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NIE 11-2-59
16 JUNE 1959
TS 117550

NATIONAL INTELLIGENCE ESTIMATE
NUMBER 11-2-59

THE SOVIET ATOMIC ENERGY PROGRAM

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Submitted by the
DIRECTOR OF CENTRAL INTELLIGENCE

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Concurred in by the
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on 16 June 1959. Concurring were The Director of Intelligence and Research, Department of State; the Assistant Chief of Staff for Intelligence, Department of the Army; the Assistant Chief of Naval Operations for Intelligence, Department of the Navy; the Assistant Chief of Staff, Intelligence, USAF; the Director for Intelligence, The Joint Staff; the Assistant to the Secretary of Defense, Special Operations; the Atomic Energy Commission Representative to the USIB; and the Director of the National Security Agency. The Assistant Director, Federal Bureau of Investigation, abstained, the subject being outside of the jurisdiction of his Agency.

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NATIONAL INTELLIGENCE ESTIMATE

THE SOVIET ATOMIC ENERGY PROGRAM

NIE 11-2-59

16 June 1959

This estimate supersedes NIE 11–2–58, 14 January 1958, the Supplement to NIE 11–2–58, 30 September 1958 and Annex C to NIE 11–5–58, 19 August 1958.

This estimate was prepared and agreed upon by the Joint Atomic Energy Intelligence Committee, which is composed of representatives of the Departments of State, Army, Navy, Air Force, the Atomic Energy Commission, The Joint Staff, the National Security Agency, the Assistant to the Secretary of Defense, Special Operations, and the Central Intelligence Agency. See appropriate footnotes, however, for the dissenting views of the Army, Navy, Air Force, The Joint Staff and the Assistant to the Secretary of Defense, Special Operations. The FBI abstained, the subject being outside of its jurisdiction.

A group of expert consultants working with the Joint Atomic Energy Intelligence Committee has reviewed this estimate and generally concurs with it. The estimate, with footnotes, was approved by the United States Intelligence Board on 16 June 1959.

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THE SOVIET ATOMIC ENERGY PROGRAM

THE PROBLEM

To estimate the current status and probable future course of the Soviet atomic energy program to mid-1964.

SUMMARY AND CONCLUSIONS

GENERAL

1. In contrast with Khrushchev's repeated statements of nuclear sufficiency, there is substantial evidence that the USSR is continuing a high priority expansion of its atomic energy program. Although the atomic energy effort remains oriented primarily toward military applications, emphasis on non-military uses has continued to increase since the formation in 1956 of the Chief Directorate for the Utilization of Atomic Energy. However, centralized control of nearly all aspects of the program has been maintained under the Ministry of Medium Machine Building, one of three industrial ministries which were allowed to retain all-union status in spite of the general Soviet program for decentralization of industrial control.

TECHNICAL CAPABILITIES

2. The emphasis on nuclear technology in the Soviet Union has continued during the past year with steady pressure on nearly all scientific frontiers. Advances have stemmed both from the USSR's own efforts and from prompt and extensive exploitation of open Western scientific work. Nevertheless, it is estimated that Soviet basic research in nuclear technology, while highly competent in specific fields, is not comparable in diversity and scope to that of the US.

PROPULSION REACTORS

Naval and Marine Applications

3. The first Soviet nuclear powered surface ship, the icebreaker LENIN, will be put into operation during the latter half of 1959. Based on the status of reactor technology evidenced in the LENIN and at nuclear electric power plants, the prototype of a submarine propulsion reactor could have been available late in 1957. Although no firm evidence of the existence of Soviet nuclear submarines has

been obtained to date, we estimate that one or possibly as many as three nuclear powered submarines could have gone into operation by the end of 1958, and that by mid-1963 the Soviets could have about 25 nuclear powered submarines.

Aircraft Nuclear Propulsion

4. Although we have no firm evidence, we estimate that the USSR has been engaged in the development and testing of aircraft nuclear propulsion (ANP) components and sub-systems for some time. We believe that at any time the USSR could fly a nuclear testbed with at least one nuclear power unit providing useful thrust during some phase of the flight. A prototype reactor system suitable for subsonic cruise propulsion on nuclear heat alone could become available by 1962, but it would be 1964 before reliable reactor systems could begin to become available for operational use.[1] Supersonic applications of ANP would require a long test and development program, and we estimate that a prototype will not be achieved until after 1964.

NUCLEAR ELECTRIC POWER REACTORS

5. The USSR is exploring the advantages of various types of power reactors in an effort to obtain competitive nuclear power and is constructing several large plants. It is also certain that they will fail by at least two years to reach the objectives laid down in 1956 in their sixth five-year plan. However, they have made considerable progress, and it is estimated that they will have 2,000 electrical megawatts (EMW) of installed nuclear generating capacity by 1963.

CONTROLLED THERMONUCLEAR REACTIONS

6. Soviet research on controlled thermonuclear reactions appears to have begun in the 1950–1951 period, and the present scope of its program is comparable to and almost on a par with that of the US and UK. This program could be successful in achieving a controlled thermonuclear reaction as soon as any other group in the world, but the production of useful energy cannot be expected for a long time.

FISSIONABLE MATERIALS PRODUCTION

Uranium Ore

7. The availability of substantial uranium ore reserves within the Soviet Bloc and particularly the USSR indicates that the amount of uranium ore production is limited only by the investment the Soviets wish to make in the program and not by a scarcity of exploitable ore deposits. The exploitation of these resources is being steadily expanded. We estimate that approximately 15,400 metric tons of recoverable uranium will be mined during 1959, of which about 6,400 metric tons will come from the USSR and about 9,000 metric tons from the Satellites. These amounts are in excess of that required to support the current estimates of fissionable materials production.

Uranium-235

8. We have firm evidence that there are gaseous diffusion plants at Verkhneyvinsk and Tomsk which have been in

[1] The Assistant Chief of Staff, Intelligence, USAF; the Director for Intelligence, Joint Staff; and the Assistant to the Secretary of Defense for Special Operations do not agree with the first three sentences of paragraph 4, above, and believe instead that the USSR has been engaged in the high priority development and testing of reactor components and sub-systems for some time, and that a reactor system suitable for nuclear propulsion of subsonic aircraft could be available to the Soviets in 1962.

operation since the early 1950's. A third plant, near Angarsk, may have gone into operation during the first half of 1958. There is evidence of continuing expansion of the capacities of these three facilities.

9. We estimate that the Soviets will have produced the equivalent of 45,000 kg. of weapons grade [2] U–235 by mid-1959 and that this cumulative amount will have increased to about 225,000 kg. by mid-1964. Figure 1 on page 4 presents the estimated cumulative production at each mid-year up to 1964. The actual production up to 1961 could range within ±50% of the stated values, with even greater uncertainties after that year.[3]

Plutonium Equivalent [4]

10. During the 1948–1955 period, the USSR put plutonium production reactors into operation at sites located in the vicinity of Kyshtym, Tomsk, and probably Krasnoyarsk. We have evidence of continuing expansion at these sites.

11. We estimate that the Soviet cumulative production of plutonium equivalent will have reached a total of about 12,000 kg. by mid-1959. This amount will probably have increased to something in the order of 37,000 kg. by mid-1964. Figure 1 on page 4 presents the estimated cumulative production at each mid-year up to 1964. The actual production up to 1961 could range from one-third to twice the stated values, with even greater uncertainties present after that year.[5] We estimate that as much as 10% of the total plutonium equivalent produced would be in the form of tritium up to mid-1959, with this percentage increasing after that date.[6]

12. The Soviets probably had strong economic incentives to process fully all available ore. However, if this course were followed and our U–235 estimate is approximately correct, the actual production of plutonium equivalent would be substantially greater than the most prob-

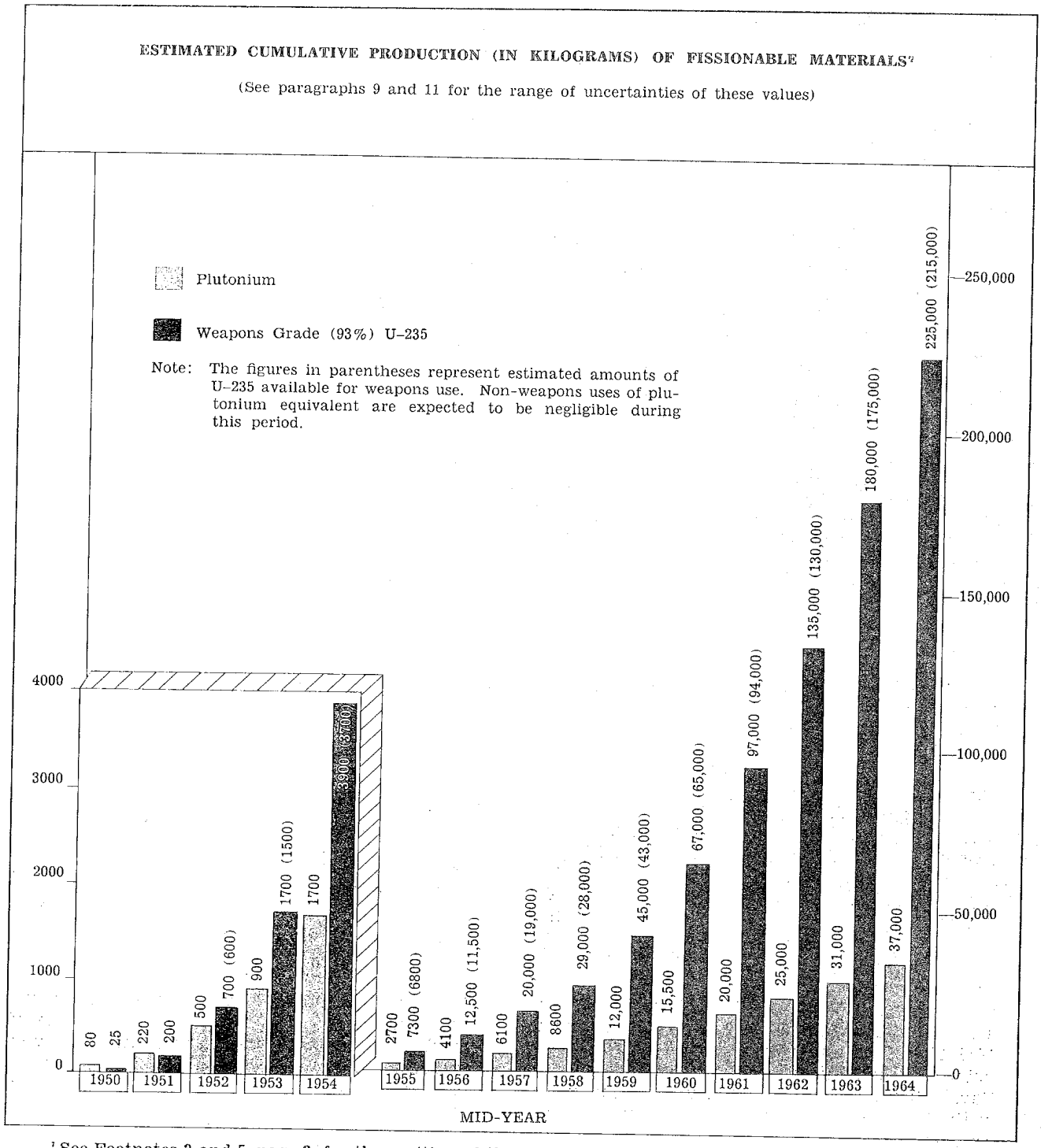
[2] 93% enriched.

[3] In order to accept the estimate of cumulative production of U–235 (Figure 1) the Assistant Chief of Naval Operations for Intelligence, Department of the Navy, finds that he would have to accept major factors of Soviet capability since 1953 which are in his opinion not sufficiently supported by available evidence. These factors include: (a) initial operation dates of new plants, (b) degree of enrichment and depletion of materials produced, (c) use of a new diffusion technology and new equipment, and (d) over-all plant efficiency. However, he believes that the assumption that an improved technology and improved plant efficiency have been developed and incorporated in new plants installed during 1953–1959 is consistent with known Soviet technological capabilities. The Assistant Chief of Naval Operations for Intelligence, Department of the Navy, believes that the lower limits of the estimated values for the cumulative production of U–235 are the more nearly correct.

[4] The production of plutonium and all other reactor-produced isotopes is of necessity estimated collectively in terms of equivalent quantities of plutonium.

[5] [redacted] In view of the above and the uncertainty of information as to the possible form and size of stockpiled uranium, as well as the uncertainty of information as to the input of uranium metal into production reactor operation, the Assistant Chief of Naval Operations for Intelligence, Department of the Navy, believes that the lower limit of the estimate, [redacted] represents the most probable value for plutonium production.

[6] For planning purposes 10 grams of tritium is considered equal to one kilogram of plutonium.



[7] See Footnotes 3 and 5, page 3, for the position of the Assistant Chief of Naval Operations for Intelligence, Department of the Navy.

FIGURE 1

able values indicated above. On the other hand, a reliable minimum estimate amounts to about one-third of the stated values.

13. Our estimates of the Soviet fissionable material production made in NIE 11–2–58 have not materially altered, but additional information obtained over the past year has increased our confidence in the estimated Soviet production of U–235 up to 1961.

NUCLEAR WEAPONS

Test Program

14. The Soviet nuclear weapon development program has grown rapidly, achieved great progress in weapons design, and included the test of a varied assortment of devices from which Soviet military planners can draw in meeting their requirements. Soviet tests have been conducted with yields ranging from approximately 1 kiloton (KT) to nearly 8 megatons (MT).

15. Thirty-one of the 74 Soviet nuclear tests were conducted during 1958. This effort represented a marked acceleration in their test program and was probably designed to exploit, in the face of a possible test ban, the several avenues of investigation which emerged from previous test series. We have evidence indicating that some relatively low-yield tests were conducted by the USSR

16. Preliminary analyses of the thirty-one Soviet tests conducted during 1958 indicate that a concerted development effort continued on thermonuclear (TN) devices. Yields approaching 8 MT were achieved,

The Soviets further developed economical low-yield (less than 10 KT) weapons possibly for air defense or tactical use.

Nuclear Weapons Capabilities

17. No direct information is available on the specific nuclear weapons types in the USSR stockpile. The estimate of Soviet nuclear weapons development potential shown in Tables 1 and 2 has been based on data acquired in connection with the 74 known Soviet tests, Some of the weapon designs listed have been de-

Table 1

ESTIMATED SOVIET THERMONUCLEAR WEAPON DEVELOPMENT POTENTIAL

(Based on estimated current Soviet capabilities, using US developments as a guide)
(Potential improvements indicated for the 1961–63 period are based on unlimited testing)

Number	Approx. Diam. (in)	Approx. Weight Class (lbs) (Reasonably attainable minimum weights) Bomb Class	Approx. Amounts of Nuclear Materials U-235	Approx. Yield (MT) 1957–58	1959	1960	1961	1962	1963
TN-1	35	12,000							
TN-2 [b]	50	[b] 11,000							
TN-3A [c]	35	6,500							
TN-3B	..	..							
TN-3C	..	..							
TN-4A [c]	35	5,500							
TN-4B [c]	..	..							
TN-5A	30	5,500							
TN-5B	..	..							
TN-5C	..	..							
TN-6A [c]	30	4,500							
TN-6B	..	..							
TN-6C	..	..							
TN-7A	30	3,500							
TN-7B	..	..							
TN-8A [c]	24	2,500							
TN-8B [c]	..	..							
TN-8C	..	..							
TN-9A [c]	22	2,000							
TN-9B	..	..							
TN-9C	..	..							
TN-10A [c]	18	1,300							
TN-10B	..	..							

[a] Includes fuzing and firing system, but not ballistic case or nose cone.

[b] These weapons would require at least one test in either full-scale or reduced-yield configurations before stockpiling on other than an emergency basis.

[c] Based on analysis of specific Soviet tests.

[d] Based on Soviet tests conducted in 1958 and would not be available in stockpile in 1959 except in limited quantities (10 to 50 weapons).

Table 2

ESTIMATED SOVIET FISSION WEAPON DEVELOPMENT POTENTIAL

(Based on estimated current Soviet capabilities, using US developments as a guide)
(See footnote [b] *re* estimated future fission weapons development capabilities)

Number	Approx. Diam. (in)	Approx. Weight Class (lbs) (Reasonably attainable minimum weights) Bomb Class	Approx. Amounts of Nuclear Materials U-235	Approx. Yield (KT) 1957–58	1959	1960–63
[redacted]						
F–1	18	350				
[redacted]						
F–2A [c]	45	3,500				
F–2B [c]	..	..				
F–3A [c]	30	1,200				
F–3B [c]	..	..				
F–4 [c]	25	1,000				
F–5A [c]	20	700				
F–5B [c]	..	..				
F–5C [c]	..	..				
F–6 [c]	20	450				
F–7A [c]	18	300				
F–7B	..	..				
F–7C	..	..				
F–7D [c]	..	..				
F–7E [c]	..	..				
F–7F	..	..				
F–8 [c]	16	350				
[redacted]						
F–9	10	450				
F–10A	8	250				
F–10B	..	..				

[a] Includes fuzing and firing system, but not ballistic case or nose cone.

[b] Assuming continued testing, we believe only slight improvement will be made in these weapon categories and we estimate that the above 1959 Soviet fission weapons development potential adequately reflects their capabilities for the period 1959–1963.

[c] Based on analysis of specific Soviet tests.

[d] Based on Soviet tests conducted in 1958 and would not be available in stockpile in 1959 except in limited quantities (50 to 100 weapons).

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rived from analysis of specific tests. Others represent projections of demonstrated techniques and the estimated status of Soviet nuclear weapons technology.

18. In Tables 1 and 2, we estimate that during 1959 the Soviets have the capability to produce thermonuclear missile warheads with weights and yields from 1,000 pounds to 6,000 pounds These same devices could be used in bombs if additional weight is allowed for the bomb casing. The Soviets could also have available in 1959 fission weapons with yields of from one to about 100 KT with a variety of weights and dimensions. If no further nuclear testing occurred, these capabilities could only be marginally improved. However, with continued unlimited testing the Soviets could improve the fissionable material economy of these weapons, increase the maximum yield, and develop still further weapons to satisfy a wide variety of military requirements.

19. In the post-1963 period, we do not expect the advancement of Soviet nuclear weapon development to be as rapid as in the past, since we believe that they have reached a state of the art where major improvements in performance are difficult to achieve.

20. Although no major changes have been made in the Soviet weapons development capabilities from those estimated in NIE 11–2–58, analyses of the Soviet tests in 1958 indicate that

Nuclear Weapons Stockpiling

21. We believe that extensive long-range plans for a dispersed assembly and storage system were under way at least as early as 1952. The development and implementation of these long-range plans have been closely integrated with the growth of Soviet nuclear weapon production capacity, and the design and construction of the physical facilities have paralleled specific requirements emerging from developing nuclear weapon designs.

22. We believe that at least three national assembly and stockpile sites were built by, and possibly are operated by, the Ministry of Medium Machine Building. They are believed to be the central part of the Soviet nuclear weapons logistics system and are designed to supply weapons for all types of military nuclear delivery systems.

23. Our knowledge of the location and nature of storage facilities available to the military is confined principally to two types of operational storage sites located at airfields of Long Range Aviation. We estimate that, in addition to these sites,

facilities for nuclear weapons storage exist at several naval airfields and airfields of the Tactical Aviation. Although no nuclear weapon storage facilities have been identified at naval surface facilities or co-located with ground force units, we believe that appropriate storage facilities for them probably exist.

ALLOCATION OF FISSIONABLE MATERIALS [10, 11]

24. We have insufficient evidence to support a firm estimate of the Soviet weapons stockpiles by number, by type, by mission, or otherwise. Accordingly, in making such an estimate we are forced to rely on our general assessments of over-all Soviet military policy and strategy and on our estimates of the types of weapon systems and missions which might employ nuclear weapons wholly or in part.

25. To derive illustrative weapon allocations, we have combined our specific estimates of Soviet development and production of nuclear weapon delivery systems, studies of probable targets for nuclear weapon systems, the estimated production of fissionable materials, and intelligence information on stockpiling practices and doctrine for the use of nuclear weapons. All of the above factors are subject to appreciable margins of error.

26. By varying the number of high-yield weapons allocated to the Long-Range Aviation (LRA) we have arrived at two alternative allocations. Alternative A entails greater emphasis on weapons for support of ground forces and air defense, and Alternative B places dominant emphasis on long range strike forces. In mid-1959, the total number of weapons is about 3,000. For Alternative A there would be approximately 800 high-yield weapons for the LRA and for missiles capable of employment against the US. For Alternative B, there would be approximately 1,200 high-yield weapons for these uses. In mid-1962, the number of weapons varies from a total of about 9,000 for Alternative A with approximately 2,300 high-yield weapons for the LRA and for missiles capable of employment against the US, to a total of about 7,000 for Alternative B with approximately 2,700 high-yield weapons for these uses. Considering the estimated availability of fissionable materials and the level of Soviet nuclear weapons technology, we believe that at present the USSR probably possesses sufficient nuclear weapons to support a major attack by its long range striking forces, including sufficient nuclear warheads for all of its operational submarine launched missiles and ground launched ballistic missiles of 700 n.m. range and greater. At present the quantity of fissionable material will limit the

[10] The Assistant Chief of Naval Operations for Intelligence, Department of the Navy, believes that the range of possible Soviet quantitative allocations to weapons stockpiles is so broad that, in view of the status of available intelligence on this subject (as indicated in paragraph 24), an estimate of "possible allocations" is unrealistic and of doubtful usefulness. Therefore, he does not concur with the general methodology employed to derive this section or with the illustrative allocations (paragraph 26).

[11] The Assistant Chief of Staff for Intelligence, Department of the Army, does not concur with the methodology employed to derive this section or with the "illustrative allocations" (paragraph 26). In view of the insufficiency of evidence on this subject (as indicated in paragraph 24), he considers that the "illustrative allocations" are merely highly speculative possibilities selected arbitrarily from an almost infinite number of alternative choices. At best such theorizing from unsupported conjecture is unrealistic and of doubtful value; it creates a high risk of inadvertent misuse, for example, in briefings for budgetary or planning purposes, leading to the danger of miscalculation by those responsible for national security.

number of nuclear weapons available for air defense and tactical uses. This shortage will be considerably alleviated by 1962.

INTERNATIONAL ATOMIC AID AND EXCHANGE PROGRAM

27. The Soviet Union apparently has two objectives behind her offers of material and technical aid to other nations throughout the world. The Soviets have used their aid and exchange program to improve and tighten their relationship with Bloc nations while maintaining a substantial degree of control over the atomic energy activities in these countries. In the offers to the Free World nations, the objective has been largely one of propaganda.

28. There is little doubt that the Soviet Union has the technical capability to fulfill the offers of aid that have been made. Promises of equipment, radioisotopes, and basic technical training to the Satellites have been largely fulfilled. Offers to the non-Bloc countries, however, have been largely on a bi-lateral basis, and neither Egypt nor Yugoslavia has a reactor in operation at present. Soviet participation in exchange conferences with the free world appears to be slanted toward propaganda purposes and collection of technical information on western atomic energy developments.

ECONOMIC ASPECTS OF THE SOVIET ATOMIC ENERGY PROGRAM [12]

29. We estimate that the approximate cumulative cost of the Soviet nuclear program through mid-1959 has been over 90 billion rubles including about 40 billion for plant and equipment and about 50 billion for operating expenses. Total expenditures have been less than 1% of Soviet gross national product in recent years. In monetary terms, Soviet investment in plant and equipment for fissionable materials production has been about 75% of that of the US, but because of estimated low process efficiencies the estimated Soviet plant capacities are relatively very much smaller. These and other cost estimates must be considered as first approximations and are subject to wide margins of error; however, it is felt that they adequately reflect general magnitudes and relations.

[12] The Assistant Chief of Naval Operations for Intelligence, Department of the Navy, does not concur in the economic section because it is based upon a method of cost analysis that he does not consider can be applied to the USSR fissionable materials estimate.