

Recoilless Weapons

Recoilless weapons¹ are direct-fire support weapons distinguished by a system of operation in which propellant gases (or another countermass such as a powder or liquid) are expelled from the rear of the launch tube or barrel. The forward momentum of the projectile is effectively balanced by the rearward momentum of the propellant gases or counter-mass, mitigating the otherwise-excessive recoil of the large, heavy projectiles that such weapons typically fire (Ferguson et al., 2015; Goad and Halsey, 1982). Most recoilless weapons are guns, of which many have smoothbore barrels. The term ‘recoilless rifle’ is frequently—but erroneously—used to denote this type of weapons system, whereas it is actually a sub-set of a larger whole.²

Recoilless weapons are generally considered to be light weapons under existing international instruments such as the International Tracing Instrument (ITI), although some larger systems would qualify as conventional artillery (and are therefore not covered here) (UNGA, 2005).³ Smaller recoilless weapons may be carried and fired by one operator, whereas large-calibre types are generally crew served and employed from a mount or vehicle. Recoilless weapons most commonly range between 40 mm and 120 mm in calibre. Many fire a range of projectile types. While anti-armour projectiles are historically the most common ammunition type, anti-personnel and ‘multipurpose’⁴ types are increasingly available for many systems. This flexibility in ammunition types is one of the key advantages of many recoilless

weapons systems, and developments in ammunition have allowed these weapons to remain relevant to contemporary warfare.⁵ Many systems are capable of firing more advanced projectiles introduced decades after the weapons first entered military service.

Various recoilless weapons are commonly documented in conflict zones, and are in service with a range of armed forces and non-state actors.⁶ Many of these common systems offer a substantial increase in firepower to mobile military units or non-state armed groups, while requiring little specialized training to operate. They are also relatively portable, moderately priced, and often readily available, and provide more firepower than many other small arms and light weapons. These attributes make them particularly attractive to non-state armed groups.

The development of the first recoilless weapon is attributed to US Navy commander Cleland Davis in 1910. This weapon was originally described as an ‘aeroplane gun’ and featured two opposing barrels. A central charge propelled the projectile from the forward barrel, while a counter-mass of grease and lead shot was propelled rearward.⁷ It was originally envisaged that the Davis Gun would be used to target enemy ships and submarines (Davis, 1911; US Navy, 1920). Subsequent recoilless developments included the so-called ‘Y Gun’, so named for its two barrels configured at 45 degrees from the vertical. Introduced in 1917, Y Guns were mounted on board US Navy destroyers and submarine chasers and used



The Soviet-designed SPG-9 recoilless gun, currently in widespread service and common in conflict zones around the world.

the recoilless principle to launch two depth charges in opposite directions (US Navy, 1920). These early examples of recoilless weapons were designed for use from mobile platforms. While some were comparable in size and weight to more modern systems, others were considerably larger. They had not yet been used extensively in land warfare.

Projecting a heavy physical counter-mass out of the rear of a weapon proved to be both dangerous and impractical, and severely limited the battlefield applications for early recoilless technology.⁸ Between the First and Second World Wars new designs were developed that relied on propellant gases travelling at very high velocities to function as the counter-mass (Newhouse, 2011).⁹

During the Second World War the United States introduced the 57 mm M18 and 75 mm M20 recoilless rifles. These were lightweight weapons that were powerful (for their time) and were regularly employed against a range of targets, including personnel, armoured vehicles, and fortifications. The 105 mm M27 was introduced during the Korean War, while the 90 mm M67 and 106 mm¹⁰ M40 and variants saw service during the Vietnam War. The M40, which is still encountered in conflict zones today, features a coaxially mounted .50 calibre spotting rifle¹¹ (Tucker, 2015).

Soviet developments following the Second World War resulted in several recoilless weapons, most notably the 82 mm B-10 and 107 mm B-11. From the 1960s onwards Soviet motorized rifle battalions were equipped with

significant numbers of recoilless weapons, including the SPG-9 and RPG-7 systems (US Army TRADOC, 1976). The RPG-7 is one of the most recognizable recoilless weapons and is frequently documented in conflict zones around the globe (see Box 1). The Soviet SPG-9 entered service in 1962, a year after the RPG-7; is significantly lighter than the B-10 and B-11; and has become one of the most widely used recoilless weapons in modern conflicts (Bazilevich et al., 2001).

Other nations have also developed recoilless weapons, including the Italian Breda Folgore; Yugoslav M60; German Panzerfaust series and Rheinmetall RMK30; British L6 WOMBAT; and Swedish Pansarvärnspjäs 1110, AT4, Miniman, Carl Gustaf series, and other systems. Basic recoilless weapons technology is widespread, with recoilless systems in service with many militaries and non-state armed groups worldwide. Licensed and unlicensed copies of recoilless weapons are also produced in a number of countries. The SPG-9, for example, is one of the most commonly copied light weapons, and is produced in Bulgaria, China, Iran, Romania, Sudan, and elsewhere.

Simpler recoilless weapon systems, such as the RPG-2, a Soviet predecessor to the RPG-7, have been copied and craft produced by a number of non-state armed groups, including Hamas, the Ta'ang National Liberation Army, and the Moro Islamic Liberation Front (ARES, 2015). More complicated recoilless weapon systems are less common, however. In the 1980s and 1990s the Provisional Irish Republican Army pioneered a number of innovative and effective improvised recoilless weapons, including the Projected Recoilless Improvised Grenade (PRIG), which used packs of biscuits as a counter-mass (TFB, 2014). Revolutionary Armed Forces of Colombia insurgents have also demonstrated examples of an improvised recoilless weapon known as the LCL 80 mm.

Modern recoilless systems offer several advantages over other weapons that are commonly employed in similar roles. They are relatively affordable,

Box 1 Rocket-assisted recoilless weapons

It can be difficult to determine whether a given weapons system is a rocket launcher, a recoilless gun, or a weapon that uses a combination of these principles. Many recoilless weapons firing rocket-assisted munitions are frequently and inaccurately described as 'rocket launchers' (Newhouse, 2011). Several common light weapons employ a combination of recoilless and rocket propulsion principles. Typically, these systems use an expelling charge to launch a munition a short distance from the weapon, at which point a rocket motor ignites and propels the projectile toward the target. A well-known example of such a system is the RPG-7. A typical RPG-7 munition, such as the PG-7V, uses an expelling charge—often erroneously referred to as a 'booster section'—to launch the projectile several metres from the barrel before the rocket motor engages and provides most of the required acceleration (US Army TRADOC, 1976). This 'two-stage' launch protects the operator from the rocket's back blast. The most common munitions fired from this system employ a combination of recoilless and rocket propulsion principles, while some projectile types (for example, the OG-7V) operate purely on the recoilless principle. Other hybrid systems include the German Panzerfaust 3 and Swedish AT4 (Jenzen-Jones, 2014).

The key characteristics of many of these systems—whether rocket launchers, recoilless weapons, or rocket-assisted recoilless weapons—are frequently the same. Most are light anti-tank weapons by design, although they are often employed in anti-personnel and anti-structure roles in contemporary usage.



A Sudanese copy of the Soviet RPG-7V recoilless weapon, known as the 'Sinar'.
Credit: N.R. Jenzen-Jones/Small Arms Survey



A range of projectiles for the Swedish Saab Carl Gustaf series of recoilless rifles, including HE, HE-FRAG, HEAT, anti-structure, smoke, illumination, and practice rounds. © N. R. Jenzen-Jones/ARES

with comparatively low-cost ammunition, and are lightweight and portable. The latest-generation Carl Gustaf M4, for example, weighs less than 7 kg. Many recoilless weapons can also fire a wide range of ammunition types, providing a distinct tactical and logistic advantage. Saab offers 15 different projectiles for its Carl Gustaf series, enabling an individual soldier to engage enemy personnel, armoured vehicles, and structures at a variety of ranges and under different battlefield conditions (Saab, 2014) (see photo).

At the same time, there are several drawbacks to using recoilless weapons. Many models are significantly heavier than disposable rocket launchers, for example. Another potentially problematic feature is the large back blast produced by many recoilless weapons, which creates a visible firing signature that may reveal an operator's position to the enemy and can also restrict or preclude these weapons' use in confined spaces (Tucker, 2015).

As noted, recoilless weapons of one type or another are in service with almost all the world's militaries and many non-state armed groups. While modern military forces have begun to phase out larger recoilless weapons systems, generally opting for lighter-

weight, more portable systems, larger systems continue to circulate in the illicit sphere (Berman and Leff, 2008, p. 23). The most common types are the Soviet SPG-9 and RPG-7, and the US M40 series weapons, including copies and derivatives. Recoilless weapons are a feature of almost all current and recent conflict zones, including (but not limited to) Iraq, South Sudan, Syria, Ukraine, and Yemen.¹² Germany supplied Panzerfaust 3 rocket-assisted recoilless weapons to Kurdish forces in Iraq, while Iranian copies of the US M40 recoilless rifle have been delivered to Iraqi Shi'a militias (Harper, 2015; Jenzen-Jones, 2014).

Now widely used around the world, recoilless weapons, together with other unguided weapons systems, have seen something of a resurgence following the experience of US and coalition forces in Iraq and Afghanistan (Herron, Marsh, and Schroeder, 2011). They are a common feature of current conflict zones and are likely to remain so for some time to come. ■

Notes

- 1 Sometimes abbreviated to 'RCL'.
- 2 All recoilless rifles are recoilless guns, but not all recoilless guns are recoilless

rifles. A 'gun' requires the combustion of a propellant to generate high-pressure gas in a sealed chamber in order to accelerate a projectile in a controlled manner. Some guns' bores are smooth, whereas others are 'rifled'. A rifled barrel has some form of internal geometry (typically spiral grooves) inside the bore that engages the projectile and causes it to rotate as it is accelerated up the barrel. This rotation imparts gyroscopic stability to the projectile, ensuring that it flies accurately and point first (Ferguson et al., 2015).

- 3 Recoilless weapons that form the organic armament of tanks or infantry fighting vehicles, such as the Soviet 2A28 Grom, are not covered in this note. The 1997 *Report of the UN Panel of Governmental Experts on Small Arms* and the 2005 ITI, for example, refer only to 'recoilless rifles' and make no specific mention of recoilless guns. The former goes so far as to include recoilless rifles in the same category as 'portable anti-tank guns', a term that specialists consider vague and not useful in modern usage (Ferguson et al., 2015; UNGA, 1997; 2005).
- 4 So-called multipurpose projectiles often have a primary anti-structure role, with additional effects designed to engage personnel and light vehicles.
- 5 Anti-armour projectiles include high-explosive anti-tank (HEAT) and high explosive squash head (HESH) types, while anti-personnel projectiles most commonly include high-explosive fragmentation (HE-FRAG) types. Some recoilless weapons, particularly rocket-assisted recoilless weapons, use over-calibre warheads in order to deliver an increased explosive payload from a lightweight, man-portable system.
- 6 They have very limited civilian applications, with small numbers employed in avalanche control programmes, most notably in the United States (Abromeit, 2004).
- 7 The recoilless principle is sometimes known as the 'Davis principle'.
- 8 Some modern recoilless weapons make use of a dense counter-mass such as salt water to reduce the back-blast effects of firing from enclosed/confined spaces.
- 9 As a result, recoilless weapons employing a propellant gas counter-mass commonly, although not exclusively, feature a prominent nozzle or nozzles towards the rear of the weapon.
- 10 The M40 is actually a 105 mm calibre weapon; however, it is described as 106 mm in order to avoid confusion with the ammunition from the earlier 105 mm M27.
- 11 A 'coaxially mounted spotting rifle' is a rifle mounted in line with the barrel of the recoilless weapon that fires a cartridge

with a projectile trajectory matching the trajectory of the recoilless weapon's projectile. Spotting rifles are used to ensure that the recoilless projectile will accurately strike its target. These devices are rarely used in service by modern militaries.

- 12 Ferguson and Jenzen-Jones (2014); Harper (2015); HSBA (2013); Jenzen-Jones (2014); Jenzen-Jones (2015).

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