Cranfield
Defence and
Security

A Hundred Years of Tiny Mortars

Close Combat Symposium 2022

Dr John D Salt

Introduction

- This presentation sketches the history of infantry mortars of the smallest class, from 37mm to 52mm in calibre

- Smaller than the universal Stokes-Brandt pattern, these were sometimes called “grenade launchers” or “grenade dischargers”

- In many languages, the term for mortar has similar emphasis on throwing:
  - German: Granatewerfer
  - Russian: Миномёт, *Minomyot*
  - Swedish: Granatkastare
  - Norwegian: Bombekaster

Three Things to do with Recoil

- Take it in the shoulder
  [Grenade launcher]



- Eliminate it by firing countermass in the opposite direction
  [Recoilless rifle, rocket launcher]



- Let the ground deal with it
  [Mortar]



A Serendipitous Design

- The pattern of modern mortars was set by Wilfred (later Sir Wilfred) Stokes with his design of “trench howitzer”

- Stokes’ original idea was a multi-stage munition to bounce around enemy trenches

- The mortar was designed as a simple launcher to experiment with this bomb

- It turned out that the bouncing munition was a bad idea

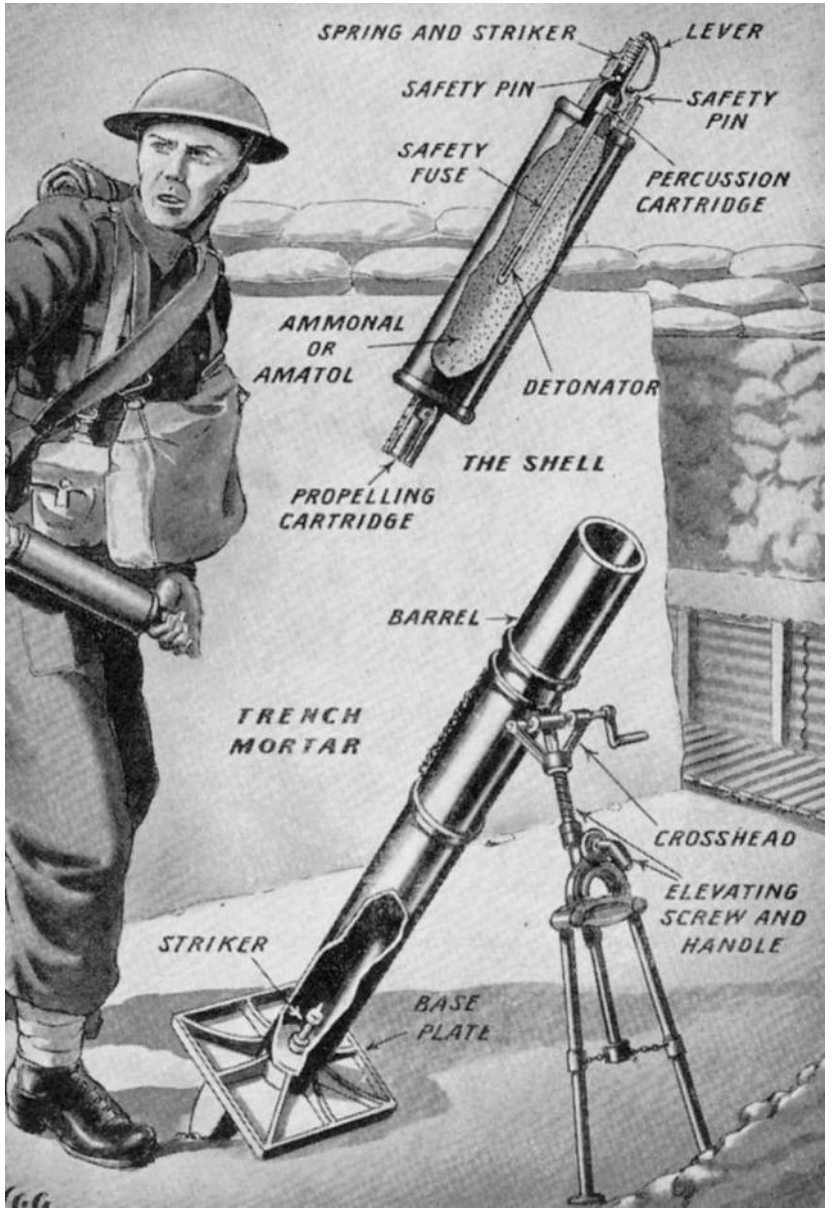
- The launcher, on the other hand, was brilliant, and quickly proved itself superior to all other patterns of trench mortar

Mr. Stokes' Mortar

- Very simple construction; smooth-bore tube, baseplate, bipod

- Crude cylindrical projectile, 3 or 4 inches in diameter; only precision parts two seating bands, one-tenth of an inch thick

- Calibres of the "3-inch" and "4-inch" models were therefore
  - 3.2 inches – 81mm
  - 4.2 inches – 107mm

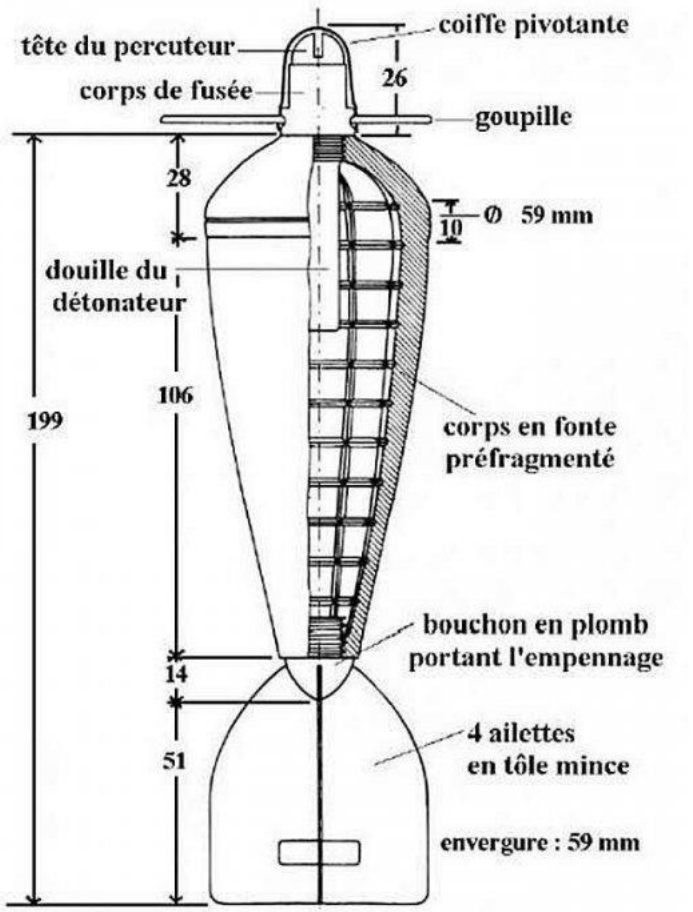


M. Brandt's Bomb

- Edgar Brandt produced two patterns (1915 and 1916) of 60mm pneumatic mortar firing a finned bomb, much more aerodynamic that the Stokes cylinder

- The combination of Stokes gun and Brandt bomb set the pattern for medium and heavy mortars that continues to this day

- It is likely that Stokes-Brandt mortars have inflicted more casualties on the battlefield than any other class of weapon over the last 100 years



L'obus modèle 1915 A pour obusiers pneumatiques de 60 mm

The Stokes-Brandt Mortar

- Original Stokes calibres 81mm and 107mm
- Brandt calibres 60mm and 120mm
- Smooth bore
- Muzzle loading
- Drop-fired
- Charge system (increments)
- Bipod mounted (some tripods or wheels)



Brandt 81mm
modèle 27/31

Big and Little Mortars

- The Stokes-Brandt pattern worked well in any calibre from 60mm to 120mm or even bigger.

- Different sizes of mortar would be found at different levels, typically:

  - Company 60mm
  - Battalion 81mm
  - Regiment 120mm (French, Russian and German)
  - Division 107mm (British and American)

Tiny Mortars

- In the 1920s, there arose a new pattern of infantry mortar

  - Smaller (45mm to 51mm in calibre, typically 50mm)
  - Typically trigger-fired rather than drop-fired
  - No charge system – use elevation, gas bleed, or variable chamber volume
  - Deployed down to platoon level
  - Often as a replacement for rifle grenades
  - Often designated a “grenade launcher” or “grenade discharger” rather than a mortar



Esperanza Valera
50mm model 1932



50mm Lance-Grenades
MAC Modèle 37

Allocation of 45-52mm Mortars

- Western European armies tended to assign 1 mortar per platoon
- Eastern European armies tended to assign 2 or 3 mortars per company
- The Italians assigned two companies each of 9 45mm mortars to battalion
- The Japanese had a squad of 3 or 4 Type 89s per platoon, never decentralised
- British Paras had 1 2-in mortar per rifle section, used only for smoke

Over-complication

- Italian Mortaio d’assalto 45/5 Brixia modello 35
  - Elevating gear *and* gas-bleed
  - Magazine for propelling charges
  - Breech loading
  - Chest pad/seat
- German 5cm leichter Granatewerfer 36
  - Large baseplate
  - Cross-levelling knobs

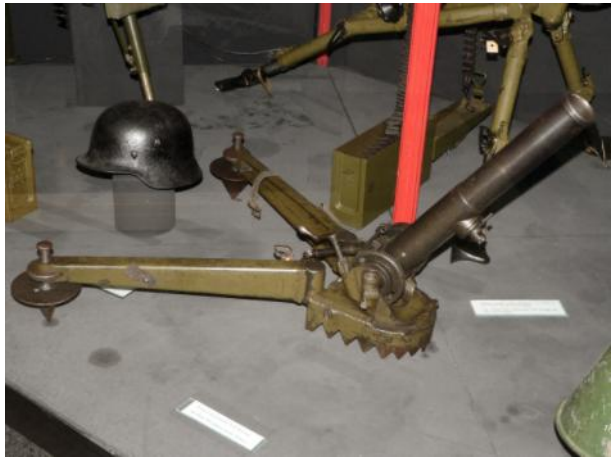




Too much weight

- Danish Madsen 51mm mortar
  - Complicated folding mount
  - Breech loading
  - Capable of anti-tank fire
- Hungarian FEG 50mm Model 39M
  - Heavy mounting legs
  - Drop firing





Japanese Inventive Genius

- Type 10 Grenade Discharger (1921)
  - Smooth bore, trigger fired, no sights or bipod
  - Fires ordinary issue hand grenades
  - Fixed elevation and gas bleed
- Type 89 Heavy Grenade Discharger (1929)
  - Rifled bore, trigger fired, no sights or bipod
  - Fires unfinned shell or ordinary hand grenades
  - Fixed elevation and variable chamber volume



On the Receiving End

- Colonel John George, *Shots Fired in Anger:*

[TheType 89], fired our way, had a set pattern of behaviour and we were damned sorry to have it used on us so often. It could always go into action faster than our 60mm. Always we would feel the shells coming down on us in the very beginning of any kind of a fight, the explosions following immediately after the first few rifle shots, and our ability to reply was only theoretical. We had to go to a lot more trouble to make our 60mm gun do the job of answering these quick shooting knee-mortars. We had taken the bipods off and carried only a few light shells, burdening down the advance guard with the load, and yet the best we could do would be to commence firing a full minute after the first enemy shells had come down.

Lightweight is the greatest single advantage an Infantry weapon can have.

Progressive Simplification: the 2-inch Mortar

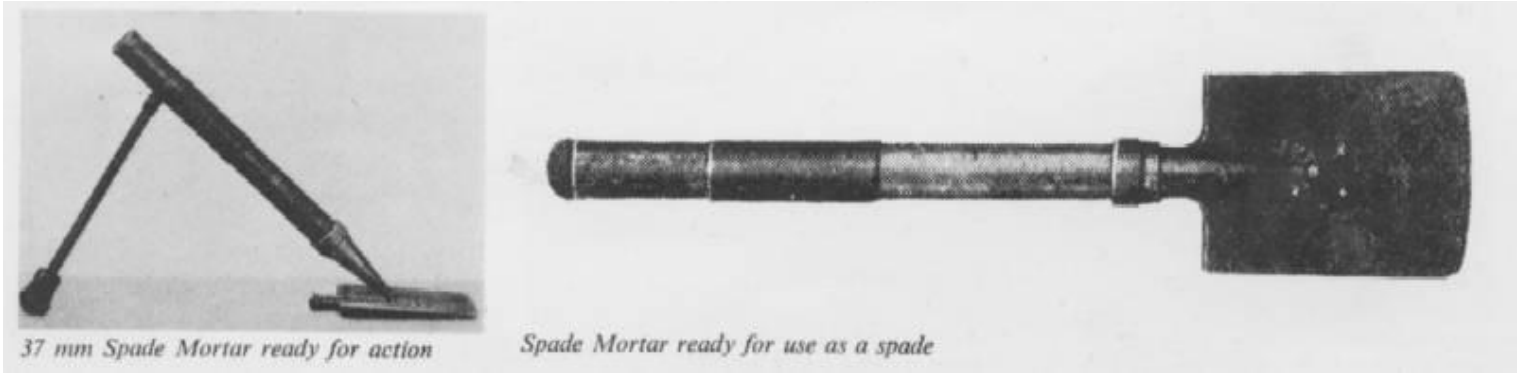
- Adapted from the Spanish Esperanza 50mm
- Adopted by the British Army in 1938
- A variety of models, over time losing sights, large baseplate, and long barrel
- *This weapon is probably the most important of the platoon weapons* [Infantry Training Part VIII, 1944]





The Tiniest Mortar

- Russian 37mm spade mortar
  - Folds up and can be used as a spade
  - Drop-firing, no sights
- Lacked robustness and explosive power, withdrawn by 1943
- “Fires like a spade, digs like a mortar”



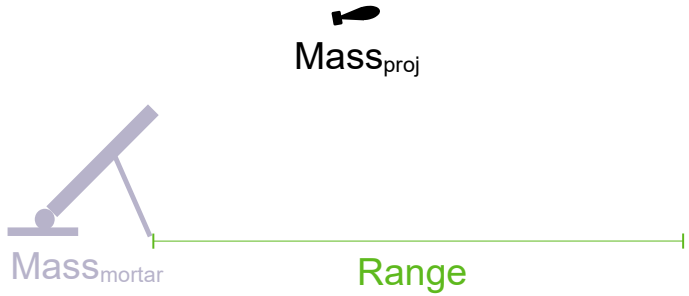
37 mm Spade Mortar ready for action

Spade Mortar ready for use as a spade

A Simple Measure of Mortar Efficiency

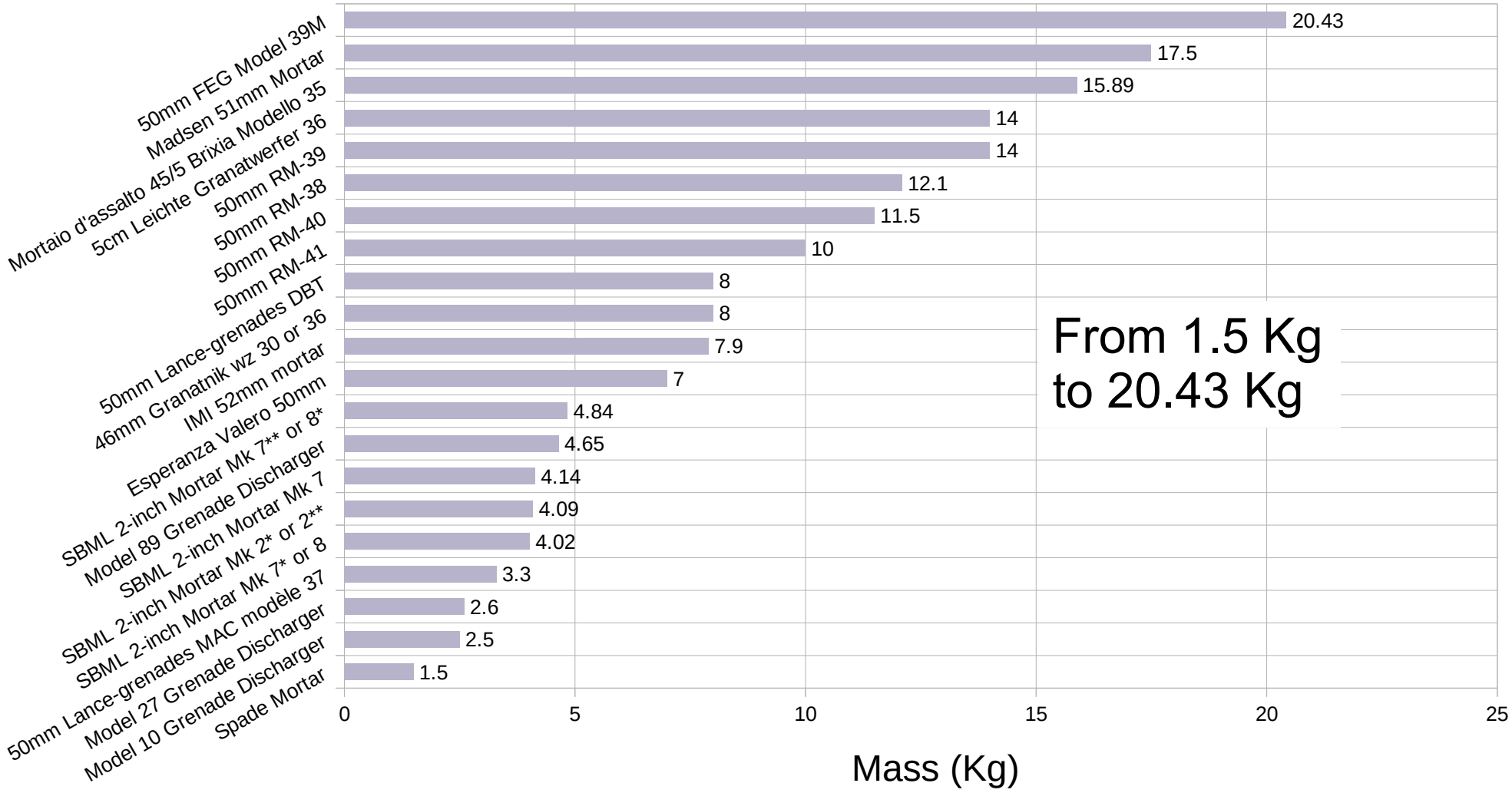
- The point of a mortar is to throw a bomb to a distance
- A reasonable measure of its efficiency in doing this might be:

$$\text{Efficiency} = \frac{\text{Mass}_{proj} \times \text{Range}}{\text{Mass}_{mortar}}$$

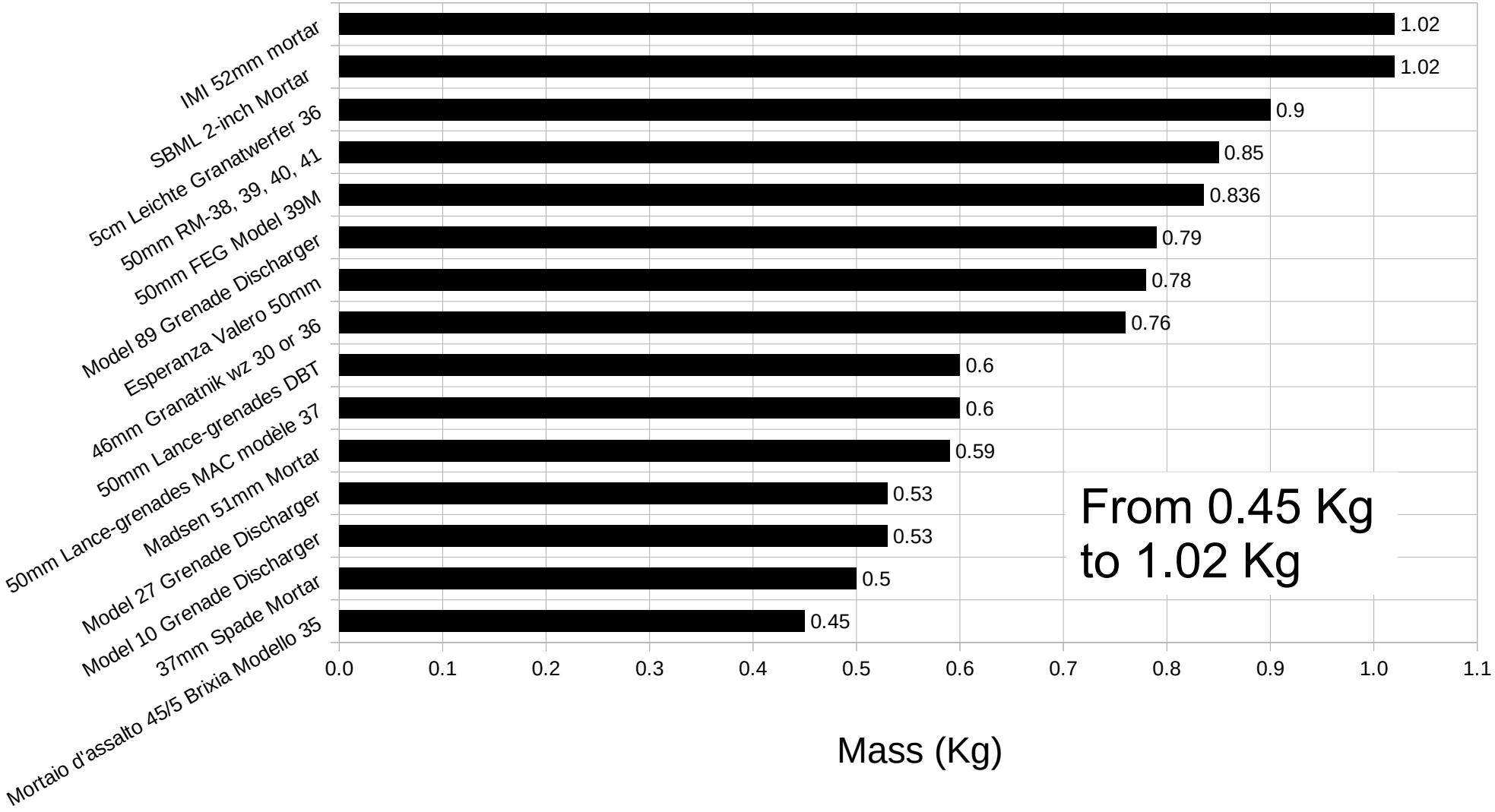


- A value of 50 might then represent
  - a 10 Kg mortar firing a 1 Kg bomb to 500m
  - a 7.5 Kg mortar firing a 1.5 Kg bomb to 250m
  - ...or all sorts of other possibilities

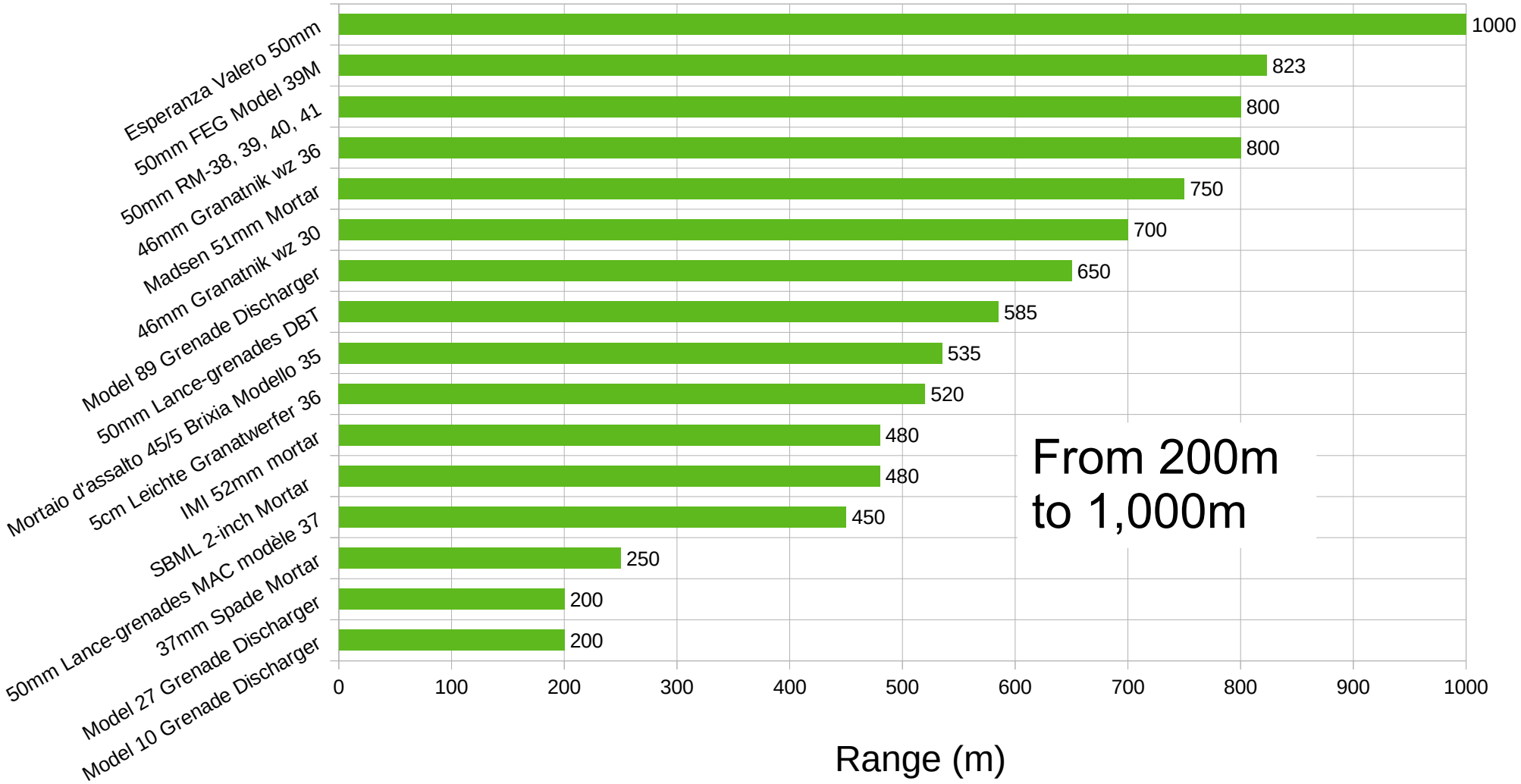
Mass of WW2-era Light Mortars, 37mm to 52mm



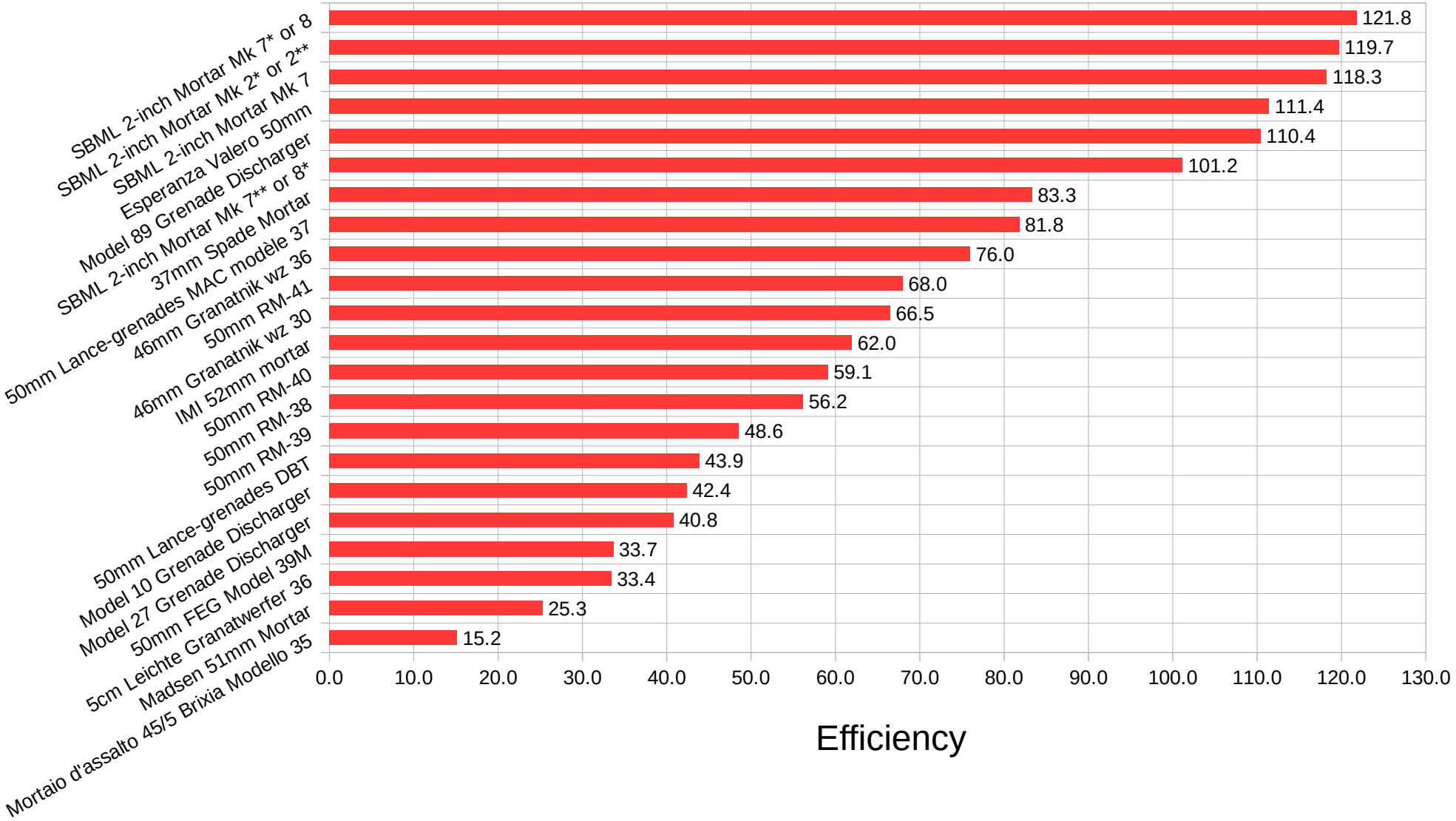
Mass of WW2-era Light Mortar Bombs, 37mm to 52mm



Range of WW2-era Light Mortars, 37mm to 52mm



Efficiency of WW2-era Light Mortars, 37mm to 52mm



WW2 Summary

- Mortars with scores more than 100 seem to have been the best
  - Notably the British 2-inch and the Japanese Type 89
- The Germans and Russians lost interest in tiny mortars about 1943
- The 45mm Brixia was outstandingly poor
- Polish and Hungarian post-war weapon acquisition would follow Russia
- Italian, French, Belgian and Japanese would follow America
- The Americans stuck with 60mm as their smallest mortar
- The Israelis liked their home-grown 2-incher
- China used the Japanese Type 89 in Korea, but also liked the 60mm

Remember this?

- Take it in the shoulder
  [Grenade launcher]



- Eliminate it by firing countermass in the opposite direction
  [Recoilless rifle, rocket launcher]



- Let the ground deal with it
  [Mortar]



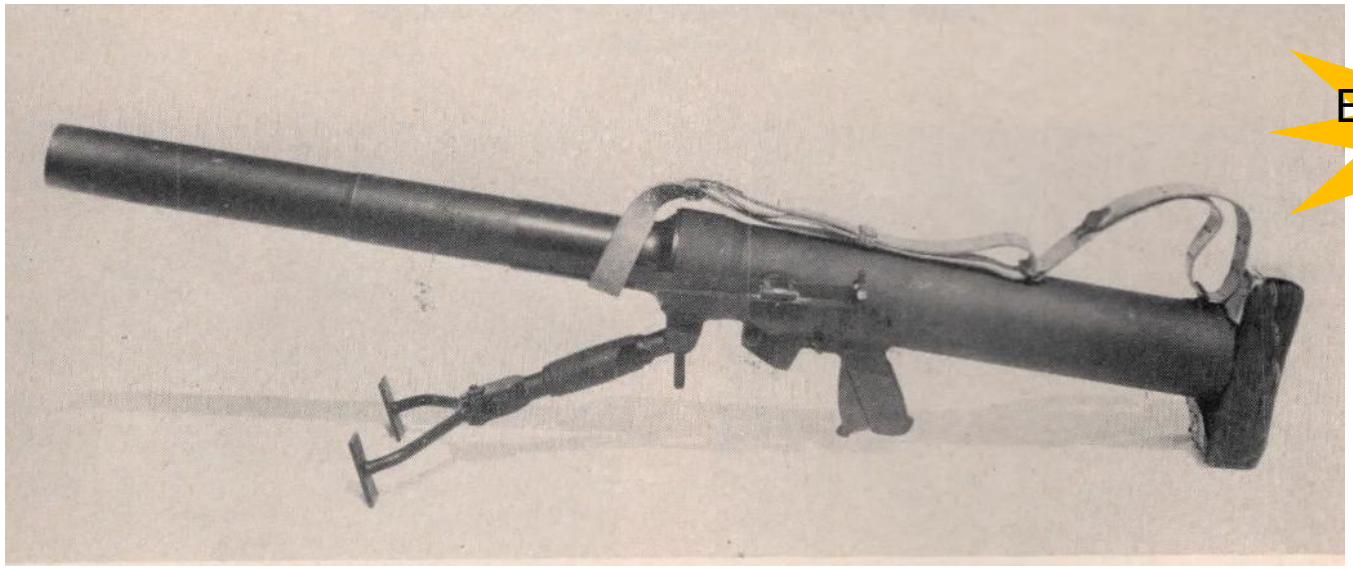
Firing from the Knee, Firing from the Hip

- The Japanese Type 89 was a subject of some confusion:
  - *Weapons supported on thigh (in kneeling position) or (usually) ground (in lying position).* [Tactical and Technical Trends No. 10, October 22, 1942]
  - *...a heavy grenade discharger, sometimes mistakenly called a "knee mortar."* [Tactical and Technical Trends No. 22, April 8, 1943]

- From the Victoria Cross citation for Lt George Knowland [London Gazette of 10th April, 1945]:
  - *Later, when a fresh attack came in, he took over a 2 in. Mortar and in spite of heavy fire and the closeness of the enemy, he stood up in the open to face them, firing the mortar from his hip and killing six of them with his first bomb.*

T20 Garrett Shoulder Mortar

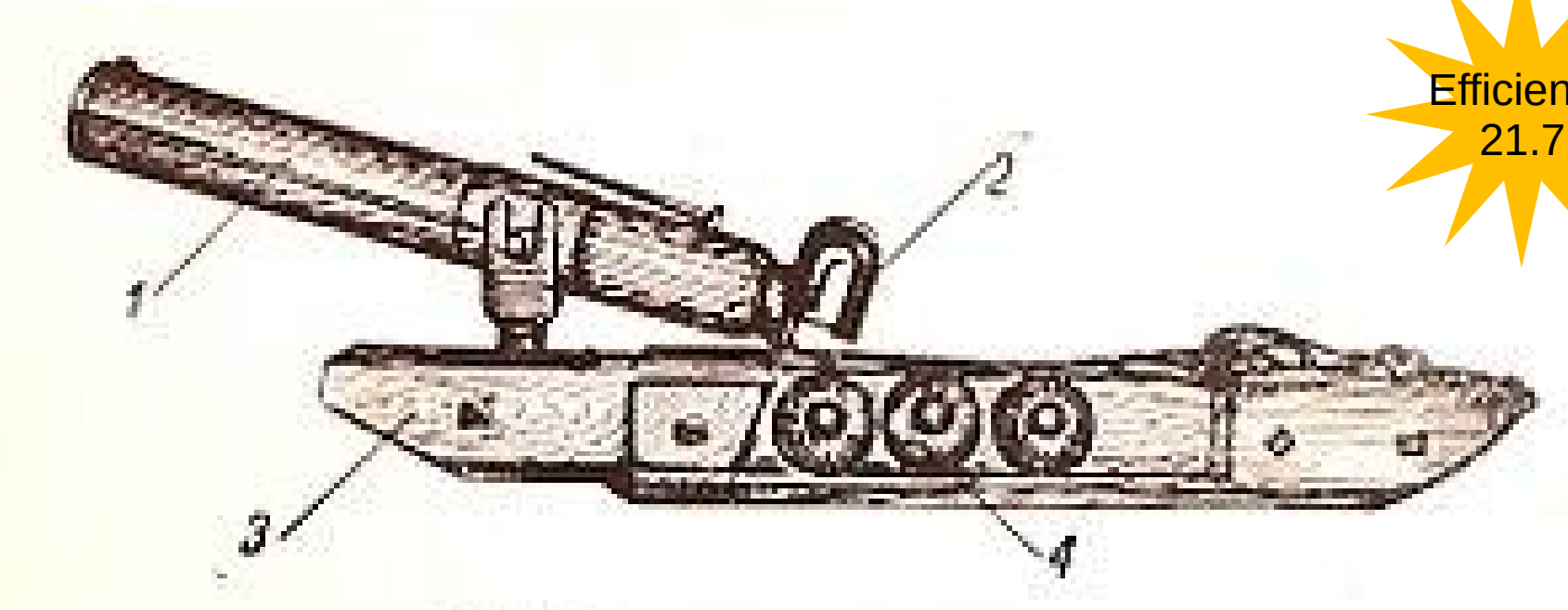
- 60mm calibre, smooth bore, muzzle loading, trigger fired
- Fires standard 60mm bomb at minimum charge
- Includes primitive recoil system
- Intended for shooting into bunker embrasures
- 100 issued to 1st USMC Division for operations on Peleliu, 1944



Efficiency
83.9

Kartukov Ampulomyot

- 125mm calibre, smooth bore, muzzle loading, trigger fired
- Intended to set fire to tanks (not a good way to kill them)
- Mounted on wooden sled containing 10 incendiary ampoules
- Variety of other mountings tried
- Not a success – issued to Red Army 1941, withdrawn 1942



Efficiency
21.7

Projector, Infantry, Anti-Tank (PIAT)

- Spigot mortar firing 88mm calibre HE/AT bomb (shaped charge)
- Muzzle loading, trigger fired
- Standard British platoon anti-tank weapon from 1943 to 1956
- Also capable of being used in higher-angle “house-breaking” rôle
- Known to the Australians as the Projector, Infantry, Tank Attack



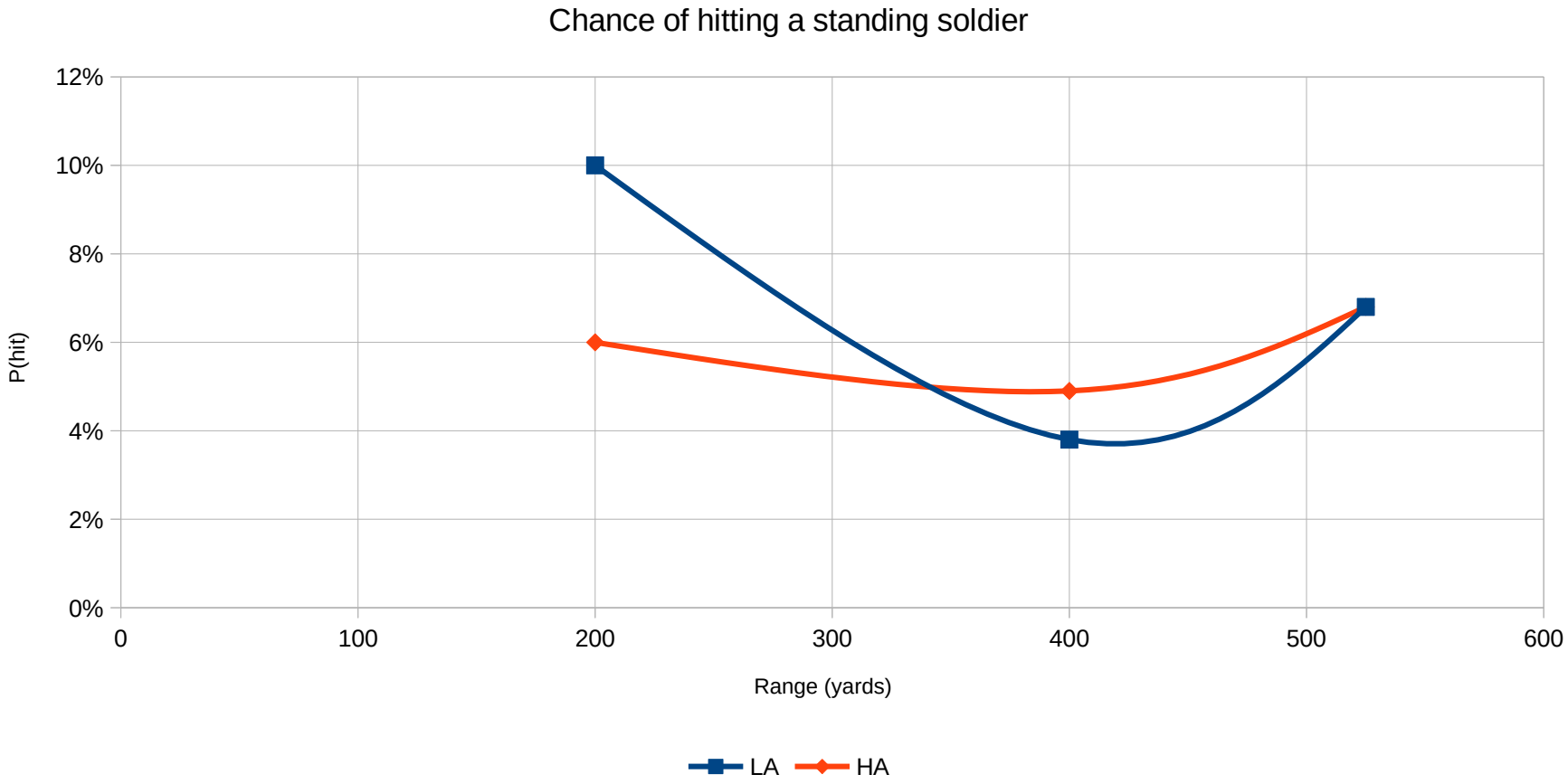
Efficiency
29.4

How Effective?

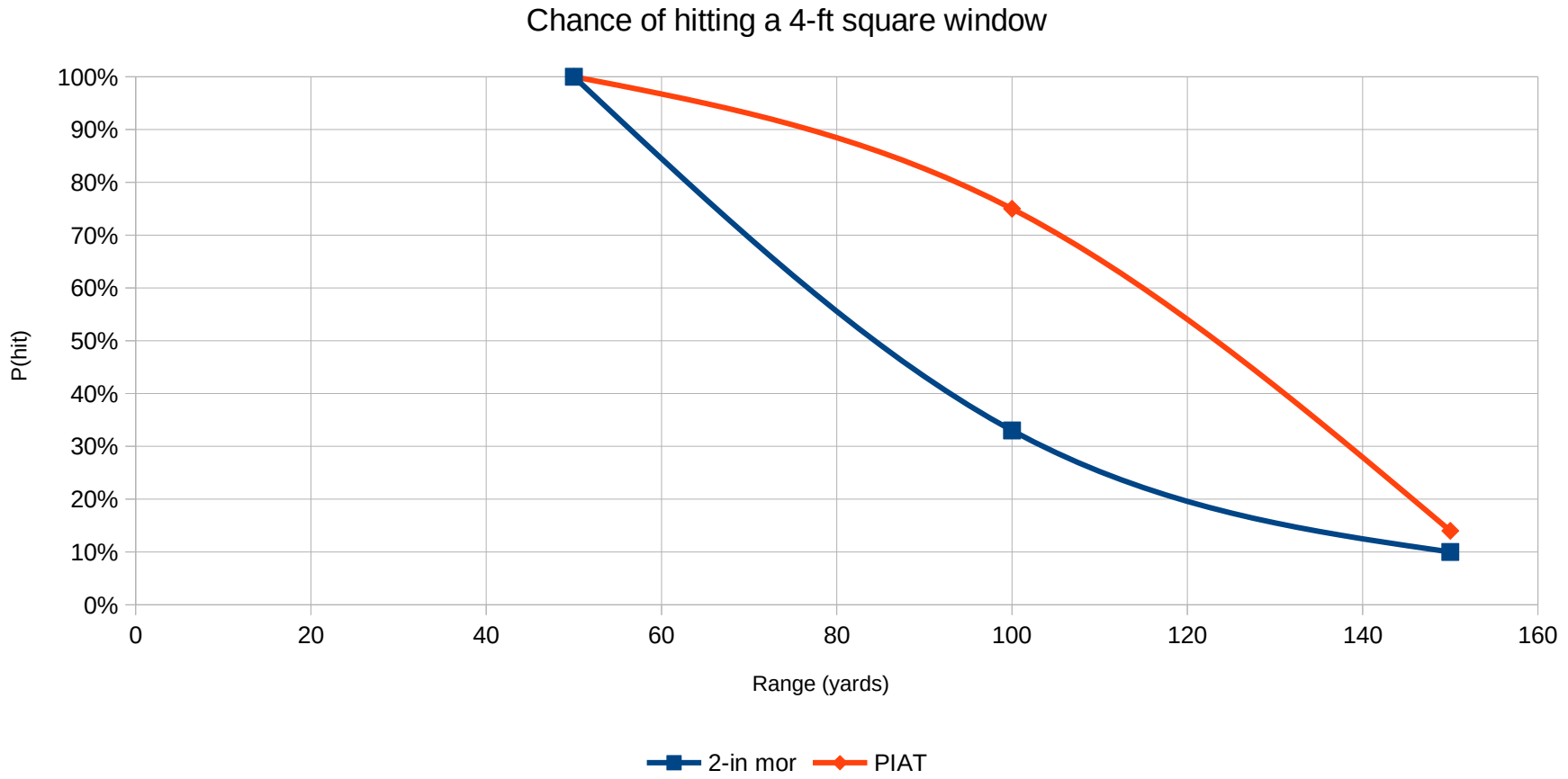
- Low muzzle velocity and relatively long times of flight mean the light mortar is never going to be the best choice against moving targets

- Light mortar HE is most useful
  - Contributing HE with minimum delay in an encounter battle
  - Dropping bombs into enemy trenches in attack
  - Putting bombs through windows in FIBUA
- Smoke is also useful
  - A 2-in mortar bomb holds 40% as much smoke composition as a 3-in
  - A 2-in bomb is worth two-thirds of a 3-in bomb for screening purposes

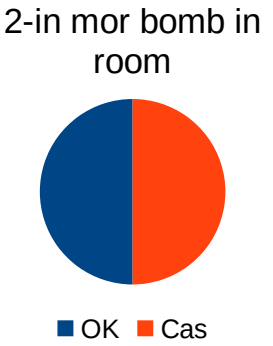
2-in Mortar Against Troops in the Open [WO 291/157]



Putting 2-in or PIAT Bombs in Windows [WO 291/156]







Bringing Things up to Date

- The 2-inch mortar soldiered on in British service until the 1980s, when the 51mm L9A1 replaced it

- This was withdrawn for no doctrinal reason I can discern

- The Hirtenberger 60mm proved too heavy to be used at platoon level

- Platoon HE fire now comes from underslung grenade launchers



A Resurgence of Spigots

- The French have a 50mm Lance-grenade Individuel F1 in each rifle section

- The Chinese have produced a similar 50mm mortar, the QLT-89

- The Vietnamese STA-50 “Three Noes” (no flash, no noise, no smoke) seems similar, but I have been able to find no detail

- All are captive-piston spigot mortars, flashless and very quiet





What of the Future?

- The stealthiness of the captive-piston spigot mortar is highly desirable
- If sophisticated technology is desired, it belongs in the round, not the launcher
  - Fragmentation should be better than WW2 projectiles
  - The platoon mortar might be a useful micro-UAV launcher
  - Raytheon have developed a PGM in 40mm
- Firing over-calibre ammunition allows for growth (consider the RPG-7)
- It still seems tactically useful to throw a 1-Kg bomb half a kilometre for quick HE fire, lobbing bombs into trenches and windows, and smoke screening

Sources

1 Capt Hartmann-Madsen's web page at https://krigsvidenskab.dk/emne/et-kongerige-en-morter
2 French museum service page on lance-grenades M37, http://www.alienor.org/collections-des-musees/fiche-objet-5594-lance-grenades
3 Grenade Launchers in China, presentation at China R&D Academy of Machinery, Juanjuan Yang, Xinlong Li, Bin Yang, Yi Ren, Junli Wang, May 15 , 2010
4 H. Dv. 101 Der leichte Granatwerfer 36 (5cm), Reichsdruckerei, Berlin, 1940
5 Handbook of the M.L. Stokes 3-inch Trench Mortar Equipments, Land Service, 1919, HMSO, 1920
6 INF 202, "Manuel d'Emploi de la Section d'Infanterie", Ministère de la Défense, Paris, 18 June 1999
7 Infantry Training, Part VIII – Fieldcraft, Battle Drill, Section and Platoon Tactics, The War Office, 4th March 1944
8 Instruction sur le Lance-Grenades D.B.T. et sur ses Munitions, Minsitère de la Défense Nationale, Brussells, 1934
9 Italian 45mm Mortar in: Tactical and Technical Trends No. 21, March 25 1943
10 Jane's Infantry Weapons 1975, F W A Hobart, Jane's Yearbooks, 1975
11 Madsen Arms Catalogue, Dansk Industri Syndikat, Copenhagen, undated
12 Mortar Ammunition: An International Survey, Tony Williams, based on a presentations at IQPC and NDIA conferences Oct 2015 and Apr 2016
13 Musée de Chevau web pages, http://www.musee-chevau.org/produits/obusier-de-tranchee-pneumatique-brandt-de-60mm-1ere-partie-645
14 Old British Army page on 51mm mortar, http://www.army.mod.uk/equipment/pw/pw_lm.html-ssi
15 Old French Army web page at http://www.defense.gouv.fr/terre/equipements/armement-individuel-et-collectif/lance-grenade-individuel
16 Order of Battle and Handbook of the Hungarian Armed Forces, War Department, Washington DC, February 1944
17 Ordnance Pamphlet 1257, Garrett 60mm Shoulder Mortar Mark 1 Mod 0, Navy Department Bureau of Ordnance, Washington DC 14 Sep 1944
18 Page on Kartukov ampulomyot, https://vk.com/@centr_nvp_sport-125-mm-ampulomet-obrazca-1941-goda
19 Regia Militia Hungrorum web page http://militiahungarorum.roncskutatas.com/1920_f_k_av_m_ma_5.html
20 RKKA web page on RM-41 mortar http://www.rkka.ru/docs/real/min50/index.htm, short service guide to 50mm mortar model 41, Voenizdat, 1942
21 Shots Fired in Anger, Colonel John George, National Rifle Association of America, 1981
22 Special Series No. 30, Japanese Mortars and Grenade Dischargers, Military Intelligence Division, War Dept, Washington DC, 15 March 1944
23 Tactics and Technique of Infantry, Advanced, 12th Edition, Military Service Publishing Company, Harrisburg PA 1942
24 The PIAT, Mathew Moss, Osprey, 2020
25 Web page on WW2 light mortars https://guns.allzip.org/topic/42/1803180.html
26 Wikipedia page on Brandt 60mm, https://en.wikipedia.org/wiki/Brandt_Mle_1935
27 Wikipedia page on Granatnik wz 36, https://en.wikipedia.org/wiki/Granatnik_wz._36
28 Wikipedia page on RM-38, https://en.wikipedia.org/wiki/RM-38
29 WO 179/1054, 2nd Canadian Div 'G' branch war diary, August 1942
30 WO 291/156, AORG report no. 167, "Street Fighting", 1945
31 WO 291/157, AORG report no. 168, "Performance of Ordnance ML 2-inch mortar", 1945



Questions?

Dr John D Salt

j.salt@cranfield.ac.uk

© Cranfield University



https://dspace.org/

A hundred years of tiny mortars

Salt, John D.

2022-07-07

https://dspace.lib.cranfield.ac.uk/handle/1826/18165

Salt J. (2022) A hundred years of tiny mortars. In: Close Combat Symposium 2022, 5-7 July 2022, Cranfield University, Shrivenham, UK

Downloaded from a DSpace repository. https://dspace.org/