THIS REPORT HAS BEEN DELIMITED AND CLEARED FOR PUBLIC RELEASE UNDER DOD DIRECTIVE 5200,20 AND NO RESTRICTIONS ARE IMPOSED UPON ITS USE AND DISCLOSURE,

DISTRIBUTION STATEMENT A

APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED,

# UNCLASSIFIED AD 458570

# DEFENSE DOCUMENTATION CENTER

FOR

SCIENTIFIC AND TECHNICAL INFORMATION

CAMEBON STATION ALEXANDRIA VIRGINIA



# UNCLASSIFIED

NOTICE: When government or other drawings, specifications or other data are used for any purpose other than in connection with a definitely related government procurement operation, the U. S. Government thereby incurs no responsibility, nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use or sell any patented invention that may in any way be related thereto.

te 10 60 10 ATL-TR-65-8 LIMITED RANGE TEST OF THE MIG RIFLE CATALOGET WITH EIGHT TYPES OF RIFLE AND HAND GRENADES by Dewey E. Calfee MAR 1 8 1965 January 1965 Directorate of Armament Development Det 4, Research and Technology Division Air Force Systems Command Eglin Air Force Base, Florida

 $\bigcirc$ 

## LIMITED RANGE TEST OF THE ML6 RIFLE WITH EIGHT TYPES OF RIFLE AND HAND GRENADES

,

by Dewey E. Calfee

#### FOREWORD

Detachment h, Research and Technology Division, directed and monitored this test of the ML6 rifle using standard Army-type rifle and hand grenades during October 1964. Manuscript was released December 1964.

While the test was arranged and monitored by Det 4, RTD personnel, the actual firings were accomplished and range test equipment was installed by personnel of the Small Arms Marksmanship Training Unit, 4420th Combat Support Group, Special Air Warfare Center (TAC), Eglin AFB, Florida.

Engineering Services Project No. 912A-0000-97205 applies to this report.

This technical report has been reviewed and is approved.

CHARLES E. WOOD

Major, USAF Chief, Ballistics Division

### ABSTRACT

Range tables have been constructed for eignt Army-type rifle and hand grenades fired from the M16 rifle. The range and time of flight were measured for launch elevation angles of 5° to 45°. Final range data are the result of averaging the individual data points and compensating for wind effects. Tables are presented for the following grenades: M21 Hand Grenade with M1A2 Adapter, M30 Hand Grenade with M1A2 Adapter, M31 Rifle Grenade, M34 Hand Grenade with M1A2 Adapter, M22A2 Rifle Grenade, M23 Rifle Grenade, M27 Rifle Grenade, and the M7A1 CN Hand Grenade with M2A1 Adapter. No breakage of component parts of the guns or gun stocks occurred during the tests.

### CONTENTS

#### Section

.

1

I	INTRODUCTION	1
II	TEST SET-UP	2
III	TEST PROCEDURES AND RESULTS	3

### TABLES

# Table

IV.	M23 Rifle Grenade (Smoke Streamer)	5
IB•	M21 Hand Grenade with M1A2 Adapter (Practice	
	Fragmentation)	6
IC.	M30 Hand Grenade with M1A2 Adapter (Practice	
	Fragmentation)	- 7
ID.	M22A2 Rifle Grenade (Smoke Impact)	8
IE•	M31 Rifle Grenade (HEAT)	9
IF.	M27 Rifle Grenade (Illuminating)	10
ТЗ.	M34 Hand Grenade with M1A2 Adapter (White	
	Phosphorous)	11
IH•	M7Al CN Hand Grenade with M2Al Adapter (Tear Gas)	12
IIA.	M34 Hand Grenade with MLA2 Adapter (White	
	Phosphorous)	13
IIB.	M7Al CN Hand Grenade with M2Al Adapter (Tear Gas)	13
IIC.	M27 Rifle Grenade (Illuminating)	14
IID.	M22A2 Rifle Grenade (Smoke, Impact)	14
IIE.	M31 Rifle Grenade (HEAT)	15
IIF.	M26 Hand Grenade with M1A2 Adapter (Fragmentation)	15
IIG.	MIGAL Rifle Grenade (White Phosphorous) at 45°	
	Elevation	16
III.	Range Tables for Eight Grenades Using the M16 Rifle	17

#### SECTION I

#### INTRODUCTION

The ultimate purpose of the test discussed in this report was to establish range tables for the ML6 rifle using standard Army-type hand and rifle grenades. The following discussion describes the manner in which test data were obtained, analyzed, and correlated to construct a table of range and time-of-flight at different launch elevation angles for several types of grenades.

The compatibility of the M16 rifle with various Army-type grenades presently used with the M14 and M1 rifle was established during the tests conducted by OOAMA (OOYEC) at Hill AFB, Utah. During the Hill AFB tests, range data were obtained for elevation angles of 30° and 45°. The test at Eglin AFB provided range data at lower elevation angles.

#### SECTION II

#### TEST SET-UP

Firings were conducted at the Eglin AFB Auxiliary Field No. 9 ammunition disposal area. Using a transit, a straight line of fire was established along which markers were placed at intervals of 50 ft. The rifle was firmly implaced with two stacks of sand bags; the hand guard rested on the front stack of bags and the butt plate was placed tightly against the rear stack. The bags were situated so as to obtain the desired rifle elevation angle. The elevation angle was measured by means of an inclinometer placed inside the rifle muzzle. The rifle azimuth was checked by means of a plumb which was extended from the rifle to the line of fire marked on the ground. The rifle was held firmly in place and the elevation angle double-checked for each firing. The range to impact was measured with a steel tape. Measurements were made both in the direction of fire and laterally to each side of the line of fire. The time of flight for each grenade was measured with stop watches. Wind direction and magnitude were determined with a portable anemometer.

#### SECTION III

#### TEST PROCEDURES AND RESULTS

For all except the M34 WP hand grenade, the ground range to impact was measured directly with the steel tape. For the M21 and M30 practice hand grenades launched at high elevation angles, the flight time exceeded the fuze time, causing air bursts. For these grenades the impact angle was assumed equal to the launch angle. From an estimate of the height of the grenades at airburst and with the assumed impact angle, the increment in range from airburst to impact was computed. This distance was subtracted from the measured impact distance to obtain the range to airburst without wind direction. For the M34 WP grenade, the range beneath the airbursts was clearly indicated by an area of burned phosphorous. The M21 practice grenades air-burst zero to 20 ft high at 35° elevation and approximately 45 ft high at 45° elevation. The M30 practice grenade airburst zero to 50 ft high at 35° elevation and approximately 75 ft high at 45° elevation. The M34 WP hand grenade air-burst zero to approximately 15 ft high at 35° and 45° elevation.

A minimum of five rounds of each type of grenade was fired at elevation angle of 5°, 15°, 25°, 35°, and 45°, with the exception of the M22 rifle grenade which was not fired at 15° and the M34 WP hand grenade which was not fired at elevation angles below 25°. An average was made of the range and the time of flight at each elevation angle. For most of the grenades fired, the deviation in range did not exceed 10% of the average range. The increment in range due to wind drift was determined by multiplying the approximate wind velocity by the average time of flight. This increment was then added or subtracted from the average measured range to obtain the range shown in Table III.

The M34 WP grenade was not fired at angles below 25° due to the potential hazard to the firing personnel without protective cover. The ranges shown in the enclosed range table were computed theoretically for angles up to 25°, and then correlated with the measured data.

Table I shows the raw data as measured at the Eglin AFB test site. Table II presents a similar set of data obtained during the Hill AFB tests. No wind data are available for the Hill AFB test. Table III presents the final correlated range data.

It is noted that detonation did not occur for any of the M31 HEAT grenades. At an elevation angle of  $45^{\circ}$  the grenades impacted at approximately  $45^{\circ}$  and buried approximately half the grenade length into damp,

firm sand. At the very low angles the grenades slid along the ground, coming to rest at a range much larger than the impact ranges shown in Tables I and III.

1

Examination of the data obtained by Hill AFB personnel indicated that no consistent variation in range was obtained when five different rifles were used during the test. Therefore, at the Eglin AFB tests, no attempt was made to identify a particular rifle with a series of firings. A total of 191 grenades were fired during the tests at Eglin AFB. No breakage of component parts of the guns or gun stocks occurred.

Although no consideration was given to the effect of rifle and cartridge temperature on grenade range, these effects might be of sufficient importance to warrant investigation.

Grenade		E.	levatio	on Angl	Le (deg	g)	
No •		5	15	25	35	45	
1	Range Time Deflection	159 1.8 1R	394 3.0 25R	474 4.5 20R	585 5.9 12L	632 6.9 6L	
2	Range Timo Deflection	174 1.4 1R	389 2•9 25R	500 4.5 0	611 6.0 18L	638 6.9 24L	
3	Range Time Deflection	203 1.5 4R	367 2.4 6L	527 4 <b>.1</b> 40R	640 6.1 24L	621 7.2 12L	
4	Range Time Deflection	249 1.3 1L	379 2,8	517 4.1 4L	645 5.6 9L	627 7.3 2L	
5	Range Time Deflection	198 1.2 <sup>)</sup> 4R	350 2.5 8r	575 4.1 5L	630 5.8 23R	565 7.2 241.	
6	Range Time Deflection		365 2.5				
7	Range Time Deflection		420 3.2 18L				
*Negligit	le Wind		•				
Legend for Tables IA-IH: AB denotes approximately air burst height. GB denotes ground burst. E denotes deflection left of firing line. R denotes deflection right of firing line. All ranges and deflections measured in feet. Time is measured in seconds.							

# TABLE 1A. M23 RIFLE GRENADE (SMOKE STREAMER)\*

.

.

.

TABLE	$IB_{\bullet}$	M21	HAND	GRENADE	WITH	MIA2	ADAPTER
(PRACI	ICE	FRACE	(ENTA)	rion)*			

		Elevation Angle (deg)						
Grenade No.		5	15	25	35	45		
l	Range	144	210	347	412	360		
	Time	1.2	2•7	3.6	4.7	6.4		
	Deflection	0	0	0	0(AB20)	0(AB45)		
2	Range	142	213	298	352	440		
	Time	1.2	2•5	3.6	4.5	6.3		
	Deflection	0	6R	5L	2L(GB)	0(AB45)		
3	Range	142	233	3 <b>11</b>	350	421		
	Time	1.3	2.8	3.6	4.7	6.2		
	Deflection	0	0	3L	0(AB20)	0(AB45)		
4	Range	138	236	309	346	404		
	Time	1.1	2.7	3.б	4.7	5.4		
	Deflection	0	0	5L	0(GB)	0(AB40)		
5	Range	145	213	315	379	394		
	Time	1,2	2.5	3.8	4•7	5.8		
	Deflection	0	6R	10R	0(AB5)	0(AB50)		
*8-knot a	verage headw	ind						

# TABLE IC. M30 HAND GRENADE WITH MLA2 ADAPTER (PRACTICE FRAGMENTATION)\*

.

.

ł

		Elevation Angle (deg)						
Grenade No.		5	15	25	35	45		
1	Range Time Deflection	140 1.3 0	259 2.8 6R	37 <b>1</b> 4.5 6L	456  15r(AB20)	459 5.8 9R		
2	Range Time Deflection	<b>136</b> 1.3 0	245 2.8 3R	383 4.0 0	427 20r(AB50)	492 5.6 20L		
3	Range Time Deflection	140 1.2 0	274 2•7 4R	365 4.0 5R	412 0(GB)	465 5.2 15R		
4	Range Time Deflection	159 1.4 0	271 2.8 8R	365 3.8 16k	131(AB20)	489 5+5 24R		
5	Range Time Deflection	128 1.2 0	285 2.8 0	386 4.0 0	432  14R(AB20)	5 <b>20</b> 5.1 9R		
*8-knot a	average headw	ind						

-

		E.	Elevation Angle (deg)						
Grenade No.		5	15	25	35	45			
ı	Range Time Deflection	152 1.1 2R		409 4.0 9R	497 5•2 4R	537 6.8 6r			
2	Range Time Deflection	156 1.3 2R		415 4.0 10R	5 <b>21</b> 5.0 6L	546 6.8 24R			
3	Range Time Deflection	161 1.3 0		438 4 <b>.</b> 2 7R	546 5.3 10R	546 6.9 32R			
Ъ,	Range Time Deflection	172 1.2 2R		447 4 <b>.</b> 2 9R	533 5.4 2L	565 6.5 20R			
5	Range Time Deflection			447 4.2 1R	550 1R	574 6.5 0			
6	Range Time Deflection			462 4.2 15R					
*Negligi	ble Wind								

# TABLE IE. M31 RIFLE GRENADE (HEAT)\*

ļ

		Ele	evation	n Angle	e (deg)	)
Grenade		5	15	25	35	45
No.						
l	Range Time Deflection	148 1.4 0	288 2.7 0	465 4.2 7L	605 	615 6.7 5R
2	Range Time Deflection	147 1.4 2R	308 2.5 5L	467 6r	613 5.5 10L	625 6.9 10L
3	Range Time Deflection	147 1.4 3R	3 <b>12</b> 2.6 3R	467 4.4 15L	607 5.8 8R	675 7.1 20L
4	Range Time Deflection	146 1.2 0	312 2.9 0	467 4.2 5R	638 5.9 17L	648 6.9 17L
5	Range Time Deflection	138 1.4 2L	316 2.8 4R	475 4.3 7L	639 5.8 13L	651 7.0 101
*5-knot	average tailw	rind				

# TABLE IF. M27 RIFLE GRENADE (ILLUMINATING)\*

L

•

.

		Elevation Angle (deg)						
Grenade No.		5	15	25	35	45		
l	Range	124	188	335	383	361		
	Time	1.1	1.9	3.8	4.9	6.6		
	Deflection	1R	3R	7R	7r	0		
2	Range	127	221	334	394	362		
	Time	1.2	2.7	3.8	4.8	5.8		
	Deflection	1R	1R	7R	6r	7R		
3	Range	128	227	345	409	4 <b>18</b>		
	Time	1.1	2.7	3•9	5.0	5•9		
	Deflection	2R	0	5R	51.	4R		
4	Range	131	230	345	400	420		
	Time	1.1	2.7	3.6	5.0	5•3		
	Deflection	2R	3L	9R	12R	3R		
5	Range	129	256	348	418	426		
	Time	1.1	2.5	3•8	4.8	5•3		
	Deflection	2R	2R	6r	2L	5R		
*Negligi	*Negligible Wind							

!	TABLE	IG.	M34	HAND	GRENADE	WITH	MIA2	ADAPTER
(	WHITE	PHOS	SPHOR	ous):	ŧ			

I

		Elevation Angle (deg)						
Grenade No.		5	15	25	35	45		
l	Range Time Deflection			252 3.5 0	318  3R	330 4 <b>.</b> 2 0		
2	R <b>ange</b> Time Deflection			232 3.5 8L	298  11L	285 4.6		
3	Range Time Deflection	1-1-1-1-1 1-1-1-1-1 2-1-1-1-1		245 2.5 8L	301 5R	285 4.9		
4	Range Time Deflection			236 3.0 0	310 <u>-</u> 3R	295 4.9		
5	Range Time Deflection			250 3-2 0	308 5• <sup>4</sup> 10R	285 4.9		
*Negligi	*Negligible Wind							

		E	Levatio	on Ang	le (deg	g)		
Grenāde No•		5	15	25	35	45		
l	Range Time Deflection	100 1.2 0	225 2.2 0	280 3.2 3R	305 4.2	318 		
2	Range Time Deflection	100 1.0 0	225 2.1 0	274 3•3 2L	325 4.1 8R	320 5 0		
3	Range Time Deflection	120 1.6 0	225 	283 3.3 6L	300 4.2 8R	324 5.1 12R		
յե	Range Time Deflection	70 	220 2.1 0	255 3.1 0	300 4.4 13R	316 5.2 0		
5	Range Time Deflection	98 1.1 0	230 2.2 0	302 3.2 2L	282 4.0 14R	315 5.3 0		
6	Range Time Deflection			295 3.1 0	345 4 <b>.1</b>			
7	Range Time Deflection			240 3•5 6R	270 3•9 8R			
*6-knot a	*6-knot average headwind							

ļ	TABLE	IH.	M7Al	CN	hand	GRENADE	WITH	M2A1	ADAPTER
(	TEAR	GAS )	\$						

.

		R	ifle	Number	
Elevation Angle	1	2	3	4	5
اي5°	305* 307 310 325 330	300 325 310 340 355	295 310 320 325 315	Air Burst 347 340 345 360	348 348 335 338 335
30 <b>°</b>		300 325 320 335 320	325 320 320 315 310	330 315 320 320 310	340 335 315 320 305

TABLE IIA. M34 HAND GRENADE WITH MLA2 ADAPTER (WHITE PHOSPHOROUS).

.

.

.

.

		Kifle	Numb	er	
Elevation Angle	1	2	3	4	5
45°	340	350	347	388	375
	338	357	400	385	365
	365	360	353	390	360
	340	375	350	400	340
	380	375	340	350	348
°0ز	345	510	310	375	390
	565	325	345	380	350
	350	340	340	340	360
	390	355	340	350	370
	310	360	350	370	3140

TABLE IIB. M7AL ON HAND GRENADE WITH NEAL ADAPTER (TEAR GAS).

<sup>\*</sup>All entries in Tables IIA-G are ranges in feet unless otherwise indicated.

		Rif	le Nu	mber	
Elevation Angle	1	2	3	4	5
45°	400 400 408 410 395	405 410 415 443 443 447	390 4C7 415 415 440	435 425 420 412 408	430 425 423 423 415
30 <b>°</b>	365 385 390 410 415	365 365 370 380 380	390 395 370 1100 1400	390 395 397 407 410	1 <sub>105</sub> 375 400 360 390

TABLE IIC. M27 RIFLE GRENADE (ILLUMINATING).

ļ

TABLE IID. M22A2 RIFLE GRENADE (SMOKE, IMPACT).

		Rifl	e Nun	ıber	
Elevation Angle	l	2	3	4	5
45°	606 613 616 612 612	620 615 630 618 660	612 612 590 625 625	610 620 620 625 630	560 615 610 600 595
<u> </u>	560 545 545 545 540 530	550 540 535 525 515	550 530 535 520 515	550 525 520 555 540	530 525 530 535 510

# TABLE IIE. M31 RIFLE GRENADE (HEAT).

,

		Rifl	e Num	ber	
Elevation Angle	1	2	3	)†	5
45°	641 643 645 650 653	618 623 624 626 630	585 610 615 618 630	600 630 640 645 625	621 635 630 625 620
<u>3</u> 0°	455 465 465 473 475	450 465 468 475 475	460 475 480 483 483 485	483 493 495 500 508	462 485 485 508 515

•	PABLE	IIF.	M26	HAND	GRENADE	WITH	MLA2	ADAPTE	R
(	FRAGN	(ENTAT)	EON).						

		Rifl	e Num	ber	
Elevation Angle	l	2	3	4	5
h5° Approximate Distance Out Approximate Airburst Height These ranges were approximate fired from each rifle. Exact	450 150 ly th data	450 150 e sam not	450 170 e for avail	450 150 5 ro able.	400 150 unds
° 0ز	425 440 440 440 445	400 435 440 445 445	410 420 425 435 450	415 420 420 435 460	470 460 445 445 45 45

TABLE IIC.	M19A1 R	IFLE GRENADE	(WHITE
PHOSPHOROUS	) AT 45°	ELEVATION*	

	Rifl	e Nvm	ber	
1	2	7,	4	5
425 440 448 450 458	445 450 450 455 465	450 445 455 455 445 445	450 445 455 455 445	495 490 470 475 475
*No	data	for 3	0°el	evation

TABLE III. RANGE TABLES FOR EIGHT GRENADES USING THE MIG RIFLE.

-120

	r	г	m	·		П	
	ith us)	Time (sec)	14000000 14000000 14000000	and Srenade 1 Adapter Gas)	Time (sec)	4 4 9 9 9 4 4 9 9 4 4 9 9 7 9 4 4 9 9 7 9 7	
	enade w dapter osphoro	Range (ft)	0.6 1.0 2.0 2.0 2.0 2.0 2.0 2.0 2.0 2.0 2.0 2		Range (ft)	269 256 269 256 269 266 269 269 269 269 269 269 269 26	
	M34 Hand Cr NJA2 A (White Th	Elevation (deg)	ちいてい ひかうゆう	M7Al CN H with M2A (Tear	Elevation (deg)	5 5 3 8 8 8 9 9 9 2 2 9 2 8 8 8 9 2 9 2 2 9 2 9 2 9 2 9 2 9 2 9 2 9 2 9	
	de	Time (sec)	H Q Q Q A S Q Q Q A S Q Q Q A S Q Q A S Q Q A S Q Q A S Q Q A S Q Q A S	ade )	Time (sec)		
	e Grena AT)	Range (ft)	255 273 273 273 273 273 273 273 273 273 273	fle Gren Ninating	Range (ft)	150 150 240 245 345 345 345 345 345 345 345 345 345 3	
	NJI RIFI (HE	Elevation (deg)	2 1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	H27 R11 (Illun	Elevation (deg)	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	
	with tation)	Time (sec)	1 0 0 0 4 4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	tõe	Time (sec)	1 0 0 M 4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
	srenade Adapter Fragmer	Range (ft)	168 3567 5567 5567 5567 5567 5567 5567 5567	Le Grena Streamer	Range (ft)	8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	
· · · ·	M5C Hand C M1A2 (Fractice	Elevation (deg)	~ 5 4 8 % % % % 9 4	M25 Rif (Smoke 9	Elevation (deg)	~99 <b>88</b> 88844	
	with r tation)	Time (sec)	๚๚๙๛๛๚๚๛๛ ๛๛๛๚๛๛๛๛๛๛	de	Time (sec)	a avo m 11 m 4 m 00 H H a m 4 4 m 00 0	
	Grenade 2 Adapte Fragmen	Range (ft)	15 212 215 215 215 215 25 25 25 25 25 25 25 25 25 25 25 25 25	Le Grena Impact)	Range (ft)	266 575 575 575 575 575 575 575 575 575 5	
	MEl Hand MIA2 (Practice	Elevation (deg)	~ 2 5 8 8 8 8 8 9 5 5 5 5 5 5 5 5 5 5 5 5 5	M22A2 Rifl (Smoke,	Elevation (deg)	、	*Air Burst

ATL-TR-65-3

INITIAL DISTRIBUTION

l Hq USAF (AFRDDE) ٦. Hq USAF (AFSPD-AE) 1 Hq USAF (AFORQ) 1 Hq USAF (AFSSS-CB) Hq USAF (AFPTR-TC) 2 AFSC (SCS-6) 1 AFSC (SCSAB) 1 AFLC (MCSWI) l 1 RTD (RTWN) 1 ASD (ASJ) SAC (IGS-IB) 1 1 TAC 2 OOAMA (OOYE) 1 OOAMA (OOYI) 1 WRAMA (NQSC) AMC (PMSO-M16) l 2 USAF Marksmanship School TECOM 2 2 PACAF (PFMSS) USMC Code (SY, 7/1)1 l MCS (MCLFDC) Springfield Armory (SWESP-RE) 1 U.S. Infantry Board (STEBC-SA) 1 Frankford Arsenal (SMUFA-5500) Т Frankford Arsenal (SMOFA) ] 1 ΛWC US Army Munition Command (AMSMU-RE-EG) 1 2 2nd Air Div 2 AF Test Unit 2 OSD/ARPA R&D Field Unit 2 13 AF Colt Patent Firearms Mfg. Co. 1 20 DDC Eglin AFB APGC 1 PGT 2 PGBPS-4 1 PGEH 1 PGOWC Det 4, 25 RTD(ATBR) 5 RID(ATWO) 2 SAWC - MARS DO (Field No.9) 2 SARC (DO)

,

UNCLA	SSIFIED
-------	---------

,

٠

.

.

alfla att.

Control Control (Comparison and Comparison and Com	DOCUMENT	CONTROL DATA - R&D
Det 4, RTD, Air Force Systems Command, Eglin Air Ford UNCLASSITED     Base, Florida     See Bear Michael Contact of the Second Sec	(Security classification of title, body of abstract and ind	lexing annotation must be entered when the overall report is classified)
Determined and the second and the se	Det L. RTD. Air Force Systems Comman	d. Eglin Air Forde INCLASSIFICATION
APPOART TITLE     LIMITED RANGE TEST OF THE MIG RIFLE WITH EIGHT TYPES OF RIFLE AND HAND GRENADE     LIMITED RANGE TEST OF THE MIG RIFLE WITH EIGHT TYPES OF RIFLE AND HAND GRENADE     Second Ending October 1964     AUTHORS (General General Indian)     Calfee, Dewey E.     APPOART DATE     Januery 1965     To Yota. No. of Passe     Januery 1965     Contract on GRANT NO.     Appoart no.     Appoart of a second module agent     Second Test of the mass. Indian     Calfee, Dewey E.     Second Test of General Indian     Second Test of Test     Second Test of General Indian Indian     Second Test of General Indian     Second Test of T	Base, Florida	26 GROUP
LIMITED RANGE TEST OF THE MIG RIFLE WITH EIGHT TYPES OF RIFLE AND HAND GRENADE DESCRIPTIVE NOTES (Type of report and monarce serie) Final Report Period Ending October 1964 AUTHOR(3) (Letther man, Indian) Calfee, Dewey E. ERFORT DATE January 1965 Contract on anAVT NO. AREA SET NO. Services Proj No. 912A- CONTACT ON CALL OF PACES CONTACT ON CALL OF A CONTACT AND SERVICES CONTACT ON CALL OF A CONTACT AND SERVICES Qualified users may obtain copies of this report from the Defense Documentatio Center. SAULA SELITY/LIMITATION NOTICES Qualified users may obtain copies of this report from the Defense Documentatio Center. SAULASELITY/LIMITATION NOTICES Qualified users may obtain copies of this report from the Defense Documentatio Center. SAULASELITY/LIMITATION NOTICES QUALIFIED AND THE MARY NOTES SAULASELITY/LIMITATION NOTICES QUALIFIE EMENTARY NOTES SAULASELITY/LIMITATION NOTICES QUALIFIE Contact on any less of 5° to 15°. Final range data are the result of averaging C Individual data points and compensating for wind effects. Tables are presented for the following grenedes: M21 Hand Grenade with MIA2 Adapter, M30 Hand Gren with MIA2 Adapter. M31 Rifle Grenade, M34 Hand Grenade with MIA2 Adapter, M30 Hand Grenade, M34 Hand Grenade with MIA2 Adapter. M30 Hand Grenade, M34 Hand Grenade, M34 Mand Grenade with MIA2 Adapter. M30 Rifle Grenade, M27 Rifle Grenade, M27 Rifle Grenade, M28 Rifle Grenade, M27 Rifle Grenade, M28 Rifle Grenade, M24 Mad Grenade with MIA2 Adapter. No breakage of component parts of the guns or gun stocks occurred during the tests.	REPORT TITLE	
4 DESCRIPTIVE NOTES (Type of report sed molecular control         Final Report Period Ending October 1964         AUTHOR() Clearname. Hint sems. Initial)         Calfee, Dewey E.         Innuary 1965         Status of the set of the se	LIMITED RANGE TEST OF THE ML6 RIFLE	WITH EIGHT TYPES OF RIFLE AND HAND GRENADES
Statistics       1000000000000000000000000000000000000	DESCRIPTIVE NOTES (Type of report and inclusive dates) Final Report Period Ending October 1	961+
Calfee, Dewey E. S. REPORT DATE Januery 1365 20 20 20 20 20 20 20 20 20 20	5. AUTHOR(S) (Last name, first name, initial)	
S. REPORT DATE January 1965       74. YOTAL NO. OF PAGES       75. NO. OF REPS         20       20       20       75. NO. OF REPS         20       CONTRACT ON GRANT NO.       ATT-TR-65-8       ATT-TR-65-8         20       ATT-TR-65-8       ATT-TR-65-8         20       Qualified users may obtain copies of this report from the Defense Documentatio Center.         21       SUPPLEMENTARY NOTES         22       STATE ARPORT NO(5) (Any other numbers that may be set if Market No(5) (Any other numbers that may be set if STATE ARPORT NO(5) (Any other numbers that may be set if Market No(5) (Any other numbers that may be set if STATE ARPORT NO(5) (Any other numbers that may be set if Market No(5) (Any other numbers that may be set if Market No(5) (Any other numbers that may be set if Market No(5) (Any other numbers that may be set if Market No(5) (Any other numbers that may be set if Market No(5) (Any other numbers that may be set if Market No(5) (Any other numbers that may be set if Market No(5) (Any other numbers that may be set if Market No(5) (Any other numbers that may be set if Market No(5) (Any other numbers that may be set if Market No(5) (Any other numbers that may be set if Market No(5) (Any other numbers that may be set if Market No(5) (Any other numbers that may be set if Market No(5) (Any other numbers that may be set if Market No(5) (Any other numbers that may be set if Market No(5) (Any other numbers that may be set if Market No(5) (Any other numbers that may be set if Market No(5) (Any other numbers that may be set if No(5) (Any other numbers that may be set if Market No(5) (Any other numbers that may be set if No(5) (Any other numbers that may be set if No(5) (Any other numbers that may be set if No(5) (An	Calfee, Dewey E.	
January 1965       20         a. CONTRACT OR DANT NO.       PROJECT NG.         A. PROJECT NG.       PROJECT NG.         Definition of the services Proj No. 912A-       PROJECT NG(S) (Any other numbers that may be serviced and the serv	REPORT DATE	74. YOTAL NO. OF PAGES 75. NO. OF REFS
CONTACT OR GRAAT NO.     A project NC.     Engineering Services Proj No. 912A-     DOCO-97205     ATL-TR-65-8     ATL-TR-7     ATL-TR-72     DETER-TR-7     ATL-TR-72     DETER-TR-72     ATL-TR-72     ATL-TR-72     ATL-TR-72     ATL-TR-72     ATL-TR-72     ATL-TR-72     ATL-TR-72     ATL-TR-72     ATL-TR-72     ATL-72     ATL-7	January 1965	20
D FORM 1473	A. CONTRACT OR GRANT NO.	94. ORIGINATOR'S REPORT NUMBER(S) ATI-TR-65-8
DODO-97205 A VAILABILITY/LINITATION NOTICES Qualified users may obtain copies of this report from the Defense Documentatio Center. USUPPLEMENTARY NOTES A SABSTRACT Range tables have been constructed for eight Army-type rifle and hand grenades fired from the MIG rifle. The range and time of flight were measured for laun- elevation angles of 5° to 45°. Final range data are the result of averaging to individual data points and compensating for wind effects. Tables are presente for the following grenades: M21 Hand Grenadeth MIA2 Adapter, M30 Hand Grena with MIA2 Adapter, M51 Rifle Grenade, M27 Rifle Grenade, and the M/A1 CN Hand Gren- with M2A1 Adapter. No breakage of component parts of the guns or gun stocks occurred during the tests. D FORM 1473 INCLASSIFIED	b. PROJECT NO. Engineering Services Proj No. 912A-	
d     d     AVAILABILITY/LINITATION NOTICES     Qualified users may obtain copies of this report from the Defense Documentatio     Center.     I. SUPPLEMENTARY NOTES	0000-97205	9. OTHER REPORT NO(S) (Any other numbers that may be assigned
AVAILABILITY/LIMITATION NOTICES     Qualified users may obtain copies of this report from the Defense Documentatio     Center.     I. SUPPLEMENTARY NOTES     I2. SPONSORING MILITARY ACTIVITY     Det 4, RTD     Eglin AFB, Florida     ADSTRACT     Range tables have been constructed for eight Army-type rifle and hand grenades     fired from the MIG rifle. The range and time of flight were measured for laun     elevation angles of 5° to 45°. Final range data are the result of averaging to     individual data points and compensating for wind effects. Tables are presente     for the following grenades: M21 Hand Grenadeth MIA2 Adapter, M30 Hand Gren     with MIA2 Adapter, M31 Rifle Grenade, M34 Hand Grenade with MIA2 Adapter, M22A     Rifle Grenade, M27 Rifle Grenade, and the M7A1 CN Hand Gren     with M2A1 Adapter. No breakage of component parts of the guns or gun stocks     occurred during the tests.	~	
Qualified users may obtain copies of this report from the Defense Documentation Center.         1. SUPPLEMENTARY NOTES         12. SPONSORING MILITARY ACTIVITY         Det 4, RTD         Eglin AFB, Florida         3. ABSTRACT         Range tables have been constructed for eight Army-type rifle and hand grenades         fired from the M16 rifle. The range and time of flight were measured for laune         elevation angles of 5° to 45°. Final range data are the result of averaging C         individual data points and compensating for wind effects. Tables are presente         for the following grenades:       M21 Hand Grenadeith M1A2 Adapter, M30 Hand Gren         with M1A2 Adapter, M31 Rifle Grenade, M27 Rifle Grenade, and the M7A1 CN Hand Gren.         with M2A1 Adapter. No breakage of component parts of the guns or gun stocks         occurred during the tests.	. AVA IL ABILITY/LINITATION NOTICES	
Center. SUPPLEMENTARY NOTES SABSTRACT Range tables have been constructed for eight Army-type rifle and hand grenades fired from the M16 rifle. The range and time of flight were measured for laun- elevation angles of 5° to 45°. Final range data are the result of averaging ti individual data points and compensating for wind effects. Tables are presente for the following grenades: M21 Hand Grenadeith M1A2 Adapter, M30 Hand Gren- with M1A2 Adapter, M51 Rifle Grenade, M34 Hand Grenade with M1A2 Adapter, M24R Rifle Grenade, M27 Rifle Grenade, M27 Rifle Grenade, and the M7A1 CN Hand Gren- with M2A1 Adapter. No breakage of component parts of the guns or gun stocks occurred during the tests. D FORM 1473 UNCLASSIFTED	Qualified users may obtain copies of	this report from the Defense Documentation
<ul> <li>1. SUPPLEMENTARY NOTES</li> <li>12. SPONSORING MILITARY ACTIVITY Det 4, RTD Eglin AFE, Florida</li> <li>3. ABSTRACT</li> <li>Range tables have been constructed for eight Army-type rifle and hand grenades fired from the M16 rifle. The range and time of flight were measured for laun elevation angles of 5° to 45°. Final range data are the result of averaging 1. Individual data points and compensating for wind effects. Tables are presente for the following grenades: M21 Hand Grenade with M1A2 Adapter, M30 Hand Grena with M1A2 Adapter, M31 Rifle Grenade, M34 Hand Grenade with M1A2 Adapter, M2AR Rifle Grenade, M23 Rifle Grenade, M27 Rifle Grenade, and the M7A1 CN Hand Grena with M2A1 Adapter. No breakage of component parts of the guns or gun stocks occurred during the tests.</li> <li>D FORM 1473</li> </ul>	Center.	
Det 4, RTD Eglin AFB, Florida 3. ABSTRACT Range tables have been constructed for eight Army-type rifle and hand grenades fired from the M16 rifle. The range and time of flight were measured for laun elevation angles of 5° to 45°. Final range data are the result of averaging to individual data points and compensating for wind effects. Tables are presente for the following grenades: M21 Hand Grenade with M1A2 Adapter, M30 Hand Grena with M1A2 Adapter, M31 Rifle Grenade, M34 Hand Grenade with M1A2 Adapter, M22A: Rifle Grenade, M23 Rifle Grenade, M27 Rifle Grenade, and the M7A1 CN Hand Grena with M2A1 Adapter. No breakage of component parts of the guns or gun stocks occurred during the tests.	1. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY
Eglin AFB, Florida ABSTRACT Range tables have been constructed for eight Army-type rifle and hand grenades fired from the MIG rifle. The range and time of flight were measured for laun elevation angles of 5° to 45°. Final range data are the result of averaging to individual data points and compensating for wind effects. Tables are presente for the following grenades: M21 Hand Grenade with M1A2 Adapter, M30 Hand Grena with M1A2 Adapter, M31 Rifle Grenade, M34 Hand Grenade with M1A2 Adapter, M2AR Rifle Grenade, M23 Rifle Grenade, M27 Rifle Grenade, and the M7A1 CN Hand Grena with M2A1 Adapter. No breakage of component parts of the guns or gun stocks occurred during the tests. D form 1473 HAT3		Det 4, RTD
ABSTRACT Range tables have been constructed for eight Army-type rifle and hand grenades fired from the M16 rifle. The range and time of flight were measured for laun- elevation angles of 5° to 45°. Final range data are the result of averaging 11 individual data points and compensating for wind effects. Tables are presente for the following grenades: M21 Hand Grenade with M1A2 Adapter, M30 Hand Gren- with M1A2 Adapter, M31 Rifle Grenade, M34 Hand Grenade with M1A2 Adapter, M22A Rifle Grenade, M23 Rifle Grenade, M27 Rifle Grenade, and the M7A1 CN Hand Gren- with M2A1 Adapter. No breakage of component parts of the guns or gun stocks occurred during the tests. D form 1473 HNCLASSIFLED		Eglin AFB, Florida
Range tables have been constructed for eight Army-type rifle and hand grenades fired from the M16 rifle. The range and time of flight were measured for laun elevation angles of 5° to 45°. Final range data are the result of averaging to individual data points and compensating for wind effects. Tables are presente for the following grenades: M21 Hand Grenadeth M1A2 Adapter, M30 Hand Gren- with M1A2 Adapter, M31 Rifle Grenade, M34 Hand Grenade with M1A2 Adapter, M2AR Rifle Grenade, M23 Rifle Grenade, M27 Rifle Grenade, and the M7A1 CN Hand Gren- with M2A1 Adapter. No breakage of component parts of the guns or gun stocks occurred during the tests.	3. ABSTRACT	
D JAN 1473	Range tables have been constructed f fired from the M16 rifle. The range elevation angles of 5° to 45°. Final individual data points and compensat for the following grenades: M21 Han with M1A2 Adapter, M31 Rifle Grenade, Rifle Grenade, M23 Rifle Grenade, M2' with M2A1 Adapter. No breakage of co occurred during the tests.	or eight Army-type rifle and hand grenades and time of flight were measured for launch l range data are the result of averaging the ing for wind effects. Tables are presented d Grenade with M1A2 Adapter, M30 Hand Grenad , M34 Hand Grenade with M1A2 Adapter, M22A2 7 Rifle Grenade, and the M7A1 CN Hand Grenad omponent parts of the guns or gun stocks
D FORM 1473		
D LORMA 1473		
D JONMA 1473		
	D 1 JAN 64 1473	UNCLASSIFIED

Security Classification

UNCLASSIFIED

Security Classific	ation							-
14. KEY WORDS				K A	LINK B		LINKC	
		HOL	<u>.</u> []	w <sub>7</sub>	ROLE	ΨT	RC _ E	W۳
NIG BIFLO				i				
MLO KIILE		1		}	1 1			
Rifle grenades								
Hand grenades								
Range tables								
					1 1			
				1	1 1			
			į					
				ì				
					1			
							ĺ '	Ī
								1
					1 1		1 1	
			_				انجي وصحيا	
	INSTRI	<b>ICTION8</b>						
1. ORIGINATING ACTIVIT of the contractor, subcontract	Y: Enter the name and address	mpound by meens	11	clamaifi	ALLOR, MAI	ng atan	lard rinto	mente
fense activity or other organ the report.	ization (comporate author) insuing	(1) <sup>14</sup> Qualifi report fr	on Antij	enggente SDC: P	ka matenji	nto enp	ien of this	i -
2a. REPORT SECURITY CI	ASSIFICATION: Enter the over				ال ايمو مس	secolo	atton of th	d n

2a. REPORT SECURTY CLASSIFICATION: Unter the over all security classification of the report. Indicate whether "Restricted Data" is included. Marking is to be in secondance with appropriate security regulations.

2b. GROUP: Automatic downgrading is upecified in Dob Directive 5200.10 and Armed Forces Industrial Manual: Enter the group number. Also, when applicable, show that optional markings have been used for Group 3 and Group 4 as authorized.

3. REPORT TITLE: Enter the complete report title in all capital letters. Titles in all cases should be unclessified. If a meaningful title cannot be nelected without classification, show title classification in all capitals in parenthesis immediately following the title.

4. DESCRIPTIVE NOTES: If appropriate, enter the type of report, e.g., interim, progress, summary, annual, or final. Give the inclusive dates when a specific reporting period is covered.

5. AUTHOR(S): Enter the name(a) of author(a) an alternation or in the report. Enter tast name, first name, middle initial. If williary, show rank and branch of service. The name of the principal other is an alterolute minimum requirement.

6. REPORT DATE: Enter the date of the report as day, month, year; or month, year. If more than one date appears on the report, use date of publication.

7.a. TOTAL NUMBER OF PAGES: The total page count should follow normal pagination procedures, i.e., enter the number of pages containing information.

7b. NUMBER OF REFERENCES. Enter the total number of references cited in the report.

8a. CONTRACT OR GRANT NUMBER: If approprinte, enter the applicable number of the contract or gront under which the report was written.

8b, 8c, & 8d. PROJECT NUMBER: Enter the appropriate military department identification, such as project number, subproject number, system numbers, task number, etc.

9a. ORIGINATOR'S REPORT NUMBER(S): Enter the official report number by which the document will be identified and controlled by the originating activity. This number must be unique to this report.

9b. OTHER REPORT NUMBER(S): If the report has been assigned any other report numbers (either by the originator or by the sponsor), also enter this number(s).

10. AVAILABILITY/LIMITATION NOTICES: Enter any limitations on further dissemination of the report, other than those

- 2) "Foreign a mouncement and dissemination of this report by 2 (4) is not authorized."
- (4) 40 B. these means agains for may obtain coston of this report size by from DDC. Other qualitied DDC uners what connect through.

(4) (4) h nat, ny agencien may obtain copie of thin report dras ty from DDC. Other applified stern what report through

(5) CAR district close of this report is controll de Qualified DDC - ers shall request through

If the report has own furnished to the  $Of(\phi)(\phi)(\phi)$  Technical Services, Department of Commerce, for supero the public, indicate this fact and  $\phi$ , if the price, if known

11. SUPPLEMENT, BY NOTION: Use for additional explanatory notes.

12. SPONSORING W LITARY ACTIVITY: Enter to name of the departmental project office or laboratory apont sting (Daying for) the research and development. Include ad irean.

13 ABSTRACT: E: or on obstract giving a bilef and factual summary of the document indicative of the report, even though it may all o appear e) ewhere in the body of the technical report. If additional science is required, a continuation sheet shall be attached.

It is highly deals ble that the abstract of classified reports be unclassified. Eac pringraph of the abstract i sail end with an indication of the a fittary security classification of the information in the paragraph, represented as (TS), (t), (G), or (U).

There is no limit tion on the length of the abstract. However, the suggested is 19th is from 150 to 225 words.

14. NEY WORDS: Kr i words are technically meaningful terms or short filinases that haracterize a report and may be used as index entries for cala iging the report. Key words must be selected so that no security classification is required. Identitiers, such as equipment model designation, trads name, military project code name, ge graphic location, may be aired as key words but will be folk wed by an indication of the indice context. The assignment if links, rules, and weigh i is c.

> UNCLASSIFIED Security Classific ation