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26 November 1957  
CIA/RR IP 574-S-2  
(ORR Project 37-2024)

ADDENDUM TO CIA DRAFT OF SNIE 11-10-57

SOVIET ICBM PRODUCTION AND DEPLOYMENT

General Economic Capability.

Based on our estimate that the development of an ICBM capability is a major Soviet objective, we believe that the USSR will seek to achieve an early operational capability with this system, and that it is prepared to accept risks in the allocation of resources for this purpose. We have no direct evidence regarding Soviet preparations to produce ICBM's and systems equipment in quantity nor do we know what production facilities are being devoted to this program. We do know, however, that the USSR possesses a highly developed industrial base which includes all the skills and facilities necessary for establishing quantity production of successfully developed missile systems.

ICBM Production.

The centralized planning of the Soviet economy will permit the USSR to very rapidly marshal economic resources for the quantity production of ICBM systems and equipment. Soviet industrial resources can be focused on the production of the major components of the ICBM; that is the engine, guidance system, control systems, warhead, and airframe. Each of these components can be produced on separate, specialized facilities on a coordinated basis. In order to minimize delays, the parallel planning of production and assembly of components is necessary; parts must be

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scheduled and produced in advance; and the flow of the major components to final assembly must be smooth. As major components are improved, new parts must be made and assembled so that the new version of the basic component can be put into missiles of current as well as past production. The more rapidly the production program is pushed, the more likely are bottlenecks to develop and the more frequent are costly changes. These delays and changes are less likely to occur in the airframe and engine than the guidance and control systems. The USSR must weigh the cost of these delays and replacements against the advantages of getting operable missiles early.

In light of extensive Soviet experience with shorter range ballistic missiles, we believe that the likelihood of large losses due to a crash production program is not very great. On this basis we believe that the Soviet view of the advantages of achieving an early operational capability will cause the USSR to marshal the necessary industrial resources on a very high priority, and that it will pursue vigorously a program for production and deployment of this weapon as soon as successful development appears assured.

A 500 ICBM Program.

We have estimated the scheduling and resource allocations required for a high priority ICBM production, construction and training program involving 500 ICBM's deployed on 50 hard sites. The figure of 500 ICBM's was selected arbitrarily and we have not attempted to define it as an optimum or minimal quantity. Although we have no direct evidence that the USSR is actually planning

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to carry out this precise program, this examination permits the assessment of the economic capability, feasibility and implications of such a program. With this in mind and on the basis of our estimate of the Soviet ICBM test program we have developed a detailed production time table for the delivery of up to 500 ICBM's to completed launching sites.

During the course of the ICBM flight test program various components or subsystems such as propulsion, airframe, control, etc., will prove their adequacy to meet design specifications. As the design of each is proven, its design will be "frozen" and production drawing and specification, as well as detailed production plans, will be prepared. Many of these steps will have been taken prior to completion of the full flight test program. When the final element of the ICBM system design is proven, the design of the system as a whole will be "frozen", immediate steps will be taken to initiate series production, and a build up to a pre-selected peak rate of production will begin.

The USSR will determine the peak production rate for ICBM's on the basis of Soviet planners' judgement, primarily with respect to their requirements for various numbers of missiles at selected points in time together with their capabilities to achieve these requirements. These capabilities will include not only those for the production of ICBM's but also those for the construction of sites, production and installation of equipment, training of troops and establishing logistic lines, we believe that a peak rate of about 40 ICBM's per month is compatible with the high priority 500 ICBM

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program examined here. A period of 10-14 months from the beginning of series production will be required to build up from a former R & D production rate of 6-7 ICBM's a month, to a monthly rate of 40 series produced ICBM's. This period of time could be compressed only under all-out mobilization conditions. Based upon a high priority buildup to a rate of 40 ICBM's a month, and continuing production at that rate we believe that ICBM deliveries will be compatible with the availability of operational sites. In addition to the ICBM's delivered to sites, many missiles will have to be produced for testing, training and logistic backup; the total number of ICBM's produced might exceed 700 by the time 500 are delivered to sites.

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Launch Sites

Detailed planning of ICBM operational bases undoubtedly was being carried out concurrently with the preliminary and detailed design of the ICBM system. In mid \_\_\_\_\_, at the time hardware design was sufficiently firm to permit the initiation of construction of launching facilities at the Soviet ICBM test range, basic decisions could have been made regarding projected ICBM deployment. These include decisions regarding the location of operational sites, and general operational concepts including the logistics; from these the detailed layout of many elements of the operational bases could have been determined, and a program of site construction and equipment initiated.

In order to take full advantage of this capability to develop and produce ICBM's, operational sites, logistic support and trained troops must be provided. Although we have no direct evidence of Soviet ICBM launching site construction, we conclude that the USSR has had ample time to complete the construction of some launching sites already, and could now be engaged in a large scale construction effort to provide the additional launching facilities needed to deploy the ICBM's it plans to produce.

We believe that Soviet criteria for operational employment of its ICBM could have included the following provisions:

- a. A very high initial salvo capability in order to achieve maximum neutralization of widely dispersed US retaliatory capabilities.

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- b. Maximum concealment of launching sites.
- c. Operational sites capable of withstanding nuclear attack.
- d. Rail transport as the basic means of logistic support.

Based on these criteria, we have estimated a Soviet program for site construction and ICBM deployment which is consistent with our estimate of the times at which various quantities of ICBM's could be available.

Postulated Operational Site System.

We have estimated that the USSR could deliver 500 ICBM's to operational sites by May 1960. With this estimate as our base and an assumed hardened underground launching configuration, the magnitude of the facility, equipment and manpower requirements can be understood as a measure of the resources which the USSR would have to invest.

The postulated ICBM system consists of 50 fixed underground launch sites hardened to withstand overpressures of 100 psi. Each launching site consists of five underground launching positions and adjacent storage, maintenance and checkout areas, and an underground guidance station. Each of the underground launch positions contains one missile erected and another in a storage area prepared for firing. Separate underground launch control centers, crew quarters and fuel storage tanks are located near each launch position. The entire system is serviced by rail. The support area contains those functions related to housekeeping, maintenance and administration.

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The initial cost of constructing and equipping each launch site (including missiles) is estimated to be about 70 million dollars or a total cost of about 3.5 billion dollars for the 50 sites in the system. The ICBM launch sites which have been postulated are highly sophisticated with respect to operational effectiveness, low vulnerability, and high degree of concealment. If the USSR were to implement this program, it would have to devote large quantities of construction resources sorely needed in other branches of the Soviet economy. The USSR may not consider so refined a system worth such a large commitment of resources and may be compelled to accept something less.

If a less refined system were chosen with far less concealment, lower operational effectiveness and higher vulnerability (say, ability to withstand overpressures of only 6 psi), the total initial cost would be about 2.2 billion dollars for the 50 sites in the system. The difference in cost between the 6-psi and 100-psi system is about 1.3 billion dollars and the savings are almost entirely in the cost of construction. The initial costs of sites harder than the 6-psi system but softer than the 100-psi would range between 2.2 and 3.5 billion dollars; for example, a 500 missile/50 site system, hardened to 50 psi, would cost about 2.9 billion dollars.

The time required for constructing a site might vary from 18-24 months for a 100-psi site to 9-15 months for a 6-psi site depending on the effort put into construction and the location of the site.

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Manpower.

In the assumed sites system, the basic manpower requirement for each launch position is a crew of 50 men, six to eight of whom are support personnel. Each underground guidance position requires a crew of 30 men including three support personnel. The site manning concept is based on a crew duty period of two weeks duration. At the end of this duty period the crews are relieved by new crews who have been stationed at the support area. Thus, each launch site requires 10 launch position crews and two guidance site crews. For a total system of 50 launch sites, the requirement would be 500 launch position crews totalling 25,000 men, and 100 guidance site crews totalling 3,000 men.

Training.

The training of these personnel is considered in two distinct phases. First, training takes place on the level of individual specialists. This type of training can require a year or more, and takes place at schools and industrial and test facilities engaged in the ICBM program. The second phase is concerned with grouping the individual specialists, technical personnel and non-technical personnel into an organizational unit required for both launch and guidance. This type of training can be accomplished in a period ranging from eight to twelve weeks and produces crews who possess only the minimum of operational training necessary to man the sites. After assignment to a site about 6 months to one year will be required to train

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the crews in order to obtain a high degree of operational proficiency.

General Economic Assessment.

A Soviet ICBM production and deployment program of the scope estimated herein would require a high order of planning and accomplishment. We believe, however, that such a program is within Soviet economic capabilities, and that the USSR could have made the necessary decisions to implement it. Our assessment of Soviet economic capabilities leads us to conclude that the production of ICBM's and systems equipment in quantity, and the acquiring and training of troops, are less likely to be limiting factors on the ICBM program than the construction of numerous launching sites with maximum operational effectiveness, low vulnerability, and a high degree of concealment which would require large quantities of resources sorely needed in other sectors of the economy. We cannot judge whether the USSR would consider so refined a launch system worth such a large commitment of resources, and, therefore, whether it might accept something less.

We estimate the USSR could deliver a first prototype ICBM, with all major elements flight tested to a limited degree, to a completed operational site by mid-1958 and that about ten of these prototype missiles could be in the hands of trained troops at one or a few operational sites in the latter half of 1958. We believe the USSR is capable of having the following quantities of operational ICBM's deployed at completed sites and in the hands of trained units by the dates indicated:

50 ICBM's:	March 1959 to October 1959
100 ICBM's:	May 1959 to January 1960
500 ICBM's:	May 1960 to December 1960

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ADDENDUM TO CIA PROPOSED DRAFT OF SNIE 11-10-57

Estimated Soviet ICBM Production Capabilities

We have no direct information regarding the production facilities devoted to the Soviet ICBM program; however, we do know the USSR has a highly developed industrial base which includes all the skills and facilities necessary for the quantity production of ICBM systems. We believe that these industrial resources will be marshalled on a first priority basis to support the Soviet ICBM program.

Two alternative Soviet ICBM production and allocation programs are considered. The first alternative (A) assumes that the ICBM under development is largely a new design with little direct extension from the shorter range ballistic missile program. It therefore, will require a comprehensive flight test program of 40 to 50 missiles to prove out the design. This program assumes that the missile "know how" acquired by the USSR from its shorter range missiles will enable it to carry out the flight test program without interruption due to major technical failures. The flight test program includes earth satellite vehicles which we assume contribute to the ICBM test program.

The second alternative (B) assumes the ICBM design under development is largely an extension from the shorter range ballistic missile program and that the USSR was confident enough of success to commit production resources early, initiate launch site construction and equipping, and in general risk these resources on the assumption of success. In alternative B about 20 missiles would be flight tested to prove out the marriage of the many already proven components and systems adapted from previous programs.

There are certain key dates of accomplishment in the ICBM program. The first of these is the date when the first Soviet prototype ICBM, having a limited operational capability, is delivered to an operational unit. This first prototype missile, provided essentially for troop training, and additional prototype missiles delivered thereafter could be used for military purposes. The second key date is the date of "design freeze", that is, the date when the decision is made to shift from R & D production status to series production. The third key date occurs when 10 prototype ICBM's could have been delivered to one or a few operational sites.

The estimated dates of attaining these important objectives in the two alternatives are as follows:

	<u>Alternative A</u>	<u>Alternative B</u>
First prototype at operation site:	in July 1958	in March 1958
Design freeze:	end of December 1958	end of April 1958
10 ICBM's delivered to operational sites:	in December 1958	in July 1958

We estimate further that the USSR could have the following quantities of operational ICBM's in the hands of trained units by the dates indicated:

	<u>Alternative A</u>	<u>Alternative B</u>
50 ICBM's in October 1959		50 ICBM's in March 1959
100 ICBM's by January 1960		100 ICBM's in May 1959
500 ICBM's in December 1960		500 ICBM's in May 1960

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These estimated alternative Soviet ICBM production and deployment programs are based on an assessment of Soviet industrial capabilities compared with the progress demonstrated by Soviet earth satellites and ICBM test launchings. We therefore consider them as sound estimates of overall Soviet capabilities in this field. Whether the USSR carries out either of these programs depends on Soviet intent, and the vigor with which the USSR may choose to exploit the capability we estimate it possesses.

Attached are two charts showing the schedules and flows for ICBM production, tests, deliveries to sites and site completions under alternatives A and B.

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ESTIMATED SOVIET CAPABILITY FOR PRODUCTION AND ALLOCATION OF ICBM'S  
(Alternative A)

		Dec 1956	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	
Operational Sites	Cum.														1	1	1	1	2	2	2	2	3	3	3	3	4	4	5	
ICBM's Delivered To Sites	Cum. No.																					1	2	4	6	8	10	13	16	19
																						1	1	2	2	2	2	3	3	3
Captive Test				①	①	①	①		①	①		①	①		①	①		①	①		①	①		①	①		①		①	
Production	R & D	1	1	1	1	0	2	2	1	3	3	3	4	4	3	5	4	5	5	6	6	7	7	6	6	5				
	Stores																											7	7	8
Flight Test	No.									1	1	1	2	2	3	3	3	3	4	3	4	3	3	4	4	4	3	2	2	
	Cum.									1	2	3	5	7	10	13	16	19	23	26	30	33	36	40	44	48	51	53	55	

DESIGN FREEZE

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ESTIMATED SOVIET CAPABILITY FOR PRODUCTION AND ALLOCATION OF ICBMS

(Alternative A -- Continued)

1958  
1959

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Operational Sites	3	3	3	4	4	5	6	7	8	10	12	14	16	18	20	23	26	29	32	35	38	41	44	47	50	50	50	
ICBMs Relocated To Sites	6	8	10	13	16	19	21	24	27	31	37	45	56	72	90	116	144	178	213	250	286	323	359	396	432	469	505	
	2	2	2	3	3	3	2	3	3	4	6	8	11	16	18	26	28	34	35	37	36	37	36	37	36	37	36	
Creative Test	(1)	(1)		(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Production R & D	6	6	5																									
Sorties				7	7	8	7	9	9	13	16	20	27	32	37	39	40	40	40	40	40	40	40	40	40	40	40	
Flight Test	4	4	4	3	2	2	4	3	3	3	1	1																
	40	44	48	51	53	55	59	62	65	68	69	70			71		72		73		74		75		76		77	

1958

1959

1959

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1960

\* Each asterisk represents an unallocated missile in consideration of degradation & spare factors

ESTIMATED SOVIET CAPABILITY FOR PRODUCTION AND ALLOCATION OF ICBM'S  
(Alternative D)

		1957												1958												1959					
		Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar		
Operational Sites	Com.													1	1	2	2	2	3	3	3	4	4	5	6	8	11	14	17		
ICBM's Delivered To Sites	Com.																		1	3	3	6	10	12	15	18	22	28	36	47	63
	No.																		1	2	3	4	2	3	3	4	6	8	11	16	
Captive Test				①	①	①	①		①	①		①	①		①	①		①	①	①		①	①	①		①		①	①		
Production	R & D	1	1	1	1	0	2	2	1	3	3	3	4	5	5	6	6	6													
	Series																		7	7	8	7	9	9	13	16	20	27	32		
Flight Test	No.									1	1	1	2	2	3	3	4	4	3	2	2	4	3	3	3	1	1				
	Com.									1	2	3	5	7	10	13	17	21	24	26	28	32	35	38	41	47	43	43	43		

ESTIMATED SOVIET CAPABILITY FOR PRODUCTION AND ALLOCATION OF ICBMS  
(Alternative D--Continued)

Operational Sites	Com.	5	6	8	11	14	17	20	23	26	29	32	35	38	41	44	47	50	50	50	50
ICBMs Allocated To Sites	Com.	18	22	28	36	47	63	81	107	135	169	204	241	277	314	350	387	423	460	496	533
	No.	3	4	6	8	11	16	18	26	28	34	35	37	36	37	36	37	36	37	36	37
Captive Test			①		①		①		①	①	①	①	①	①	①	①	①	①	①	①	①
Production	R & D																				
	Series	9	13	16	20	27	32	37	39	40	40	40	40	40	40	40	40	40	40		
Flight Test	No.	3	3	1	1			1		1		1		1		1		1		1	
	Com.	38	41	42	43	43	43	44	44	45	45	46	46	47	47	48	48	49	49	50	50
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May

\* Each asterisk represents an unallocated missile in consideration of degradation and spare factors.

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**MEMORANDUM FOR:** CIA Member of CMIC

**SUBJECT:** Transmittal of ORR Contribution to CIA Draft of  
SME 11-10-57 for CMIC Consideration.

**REFERENCE:** CMIC Memorandum of 11 October, "Change in Scope of  
SME 11-10-57: Soviet ICBM".

Attached is the ORR contribution called for in the referenced memorandum. It is for inclusion in the CIA Draft of SME 11-10-57 which will be forwarded to CMIC for its consideration. An ORR representative will attend the CMIC deliberations on SME 11-10-57 and will provide detailed support for the conclusions reached in this contribution.

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/S/  
[Redacted]  
Acting Assistant Director  
Research and Reports

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6 November 1957  
CIA/RR IP 574  
(CIR Project 37,228)

**CIR Contribution to CIA Proposed Draft of SSIR 11-10-57 for CIR  
Consideration**

**REVISED SOVIET ICBM PRODUCTION CAPABILITIES**

We have no direct information regarding the production facilities devoted to the Soviet ICBM program; however, we do know the USSR has a highly developed industrial base which includes all the skills and facilities necessary for the quantity production of ICBM systems. Assuming that these resources are marshalled on a first priority basis we estimate the USSR could have the following quantities of operational ICBM's in the hands of trained units by the dates indicated:

50 ICBM's by September 1959  
100 ICBM's by November 1959  
500 ICBM's by November 1960

We estimate further that the first prototype missile having a limited operational capability could be delivered to an operational unit by May 1958. This missile provided essentially for troop training, and additional prototype missiles delivered thereafter.

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ESTIMATED SOVIET ICBM PRODUCTION CAPABILITIES

could be used for military purposes; by the end of 1958 at least a total of ten such missiles could be in place at one or a few operational sites.

We believe the USSR is capable of flight testing about 50 ICBM's (including earth satellite vehicles which we assume contribute to the ICBM test program) by the end of 1958; at which time a "design freeze" decision could be made and series peak production of operational ICBM's initiated. A production rate of 40 missiles per month could be achieved by early 1960 and by the fall of 1960 about 50 operational sites fully equipped and manned by trained troops could be ready.

This estimated Soviet ICBM production and deployment program is based on an assessment of Soviet industrial capabilities time-phased with the progress demonstrated by Soviet earth satellites and ICBM test launchings. We therefore consider it a sound estimate of overall Soviet capabilities in this field. Whether the USSR carries out this program depends on Soviet intent, and the vigor with which the USSR may choose to exploit a capability we estimate it possesses.

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