Copy # 2a

WATERTOWN ARSENAL LABORATORY

MEMORANDUM REPORT

NO. WAL 710/658

Resistance of Regulation "Flak-Jacket" to Perforation by Fragment-Simulating Projectiles

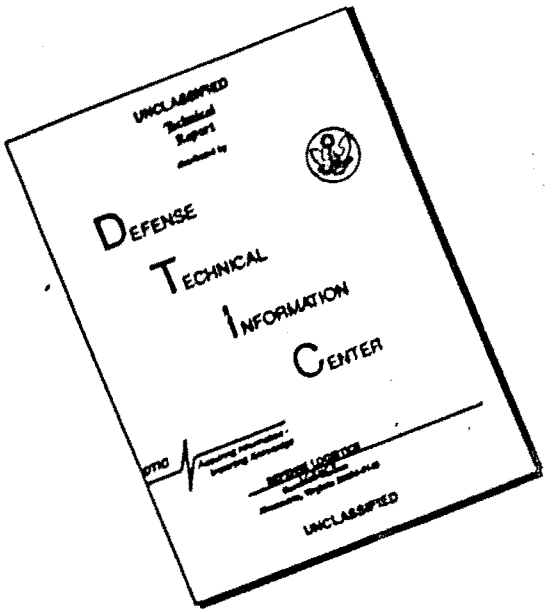
BY

J. F. SULLIVAN
Asst. Engineer

DATE 1 July 1944

WATERTOWN ARSENAL
WATERTOWN, MASS.

DISCLAIMER NOTICE



THIS DOCUMENT IS BEST QUALITY AVAILABLE. THE COPY FURNISHED TO DTIC CONTAINED A SIGNIFICANT NUMBER OF PAGES WHICH DO NOT REPRODUCE LEGIBLY.

WATERTOWN ARSENAL LABORATORY

MEMORANDUM REPORT NO. WAL 710/658

Fifteenth Partial Report on Problem B-8.2

1 July 1944

Resistance of Regulation "Flak-Jacket" to Perforation by Fragment-Simulating Projectiles

1. In accordance with a request of the Office, Chief of Ordnance[1], there is being conducted at this arsenal a program of development of improved body armor components. Of interest to this program was a determination of the resistance of a standard "flak-jacket" to perforation by various fragment-simulating projectiles developed at this arsenal[2,3] and by standard cal. .45 (steel-jacketed) ball projectiles.

2. Under impact of the fragment-simulating projectiles the resistance of the "flak-jacket" is appreciably superior to that of the basic steel component (.044" of Hadfield manganese steel) but under impact of the cal. .45 (steel-jacketed) ball projectile it is not decisively superior.

3. The sample "flak-jacket" was a standard back piece of armor, Flyer's Vest M1, manufactured by Crawford Manufacturing Company as procured under Contract W-36-034-Ord-1654 in accordance with Specification AXS-1170. It was mounted on a sawdust-filled canvas dummy and impacted with 150-grain and 34-grain fragment-simulating projectiles G-1-A and G-1-S, 17-grain cal. .22 fragment-simulating projectile G-2 and the standard cal. .45 (steel-jacketed) ball projectile. The results appear in Table I.

---

1. O.O. 422.3/71 - Wtn 470.5/7443, dated 28 September 1943.

2. Watertown Arsenal Laboratory Memorandum Report No. WAL 762/247, Development of Projectiles to Be Used in Testing Body Armor to Simulate Flak and 20 mm. HE Fragment, 17 December 1943.

3. Watertown Arsenal Laboratory Memorandum Report No. WAL 762/253, Development of a Projectile, to Be Used in Testing Body Armor, to Simulate Fragments of a 20 mm. H.E. Projectile, 7 January 1944.

4. Under impact of projectile G-1-A the resistance of this jacket to perforation (647 feet-per-second) was appreciably superior to that of Hadfield manganese steel in sheet form equivalent in thickness (.044" average) to that of the basic steel component (about 500 feet-per-second). Under impact of projectiles G-1-S and G-2 its resistance (1449 feet-per-second and greater-than-1980 feet-per-second respectively) was similarly superior to that of the basic steel (1020 and 1660 feet-per-second respectively).

5. However, under impact of the cal. .45 ball projectile its resistance (974 feet-per-second) was not as much superior to that of the basic steel as the addition of fabric components would imply. Inspection of the assembly after firing disclosed that penetration by this heavy blunt projectile was generally effected by bending and turning the small components aside so that infiltration between the components rather than perforation of the components resulted. Thus, the full resistive characteristics of the Hadfield manganese steel are not being exploited.

6. It appears that components of larger area are called for so that this turning aside may be minimized. It is realized that the present size of the components is a reflection of the limitation which the size of a component places upon the flexibility of an assembly. It is contended however, that larger components may be employed without sacrifice of flexibility by utilizing a different system of integrating the components.

J. F. Sullivan

J. F. SULLIVAN
Asst. Engineer

APPROVED:

N. A. MATTHEWS
Major, Ordnance Dept.
Chief, Armor Section

[redacted]

Table I

Summary of Penetration Tests Conducted at Watertown Arsenal on Standard "Flak-Jacket"

Sample	Equivalent Steel Gauge	Ballistic Limits (F/S)			
		G-1-A[1]	G-1-S[2]	G-2[3]	Cal. .45[4]
"Flak-jacket"	not determined	647	1449	1980	974
For Comparison:					
Hadfield manganese steel sheet	.044"	(500)*	1020	1660	940

[1]Cal. .30 fragment-simulator - 150 grains.
[2]Cal. .30 fragment-simulator - 34 grains.
[3]Cal. .22 fragment-simulator - 17 grains.
[4]Cal. .45 (steel-jacketed) ball projectile - 230 grains.

*Estimated from rather meager data.

[redacted]