

~~SECRET~~

S-UR  
TL 783.3  
M 671A  
C-3

DST-1040 - ~~1002~~

COPY NO. 280

ST-CS-10-399-75



# DEFENSE INTELLIGENCE AGENCY



DIASI DATA BASE

*[Handwritten scribbles]*

## SCUD B STUDY (U)

AUGUST 1974

~~WARNING~~

~~THIS DOCUMENT CONTAINS INFORMATION AFFECTING THE NATIONAL DEFENSE OF THE UNITED STATES WITHIN THE MEANING OF THE ESPIONAGE LAWS, TITLE 18 U. S. C. SECTIONS 793 AND 794. ITS TRANSMISSION OR THE REVELATION OF ITS CONTENTS IN ANY MANNER TO AN UNAUTHORIZED PERSON IS PROHIBITED BY LAW.~~

PREPARED BY

MISSILE INTELLIGENCE AGENCY  
U.S. ARMY MISSILE COMMAND  
REDSTONE ARSENAL, ALABAMA

~~NO FOREIGN DISSEM~~

*Ext and Contd Manned Systems Branch, Systems Section, MITA*  
74 11558

CLASSIFIED BY: ~~MMG~~  
~~EXEMPT FROM GENERAL DECLASSIFICATION~~  
~~SCHEDULE OF EXECUTIVE ORDER 11652~~  
~~EXEMPT CATEGORY: 1 + 2~~  
DECLASSIFY ON: *Notification of Originator*

~~SECRET~~

SCUD B STUDY (U)

ST-CS-10-399-75

DIA TASK NO. T74-10-04

AUGUST 1974

~~WARNING~~

~~THIS DOCUMENT CONTAINS INFORMATION AFFECTING THE NATIONAL DEFENSE OF THE UNITED STATES WITHIN THE MEANING OF THE ESPIONAGE LAWS, TITLE 18 U. S. C. SECTIONS 793 AND 794. ITS TRANSMISSION OR THE REVELATION OF ITS CONTENTS IN ANY MANNER TO AN UNAUTHORIZED PERSON IS PROHIBITED BY LAW.~~

THIS IS A DEPARTMENT OF DEFENSE INTELLIGENCE PRODUCT  
PREPARED AND PUBLISHED BY THE  
MISSILE INTELLIGENCE AGENCY  
FOR THE DEFENSE INTELLIGENCE AGENCY

~~NO FOREIGN DISSEM~~

~~CLASSIFIED BY: DIA~~  
~~EXEMPT FROM GENERAL DECLASSIFICATION~~  
~~SCHEDULE OF EXECUTIVE ORDER 11652~~  
~~EXEMPT CATEGORY: T.B. PART IV~~  
~~DECLASSIFY ON: N/A~~

PREFACE (U)

~~(S)~~ This study presents an assessment of the Soviet SCUD B short range ballistic missile (SRBM) system. The scope of this study is intended to fulfill the requirements of all consumers for scientific and technical intelligence on the Soviet SRBM systems within the limits of the available information. Comments related to increasing the usefulness of the study are encouraged and should be forwarded to DIA (ATTN: DT), Washington, D.C. 20301.

~~(S)~~ This study was prepared by the Missile Intelligence Agency of the U.S. Army Missile Command, Redstone Arsenal, Alabama.

TABLE OF CONTENTS (U)

	<u>Page No.</u>
PREFACE (U).....	iii
SUMMARY (U).....	vii
SECTION I: BACKGROUND (U).....	1
1. Introduction (U).....	1
2. Major Exploitable Items (U).....	1
3. Exploitation Results (U).....	2
SECTION II. SYSTEM CONSIDERATIONS (U).....	3
1. General (U).....	3
2. SCUD B Warhead Considerations (S).....	3
3. Missile Skin Considerations (U).....	5
4. Conclusions (U).....	6
SECTION III. <span style="background-color: black; color: black;">██████████</span> AS THE EXPLOITED MISSILE (S-NFD).....	7
1. Background (U).....	7
2. Conclusions (U).....	8
DD FORM 1473 (U).....	9
DISTRIBUTION LIST (U).....	11

SUMMARY (U)

Background (U)

~~(S-NFB)~~

Among the weapons used for the first time was a Soviet short range ballistic missile (SRBM). This firing was the first combat use of a guided ballistic missile system since World War II.

~~(S-NFB)~~

an SRBM was fired

The results of the exploitation and its significance are discussed in this study.

Data Sources (U)

~~(S-NFB)~~

The missile exploited consisted of tank skin and propulsion equipment from the aft portion of the missile.

~~(S-NFB)~~

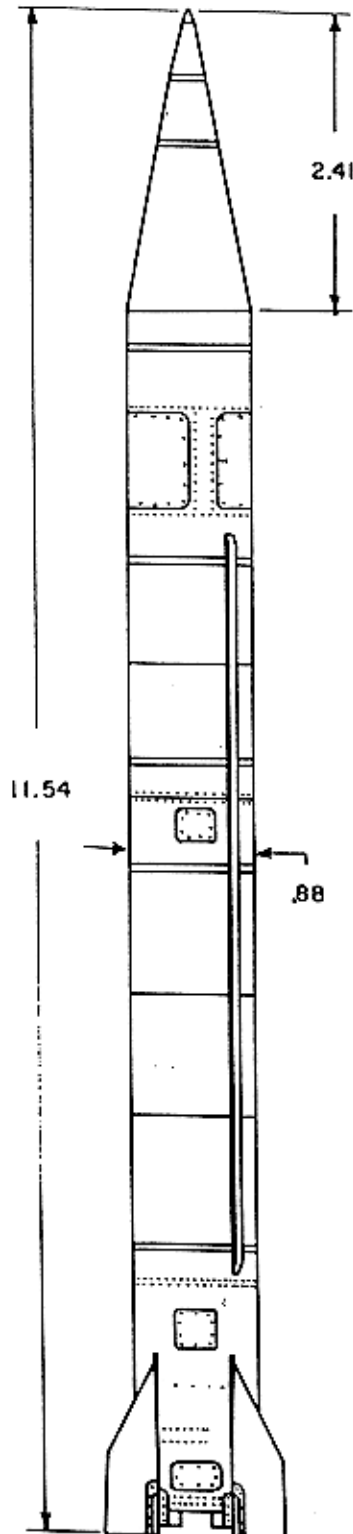
Conclusions (U)

~~(S-NFB)~~

The missile was probably a Soviet SCUD B SRBM system.

~~(S)~~ The SCUD B SRBM is now assessed to have the capability to deliver a 2,200-lb payload to a range of 30 to 160 nm (60 to 300 km). The payload options are nuclear, high explosive, and chemical.

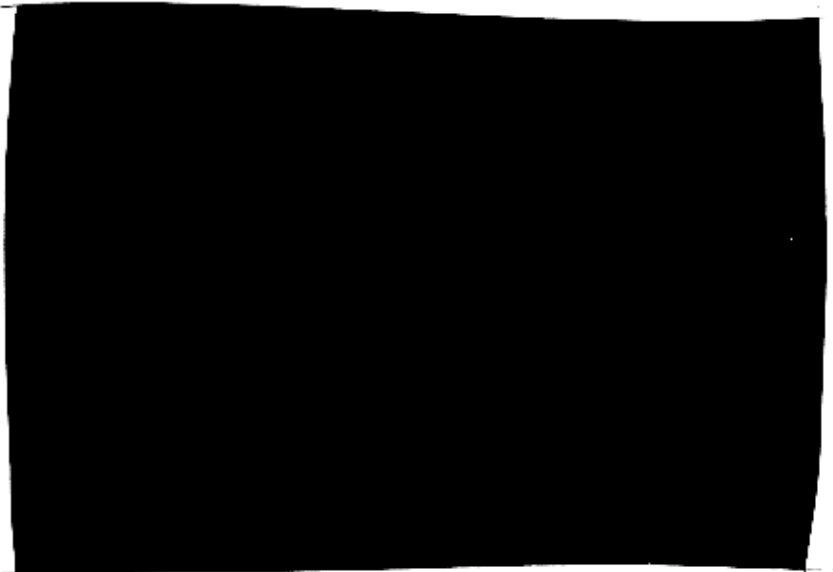
~~(S)~~ The propulsion system is a lightweight, bipropellant, turbopump fed, liquid rocket engine.



SCUD B Weapon System Characteristics (S)



Range (nm)	160 (300 km)
Payload Weight (lb)	2,200
Warhead	Nuclear, HE, CW
CEP (nm)	0.25 - 0.7
(meters)	480 - 1,300



Deployment	Ground Mobile
Employment	Offensive Tactical

NOTE:  
DIMENSIONS IN METERS

~~SECRET~~

SCUD B Missile Description (S)

Configuration	Single stage, nonseparating payload
Gross Lift-off Weight	13,000 lb (5.9 metric tons)
Guidance	Inertial
Control	Four jet vanes
Propulsion	Single nozzle, fixed position, liquid fueled rocket engine. Sea level and vacuum specific impulses are 226 and 258 seconds, respectively, Total thrust delivered at sea level is about 21,000 lb.

x

~~SECRET~~

SECTION I  
BACKGROUND (U)

1. Introduction (U)

~~(S-NFD)~~ [redacted] a Soviet short range ballistic missile (SRBM) was fired to about 50 nm (100 km) [redacted]

~~(S-NFD)~~ [redacted]

2. Major Exploitable Items (U)

~~(S-NFD)~~ [redacted]

[redacted] Items which have been identified are as follows:

a) Combustion chamber - related:

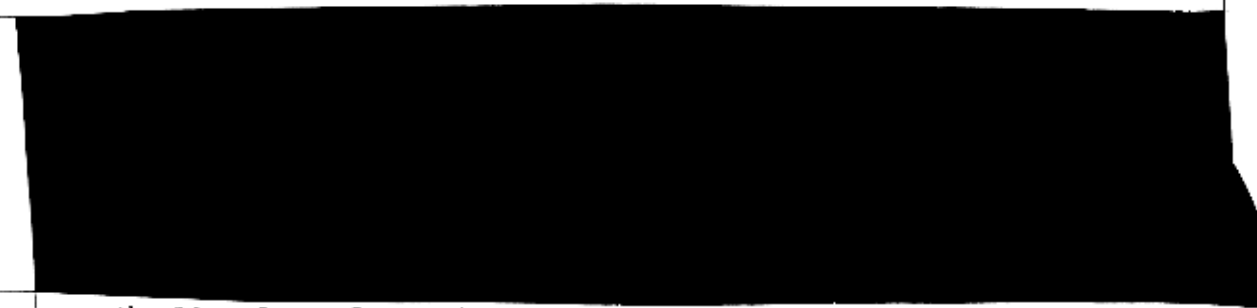
[redacted]

b) Turbopump assembly - related:

[redacted]



c) Missile skin structure:



d) Ring frame fragments:



3. Exploitation Results (U)

~~(S-NFD)~~ As a result of the exploitation, the following is known about the missile:

- a) It uses a skin of relatively heavy stainless steel.
- b) The propellant tanks have no integral stiffeners.
- c) It uses a turbopump propellant feed system.
- d) The engine [redacted] is relatively small and lightweight.
- e) The airframe is an [redacted] (SCUD B) airframe.
- f) The gas generator uses a mixture of missile oxidizer and fuel rather than a separately stored propellant.

SECTION II

SYSTEM CONSIDERATIONS (U)

1. General (U)

~~(S-NFD)~~ From shortly after the Second World War until the late fifties or early sixties, [REDACTED] However, between 1957 and 1962, all new ground forces systems [REDACTED]

~~(S-NFD)~~ [REDACTED] the airframe of the system is probably a SCUD B airframe. However, because of the age of the SCUD B system, many changes could have been made to the original system with little or no external differences which would indicate a newer and a modified SCUD B system.

~~(S-NFD)~~ [REDACTED]

~~(S-NFD)~~ [REDACTED]

~~(S-NFD)~~ Because the SCUD A could deliver its nuclear warhead to a reduced range of 160 km (86 nm) versus a lighter conventional warhead to 300 km (162 nm), and since the SCUD B had about 7 percent more propellant tankage, it was assessed that the SCUD A had been modified (into the SCUD B configuration) in order to deliver a nuclear warhead to the full design range of the SCUD system, i.e., 300 km.


[REDACTED] Thus, the SCUD B was estimated to be a simple outgrowth of the SCUD A, capable, [REDACTED] of delivering an 1,800-lb warhead section to the 300 km.

2. SCUD B Warhead Considerations (S)

~~(S-NFD)~~ There has never been any confirmation of the 1,800-lb SCUD B warhead section weight. [REDACTED]

[REDACTED]

~~(S)~~ [REDACTED]



(U) An increase in the specific impulse (without changing the propellant combination) can be accomplished by increasing the vacuum specific impulse ( $I_{sp_v}$ ), or increasing the sea level specific impulse ( $I_{sp_s}$ ), or a combination of both.

(U) The  $I_{sp_v}$  can be increased by increasing the expansion ratio at the expense, however, of increased nozzle weight and more importantly a decrease in  $I_{sp_s}$ . Obviously this method is self-defeating.

(U) The  $I_{sp_s}$  can be increased by increasing the chamber pressure. Everything else being equal this causes a reduction in the throat area. Obviously, this step requires a major engine modification or, strictly speaking, forces the adoption of a new engine.

(U) To increase both  $I_{sp_v}$  and  $I_{sp_s}$ , both methods stated above would have to be used. In this case, however, the designer must be careful such that the increase in  $I_{sp_v}$ , obtained by increasing the expansion ratio, does not at the same time reduce the  $I_{sp_s}$  more than the increase in chamber pressure raises the  $I_{sp_s}$ .

(U) Ultimately, to increase the specific impulse it becomes necessary to adopt a new engine.

~~(S)~~ There is a third method to provide more energy to the system; i.e., by changing the propellant combination



The remainder have approximately the same characteristics.

(U) Therefore, the most probable and practical method to increase the total system energy is to provide a new engine.

~~(S)~~

[REDACTED]

~~(S-NFD)~~ The [REDACTED] engine assembly was the only item exploited from which some missile operating characteristics could be obtained.

[REDACTED]

~~(S)~~ If the assumption is made that the missile exploited and the SCUD B are the same, then the use of the [REDACTED] engine provides the SCUD B the capability to deliver a 2,200-lb (1 metric ton) warhead section to the 160-nm (300 km) design range. A range versus payload trade-off is involved and the system will carry more weight to a shorter range, or achieve a greater range with a lighter payload. Thus, by using the [REDACTED] engine, the SCUD B can deliver a metric ton payload to 300 km,

[REDACTED]

3. Missile Skin Considerations (U)

~~(S-NFD)~~

The material of the propellant tank has a probable yield stress of about 142 KSI. Thus, the maximum tank pressure is about 650 psi.

Therefore, the SCUD B with the [REDACTED] engine must have a turbopump feed system.

~~(S)~~ However, a majority of turbopump systems operate with tank pressures of 75 to 100 psi.

[REDACTED]

~~(S)~~

[REDACTED]

~~(S-NFD)~~

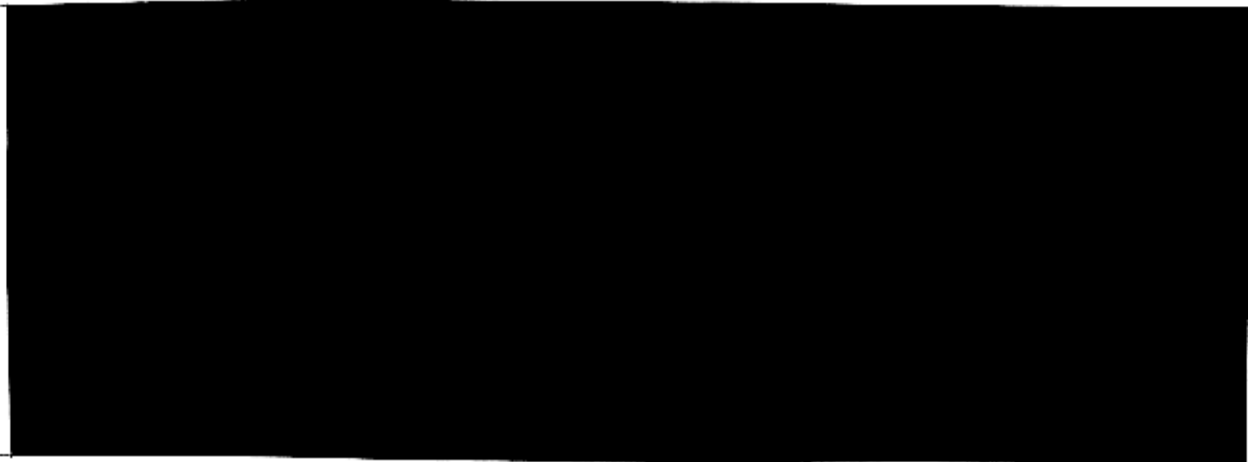
[REDACTED]

~~(S-NFD)~~

[REDACTED]

~~(S-NFD)~~ At present it seems that the last postulation is the most plausible

of the three for the following reasons:



4. Conclusions (U)

~~(S-NFD)~~ Thus, at present it seems that the [redacted] engine assembly was part of the original equipment on the SCUD B and that the missile fired [redacted] [redacted] was probably the SCUD B.



system is an unknown missile.

2. Conclusions (U)

~~(S-NFO)~~ [REDACTED] is a basic SCUD B booster with a lighter warhead, 1100 lb (0.5 metric tons), capable of obtaining a range of 275 to 325 nm (500 to 600 km).

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author) Missile Intelligence Agency U.S. Army Missile Command Redstone Arsenal, Alabama 35809		2a. REPORT SECURITY CLASSIFICATION <del>S - NFB</del>	
3. REPORT TITLE SCUD B SUMMARY		2b. GROUP <del>XGDS</del>	
4. DESCRIPTIVE NOTES (Type of report and inclusive dates)			
5. AUTHOR(S) (First name, middle initial, last name) [REDACTED]			
6. REPORT DATE August 1974		7a. TOTAL NO. OF PAGES	7b. NO. OF REFS
8a. CONTRACT OR GRANT NO.		9a. ORIGINATOR'S REPORT NUMBER(S) ST-CS-10-399-75	
8b. PROJECT NO.		9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)	
8c. DIA TASK NO. T74-10-04			
10. DISTRIBUTION STATEMENT In addition to security requirements which apply to this document and must be met, each transmittal outside the Department of Defense must have prior approval of the Defense Intelligence Agency.			
11. SUPPLEMENTARY NOTES		12. SPONSORING MILITARY ACTIVITY Defense Intelligence Agency Washington, D. C.	
13. ABSTRACT <del>(S - NFB)</del> This study presents an assessment of the SCUD B weapon system which was fired [REDACTED]			



KEY WORDS	GROUP A		GROUP B		GROUP C	
	ROLE	WT	ROLE	WT	ROLE	WT
SCUD B [REDACTED] SRBM Payload						

~~SECRET~~

R155 CIA/DS-465 (PP)

001 COPY(S)

4291-35

5811

~~SECRET~~

**NATIONAL  
SECURITY  
ARCHIVE**

This document is from the holdings of:

The National Security Archive

Suite 701, Gelman Library, The George Washington University

2130 H Street, NW, Washington, D.C., 20037

Phone: 202/994-7000, Fax: 202/994-7005, [nsarchiv@gwu.edu](mailto:nsarchiv@gwu.edu)