped.

The rationale for intelligence systems is that the United States put major developmental effort into satellite collection systems, whereas the

Soviet effort was more modest, quite possibly because the Soviet needs were less. The space systems line of Table 2 refers to civil space, NASA and its equivalent in the Soviet Union, and the technological leads refer primarily to those of manned flight systems where the major efforts have been expended.

A weighted average technological lead can be obtained for each of the three years by weighting the technological lead for each category proportional to the funding level for that category. The purpose of such weighting is to avoid over-emphasis on the less costly categories. (A similar weighting could be used to derive Table 2 from Table 1, but the weighting rules would have to account for the asymmetries in weapons systems as well as the more directly comparable developments.)

Looking at the extremes of the weighted average, one sees that the US gained between 0.6 and 1.8 years of technological lead during the eight year span 1960-1968. If the assumption is made that additional lead is produced by greater relative effort, then the gain in lead corresponds to an additional relative effort by the United States over the Soviet Union of 10% to 20%*.

The same calculations can be made with the civil space systems excluded, resulting in the military RDT&E showing either a gain in

* These percentage numbers are rounded off to the nearest 10% point in order not to imply greater accuracy than the available data.

technological lead of 0.6 years or a loss of 1 year, which equates to an additional effort between minus 10% and plus 10%, with the minus meaning that the American effort was less than that of the Soviets.

Table 2 might be summarized by saying that in the 1960's the U.S. gained a significant technological lead in civil space systems and approximately held its own, relative to the Soviet Union, in military RDT&E. Expressed in terms of relative effort, we clearly expended more in the civil space side than the Russians and evidentally expended about the same amount as the Russians in military RDT&E.

It is important to note that "effort" as used here is measured in terms of the results in being able to change technological lead positions over the years. This effective effort therefore includes many factors which affect the efficient use of RDT&E resources such as the breadth of the national technological base, the erosion of technologies by the appearance of different technologies, and managerial efficiency. Fortunately, separate analysis of each of these factors is not essential for net assessment because the parameters of interest are not the absolute values of these factors in each country but rather only the differences in the percentage changes with time of one country with respect to the other. These differences can be expected to change slowly, and consequently fairly short range predictions -- on the order of 5 years or so -- can probably be made with accuracies comparable to that of the technological lead data. For example, the US may have improved its managerial efficiency by 20% during the 1960's, but the USSR, for similar reasons may have improved about as much -- say 25%. Over an 8 year span, the net difference is a fraction of a percent. per year.

IV. THE RELATIONSHIP OF EFFORT AND FUNDING

The technological lead comparisons of Tables 1 and 2 suffer from a common problem: reasonably reliable data ends in 1968 and this makes projection as far as 1976 speculative without some form of additional information.

The additional information is funding patterns and to use them requires the following assumption: effort is proportional to funding.

This assumption has both strengths and weaknesses. Generally speaking, more money does indeed produce more effort, providing that management is sound, that the RDT&E resource base is not "saturated", that the research and technology base has sufficient ideas which can be exploited, and that the range of the variables (money and effort) is not too great. These conditions appear to be satisfied in both the Soviet Union and the United States at this time and until at least 1976. Very few individual areas of technology are saturated, much less the total RDT&E base. Rather, particularly in the United States, militarily relevant research in advanced technology is being decreased solely for budgetary reasons, not lack of ideas or the means to exploit them. In the Soviet Union, an extensive educational and facilities program is continuing at a high rate. Both countries have "convertible" civil space efforts and resources which could be diverted to military RDT&E by adding funds to it. There appear to be few fields in which the effort could not be doubled in three to five years. On the Soviet side in particular, there is no evidence that Soviet military RDT&E reached saturation limits at any time during the 1960's.

On the other hand, the weaknesses in comparing budgets are that the U.S. and USSR budget systems are different, the national security organizations are different, and costs are different in the two countries to perform the same required tasks. A detailed budget comparison by major category is not readily possible. The uncertainties in converting the Soviet budget in rubles to equivalent US budgets in dollars is on the order of 20%, too great for the budgets, alone, to be useful as an accurate predictor. However, the long term trends of each country by itself, the <u>shapes</u> of the funding curves with time, can be much better established and are much less controversial. The general rise and fall of U.S. military RDT&E funding and equivalent effort in the 1960-1970 period is well established. For the Soviets, their published budgets permit a similarly internally-consistent funding pattern to be derived for the sum of civilian space and military RDT&E for the period 1953-1970. The remaining difficulty in comparing the two funding patterns arises over two points:

(1) The conversion of the Soviet funding pattern, expressed in rubles, to an equivalent pattern expressed in US dollars, and

(2) The division of the Soviet total funding into a "civil space" part and a "military RDT&E" part.

This assessment treats both of these difficulties by using the technological lead comparison data presented earlier. In brief, that technological lead data showed that the US put in 10% to 20% more equivalent effort in the 1960 - 1968 time period than the USSR which means that if the US and USSR fundings for these efforts are plotted on the same graph (dollars vs. time) then the total Soviet "dollars" for the period of 1960 to 1968 should be about 10% to 20% less than the total US dollars. Figure 3 is a plot of the US and USSR funding patterns from 1953 to 1970 based on DoD and NASA data for the United States and CIA data for the USSR. The USSR curve is 15% below the US curve in the period 1960 - 1968, which means that in equivalent technological effort, it agrees with the results of the technological lead comparison given earlier. The uncertainties in the USSR curve are thus within plus/minus 10% and possibly plus/minus 5%. Were the USSR efforts appreciably greater or less than this uncertainty a significant loss or gain in the US technological lead should have been observed.

Parenthetically, the USSR curve on Figure 3 is the actual CIA estimate and it did not require adjustment in absolute magnitude to be plotted as equivalent technological effort in dollars. The CIA derived their USSR curve solely on the basis of Soviet budgets and their own estimates of the equivalent costs, expressed in U.S. dollars, for the Soviets to perform the same kind of work as is required in military and space technology. The past debates over the CIA estimates have largely involved scale factors and not shape. The technological lead comparison given in this assessment would appear to confirm the CIA's scale factor within fairly narrow limits. Or, stated another way, there are several different ways that Figure 3 can be derived and they agree to 10% or better.

The importance of using funding patterns for this assessment is now apparent: there has been a marked divergence in the efforts of the USSR and the US since 1968, something which the technological lead comparisons of Tables 1 and 2 could not predict and whose effects will not become readily apparent until technological lead comparison data is available for 1972.

Figure 4 is the same as Figure 3 with the addition of an uncertainty band around the USSR curve corresponding to the uncertainties in technological lead measurement. It can be seen that the divergence of the USSR and US efforts is far greater than the uncertainties in the data.

The next step is to try to divide the total technological efforts into civilian space and military efforts. The CIA has made such a division by using a NASA formula to estimate the Soviet civilian space costs. The remaining effort, after the Soviet civil space effort is subtracted, is the USSR military effort, by definition. The results are shown on Figure 5, along with the US efforts.

Figure 5 shows that the USSR military effort from 1962 to 1967 was essentially constant, with increases in the total Soviet technological efforts going into their civil space program. But after 1967, the Soviet space program evidently remained about constant and the continued expansion went to the USSR military effort. In the US case, the US military technological efforts, expressed in 1968 dollars, have remained more or less constant during the 1960's, with the US space effort peaking and then dropping off.

The CIA estimates of Figure 5 can be somewhat refined by using the technological lead data given earlier, which showed that the U.S. picked up lead on the Soviets in the civil space sector, but held essentially constant in the military sector. This refinement, shown in Figure 6, results in a somewhat larger fraction of the total Soviet effort being devoted to military RDT&E and a somewhat smaller fraction to their space program. The uncertainty band, carried forward from the technological lead comparison uncertainties, includes the CIA estimate at its lower edge. Stating it another way, if the CIA estimate of the USSR military RDT&E were correct, then the technological lead numbers we should use are those which show the US holding its own during the 1960's. If the upper edge of the uncertainty band is correct, we should put credence in the US military RDT&E slipping about one year in average lead over the 1960-1968 time period. One cannot go very far outside the uncertainty band and still be credible. The US certainly did not lose as much as two years, nor is there much evidence that we gained significant military lead, on the average, during the 1960's. There were spectacular gains in strategic offense and intelligence systems, but these were offset by a slow erosion in the much bigger area of tactical systems and of strategic defense.

The next step is to project from 1970 to 1976. This assessment will not be concerned with the civil space projections other than to note that the USSR has the option to convert a significant amount of civil space efforts to military RDT&E, if it so chooses. The reasoning might be quite simple: their civil space has been a "loser" and the majority of the civil space is already a part of the military structure.

Projections for the US through 1976 for military RDT&E are straightforward: this assessment will use the fiscal guidance numbers.

Projections for the USSR through 1976 can be made several different ways:

(1) The trend for the last 20 years can be continued for the next six by a simple straight-line projection. This projection consists of two factors, the steady increase of the GNP of about 5% per year and an increasing fraction of the GNP being devoted to military and civil space efforts (Figure 7).

(2) The USSR could decide to peg the future increases to the 3% of the GNP that it had in 1970.

(3) The USSR could freeze its effort at its 1970 level.

These three possibilities are shown in Figure 8 with possibilities 1 and 2 extrapolated from the adjusted curve (the one ODDR&E thinks is the most probable) and possibility number 3, extrapolated from the CIA (lower bound) curve.

V. POSSIBLE TECHNOLOGICAL LEAD POSTURES IN 1976

Figure 8 directly yields three different values of US/USSR relative effort over the period 1968 to 1976, which in turn makes possible calculations of the changes in technological lead which would be expected upon the funding patterns followed. Figure 9 shows the results. If the USSR follows either Plan 1 or 2, all US leads become lags. Figure 9 adds one more category, Research and Technology (R&T) to those given earlier in order to make the point that even this area, amounting to about 10% of the total RDT&E effort, could be pre-empted by the Soviets by Plans 1 or 2. If the Soviets follow Plan 3, the erosion in US technological lead will be noticeable.

This situation raises several questions, the first of which is, how much technological lead is adequate for the United States? The leads in 1968 appeared to be adequate at the time and in retrospect, at least within the limitation of our understanding of the more recent Soviet developments (1965-1970). These 1968 leads seemed to be adequate for understanding and responding to Soviet developments and strategic offence, intelligence systems, and space systems; crash programs were few, deployed weapons continued to be generally equal or superior technologically. There are some limited areas of serious concern. We have not engaged first line Soviet tactical equipment;

ICBM/ABM technology has never been evaluated in battle; our estimate of lead may be out of date due to accelerating efforts; our strategic defense technology has fewer options and possibilities than that of the Soviets. But, on balance, the 1968 technological leads did not appear to give serious concern to military planners and strategists. Twice as much lead time would probably be viewed as unnecessary. On the other hand, a zero lead in an area has historically been a cause for alarm and has resulted in a major US compensating effort. A reasonable conclusion might be that for the U.S. the lead time should at least exceed the measurement uncertainty (about 1 year) and should be longer than a year for costly weapons directly affecting national survival. A lead of at least several years in research and technology appears advisable to counterbalance superior Soviet force levels and to avoid surprises from completely new technologies. From the Soviet point of view, their needs are probably different. In general, they will have advantages in force levels and intelligence collection. Thus a zero U.S. technological lead is dangerous for the United States and desirable for the USSR.

This reasoning leads to a Soviet RDT&E strategy which is both attractive and practical for the USSR. The USSR can zero out all US leads by 1976 if it sets its military RDT&E effort at an equivalent of $10 to $10.5 billion a year and then stays at that value thereafter. (As can be seen from Figures 6 and 8, the USSR is essentially at that equivalent level now.) They could do still better if they wished to invest more.

For purposes of this net assessment, therefore, we will define a "base line Soviet strategy as a $10.5 billion dollar a year military RDT&E effort from 1970-1971 onward.

If the US stays with its fiscal guidance, then the USSR would be investing about $3 billion a year more than the US in equivalent effort. For this the USSR should be able to produce "Sputniks"* in military RDT&E.

Table 3 is an illustrative listing of potential "Sputnik" areas roughly in order of priority and probability as might be viewed by the Soviets. A brief description of each follows.

In undersea warfare, the relative invulnerability of our submarines is largely based on the belief that the sea is opaque for all practical purposes. But, non-acoustic and optical sensors, as well as better acoustic sensors, might significantly change that belief, particularly if the problem was simplified by building sensor barriers rather than instrumenting the whole sea. The undersea task force is an alternate line of development to the "silent service" submarines operating alone.

* For purposes of this assessment, "Sputniks" have the following characteristics:

(1) Their appearance would seriously undermine our confidence in a major element of US national security, probably by obsoleting a major portion of our defense equipments within a few years thereafter.

(2) The requisite technologies exist in early form today in the United States.

(3) The equivalent of the 1950-era "space cadets" can be found for the 1970 Sputnik technology; i.e., there are enthusiasts in the Services and industry eager to talk about the field.

In an undersea task force, different submarines have different functions, much as is the case with surface task forces. There is reason to believe the Soviets may be following this approach. The shallow confined seas present much different naval problems and opportunities from the deep oceans. A case can be made that the Soviet Navy is concentrating first on control of the shallow of confined seas (such as the Mediterranean, the Red Sea, Persian Gulf, the North Sea, the seas off the coast of China, the Sea of Japan, the Sea of Okhotsk, and even the Gulf of Mexico). If the Soviets could control the Mediterranean and the seas around the United Kingdom and North Europe, the credibility of US support to NATO would drop very sharply.

Airborne, destructive lasers provide a method of aircraft attack which is more nearly omnidirectional than by using guided missiles, which are typically limited to a forward cone of attack of perhaps 20°. The most probable use is at altitudes above the clouds, which are largely opaque to lasers, in the "air superiority" altitude range.

Technical counterintelligence is an option more available to the Soviets than to the United States. It involves denying the United States access to ELINT, COMINT, and PHOTINT by various coding and camouflage means.

If exoatmospheric discriminants against re-entry vehicles existed for antiballistic missile defense, destruction of RV's while they are still in space would be clearly practical. In the Soviet case, such a development might make possible the use of SA-5's (or other barrier-like systems) which are presently limited by saturation by penaids.

A night operations capability, if widespread in the Soviet land forces, could profoundly influence the ability of NATO to deter or ward off an attack. Few, if any, night operations can be carried out successfully at present by NATO forces.

A different kind of development might be new uses for politically controversial weapons such as tactical nuclear weapons or non-lethal chemical weapons. Such weapons suffer from being a different kind of weapon which can invite escalation. The use of such weapons in a different mode might appear "justified" by world opinion. One example might be an undersea nuclear-armed barrier for blockade purposes which is triggered only by the "aggressor" trying to break the blockade. Another example might be the use of small nuclear weapons for control of near-space whenever "aggressive" satellites or FOBs passed overhead. The significance of these "Sputniks" is that they would combine political as well as technical revolutions.

The increasing fire power of the foot soldier, now capable of carrying even antiaircraft missiles, means that dispersed fire power carried by large numbers of individuals could effectively preclude air operations and helicopter-borne armies.

Many of these potential Sputnik areas could be covered by the Soviets within their "baseline strategy".

VI. IMPLICATIONS FOR U.S. MILITARY RDT&E STRATEGIES

As of September 1970, it is unlikely that the U.S. military RDT&E appropriation for FY 1972 will exceed the Fiscal Guidance, and it is likely to be somewhat less. For purposes of this discussion, it will be assumed that the first fiscal year in which a change could be made would be FY 1973 and that the Soviet strategy is the $10.5 billion per year "baseline strategy" discussed earlier.

The first implication for possible US military RDT&E strategies is that a close watch must be kept on Soviet military RDT&E and its budgets. Comparisons of US and USSR technologies and weapons systems should be made on a more continuing and intensive basis to help verify trends. It is possible that the Soviets would not follow the strategies given here, that Soviet development programs would run into severe difficulties, or that the Soviets would react to the decreased US military RDT&E by a decrease of their own. In any case, the initiative for increasing military RDT&E has clearly passed to the USSR. If the USSR recognizes this, a Soviet counter move to our increased interest in their RDT&E could be an increased secrecy in Soviet weapons systems development so that the United States would not be aware of RDT&E trends until as late as possible.

In the past, US military RDT&E policy has been one of maintaining overall excellence across a whole spectrum of missions, conflict, and contingencies. If the Soviets now follow a policy likely to lead to Sputniks, the US counter-policy within fiscal guidance probably should be changed to Sputnik avoidance; i.e., US should work to minimize the maximum risks. This minimax strategy could be called an "avoidance of surprise" strategy.

From past history, however, it is unlikely that the US would permit its critical technological leads to be reduced to zero. Once that possibility was very clear, recovery efforts would be likely. The recovery efforts would necessarily involve major funding changes, although these changes are not beyond the technical capacity of the US to undertake.

For example, if a recovery plan were initiated in 1973 with the intent of returning to the 1968 technological position by 1976, it would require $13.7 billion a year in 1973 through 1976, followed by $10.5 billion a year (USSR baseline) thereafter.

As another example, if the recovery plan is to start in fiscal 1973 but recover to the 1968 plan only by 1978, the budget from 1973 to 1978 would be $12.5 billion per year, followed by $10.5 billion per year thereafter.

Recovery plans of this magnitude seem so large as to be unbelievable under present financial and political conditions. A true Sputnik may be required to trigger off the recovery. Considering the status, motivations, and "baseline strategy" funding for the Soviet programs, a Sputnik is unlikely before 1973 but probable by 1976. This would tend to say that actual US recovery efforts would more likely be later but still larger.

The large magnitude of such recovery plans, when discussed with some members of the Services, revealed an interesting phenomenon: the self-limiting of ideas in the RDT&E community by the narrow confines of the budgetary restrictions. The RDT&E people were almost automatically excluding from any consideration any projects of "great" size. Instead, the thinking tended to be on a large number of smaller projects, many of which might not survive, but at least some of which could be shoe-horned in. The exclusion of the larger projects from consideration or even paper studies could present a special kind of danger to the United States -- the Soviet R&D people need not be so bound.

It therefore may be important in any US RDT&E strategy for the next several years to make sure that larger projects, such as the Soviets might well undertake, at least be studied by the US, if not tried out on a much scaled down basis.

VII. SUMMARY AND CONCLUSIONS

A. In 1968 US had about a 2-year, positive, technological lead over the USSR, on the average, in military RDT&E.

B. In 1968 the US and USSR effective efforts were approximately equal.

C. Since 1968 the US effort has declined and the USSR effort increased at rates which, if continued in likely ways, would reduce the US lead to between zero and minus several years by 1976.

D. Changes in US military RDT&E strategy to minimize the effects of these trends include changes in program emphasis (avoidance of surprise) and budgets (recovery plans). If the Soviets adopt the "baseline strategy" given here, the magnitude of the US RDT&E funding problem is \$3 billion to \$5 billion per year through 1976.

E. RECHTIN
18 Sept. 1970

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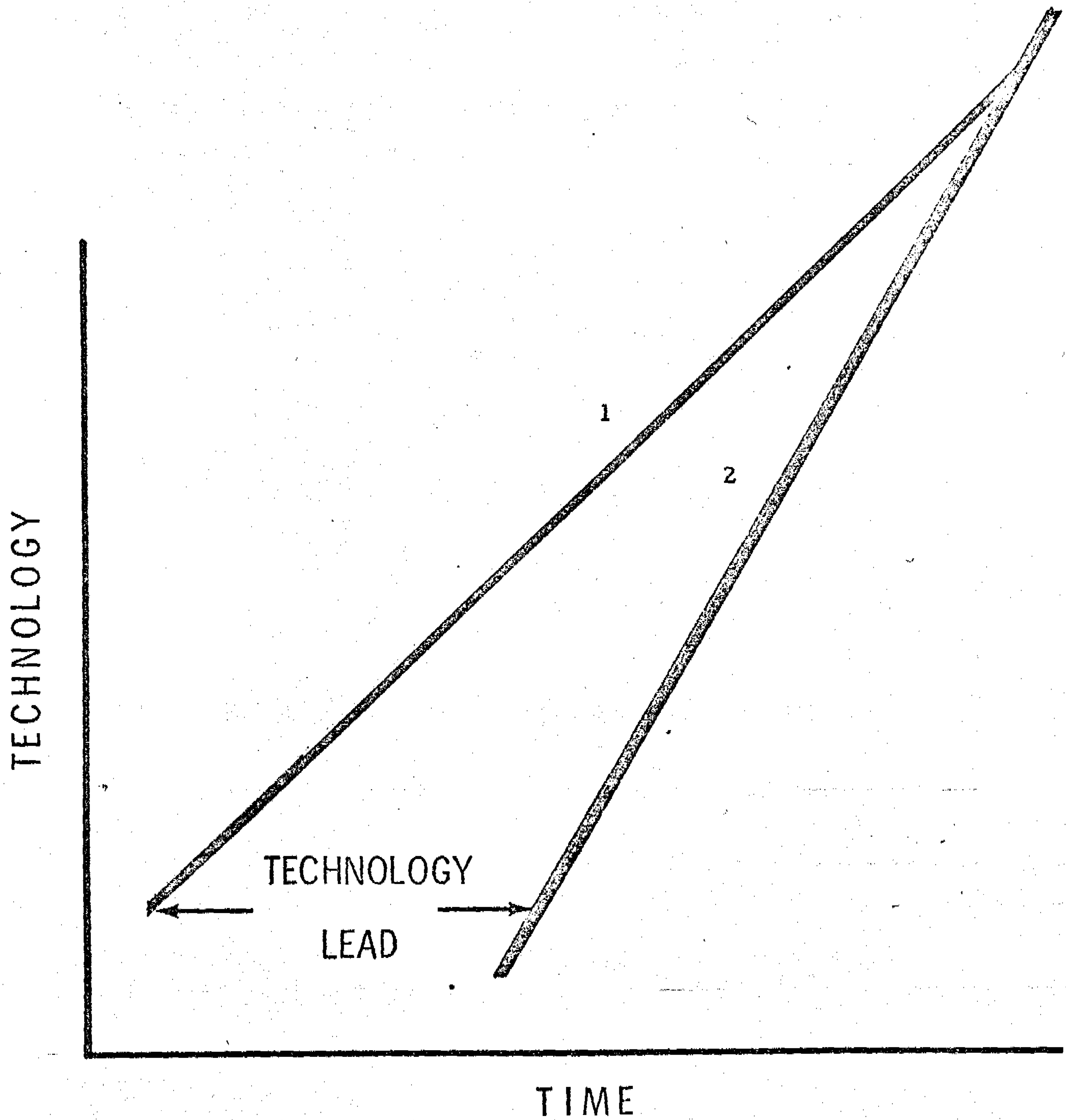

FIGURE 1 TECHNOLOGY COMPARISON I

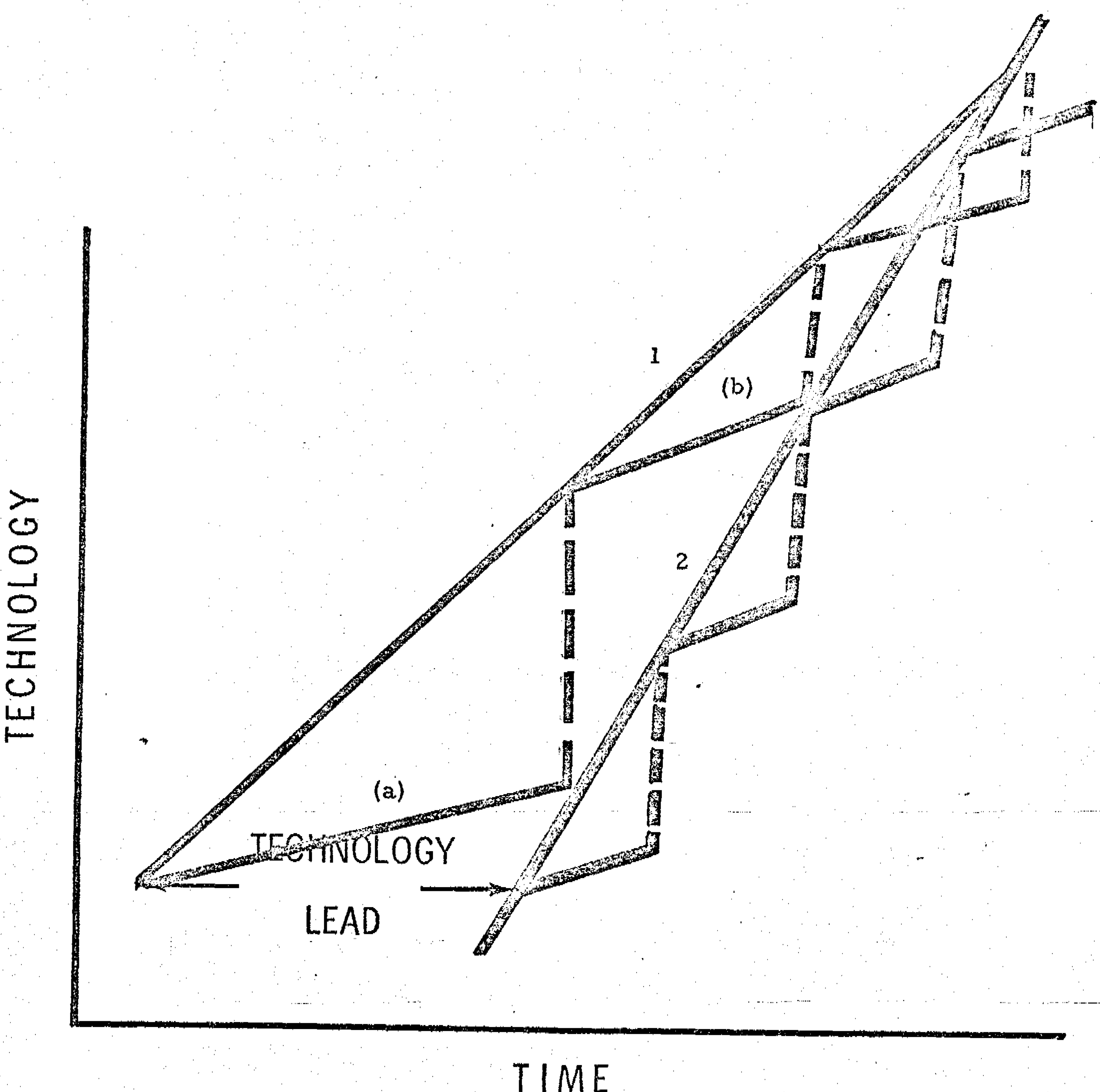

FIGURE 2 TECHNOLOGY COMPARISON II

No Objection to Declassification in Full 2013/08/02 : LOC-HAK-12-1-3-3

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TECHNOLOGICAL LEAD (YEARS)

US	USSR	1960	1964	1968
STRATEGIC OFFENSE				
ATLAS	SS-6	0		
TITAN II	SS-7		3	
MM-III	SS-9(M)			3
POLARIS	Y-CLASS			5
B-47	BADGER	5		
B-52	BISON	1	1	1
STRATEGIC DEFENSE				
NIKE-ZEUS	MOSCOW (1)	3		
SAFEGUARD	MOSCOW (2)			2
NIKE-HERCULES	SA-2	1	0	0
HAWK	SA-3	2	0	
RC-121	MOSS	5	3	-1
TACTICAL A/C				
INTERCEPTORS		5	1	0
FIGHTER BOMBERS		5	5	6
AIR SUPERIORITY FGTRS		0	0	0
MIL AIRLIFT		1	3	4
HEAVY LIFT HELO		-3	-3	-4

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CONTINUED
TECHNOLOGICAL LEAD

US	USSR	1960	1964	1968
ATTACK SUBS & ASW				
SOSUS, S-3 - TOWED ARRAYS		6	5	4
CRUISE MISSILE SUBS		+4	-5	-5
SURFACE SHIPS				
CRUISERS		6	6	7
DESTROYERS		1	-2	-2
ARTILLERY		0	0	0
TANKS				
M-48	T-54	-1		
M-60	T-62		-1	
MBT-70	-			0
IRBM				
THOR	SS-4			
JUPITER	SS-5	0	-2	-2
PERSHING	SS-11			
CIVIL SPACE				
MERCURY	VOSTOK	-1		
GEMINI	VOSHKOD		0	
APOLLO	-			+3

SECRET

TABLE 1 B

No Objection to Declassification in Full 2013/08/02 : LOC-HAK-12-1-3-3

SECRET

TECHNOLOGICAL LEAD (YEARS)

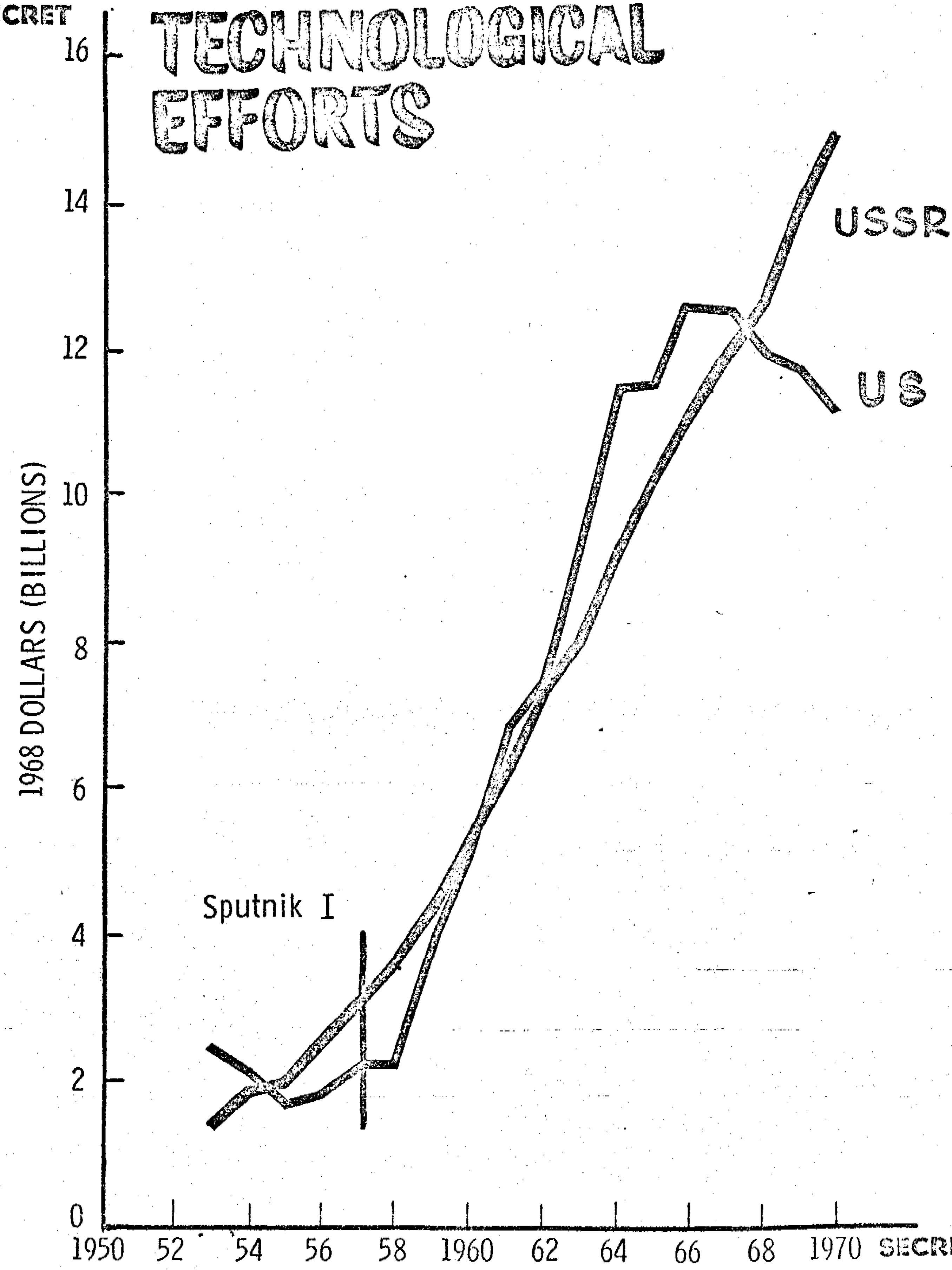
Major Categories	1960	1964	1968
STRATEGIC OFFENSE	1 TO 2	2	3
STRATEGIC DEFENSE	3	2	1 TO 2
TACTICAL	2 TO 3	2	1 TO 2
INTELLIGENCE SYSTEMS	1	2	3
SPACE SYSTEMS	-1	0	2 TO 3
WEIGHTED AVERAGE	0.7 TO 1.2	1.3	1.8 TO 2.5
ADDIT. RELATIVE EFFORT	10% TO 20%		
MILITARY RDT&E ONLY WEIGHTED AVERAGE	1.7 TO 2.6	2.0	1.6 TO 2.3
ADDIT. RELATIVE EFFORT	-10% TO 10%		

SECRET

No Objection to Declassification in Full 2013/08/02 : LOC-HAK-12-1-3-3

SECRET

TECHNOLOGICAL EFFORTS



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No Objection to Declassification in Full 2013/08/02 : LOC-HAK-12-1-3-3

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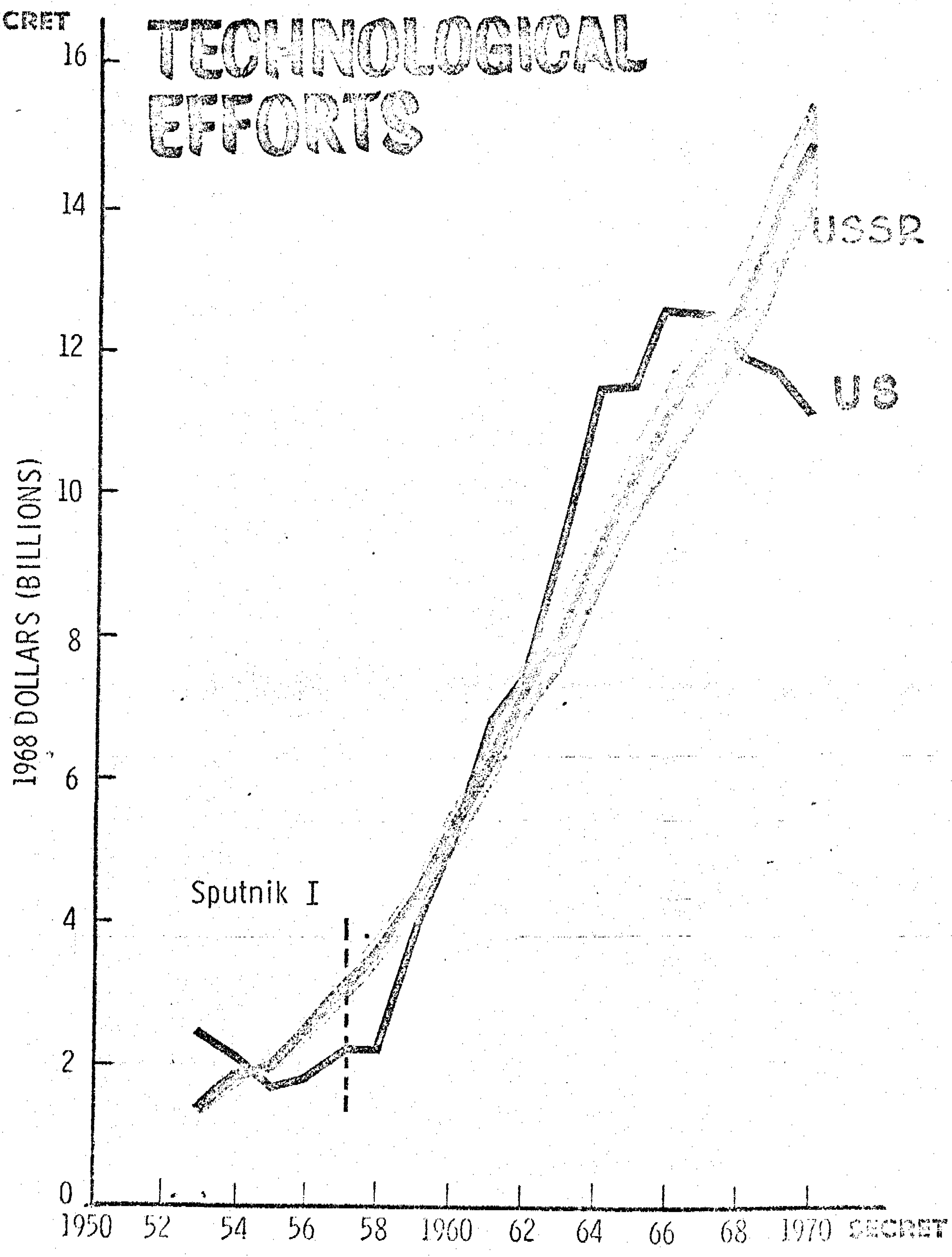

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No Objection to Declassification in Full 2013/08/02 : LOC-HAK-12-1-3-3

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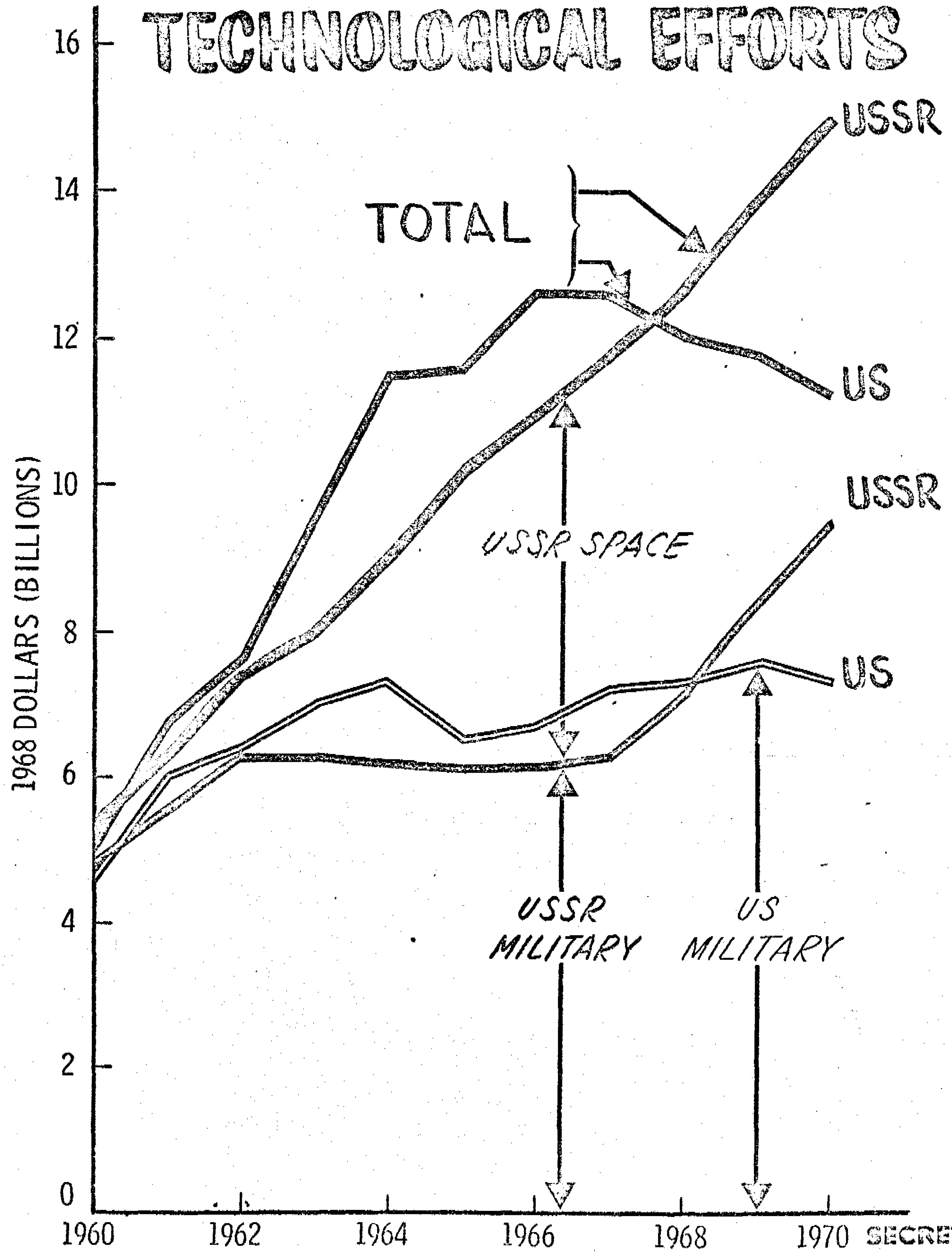

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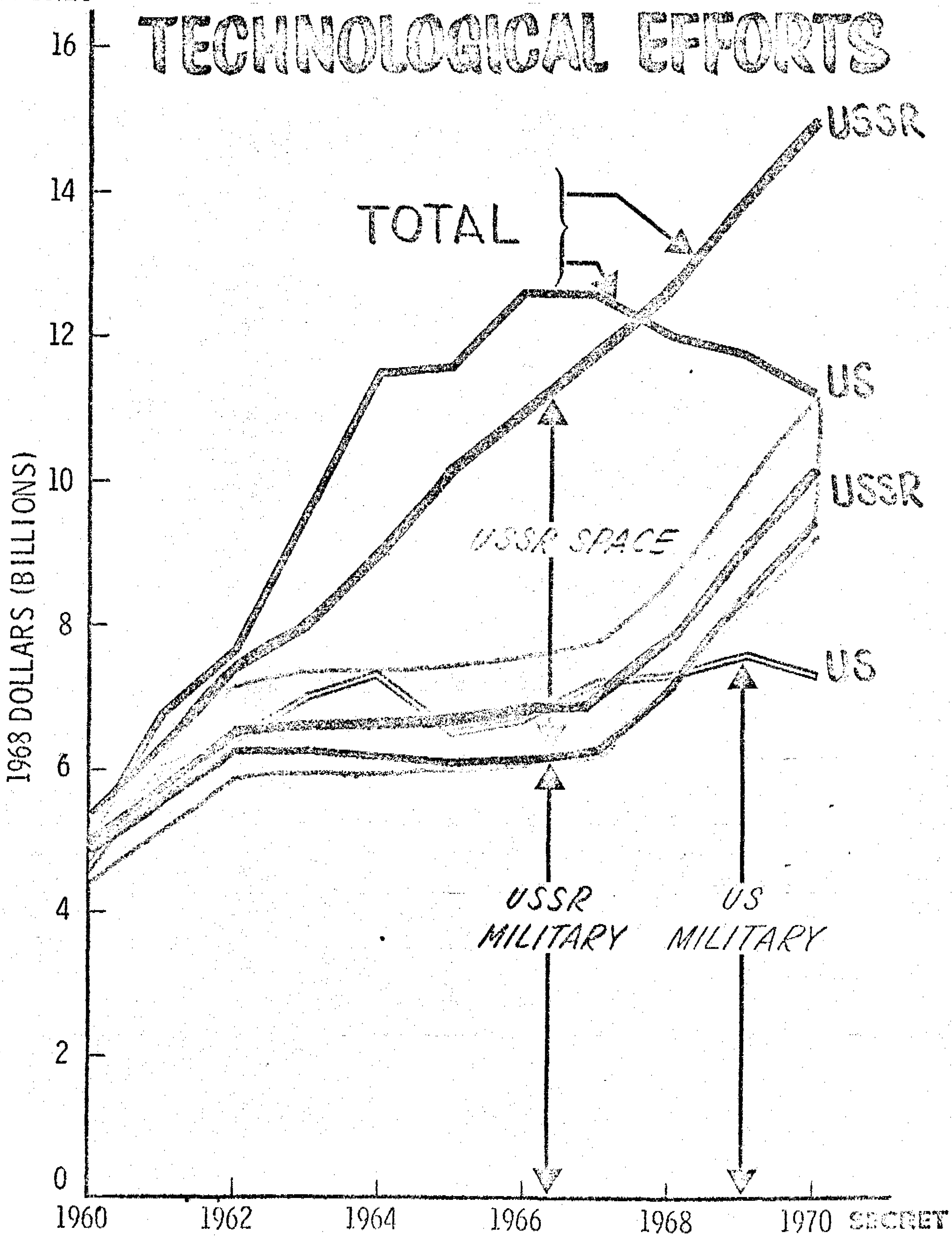

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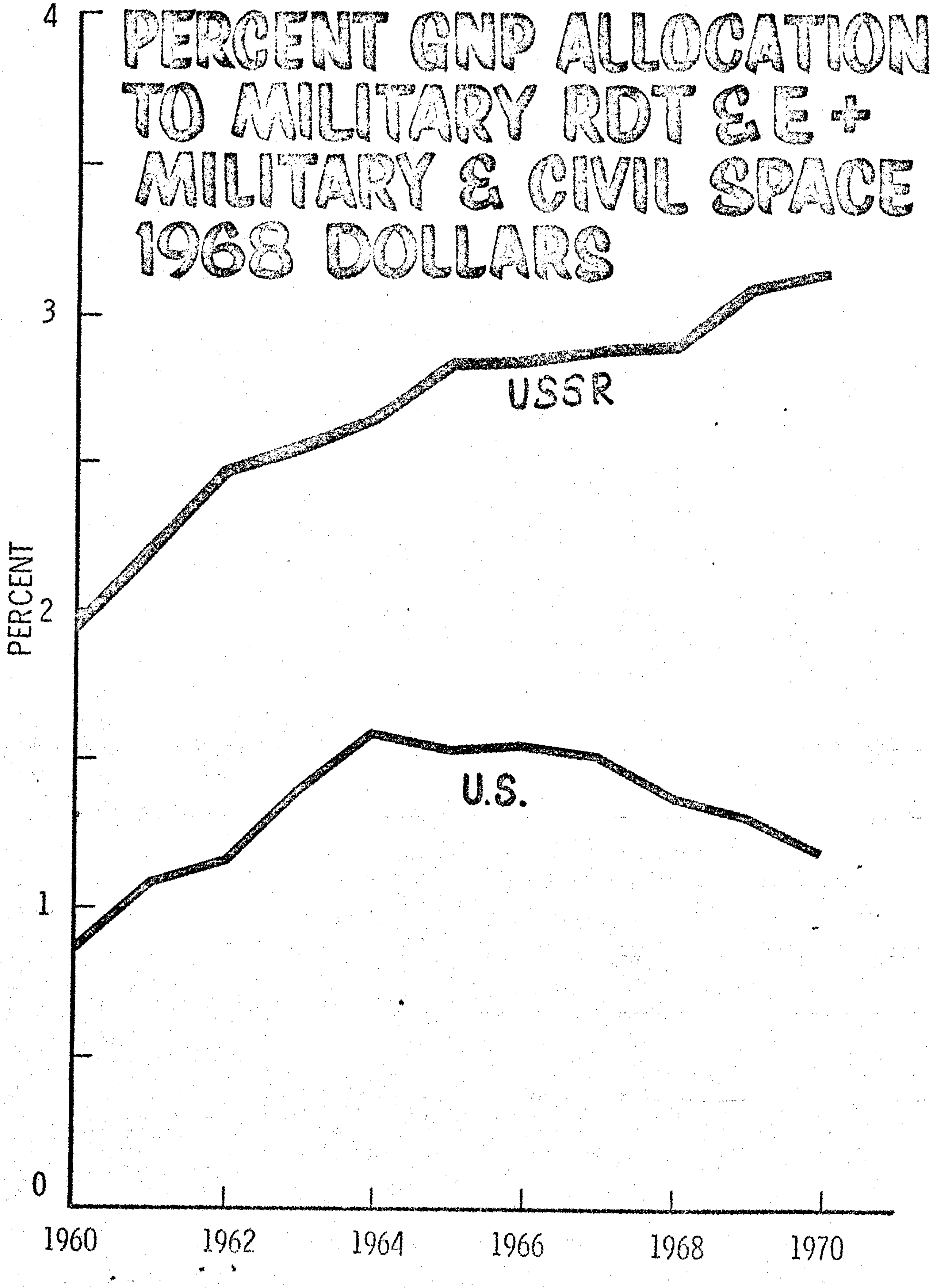
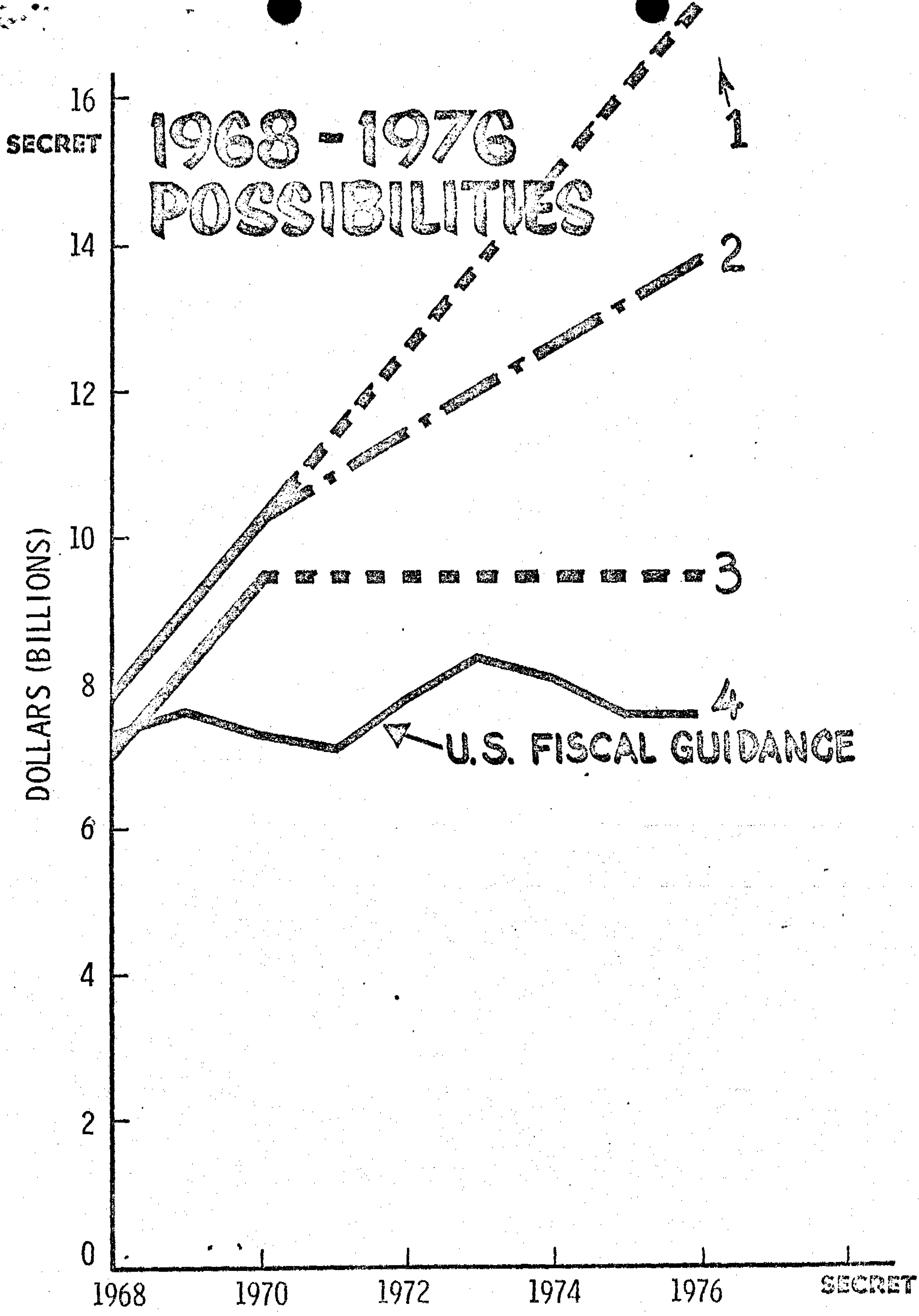
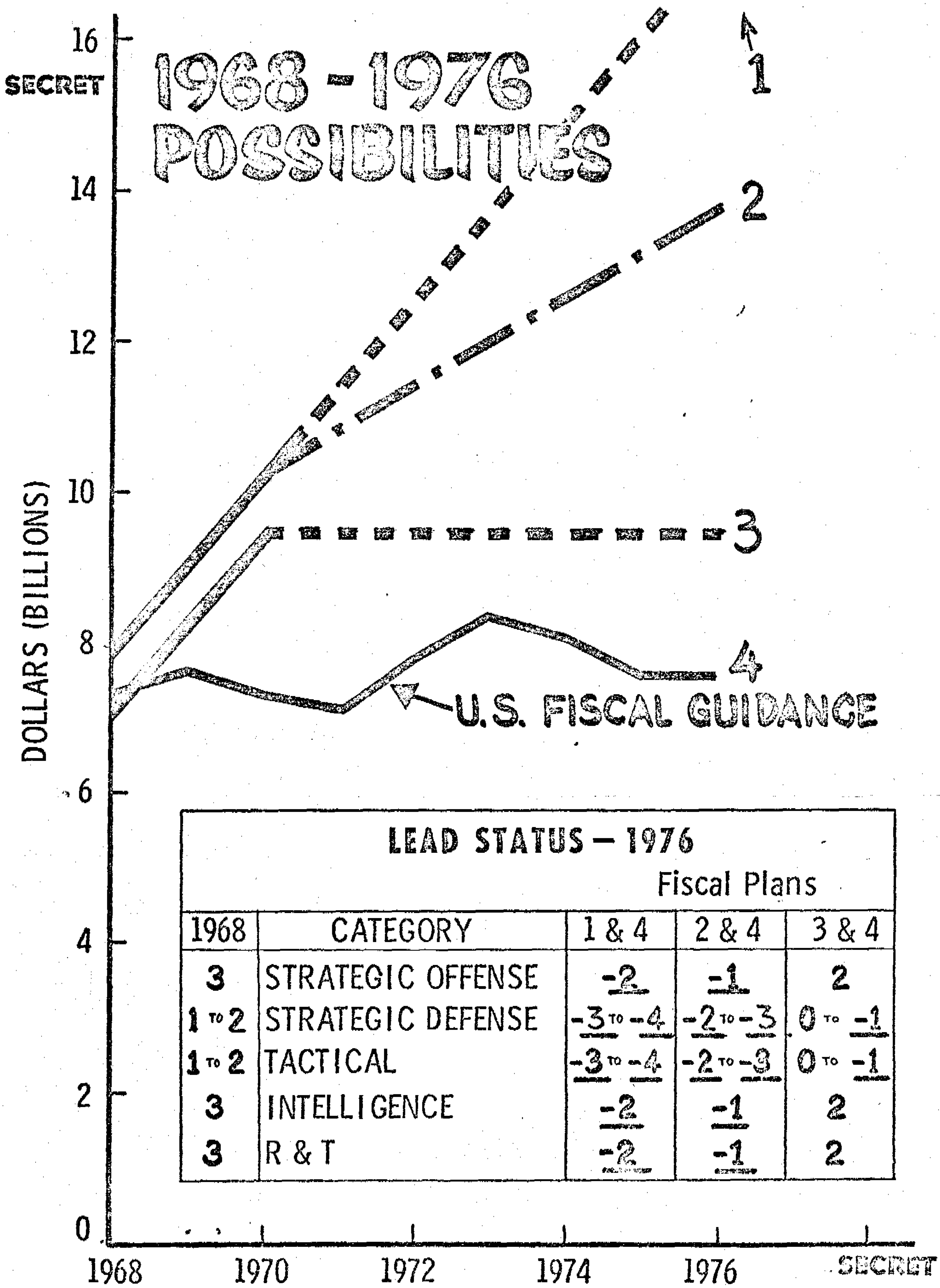
No Objection to Declassification in Full 2013/08/02 : LOC-HAK-12-1-3-3



No Objection to Declassification in Full 2013/08/02 : LOC-HAK-12-1-3-3


SECRET
1968 - 1976
POSSIBILITIES
16
14
12
10
8
6
4
2
0
DOLLARS (BILLIONS)
1
2
3
4
U.S. FISCAL GUIDANCE
1968
1970
1972
1974
1976
SECRET



LEAD STATUS — 1976

1968	CATEGORY	Fiscal Plans 1 & 4	2 & 4	3 & 4
3	STRATEGIC OFFENSE	-2	-1	2
1 TO 2	STRATEGIC DEFENSE	-3 TO -4	-2 TO -3	0 TO -1
1 TO 2	TACTICAL	-3 TO -4	-2 TO -3	0 TO -1
3	INTELLIGENCE	-2	-1	2
3	R & T	-2	-1	2

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POTENTIAL "SPUTNIK" AREAS

1. UNDERSEA WARFARE
   a. THE TRANSPARENT SEA; BARRIERS
   b. THE UNDERSEA TASK FORCE
   c. THE SHALLOW CONFINED SEAS
2. AIRBORNE LASERS & AIR SUPERIORITY
3. TECHNICAL COUNTER-INTELLIGENCE
4. EXOATMOSPHERIC DISCRIMINANTS FOR ABM
5. NIGHT OPERATIONS
6. TACTICAL NUCLEAR WEAPONS FOR BARRIERS AND NEAR SPACE CONTROL
7. FOOTMOBILE AA & ANTI-HELICOPTER

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TABLE 2