

M16-A2 Exploded

The round went off and sent the bullet down the barrel—plowing up sand as it went.

By Capt. Jason D. Arthaud

Felt like I had been shot, or hit with a bat, and I've had both happen before." That's how a lance corporal described an injury he suffered during a live-fire grenade-assault course in the desert.

While riflemen suppressed targets from squad base-of-fire positions, another squad maneuvered within hand-grenade range. After tossing grenades, the Marines ducked behind berms for cover. After the grenades detonated, the squad resumed suppression. One corporal picked up his M16, and when he fired, it exploded. His receiver shattered, and a fragment blew off, cutting a lance corporal who was behind him, in the neck.

A review of this incident showed that four other M16-A2 rifles had been similarly damaged during the two-week training. One rifle had a bullet and cleaning-rod section lodged in the bore, while the other four were

probably fired with sand in their bores. The mishap rifle had a bullet lodged in its barrel, and since the shrapnel from this weapon contributed to the injury, it was set aside for the investigation.

The corporal hadn't had any malfunctions or ammunition problems, and he hadn't heard an audible pop from his weapon before the explosion.

An audible pop is a strange noise made when a primer detonates but fails to ignite all or any of the propellant. The primer has enough power to kick the projectile out of the case, and if a small portion of the propellant ignites, it can lodge the projectile partway down the barrel. To clear the weapon, a Marine must unload, remove his bolt, and punch out the lodged bullet. If a Marine fails to clear the projectile and simply performs imme-

Photo by Cpl. Branden P. O'Brien
Modified by Allan Amen



diate action (ejecting the partly spent cartridge and chambering another round), then fires, the weapon likely will explode.

The ammunition was tested, and nothing unusual was discovered. If a case had been overloaded or exposed to direct sunlight, the chamber pressure during firing wouldn't have exceeded 70,000 psi. The damaged rifles were exposed to pressures nearly three times the normal amount (fig. 1).

Did the armorers fail to maintain the weapons? No. The unit's weapons had been inspected on schedule and had gauged within standard. With everything else ruled out, it became clear these weapons were destroyed



What Happens When M16 Barrel Pressures Are Too High?

Figure 1.

PSI	Event	Results
55,000	Normal firing	no damage
70,000	Proof-test firing	no damage
90,000	Test	no damage visible
100,000	Partial-barrel obstruction	case bulged, primer flattened
110,000 to 140,000	Barrel obstruction located mid-barrel to muzzle	receiver cracked or bulged, extractor peeled back, rounds blown down and out of magazine.
160,000	Barrel obstruction near chamber	receiver ruptured, bolt carrier split, extractor peeled back, barrel extension cracked, rounds blown down and out of magazine, receiver pivot pin lugs sheared off.

because operators handled them carelessly, and let sand collect inside their barrels.

The corporal was lying behind a berm with his weapon, while Marines from another squad threw grenades. When the last grenade went off, he picked up his rifle, unintentionally scooped up sand with his muzzle, and fired. The round went off and sent the bullet down the barrel—plowing sand as it went. The sand wedged between the bullet and the bore, creating so much friction the bullet skidded to a stop. The powder behind it, however, continued to burn, and the chamber pressure rose above 100,000 psi. With the barrel blocked, the path of least resistance was now through the cartridge-case head.

The intense heat and extreme pressure forced its way through the unsupported base of the brass case into the receiver through the extractor slot (fig. 2). Since the M16's extractor isn't fully supported by barrel-locking recesses, the extractor peeled back, and the bolt carrier and upper receiver split (fig. 3). Gas vented down through the magazine and out the right side of the rifle through the ejection port. The left side of the receiver provided no escape for the gas, and the left side ruptured, blew off, and hit the lance corporal. The limited technical inspection (LTI) following the mishap didn't list the lower receiver as damaged; but often the lower receiver bulges, and the front pivot-pin lugs are sheared off.

During this training, Marines had to move, shoot and throw grenades. Rushing from one position to another, repeatedly diving to the prone, firing and laying rifles in the sand to throw grenades, presents a number of opportunities for sand to enter a weapon's barrel.

The mishap board recommended the unit "ensure proper maintenance is being conducted during live-fire training." Instead of saying "proper maintenance," they should have said "proper weapons *handling*." Since armorers aren't expected to check headspace and barrel erosion during an assault, and operators can't clean weapons while moving downrange, the endorsing chain switched "during" to "before and after." This recommendation is more practical, but, clearing sand after it's in your weapon is reactive. Wouldn't it be better to determine how sand collected in the barrels and find ways to keep it out?

The injured lance corporal and the five destroyed rifles could have been spared if this potential hazard had been identified and some simple controls had been implemented to reduce it.

Make sure Marines don't stick their muzzles in the sand, and don't assume they won't do it. All it takes is a momentary distraction. Squad and team leaders are the most likely candidates, followed by AT4 gunners and gun team members.

Marines have limited experience using both grenades and small arms on live-fire maneuver ranges. If they use both hands to prep a grenade while lying in the prone, where is their rifle? Probably lying in the sand.

Sling and carry weapons muzzle down; present them from the alert, ready or "indoor-ready," not the tactical carry. If a Marine scoops a flash-hider full of sand and

Figure 2.

A number of parts were destroyed when this rifle was fired with sand in its barrel.



dirt when he prepares to rush, where will sand run when he advances with his weapon pointed up?

Use the issue, shoot-through, plastic muzzle caps to keep sand and dirt out of weapon barrels. The \$2,000 spent to replace five rifles could have bought 40,000 5-cent muzzle caps.

Training Marines to adjust to their operating environment is the cheapest option. Injuring one Marine, destroying five rifles, and leaving five Marines unarmed is too costly.

Operation Under Unusual Conditions (page 81, TM 05538C-10/1A)

Hot, Dry Climate—Desert

- 1. Clean Daily.** Dust and sand will get into the rifle and magazines. This will cause malfunctions. Give the inside and outside areas and functional parts of the rifle a thorough cleaning every day and after every firing mission.
- 2. Don't use too much oil.** Corrosion is less likely to form on metal parts in a dry climate; therefore, lubrication

should be applied to the internal working surfaces and functional parts only. Use normal amounts of CLP for lubrication. Unload and dry ammo and inside of magazines daily. Do not lube magazines.

3. Use bags and caps. The use of overall rifle protection cover, muzzle cap, and spare magazine protective bags will help protect the rifle and ammo from sand or dust. Use these items when the tactical situation permits.

4. Keep ejection port cover closed. However, as a minimum effort to keep out sand and dust, keep the bolt and ejection port cover closed, a magazine installed in the rifle, and a muzzle cap on the muzzle.

Note: Removal of the muzzle cap before firing is recommended. Place it in your pocket for future use. However, it is not dangerous to fire the rifle with the cap installed.

A PowerPoint brief of a similarly ruptured M16-A2 may be viewed at the following link. <http://www.safetycenter.navy.mil/publications/GroundWarrior/presentation/m16rupture.htm>. The brief may be previewed on the web page, but resolution is better if you download it first.

Figure 3.

