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ARMY OPERATIONAL RESEARCH GROUP

REPORT No. 167

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Street Fighting

Communicated by Superintendent, A.O.R.G.

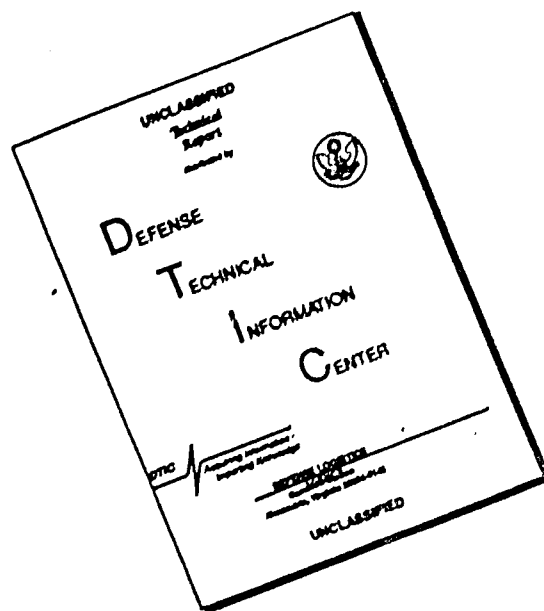
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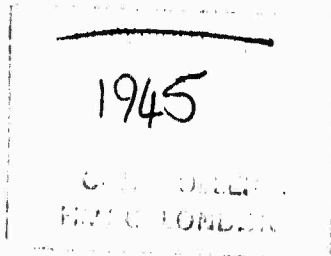
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Street Fighting.

Communicated by Supt., A.O.R.G.
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ABSTRACT.

- i. Various methods of holing walls with infantry weapons are considered.
- ii. The number of casualties caused by firing at troops in houses from outside is estimated.
- iii. A comparison is made of the accuracy of the Sten and the pistol against moving targets.
- iv. The use of smoke and incendiary projectiles is considered.
- v. The effect of wire-netting over windows is discussed.



- i -

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Street Fighting.

A. INTRODUCTION.

1. To overcome a defended house one of the following tasks has to be carried out:-
 - (a) entering the house and killing or capturing the man inside;
 - (b) killing the defenders by weapons from outside the house;
 - (c) destroying the house, by burning, explosives or bombardment.
2. To enter a house with minimum casualties inflicted on the attackers, it is frequently necessary to blow a hole in the wall. The use of smoke must also be considered.
3. Present teaching considers these aspects of street fighting and suggests the use of the following weapons:-
 - (a) weapons for holing a wall: standard pole charges;
Piat anti-tank bomb;
Beehive;
 - (b) weapons for killing the defenders: bullet weapons fired through windows;
grenades thrown through windows;
Piat anti-tank bomb fired at the wall;
Bullet weapons and grenades inside the house;
 - (c) weapons for setting fire to the house: 1½ lb. hand incendiary bomb.
 - (d) smoke weapons in various roles.
4. This report considers these and other possible infantry weapons, and attempts to determine their most effective roles. It does not deal with flame throwers, anti-tank guns or the use of the fire-power of supporting arms such as tanks, artillery and aircraft. Some mention has, however, been made of the 20 mm. gun, since this was, until recently, an infantry weapon, and it seems well fitted for street fighting tasks.

METHODS AND TARGETS.

5. For the purpose of trials the following targets have been used :-
 - (a) A 9" brick wall especially built for trials, probably as strong as any likely to be encountered;
 - (b) House in the street fighting area of the London District School of Tactics;
 - (c) A derelict farm - West Loups - consisting of several partly damaged buildings of 20" stone walls (mill-stone grit);
 - (d) A derelict farmhouse - Kittingham - with 20 inch brick walls.

6. To assess the lethal effect of explosive projectiles, in most cases standard A.O.R.G. targets 5 ft. high were used, with which 'throughs' represent incapacitations. Otherwise a strike was counted as incapacitating when it had penetrated more than $\frac{1}{2}$ in. in 1 in. wood.
7. In the series to determine the accuracy of the various weapons, 10 round patterns were fired at each range, and the fall of shot plotted. From these plots the 90% zones and the chance to hit various targets have been calculated.

B. HOLING WALLS.

8. The problem: In advancing along streets, the houses are generally attached, or separated by narrow passages only, and are entered from the roofs or backs. A difficulty arises on reaching crossroads or when it is necessary to attack across a road or against a detached house. The approaches to such a house are likely to be covered by enemy fire, and it is usually necessary to enter by means of holes previously blown in a wall.
9. The standard method is to place a pole charge against the wall, but to do this the pole charger has to expose himself to the enemy fire for perhaps 20 seconds. He is supported by covering fire, smoke and possibly a flame thrower, but, nevertheless, this is a hazardous task, and if he becomes a casualty the advance is held up.
10. The hole made in a wall must be big enough for men wearing equipment to get through quickly and singly, and 2 ft. diameter may be taken as a minimum. The possibility of producing such a hole from a distance by means of infantry weapons without exposure of a pole charger is here considered.
11. For the sake of comparison, a few pole charges were exploded against 20 inch brick and stone walls. The amount of explosive necessary to blow a hole 2 ft. square was as follows (no difference being noticeable between stone and brick walls):-
- | | |
|----------------------|-----------------|
| 2 or 3 | No. 75 Grenades |
| 4 | Guncotton Slabs |
| <u>or</u> 4 to 5 lbs | Nobel's 808. |
12. For the purpose of holing walls from a distance, four weapons have been considered :-
- | | |
|-----|-----------------------|
| (a) | Piat; |
| (b) | Bren LMG; |
| (c) | 20 mm. MG; |
| (d) | Beehive 5 lb. charge. |
13. PIAT: This bomb, being designed for anti-tank work, has a hollow charge which is undesirable for holing walls. It will penetrate as much as fifteen inches of brick work, but the hole produced in any but the weakest structures is only of about 2 ins. diameter at the front and from 4 - 12 ins. at the back. The surrounding brickwork is weakened, however,

and the wall can be breached by firing several rounds in a tight pattern, the number depending on the thickness and condition of the wall. From various theatres of war the Piat has been recommended in this role; and it is therefore assumed that either the walls encountered have been weaker than those considered in this report, or that the effect on the morale of the defenders is considerable.

14. It was found that the number of bombs necessary to make a 2 ft. hole in a 20 inch stone wall (target (c)) varied from 2 to 12, according to the condition of the wall. A similar result was obtained against a 20 inch brick wall.
15. At the ranges considered in this role, 25 yards to 50 yards, the accuracy of the projector is such that all rounds should fall in a 2 ft. circle.
16. Bren LMG: When fired from a tripod at ranges of from 100 to 200 yds. at 20 inch stone or brick walls, about 100 rounds were sufficient to make a hole of about 1 ft. diameter. Another 300 rounds approximately are necessary in order to enlarge the hole to 2 ft. diameter. A slight shifting of the point of aim may be necessary. It was found that the substitution of armour-piercing bullets for ordinary ball had practically no effect on the difficulty of holing the wall.
17. 20 mm. MG: At a range of 200 yards, 10 rounds of ball produced a hole of about 18 ins. diameter. This was tried both with Hispano (ball) and Polsten (Ball/tracer), but only against target 'c', the 20 inch stone wall.
18. Beehive 5 lb. charge: The standard use of this charge is to place it, in the same way as a pole charge, against a wall to be holed. Although effective against a weak structure, this merely results in a small hole similar to that made by the Piat in strongly built walls. Two alternative methods giving more satisfactory results have been tried out:-
 - (a) By placing the charge several feet from the wall to be holed and aiming the explosive jet at the wall by sighting along one of the legs of the charge.
 - (b) By placing the charge reversed against the wall.
19. In each of these methods satisfactory 2 ft. holes were blown in target (c). With both methods precautions are necessary to protect the attacking personnel from the back blast of the charge; in the latter method at least two walls must protect personnel on or near the axis of the jet, one wall probably being sufficient at a distance from the axis. In the former method one wall would be sufficient, provided that it is several feet away from the charge.
20. Similar results were obtained against target 'd', 20 inch brick wall. Two beehives placed side by side were also tried (simultaneous detonation being ensured by the use of cordtex), and it was found that a hole 2 ft. square could be blown from a distance of 15 ft.
21. It should be emphasised that a number of walls that will be encountered will be considerably thinner than those experimented on and will require less effort to hole.

C. KILLING THE DEFENDERS
FROM OUTSIDE THE BUILDING.

22. For attack on the defenders from outside the house, the necessary characteristics of the projectile are that it should penetrate the wall or roof and still be lethal after doing so, or that it should be able to be fired through a window and produce an all round effect within the room.
23. In the former category have been considered the following weapons :-

- (a) 3 inch Mortar;
- (b) 20 mm. Gun;
- (c) Bren LMG;
- (d) Piat.

In addition, some measurements have been made of the effect of (e) pole charges and (f) beehives on the occupants when used for blasting holes as described above.

24. In the latter category have been considered :-

- (g) Piat;
- (h) 2 inch Mortar;
- (j) Grenades.

25. 3" Mortar: By reason of its high trajectory this weapon will normally attack the roof of a building. Para.57 and Appendix E show the chance of scoring a hit at various ranges, when fired with primary only or with one secondary (280 grs noonite).
26. The British bomb is not fitted with a delay fuze, and the effect on the roof when a hit is scored is small, a hole about 18-ins. to 2 ft. diameter being made. No casualties are likely to be caused among the defenders unless the roof has previously been blown away.
27. The effect of fitting this bomb with a delay fuze was investigated by means of static detonations inside a room. The results showed that little structural damage would have been caused but that apart from shielding by furniture and barricades, it is probable that 100% casualties would result.
28. Trials were also carried out with the American 10 $\frac{3}{4}$ lb. bomb M56, fitted with fuze PDM 53 (0.1 sec. delay). This bomb has a much higher charge/weight ratio than the British, and in addition to causing casualties, wrought considerable structural damage. As an example, when fired at West Loups Farm, the first bomb to hit the roof removed all the slates, broke three joists (7 ins. x 2 ins.) and incapacitated 5 targets out of 8 in the loft below. The second bomb made a 4 ft. diameter hole in the floor of the loft, displaced several rafters, and incapacitated 9 targets out of 11 in the room below the loft.
29. 20 mm. MG: With this weapon, two possibilities exist: either to fire through windows and embrasures, or to fire at a wall and to continue firing after the wall has been holed. In each case rounds will enter the room and explode on the inner wall of the room. It appears from several trials that a short burst of 3 or 4 rounds is likely to produce about 30% of incapacitations. Full results are given in Appendix A.

30. Bren LMG: Since the bullet is not explosive, it will be expected that a smaller proportion of casualties will result, since apart from those defenders who stand directly in the line of fire, the only danger is from ricochets. In the trials, about one man in five was killed for every 100 bullets entering the room. Full results are given in Appendix A.
31. PIAT: The effect of this bomb on a wall is described in para.13. The anti-personnel effect is confined to a narrow zone around the jet. To determine this, bombs were fired at target 'a' behind which was placed a continuous row of 1 inch deal boards, 6 ft. high, at a distance of 5 ft. from the wall. It was found that the majority of incapacitating strikes were within 18 ins. of the jet hole. Full results are in Appendix B.
32. In addition, some of the defenders may be killed by ricochet. In one trial, when 10 targets were placed in a room 18 ft. x 15 ft., 4 incapacitations were caused by 7 bombs, all being out of the direct path of the blast.
33. To assess the effect of a bomb fired at the roof of a house, twelve bombs were fired at a stone built house 24 ft. x 13 ft. with stone roof (part of target (c)). Three hits were scored, but no injury was caused to 10 men-targets in the room below.
34. Although the Piat bomb used in this way has little anti-personnel effect, WTSEFF reported that, in the Street Fighting in Ortona, the explosion of the bomb caused the defenders to leave the house. It is probable therefore that the effect on morale is high.
35. An alternative method of using this bomb is to fire it through windows or through a hole previously made in a wall. In this way, the unfocussed fragmentation from the back of the bomb is utilised. Trials that were made (see Appendix B) showed that when a bomb entered a room about 75% of the defenders were incapacitated, and it is a fair assumption that the remainder would be, at the least, extremely shaken by the blast. This figure of 75% may be reduced by shielding, but since barricades are usually erected to protect the defenders from small arms fired through the windows, such shielding will be less effective against a bomb exploding at the back of the room. In addition to the anti-personnel effect, a considerable dust cloud is raised which would assist the immediate assault of the house.
36. Pole charges and Beehive: The number of casualties caused by pole charges and beehives was variable. In some cases, all the targets were destroyed; in others only a few targets in the direct line of the explosion were incapacitated. No doubt the condition of the wall causes this variation, but the point does not appear to be of great importance as the primary object of such charges is to hole the wall.
37. 2 inch Mortar: Trials on the number of casualties caused to targets when 2 inch Mortar HE was fired through a window showed that about 50% were incapacitated for each bomb exploding in the room. Full results in Appendix C.

38. Grenades: When exploding in a room, almost any HE grenade with a metal case is sufficiently lethal to produce a high proportion of casualties among unshielded personnel. The difficulties with existing grenades are that :-
- (a) The No. 36 has a time fuse, and will therefore bounce back from wire covering over windows or may be thrown out by defenders if there is no covering. Even if they have not the nerve to throw it out they probably have a second or so to take cover behind furniture.
 - (b) The No. 69, while having a percussion fuse, is contained in a bakelite case and is not sufficiently lethal to produce many casualties inside the room.
39. The experimental No. 70 Grenade is as lethal as the No. 36 at short ranges up to 12 ft. from the burst (see A.O.R.G. Report No. 166) and has a percussion fuse. It appears therefore as the ideal grenade for this use.

D. KILLING THE DEFENDERS AFTER AN ENTRY HAS BEEN FORCED.

40. The procedure after an entry has been forced seems to be well understood. Here we confine ourselves to (a) an appreciation of the relative merits of the pistol and Sten (b) a note on grenades.
41. Pistol and Sten Gun: It does not appear that any strictly comparative trials of the two weapons have been made using average firers. A few such trials have therefore been carried out and are described herein.
42. It was proposed at first to compare the results of using the Pistol and Sten at surprise targets arranged in a course through blitzed houses at the London School of Street Fighting. It was found, however, that the number of hits with either weapon was so small that no conclusions could be drawn.
43. It was then decided to set up a standard moving target consisting of a plain sheet 4 ft. high and 1 ft. across. This was moved at a speed of approximately 10 ft. per sec. (a) across and (b) towards the firer. The 'run' was about 33 yds. and the time of exposure about 10 secs. The number of hits on the target was counted.
44. Seven firers took part. The following methods of fire were used :-
- (a) Pistol from hip: 6 shots in chambers
 - (b) Sten from hip in short bursts: 20 shots in magazine
 - (c) Sten from hip, single shot: 6 shots in magazine
 - (d), (e) and (f) as above, but aimed, i.e. standing, using sights; Sten up to shoulder.
- A .38 inch pistol and a Sten Mk.III were used.
45. Full results are given in Appendix D. To summarise, taking the number of hits per engagement, the Sten showed a considerable improvement on the pistol, an extremely good result being obtained from the Sten using single shots from the shoulder.

46. Grenades: In this use a time-fused grenade suffers similar disadvantages to those mentioned in para. 38, namely, that the defenders can either -

- (a) take cover behind furniture, etc., or
- (b) throw the grenade out.

The 69 Grenade on the other hand should produce sufficient noise and surprise within a room to allow the attackers to enter, but once again will not incapacitate the defenders. The No. 70 suffers none of the disadvantages of the 36 and 69, and appears to be the most effective grenade for this purpose.

E. INCENDIARY PROJECTILES.

47. The only existing ammunition whose primary role is incendiary is the 1½ lb. hand incendiary bomb. This is not very effective, as it tends to burn a small hole in the floor and any resultant fire can easily be dealt with by the defenders.

48. It has been reported from various theatres of war that white phosphorus is an effective incendiary agent. Trials have been carried out with :-

- (a) 3 inch Mortar W.P. bomb
- (b) American 81 mm. Mortar W.P. bomb (M57)
- (c) Piat W.P. bomb.

In no case was it found possible to set fire to the houses, although one 'house' was a barn filled with hay, and another house with wooden floors had heaps of loose wood piled inside to simulate furniture.

49. The Piat was fired into a room through an open window. The 3 inch Mortar was fired through the roof, the American bomb being used because it contains more W.P. than the British 3 inch.

50. As it had been suggested that a delay fuse might help the incendiary effect, this was simulated by detonating a 3 inch Mortar bomb statically inside a house. Even this failed to start a fire.

51. It is possible that fires might be started by W.P. in houses which still contained large quantities of curtains and other drapery and possibly also in very dry climates. For normal use in street fighting, W.P. does not appear to be useful from the incendiary point of view.

F. SMOKE.

52. Smoke may be used in street fighting :-

- (a) To screen the movements of advancing troops.
- (b) To cover a close approach, e.g., by a pole charge party.
- (c) For clearing houses by making use of its neutralising value.

53. For use (a), the smoke is usually required at a greater range than may be obtained with hand grenades. On the other hand it is rarely required at such long ranges as it is in open warfare. A common practice has been to ricochet 2 inch Mortar smoke bombs from houses in order to reduce the range to the point of origin. Where prolonged street fighting is anticipated, the issue of bomb smoke, 2 inch bomb thrower Mk. I or Mk. II (HCE) or Mk. III (WP) for use in the 2 inch Mortar might be considered. The advantages would be increased accuracy and reduced range due to the small propellant charge, and, in the last case, an instantaneous screen.
54. An experimental W.P. filled bomb for the PIAT has been made up. These bombs would be very suitable for the production of covering screens in street fighting. The tendency of W.P. to pillar is not a disadvantage in streets, where the smoke is required to fill a street to the height of the houses.
55. There are four types of hand smoke grenades, No. 77 (WP), No. 79 (fast HCE), No. 80 (WP), and No. 81 (WP + HCE = Duplex). Only the No. 77 and No. 79 are generally available to Infantry. Of these, the No. 77 is to be preferred, since it gives an instantaneous screen, and it may be used as an offensive grenade because of its incendiary effect. If the No. 81 becomes generally available it may be preferred, since it combines the advantages of the No. 77 with the continuous emission of the No. 79.
56. Some experiments were carried out to determine the effect of smoke grenades inside rooms. In a room 13 ft. square with an open window 6 ft. x 4 ft., one No. 77 grenade produced a concentration of smoke which was intolerable for one minute and produced severe coughing for the next two minutes. About 1/6th of the 2 sq. ft. targets in the room received one or more splashes greater than 1 1/4 ins. in diameter. The smoke from the number 79 lasted longer, but did not fill the whole room at any one time. Moreover, the grenade could have been picked up and thrown out. It was noticed that the ordinary respirator gave complete protection (as is probably well known).

G. ACCURACY SHOTS.

57. On the results of several accuracy shoots the chances have been calculated :-
- (a) of hitting a house 10 yds. square at various ranges with 3 inch Mortar and Piat;
 - (b) of firing through windows with 2 inch Mortar and Piat.
- Results are given in Appendix E.
58. When the British 3 inch Mortar bomb is fired at low charges, there is likely to be a proportion of blinds. This proportion varies considerably between different fuse lots, but on the average, is about 10% for primary only and 3.5% for one secondary (280 gr NRM).

H. DEFENSIVE MEASURES.

59. The only defensive measure considered here is wire-netting fixed over the window. The effect of this on the following weapons has been considered :-

- (a) Piat (anti-tank bomb)
- (b) 2 inch Mortar HE
- (c) 70 Grenade

The effect varies according as the wire is light wire such as chicken wire, or heavy wire such as concrete reinforcement.

60. Light Wire: Piat and 2 inch Mortar bombs pass through without exploding. No. 70 Grenades may do so, but in the majority of cases either explode on the wire or fall back to explode on the ground outside. Results of a test are given in Appendix F.
61. Heavy Wire: In general the bomb or grenade detonates against the wire. In the case of the Piat the lethal effect is not much reduced since a considerable number of fragments of the wire itself are projected lethally into the room.

I. CONCLUSIONS.

62. The following conclusions may be drawn :-

- (a) PIAT: This is the only "projected pole charge" and is fairly effective in holing walls. A much more effective use of this round is to fire it through windows and thus to utilise its anti-personnel effect.
- (b) 2 inch Mortar: The H.E. bomb may be effectively used at ranges up to 100 yards for firing through windows.
- (c) Bren: This can be used from the tripod to shoot a hole in a wall.
- (d) Beehive: The most effective ways of using this charge for holing walls are :-
 - (i) to place it several feet away from the wall, or
 - (ii) to place the back of the charge against the wall.
- (e) 3" Mortar: The most effective bomb to use in Street Fighting is the American high capacity M56 bomb fitted with a delay fuse.
- (f) 20 mm. gun: When fired from a stable mounting this weapon is effective both for holing walls and incapacitating the defenders.
- (g) Grenades: The most effective hand grenade is the No. 70 both for use inside and outside houses.
- (h) Wire netting: The fixing of wire netting over windows has little effect when the PIAT is used by the attackers. It reduces the efficiency of the 2 inch Mortar and the No. 70 Grenade.

APPENDIX A.

Casualties caused by Machine-gun fire into rooms are given in the following tables. In each case a hole had previously been shot through the wall and the casualties are assessed for subsequent bursts.

TABLE 1: 20 mm. MG.

Ammunition	No. of rds.	Size of Room	No. of targets in room	No. of targets incapacitated
Hispano HE	1	30 ft. x 10 ft.	9	3
"	1	"	9	3
"	1	"	9	2
"	5	"	9	7
Polsten	3	7 ft. x 7 ft.	5	0
HE/T	5	"	5	2
"	3	"	5	1
"	2	"	5	1
"	2	"	5	2
"	5	13 ft. x 13 ft.	6	1
"	2	"	6	3
"	3	"	6	3

TABLE 2: Bren LMG.

Ammunition	No. of rds.	Size of Room	No. of targets in room	No. of targets incapacitated
.303" Mk. VII	150	14 ft. x 14 ft.	8	6
"	100	"	8	5
"	100	13 ft. x 13 ft.	10	0
"	100	"	10	0
"	100	"	10	2
"	100	"	10	1
"	100	"	10	1
"	100	18 ft. x 15 ft.	10	3
"	100	"	10	3
"	100	"	10	3
.303" armour-piercing	100	12 ft. x 9 ft.	5	1
"	100	"	5	1
"	100	"	5	1

APPENDIX B.

The following tables show casualties caused by Piat HE Bombs.

TABLE 3: Anti-personnel effect of Piat Bomb behind a 9 inch brick wall.

Bomb No.	Diameter of jet hole in target.	No. of incapacitating strikes and distance from jet hole.	Diameter of circular zone of light strikes round jet hole.
1	3 ins.	several within 9 ins. 11 others within 23 ins.	48 ins.
2	2.5 ins.	several within 9 ins. 9 others within 18 ins.	48 ins.
3	5 ins.	several within 11 ins. 6 others within 12 ins.	30 ins.

TABLE 4: Anti-personnel effect of Piat Bomb fired through windows.

Bomb No.	Target Room	No. of "men" in room.	No. of incapacitations.	Remarks
1	15 ft. square	7	7	
2	"	7	7	
3	"	8	6	Bomb exploded on hitting a "man"
4	15 ft. square	10	3	} Window covered with fine XFM (see para.61)
5	"	10	10	
6	15 ft. square	7	4	Window covered with heavy XFM (see para.61)
7	15 ft. square	10	4	} These bombs missed the window by about 2 ins.
8	"	8	4	

In addition, in one experiment, 7 bombs were fired at a 20 inch brick wall. The first six bombs made small holes and the seventh caused a large portion of wall, over 3 feet square, to fall in. Inside the room (18 ft. x 15 ft.) targets were placed, casualties being as follows :-

TABLE 5: Casualties in room attacked by Piat HE.

Bomb No.	No. of targets exposed	No. of targets incapacitated
1	10	2
2	10	2
3		
4	10	1
5		
6	10	3
7		

APPENDIX C.

TABLE 6: Anti-personnel effect of 2" Mortar HE Bomb fired through windows.

Bomb No.	No. of "men" exposed	No. of incapacitations	Remarks
1	6	4	Window covered with fine XPM (see para. 60)
2	6	1	} Window covered with heavy XPM (see para. 61)
3	6	2	

APPENDIX D.

The following tables give the results of trials of Sten and 38 in. pistol against moving targets.

TABLE 7: Crossing Targets.

Type of Engagement	Av. Hits per shot	Av. Hits per engagement	Av. No. of shots per engagement.
Pistol from hip	.08	.43	5
Sten-burst from hip	.12	1.9	16
Sten single shot from hip	.12	.71	6
Pistol - aimed	.14	.71	5
Sten-bursts - aimed*	-	-	-
Sten single shot - aimed	.50	2.9	6

* No tests were made of Sten-bursts, aimed for crossing targets.

TABLE 8: Approaching Targets.

Type of Engagement	Av.Hits per shot	Av.Hits per Engagement.	Av.No.of shots per Engagement.
Pistol from hip	.27	1.6	6
Sten-burst from hip	.21	4.3	20
Sten single shot from hip	.14	.86	6
Pistol - aimed	.29	1.7	6
Sten-bursts - aimed	.57	11.8	19
Sten single shot - aimed	.83	5.0	6

APPENDIX E.

The following tables give the chances of hitting a house 10 yds. square with 3 inch Mortar and Piat (high angle).

TABLE 9: Chance of hitting house 10 yds. square with 3 inch Mortar.

Charge	Primary Only			Primary + 1 secondary (280 gr NRM)				
	(yds.)			(yds.)				
Range	70	150	200	250	400	500	600	700
Proportion of bombs hitting	3/4	2/5	1/4	1/7	1/8	1/9	1/13	1/30

TABLE 10: Chance of hitting house 10 yds. square with Piat (high angle).

	(yds.)		
Range	200	250	350
Proportion entering	2/5	3/5	4/9

The following tables give the chance of firing 2 inch Mortar and Piat through windows 4 feet square.

TABLE 11: Chance of 2 inch Mortar bomb entering a 4 foot square window.

	(yds.)		
Range	50	100	150
Proportion hitting	All	1/3	1/10

Appendix E cont'd.

TABLE 12: Chance of Piat Bomb entering a 4 foot square window.

	(yds.)		
Range	50	100	150
Proportion entering	All	3/4	1/7

APPENDIX F.

In order to test the functioning of the Allways fuse as on the No. 70 Grenade against wire-netting, live allways fuses were attached to a dummy No. 70 Grenade. This was thrown against light wire-netting of 2 inch mesh fixed over a window opening. In all 13 throws were made with the following results :-

Detonated on netting:	2
Bounced off netting: detonated on ground	3 *
Bounced off netting: failed to detonate on ground: detonated when thrown subsequently against a wall	2
Bounced off netting: failed to detonate on ground: or when subsequently thrown and shaken	1
Passed through netting and detonated on wall or floor of room	5

*It is possible that in one of these cases the tape may not have unwound fully: in all other throws it certainly did so.

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B.A.S. (W) } (6)
New Dev. Div. }
O.R.S's. overseas
S.D.2.

No. 2 O.R.S., 21 Army Group
W.T.S.F.F., 21 Army Group
S.M.A. M. of S. thro' S.R.15.
D.G.S.R.D. thro' S.R.15
C.P.R.S.D. " "
D.G. of A. (2)
C.C.D.D.
C.D.E.S. Porton
C.S.A.R.
C.S.A.R. (Prof. Mott)
C.E.A.D.
I.G.A.
C.P.D.
C.S./P.D.E.
D.M.D.I.
Sec., S.A.C.
Sec., Ordnance Board
D.N.P.L.
D.R.R.L.
O.A.C.
Imperial and Foreign Liaison (34) thro' S.R.7

B.C.S.O. (3)
O.S.R.D. (3)
U.S. Military Attache (2)
U.S. Naval Attache (1)
U.S. Naval Air Attache (1)
E.T.O.U.S.A. (2)
C.M.H.Q. (2)
A.S.R.L.O. (2)
Australian Army Staff (2)
N.Z.S.R.L.O. (2)
N.Z.M.L.O. (2)
O.C.O. India (5)
M.G.O. India (2)
South Africa (1)
B.S.M. (3)
Aberdeen Proving Ground (1)

D.G.D. Admiralty
D.M.W.D. "
C.A.O.R. "
D.D. Sec., Air Ministry
D.S.R. M.A.P.
R.D. Arm 3 M.A.P. (Dr. Richards)
W.S.
C.R. & E., Ministry of Home Security
Prof. Zuckerman