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ARES Research Note 8 – Durability & Longevity of Self-Loading Rifles

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Background

Firearms are one of the best examples of durable manufactured goods. With relatively little preparation and care, they can be stored for long periods of time and suffer only minimal degradation. Poor maintenance is likely to result in a firearm which is less accurate but often no less functional than one properly taken care of. For these reasons, firearms, including self-loading rifles, are often found in use many decades after manufacture.

A self-loading rifle is one with an action which extracts and ejects the fired cartridge case immediately after firing, and chambers a new round from the weapon's magazine. These rifles may be semi-automatic or automatic.

The major components of a self-loading firearm must necessarily be made of materials strong enough to withstand the heat and pressure effects of cartridges being fired. In addition, military rifles are specifically designed to continue functioning through adverse combat conditions. This dictates that their major components are not liable to break from repeated use, nor from storage. In the simplest terms, they are stout mechanical devices most typically produced from steel or alloyed metals.

Given the rarity of fundamentally catastrophic damage to a self-loading military rifle in the course of normal use or storage and the easy reparability of the most common sources of damage, it is not uncommon for such a weapon to have a service life of many decades. The United States' Civilian Marksmanship Program (CMP), for example, is still selling M1 Garand rifles which were manufactured in the 1940s and 1950s. The oldest mass-produced self-loading military rifles in existence date to the late 1930s and early 1940s, and it is not uncommon to find military rifles of this age (70 years or more) in conflict zones to the present day. ARES has documented such rifles in Mali, Libya, Ukraine, Syria, and elsewhere.

Components Prone to Damage or Degradation

There are three key component types within a self-loading rifle which are especially prone to damage or degradation in the course of normal use and storage. These are:

- Rifling in a firearm's barrel;
- Wooden or polymer stocks and other furniture; and
- Springs

Rifling

The barrel of a self-loading rifle is a precisely machined component, which features internal geometry ('rifling') inside the bore which engages the projectile and causes it to rotate, imparting gyroscopic stability. The barrel must also seal the projectile in the bore to prevent bypass of the propellant gasses during firing, and must allow the projectile to exit the muzzle in a precisely repeatable manner with each shot (to ensure accuracy). Because of the heat and pressure generated by firing, the inside of a rifle barrel is not able to receive many of the same types of protective finishes as the exterior parts of a weapon. Some methods have been adopted to improve the resistance of the bore to damage, such as chrome lining, but these are neither infallible nor universally employed. The interior of the barrel is liable to corrode if left exposed to water – especially salt water – for extended periods of time. Some types of ammunition make use of primer compounds which leave salt residues inside rifle barrels; these salt crystals are hygroscopic and can attract atmospheric water, contributing to barrel corrosion. If barrels are not cleaned and lightly coated in a protective oil, corrosion can lead to degraded accuracy. The speed and likelihood of this type of damage depends on the ambient humidity, the type of ammunition used, the quantity of ammunition fired, the composition of the barrel, and other environmental factors. However, this damage only results in an unsafe or non-functional firearm in the most severe of cases. It is much more common for the rifle to simply be less accurate when fired.

Figure 1: A badly corroded firearm barrel (credit: KIR).
Figure 2: Replacement furniture for an AKM type rifle produced by a local workshop in Libya (credit: Hassan Morajea/ARES).

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Furniture

The grip, hand guards, and stock (collectively known as furniture), are another element of self-loading rifles which may be more readily damaged than others. These components are typically made of wood or polymer materials, and are less resistant to damage than the primary metal components. Dropping a rifle, using it as a crutch, club or pry bar, or other strenuous activity can result in breakage of furniture. This may not necessarily make the weapon unusable, though this is largely dependent on the rifle design. For example, AR-15 type rifles feature a critical recoil spring housed in the butt stock, and damage to the stock may impede the weapon's function. Damage to a rifle's furniture rarely results in a weapon being discarded, as replacement furniture components are relatively simply to source from more fundamentally damaged weapons, to acquire as spare parts, or to fabricate or improvise from locally-available materials.

Springs

The various springs within a self-loading rifle are the final component type most susceptible to degradation or damage. Several critical elements of a rifle's functioning depend on different springs in the weapon and these springs can wear or fail under the stress of repeated use. Critical springs include magazine springs (which feed cartridges from a magazine), recoil or mainsprings (which allow weapons to function as self-loaders), extractor springs (which allow the weapon to remove fired cartridge cases from the chamber after firing), firing pin, hammer or striker springs (which provide the force for firing the cartridge once it has been chambered), and trigger springs (which reset the firing mechanism after each shot). These springs take various forms (coil and leaf being the most common) and the typical self-loading rifle will have at least three springs of various types. A broken spring can render a weapon effectively non-functional, and springs are typically much harder to precisely fabricate than furniture. However, springs are almost invariably replaceable, and a weapon with a broken spring may be returned to service once a replacement is found.

Figure 3: AKM type rifle components, including hammer and trigger mechanism springs (credit: N.R. Jenzen-Jones/ARES).

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Safety Information

Remember, all arms and munitions are dangerous. Treat all firearms as if they were loaded, and all munitions as if they were live, until you have personally confirmed otherwise. If you do not have specialist knowledge, never assume that arms or munitions are safe to handle until they have been inspected by a subject matter specialist. You should not approach, handle, move, operate, or modify arms and munitions unless explicitly trained to do so. If you encounter any unexploded ordnance (UXO) or explosive remnants of war (ERW), always remember the 'ARMS' acronym:

AVOID the area

RECORD all relevant information

MARK the area to warn others

SEEK assistance from the relevant authorities

Disclaimer

This report is presented for informational purposes only. It is not intended to provide instruction regarding the construction, handling, disposal, or modification of any weapons systems. Armament Research Services (ARES) strongly discourages non-qualified persons from handling arms and munitions. Arms or munitions of any variety should not be handled without the correct training, and then only in a manner consistent with such training. Subject matter experts, such as armourers, ATOs, and EOD specialists, should be consulted before interacting with arms and munitions. Make a full and informed appraisal of the local security situation before conducting any research related to arms or munitions.

Images from Keg Island Research, Hassan Morajea (ARES), and N.R. Jenzen-Jones (ARES).

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