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IMPLICATIONS
OF A
COMPREHENSIVE TEST BAN TREATY
ON THE
U.S./SOVIET STRATEGIC FORCE BALANCE (U)

BRIEFING BOOK

This study was conducted for the Lawrence Livermore Laboratory under Contract 5185803.

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11-M-1361-A1

(U) IMPLICATIONS OF A CTBT ON THE US/SOVIET STRATEGIC FORCE BALANCE (U)

(U) THE ISSUE (U)

(U) This study set out to identify strategic issues which could have a significant impact on nuclear warhead design. Early analyses showed that one of the most critical issues facing the U.S. today is associated with the potential implications of a Comprehensive Test Ban Treaty (CTBT). The question is whether a CTBT is likely to constrain the future strategic effectiveness of the U.S. more than that of the Soviets. To quantitatively explore this issue, the study focused on a detailed comparison of U.S. and Soviet MIRV-capable missile forces, warhead technologies and associated special nuclear materials requirements and availability.

(U) THE ISSUE (U)

- WOULD A CTBT CONSTRAIN ONE SIDE MORE THAN THE OTHER?

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(S) SUMMARY (U)

JS 3.3(b)(5)

(U) Research to date indicates that a CTBT by itself would probably do little or nothing to prevent the Soviets from fielding a strategically superior force; but a CTBT could seriously hamper U.S. options to counter such a force.

OSD 3.3(b)(8)

[redacted]

(S) Implementation of appropriate SALT provisions could, if enforceable, limit potential Soviet advantages under a CTBT. These provisions should be primarily oriented toward prohibiting further Soviet fractionation of their large throw-weight missiles. One example would be the prohibition of flight tests of RVs smaller than those presently deployed in order to deny confidence in the accurate and reliable delivery of RVs from highly fractionated payloads. Hence, negotiation of a CTBT can be viewed as dependent on the prior achievement of enforceable SALT limitations.

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OSD 3.3(b)(2),(4),(8)

(S) SUMMARY (U)

JS 3.3(b)(8)

OSD 3.3(b)(8)

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(U) BRIEFING OUTLINE (U)

(U) The potentially asymmetric effect of a CTBT on the U.S. and U.S.S.R. was examined through an analysis of U.S./Soviet MIRVable missile forces. The effectiveness of a Soviet decision to utilize existing nuclear technology to adapt the payloads of their large throw-weight MIRVed missiles to counter future U.S. ICBM strategic force deployments was investigated. This potential Soviet capability, and its implications, was explored in three parts:

(1) the potential for Soviet ICBM payload adaptability,

(2) the effectiveness of Soviet ICBM payload adaptability, and

(3) implications for the U.S.

(U) BRIEFING OUTLINE (U)

- THE POTENTIAL FOR SOVIET PAYLOAD ADAPTABILITY
- THE EFFECTIVENESS OF POTENTIAL SOVIET PAYLOADS
- IMPLICATIONS FOR THE U.S.

The Potential for Soviet Payload Adaptability (U)

(U) APPROACH (U)

(U) The total number of RVs deployable at a given yield by either the U.S. or Soviets is a function of available missile throw-weight, nuclear design technology, and the availability of special nuclear materials (SNM) required to fabricate the warheads.

(U) In the following several charts, the total projected 1985 MIRVable throw-weight available to the U.S. and Soviet strategic forces, known U.S./Soviet nuclear technology (measured by yield-to-weight ratio), and estimated SNM availability are combined to illustrate the potential number of RVs at a given yield each side could deploy.

THE POTENTIAL FOR SOVIET PAYLOAD ADAPTABILITY (U)

(U) APPROACH (U)

- U.S./SOVIET MIRVABLE THROW WEIGHTS
- U.S./SOVIET NUCLEAR DESIGN TECHNOLOGIES
- SPECIAL NUCLEAR MATERIALS (SNM) AVAILABILITY
- TOTAL NUMBER OF RVs DEPLOYABLE

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JS 3.3(b)(1),(6)

The Potential for Soviet Payload Adaptability (U)

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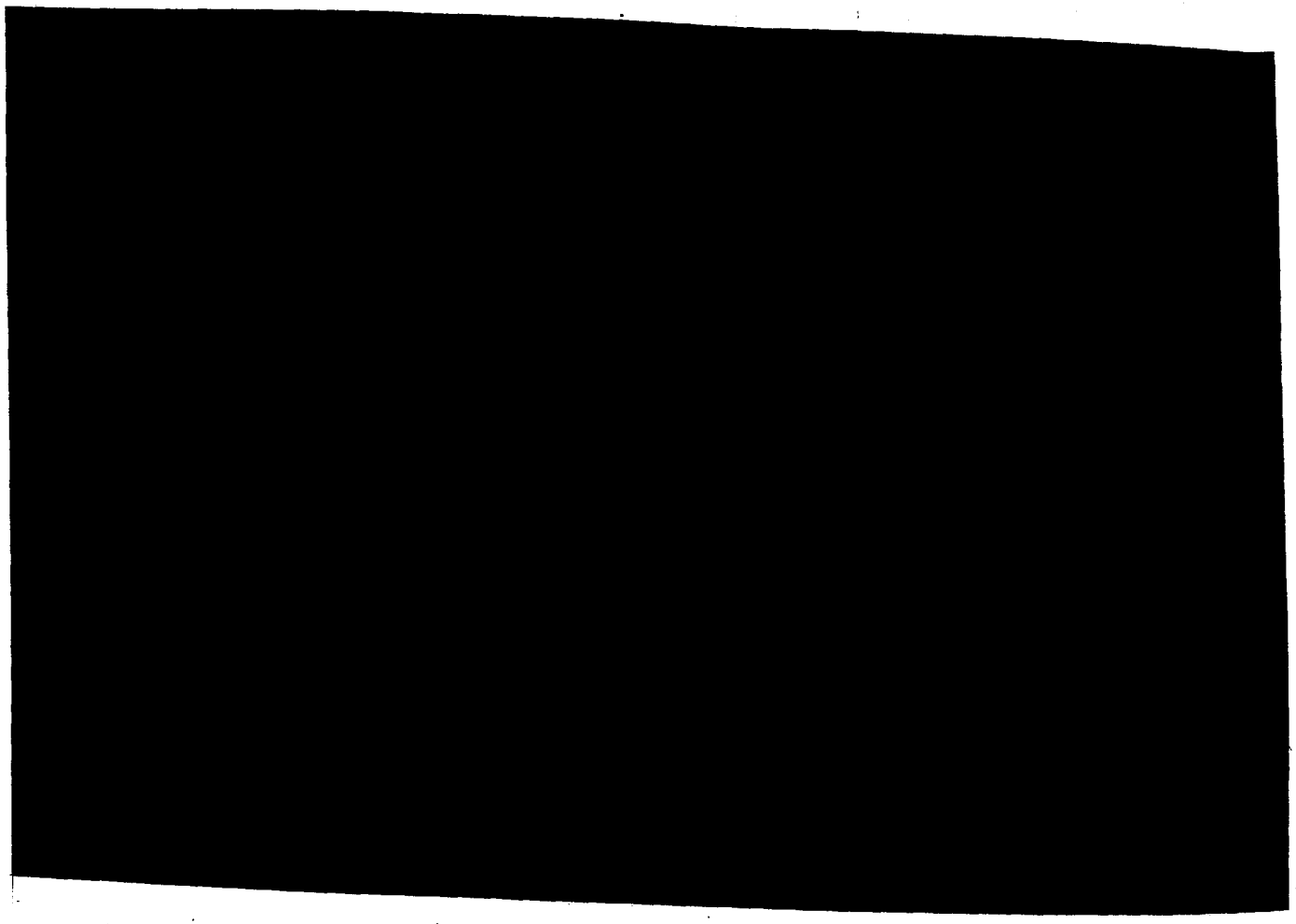

JS 3.3(b)(6),(b)

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The Potential for Soviet Payload Adaptability (U) JS 3.3(b)(5),(6)

COMPARISON OF U.S./SOVIET MIRVABLE THROW-WEIGHT (U)

[redacted]

(U) This large asymmetry in U.S./Soviet MIRVable throw-weight is a key factor allowing for the deployent of a Soviet RV force much larger than that which could be deployed by the U.S.

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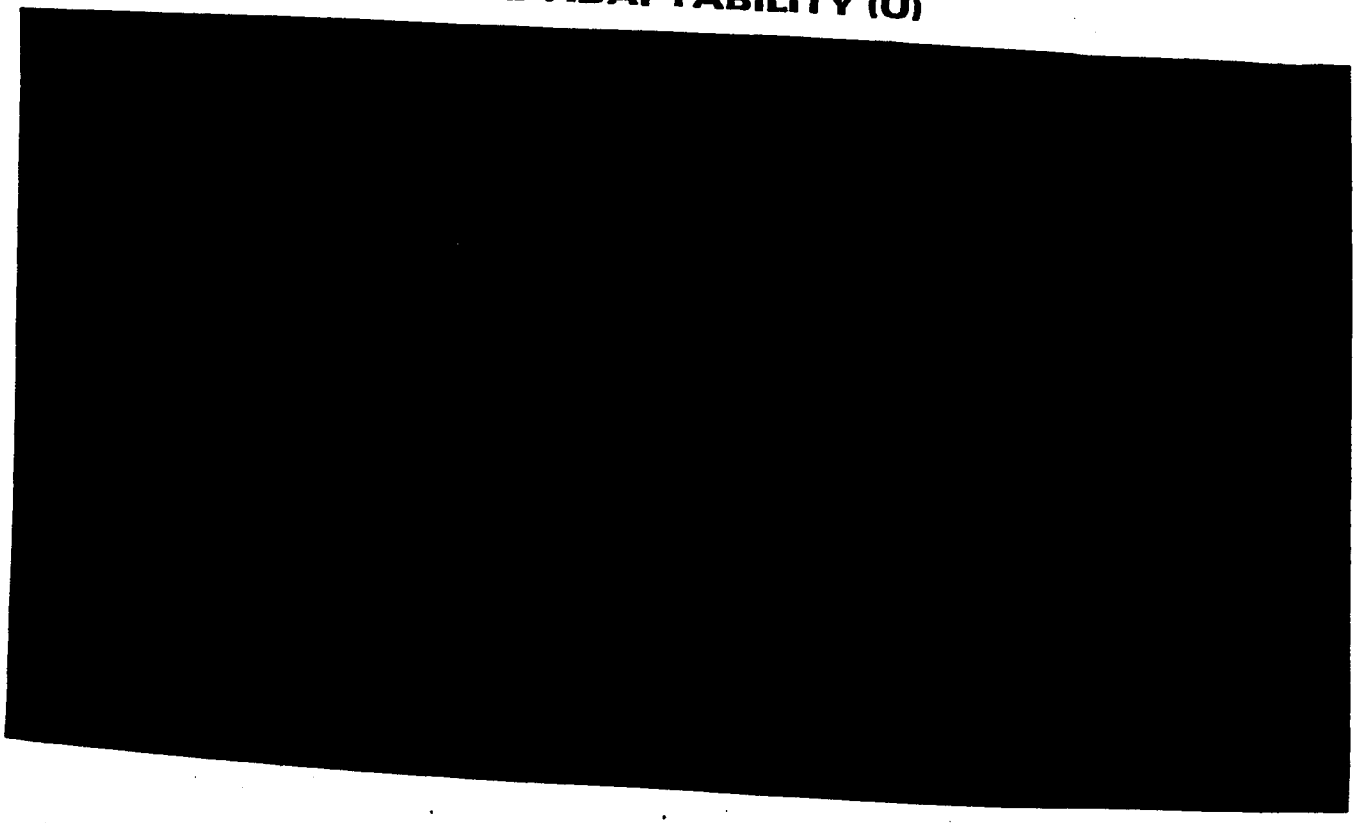
THE POTENTIAL FOR JS 3.3(b)(5),(6) SOVIET PAYLOAD ADAPTABILITY (U)



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The Potential for Soviet Payload Adaptability (U)

(S) U.S./SOVIET NUCLEAR DESIGN TECHNOLOGY (U)

(S) To determine the number of RVs at given yields which could be deployed within fixed throw-weight constraints, a knowledge of warhead weight for the various yields of interest is required. [redacted]

[redacted] OSD 3.3(b)(1)

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THE POTENTIAL FOR SOVIET PAYLOAD ADAPTABILITY (U)

~~(S)~~ U.S./SOVIET NUCLEAR DESIGN TECHNOLOGY (U)

[redacted]

OSD 3.3(b)(1)

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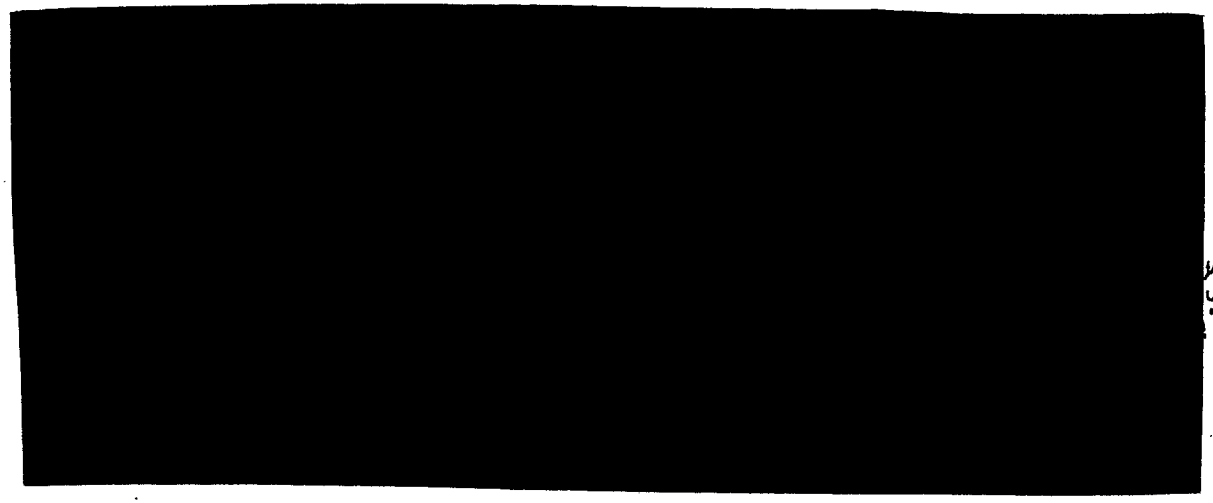
The Potential For Soviet Payload Adaptability (U)

JS 3.3(b)(6),(8)



OSD 3.3(b)(2),(4)

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[redacted]

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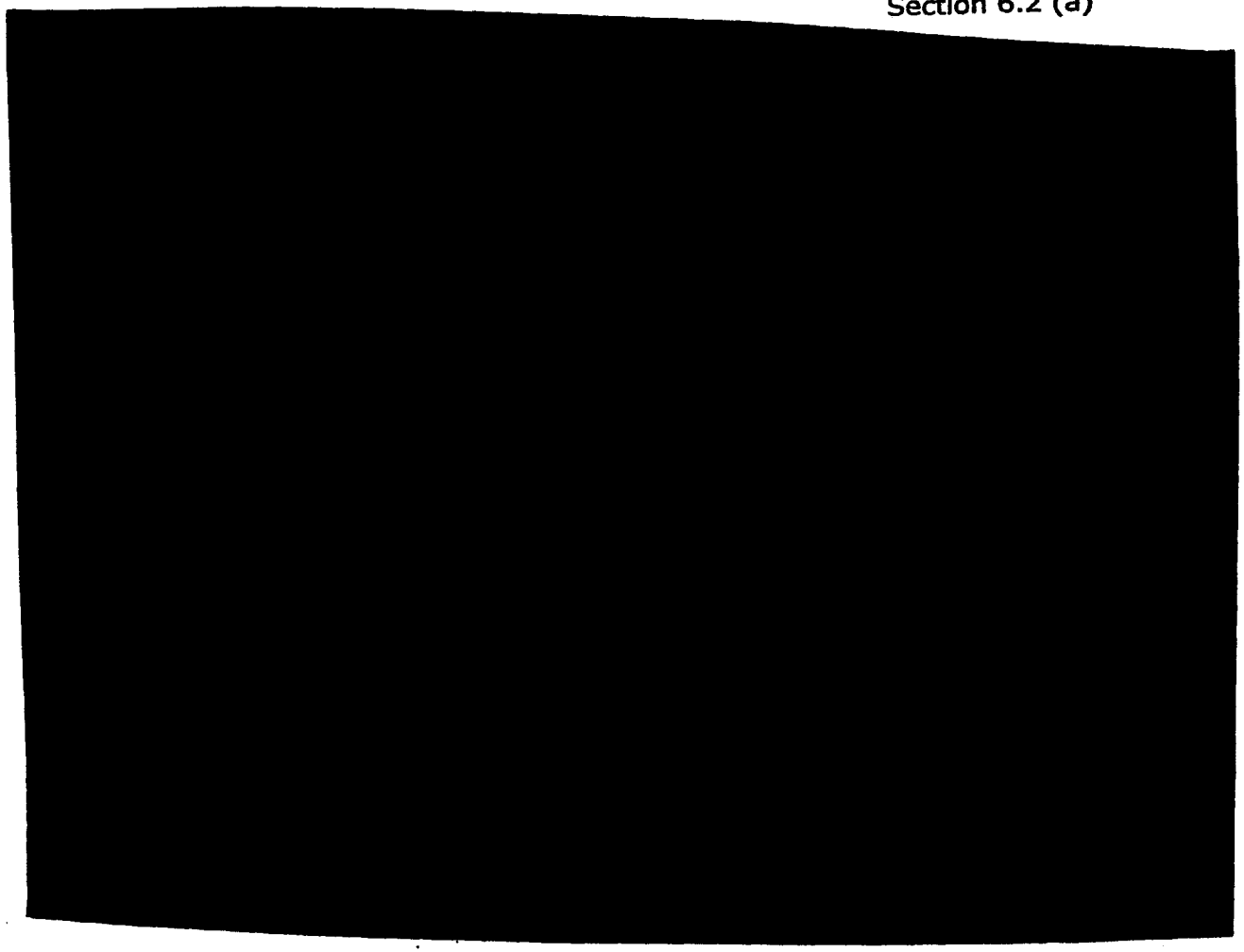
The Potential For Soviet Payload Adaptability (U)

JS 3.3(b)(5),(6)

[redacted]

JS 3.3(b)(6),(8)

OSD
Section 6.2 (a)



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The Potential For Soviet Payload Adaptability (U)

JS 3.3(b)(5),(6),(8) SNM CONSTRAINTS (U) OSD 3.3(b)(2),(4),(8)

A crucial ingredient in the fabrication of nuclear warheads is the availability of special nuclear materials (SNM).

Based on estimates* of Soviet SNM availability, and on U.S. SNM availability estimates contained in DoE's Production and Planning Document 78-0, the additional impact of SNM limitations on the total number of RVs which could be deployed on the MIRVable forces of the U.S. and Soviets is shown.

[redacted]

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JS 3.3(b)(6),(8)

OSD
Section 6.2 (a)

78-6-2 52-128

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The Potential For Soviet Payload Adaptability (U) JS 3.3(b)(6),(8)

GENERIC SOVIET RV CLASSES (U)

(U) To take advantage of the potential adaptability of their MIRVable payloads, the Soviets would need warheads in a wide yield range. A CTBT would prohibit the testing of new warheads. However, a CTBT would not prohibit the Soviets from using existing warheads and warhead technology to change their MIRVable payloads.

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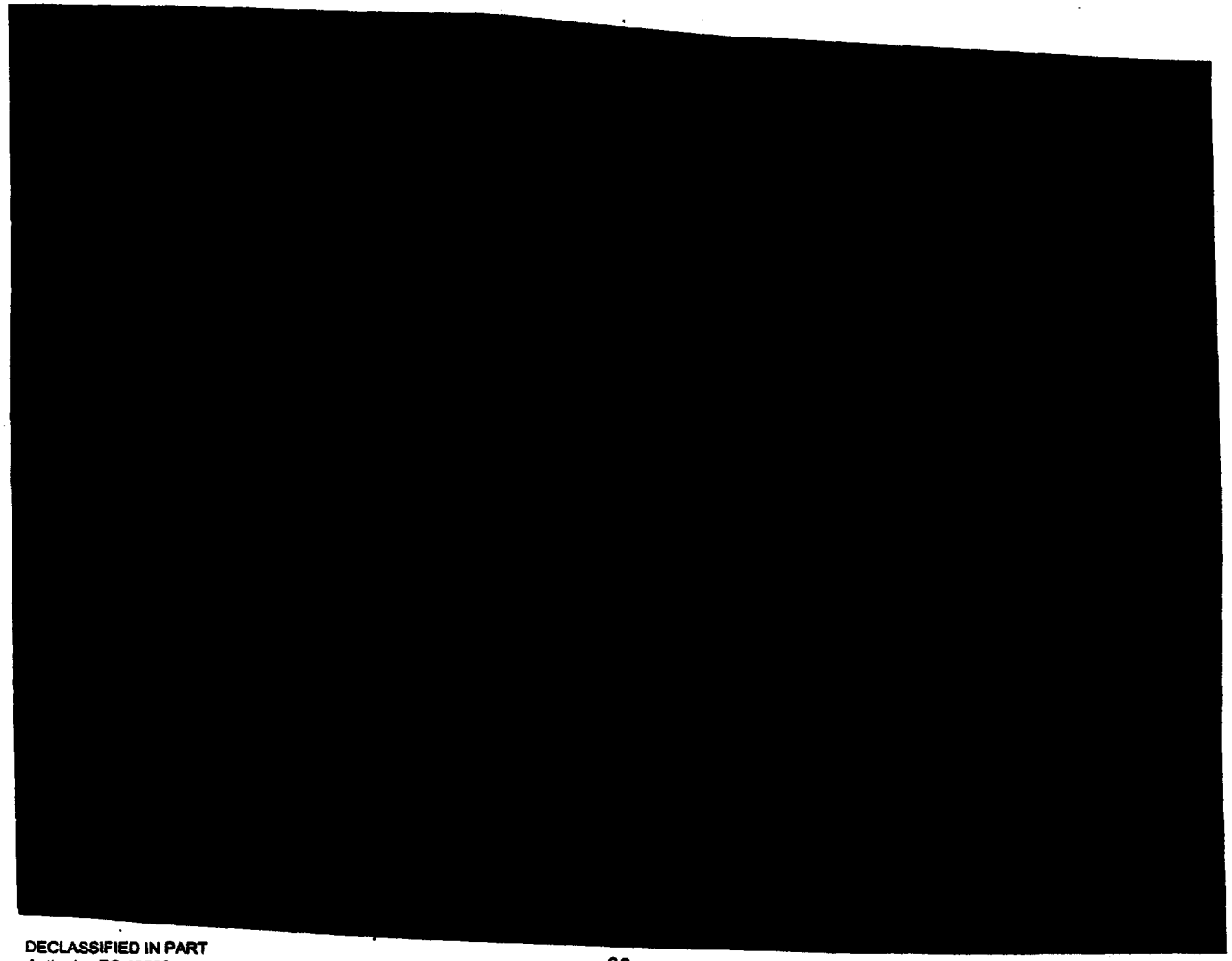
JS 3.3(b)(6)

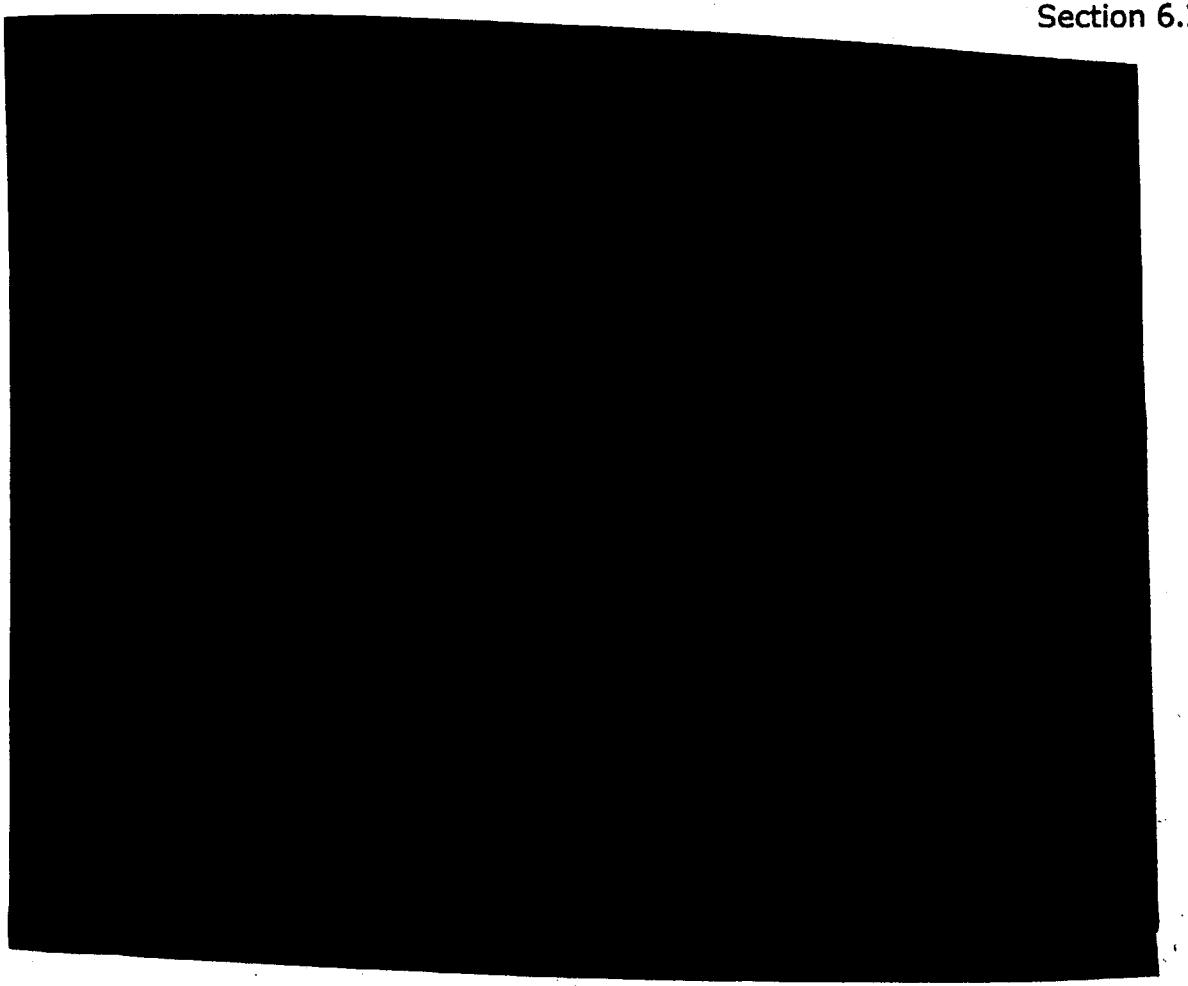


[redacted]

(S) Between 1965 and 1977, 50 Soviet nuclear test events in excess of 100 kt were detected, and 23 new RVs observed in flight tests. This represents an average of 2.2 warhead tests per RV. [redacted]

JS 3.3(b)(6),(8) OSD 3.3(b)(2),(4)

JS 3.3(b)(6) OSD
Section 6.2 (a)



The Potential For Soviet Payload Adaptability (U)

(U) THE HISTORY OF U.S./SOVIET NUCLEAR TESTING (U)

(U) Also supporting the concept of an established standardized Soviet warhead inventory is the history of detected Soviet nuclear test events.

[redacted]

JS 3.3(b)(6)

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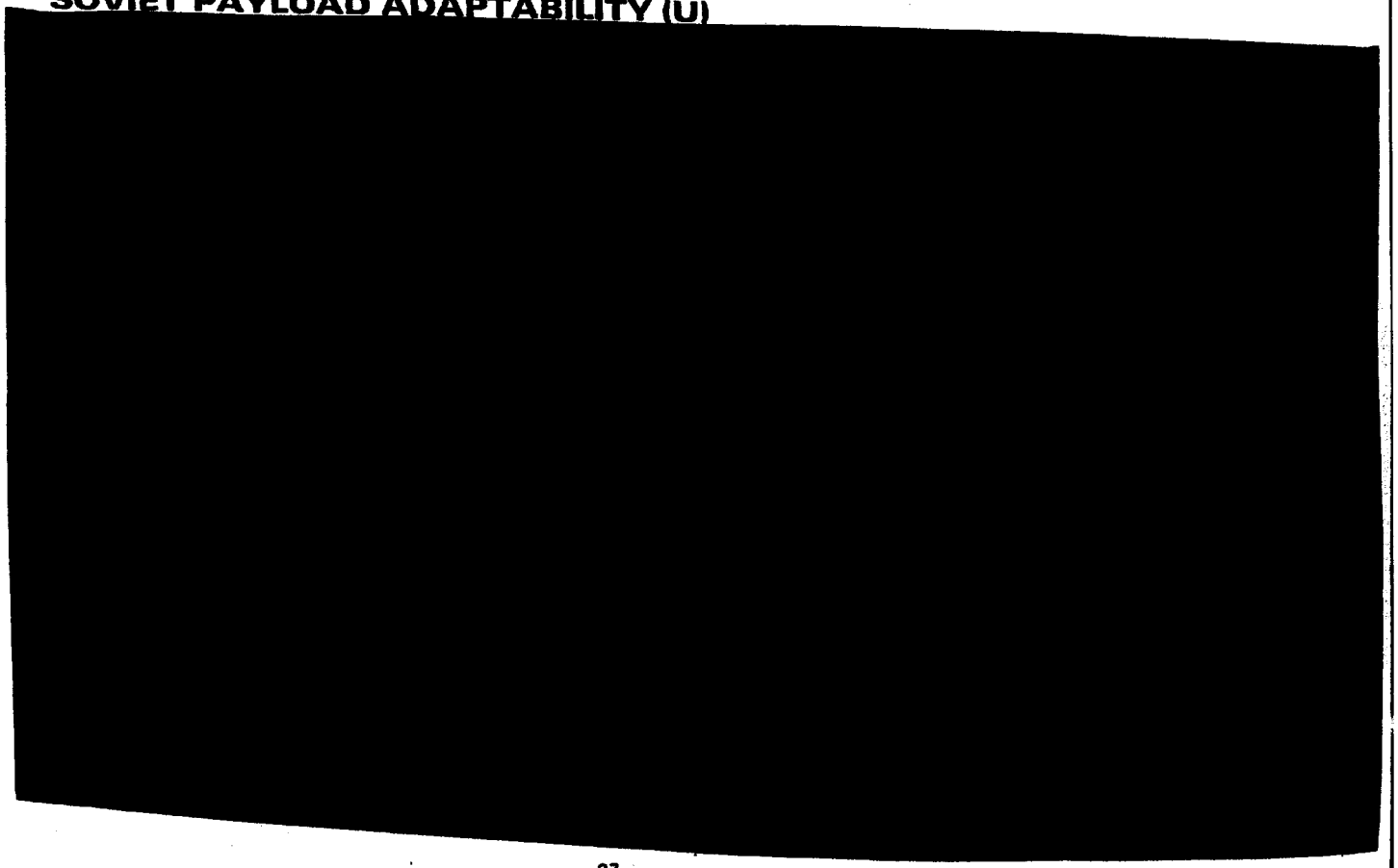
THE POTENTIAL FOR SOVIET PAYLOAD ADAPTABILITY (U)



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The Potential For Soviet Payload Adaptability (U) JS 3.3(b)(1),(6)

U.S./SOVIET WARHEAD DESIGN DIFFERENCES* (U) OSD 3.3(b)(2),(4)

[redacted]

During their life cycle, nuclear weapons can be exposed to a very wide temperature variation. [redacted]

* Reference: DIA: TCS-565582-78

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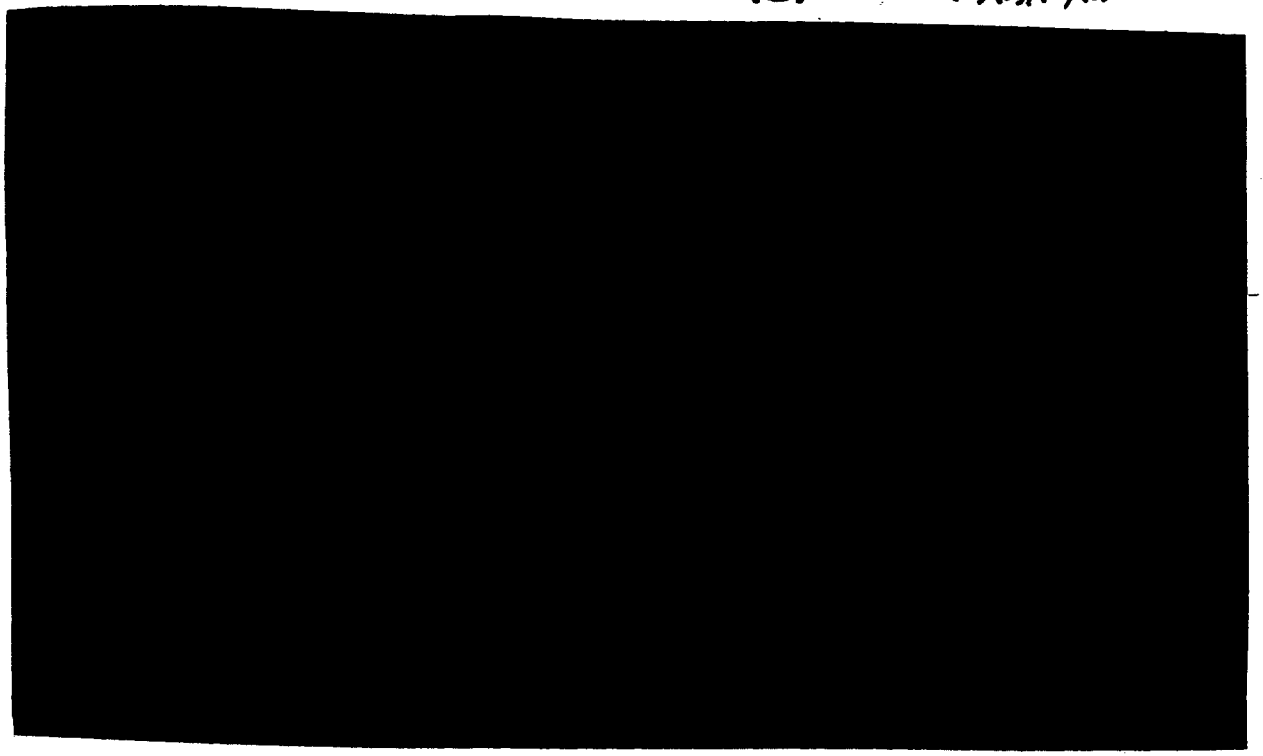
THE POTENTIAL FOR SOVIET PAYLOAD ADAPTABILITY (U)

JS 3.3(b)(5),(6),(8)



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The Potential For Soviet Payload Adaptability (U) JS 3.3(b)(5),(6),(8)

(S) SUMMARY: SOVIET FRACTIONATION (U)

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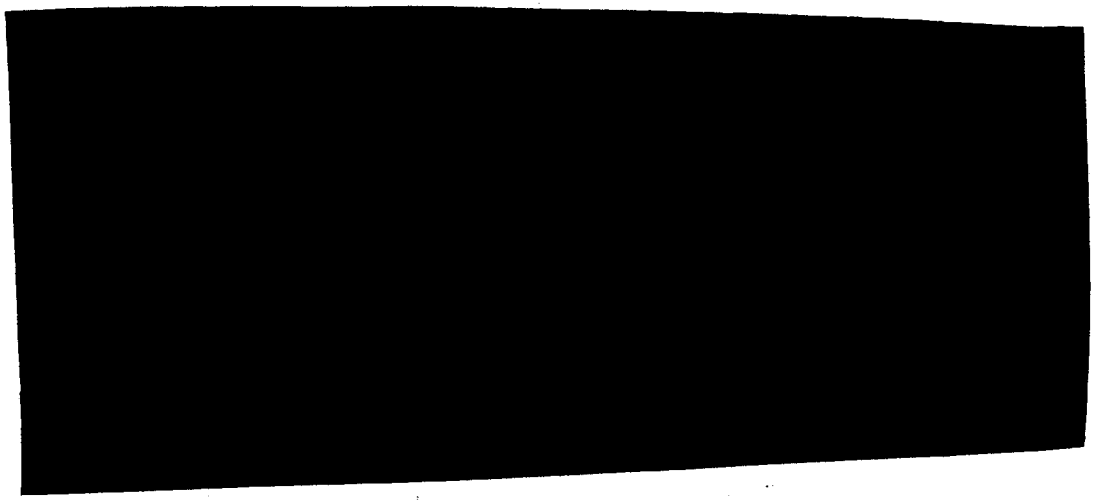
THE POTENTIAL FOR JS 3.3(b)(6) SOVIET PAYLOAD ADAPTABILITY (U)



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The Effectiveness of Potential Soviet Payloads (U)

JS 3.3(b)(8) ~~(S)~~ APPROACH (U) OSD 3.3(b)(8)

(U) Although the combination of Soviet ICBM throw-weight, existing nuclear weapon design technology, and SNM availability provides a significant foundation for the potential Soviet deployment of large numbers of warheads at given yields, total numbers of warheads alone provide only one contribution to an effective force. Also required are a consideration of warhead accuracy, multiple RV delivery, system reliability, and target vulnerability.

(U) To illustrate the potential effectiveness and adaptability of a large Soviet RV force, three Soviet SS-18/SS-19 first strike scenarios against U.S. land-based missile forces are presented.

[redacted]

(U) (2) In the second scenario, U.S. ICBM survivability against currently projected SS-18 or SS-19 forces is shown to be regained by a U.S. deployment of a fraction of its land-based ICBM force in a multiple aimpoint (MAP) basing scheme.

(U) (3) In the third scenario, Soviet SS-18 or SS-19 payloads are "adapted" to carry a larger number of smaller yield RVs, based on Soviet warhead technology and available missile throw-weight. This adaptability is shown to provide an effective counter to a 1985 U.S. MAP deployment.

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THE EFFECTIVENESS OF POTENTIAL SOVIET PAYLOADS (U)

(U) APPROACH (U)

SOVIET EFFECTIVENESS IS ILLUSTRATED BY DRAWDOWNS

- VULNERABILITY TO CURRENTLY PROJECTED SS-18 OR SS-19 FORCE OF—
  - CURRENT U.S. LAND-BASED ICBMS
  - A 1985 U.S. MAP DEPLOYMENT
- VULNERABILITY TO AN ADAPTED SS-18 OR SS-19 FORCE OF—
  - A 1985 U.S. MAP DEPLOYMENT

The Effectiveness of Potential Soviet Payloads (U) JS 3.3(b)(5),(6)

VULNERABILITY OF THE CURRENT U.S. ICBM FORCE (U)

[redacted]

OSD 3.3(b)(2),(4),(5),(8)

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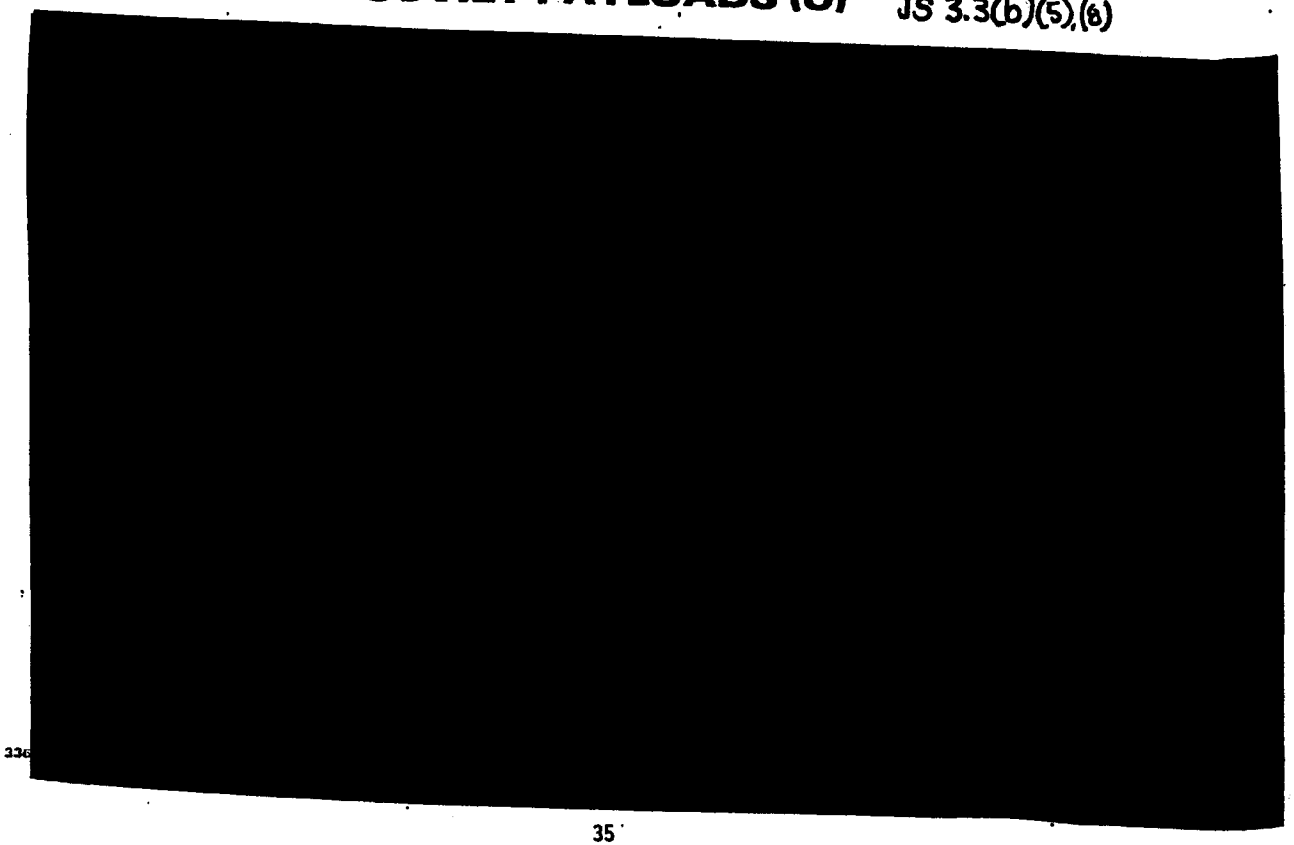
OSD
Section 6.2 (a)

THE EFFECTIVENESS OF POTENTIAL SOVIET PAYLOADS (U)

JS 3.3(b)(5),(6)



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The Effectiveness of Potential Soviet Payloads (U)

JS 3.3(b)(5),(6),(8)

VULNERABILITY OF 1985 MAP DEPLOYMENTS TO CURRENTLY PROJECTED SS-18 OR SS-19 FORCES (U) OSD 3.3(b)(2),(4),(5),(8)

[redacted]

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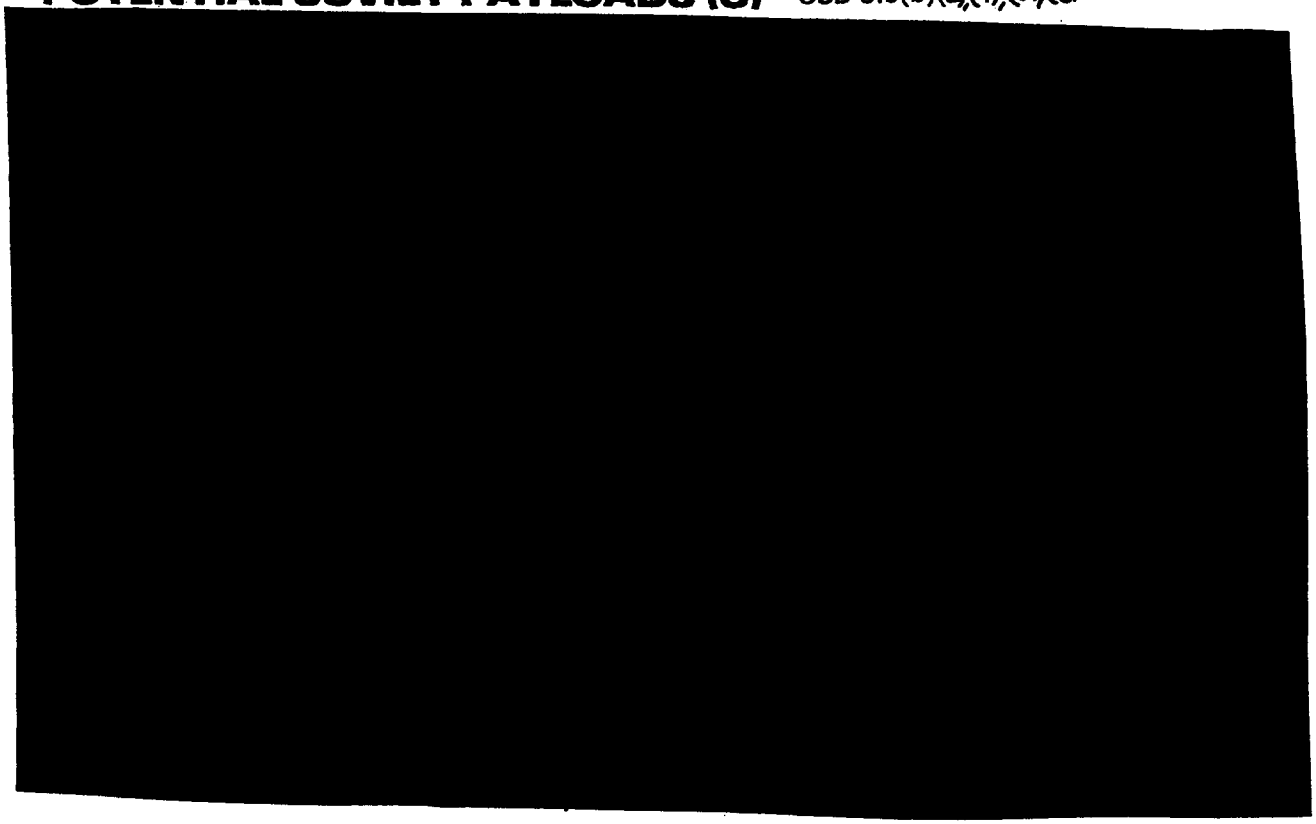
THE EFFECTIVENESS OF JS 3.3(b)(5),(6),(8) POTENTIAL SOVIET PAYLOADS (U) OSD 3.3(b)(2),(4),(5),(8)



The Effectiveness of Potential Soviet Payloads (U)

(S) POTENTIAL SS-18/SS-19 PAYLOAD FRACTIONATION (U)

[redacted]

(U) Although these potential levels of fractionation are feasible based on estimates of the existing Soviet warhead inventory and technology, the effective delivery of highly fractionated payloads may require additional flight testing or the enhancement of current delivery system technological capabilities. However, a CTBT alone would not prevent the development of these capabilities.

JS 3.3(b)(5),(6),(8)

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* Private communication, W. Barletta, Lawrence Livermore Laboratory.

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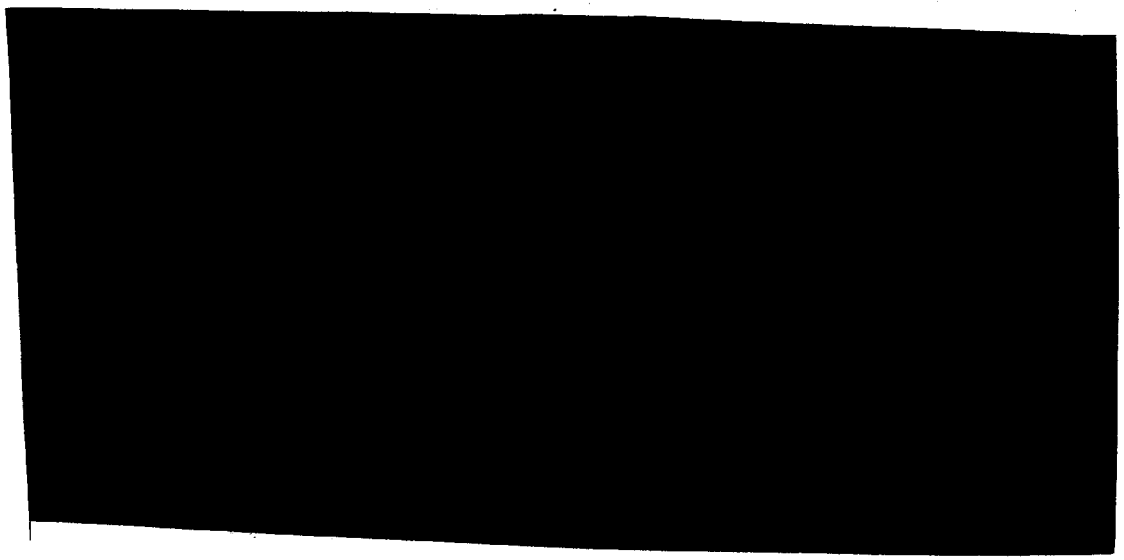
THE EFFECTIVENESS OF JS 3.3(b)(5),(6),(8) POTENTIAL SOVIET PAYLOADS (U)

(S) POTENTIAL SS-18, SS-19 PAYLOAD FRACTIONATION (U)



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OSD 3.3(b)(8)

The Effectiveness of Potential Soviet Payloads (U) JS 3.3(b)(5)(8)

(S) VULNERABILITY OF IMPROVED U.S. ICBM DEPLOYMENTS TO ADAPTED SS-18 OR SS-19 FORCES (U)

[redacted]

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THE EFFECTIVENESS OF POTENTIAL SOVIET PAYLOADS (U)

JS 3.3(b)(5),(6),(8)

OSD 3.3(b)(2),(4),(7),(8)

[redacted]

Implications For The U.S. (U)

(U) U.S. RESPONSES (U)

(U) In the face of a potential Soviet adaptation or reconfiguration of their MIRVable payloads under a CTBT by the use of existing warhead technology and an off-the-shelf inventory approach, the U.S. must consider available alternatives for the continued maintenance of a credible deterrent posture including retaining the retaliatory capability of its land-based ICBM forces.

(U) Two generic U.S. options are available: first, attempt to enchance U.S. capabilities by implementing those options which will ensure a sufficient surviving warhead force; and second, attempt to limit Soviet capabilities through mutual agreement.

IMPLICATIONS FOR THE U.S. (U)

(U) U.S. RESPONSES (U)

TO MAINTAIN ICBM SURVIVABILITY, TWO GENERIC APPROACHES ARE AVAILABLE—

- **INCREASE U.S. CAPABILITY**
  - **— INCREASE THE NUMBER OF WARHEADS SURVIVING**
- **LIMIT SOVIET OPTIONS**
  - **— ELIMINATE THE POTENTIAL THREAT THROUGH NEGOTIATED AGREEMENT**

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Implications For The U.S. (U)

INCREASING THE TOTAL NUMBER OF U.S. WARHEADS (U)

(U) Several options are available for increasing the total number of U.S. warheads, and hence the number which would survive a first strike.

[redacted]

JS 3.3(b)(5)(6)

(U) Other options intended to increase the total number of warheads, such as higher yield-to-weight technology and the use of new nuclear materials, etc., are new technologies. Experimental results are essential for developing a thorough understanding of new technology. Thus, these options are likely to require testing and therefore could not be implemented under a CTBT.

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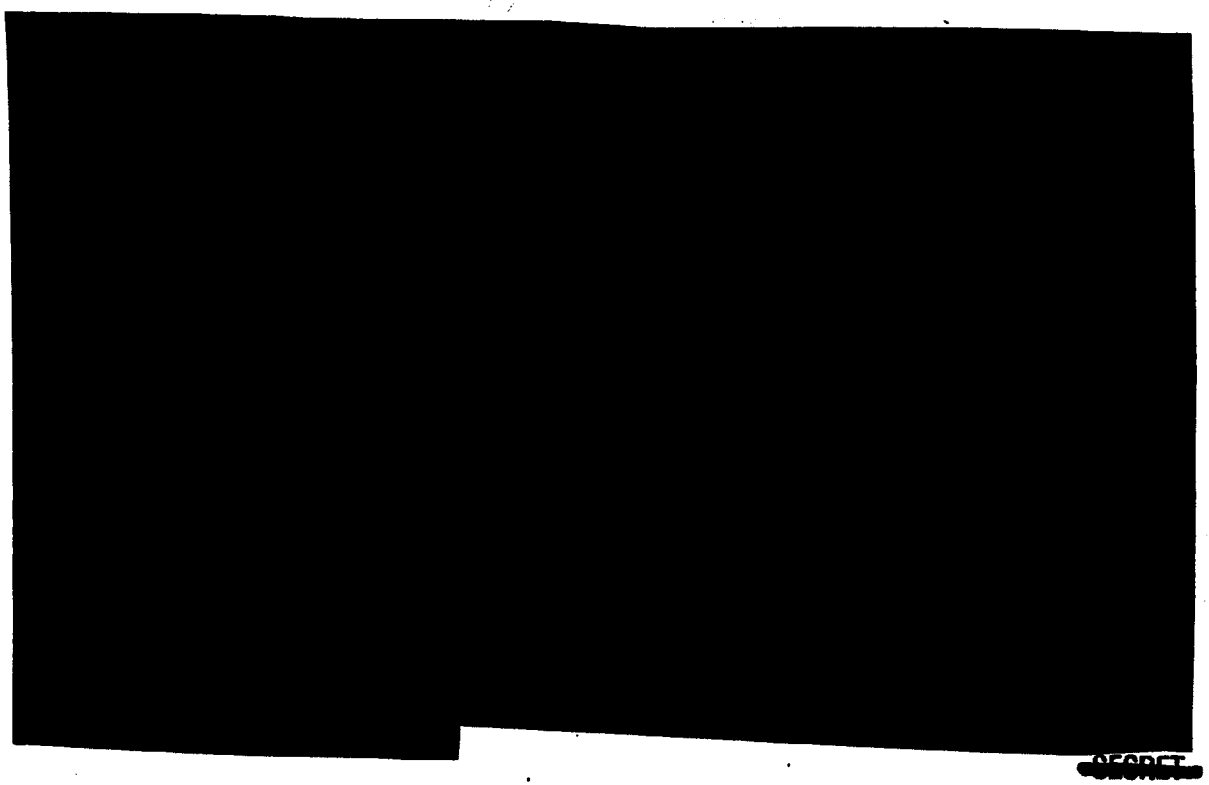
IMPLICATIONS FOR THE U.S. (U) JS 3.3(b)(5)



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Implications For The U.S. (U)

(U) INCREASING VEHICLE SURVIVABILITY (U)

(U) The total number of U.S. warheads surviving a first strike can also be increased by ensuring the survivability of the delivery system. A number of future options to replace the ICBM force or enhance its survivability are listed opposite. Also shown are concerns associated with these concepts which may require future nuclear testing for clarification.

(U) The concepts listed could provide substantial potential to survive the projected capabilities of a large adaptive Soviet RV force. However, the exact technological requirements which must be fulfilled to implement any of these options are not precisely known, but will most likely rest strongly on some aspect of a continued U.S. ability to test nuclear weapons.

(U) Thus, a CTBT would constrain many of the options available to the U.S. for the maintenance of a strong U.S. TRIAD:

IMPLICATIONS FOR THE U.S. (U)

(U) INCREASING VEHICLE SURVIVABILITY (U)

CONCEPT

- MULTIPLE-AIM-POINT
- LAND AND AIR MOBILE
- DEEP CHAMBER/LAKE BOTTOM BASING
- ACTIVE ABM
- INCREASED SEA BASING
- SPACE PLATFORMS

POTENTIAL NUCLEAR TEST REQUIREMENTS

- WARHEAD SAFETY/SECURITY
- WARHEAD EFFECTS/ VULNERABILITY
- WEAPON DESIGN

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Implications For The U.S. (U)

OSD 3.3(b)(8) THE IMPACT OF A CTBT (U) JS 3.3(b)(1),(8)

(U) In summary, the differing trends in U.S./Soviet strategic force evolution are such that under a CTBT, the Soviets would not be constrained in the development of a large, adaptable and effective RV force, whereas many future U.S. counter-options to a Soviet payload or target set change would be foreclosed.

[redacted]

(U) This evolution of the U.S. strategic capability has placed a higher emphasis on nuclear testing than has the Soviet strategic evolutionary track.

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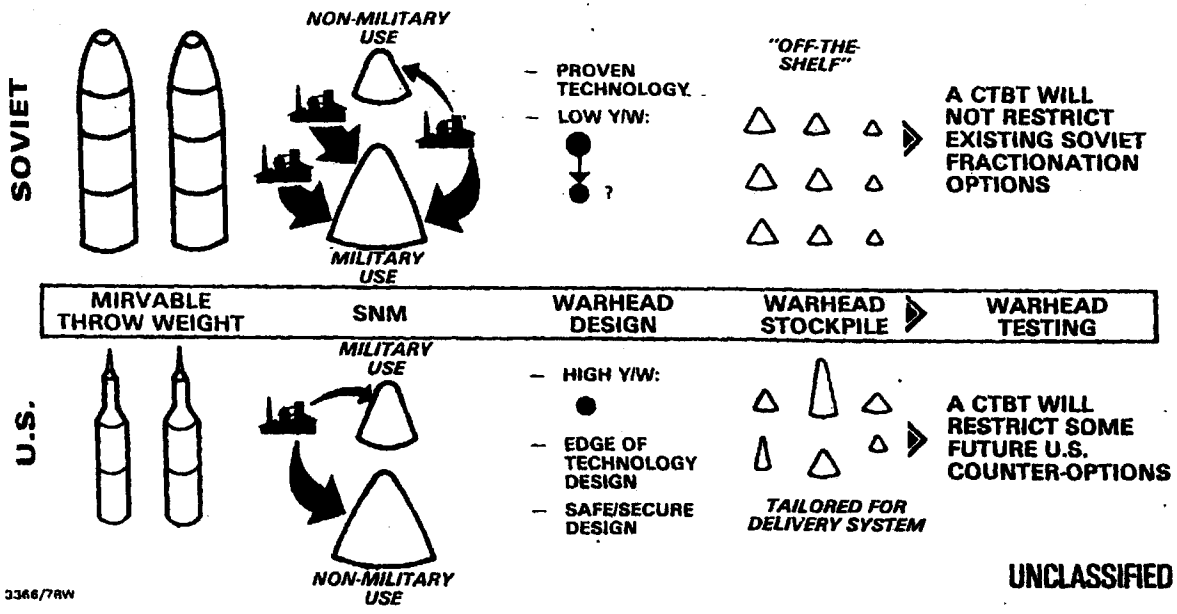
(U) SUMMARY: IMPACT OF A CTBT (U)



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Implications For The U.S. (U)

JS 3.3(b)(5),(6),(8) (U) LIMITING SOVIET CAPABILITIES (U)

[redacted]

(U) Consequently, to limit potential Soviet advantages under a CTBT, implementation of appropriate SALT provisions is necessary. [redacted]

IMPLICATIONS
FOR THE U.S. (U)

(S) LIMITING SOVIET CAPABILITIES (U)

[redacted]

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JS 3.3(b)(5),(6),(8)

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(U) MAJOR FINDINGS (U)

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JS 3.3(b)(5)(6)(8)

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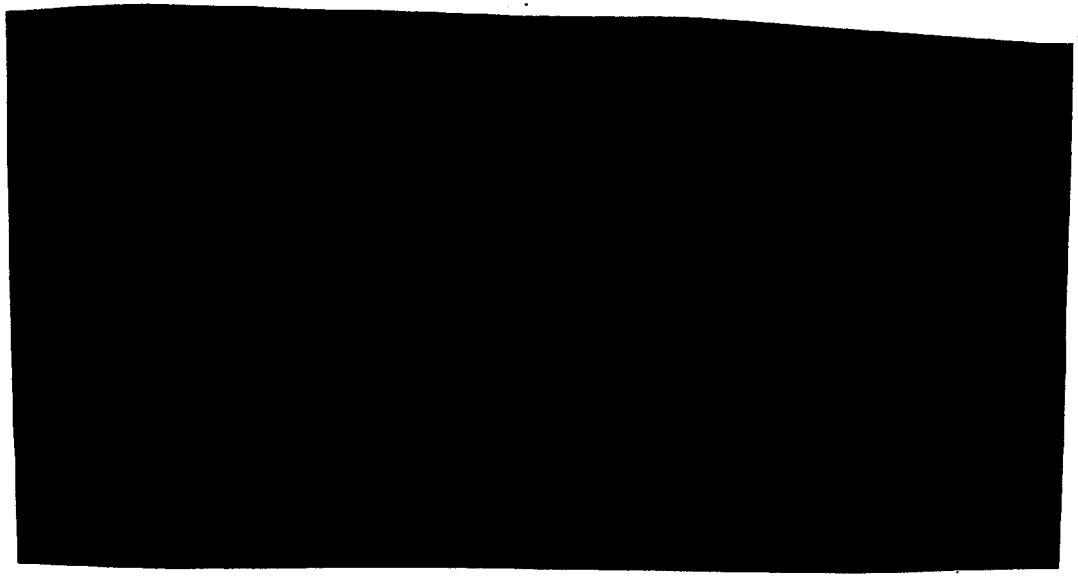
(S) MAJOR FINDINGS (U)



JS 3.3(b)(5),(6),(8)

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