A 21st century

The Army's plans for a carbine competition could spur innovations in military weapon design.

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Resources

Colt Defense LLC M4 page, ***www.colt.com/mil/M4.asp***

Congressional Research Service M4 report, ***fas.org/sgp/crs/weapons/RS22888.pdf***

Sabre Defence Industries LLC, Nashville, Tenn., ***www.sabredefence.com***

The M4 rifle has been standard issue for U.S. soldiers for the past 15 years. But that could change thanks to a competitive "shoot off" among gun makers planned for this year. The competition is being heralded as one that could entice dozens of small arms companies into submitting designs. In so doing, it could stimulate interesting new approaches to gun design and construction.

Colt Defense LLC has owned the design rights to the M4 but relinquished them to the Army last year. Though Colt's M4 has worked well throughout its history, it has also undergone a number of modifications aimed at improving its performance. These lessons-learned could also be put to use in designs coming off the drawing board for the upcoming competition.

The M4 is a descendant of the M16 used in Vietnam. It is a shorter and lighter version of the M16A2 assault rifle with many of the same parts. The M4 fires 5.56 × 45-mm NATO ammunition and uses a gas-operated reloading system wherein a portion of the high-pressure gas from a fired cartridge goes into extracting the spent casing and chambering a new cartridge.

The gas system on the M4, which operates on the same principle as that on the M16, has become a point of controversy recently. The rifle uses a direct impingement method where gas vents through a tube running back to the bolt carrier. Gas then directly impinges on the bolt carrier to extract the casing and chamber a cartridge. The advantage of this setup is a minimum of recoiling parts. Using fewer moving parts promotes straight shooting because there is less moving mass to unbalance the rifle.

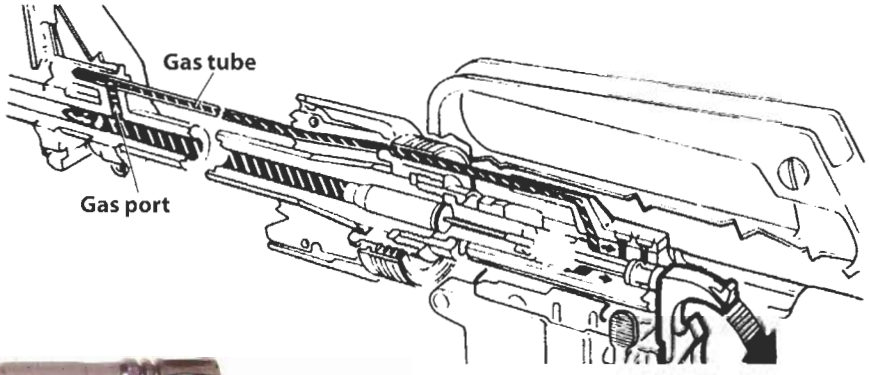
The problem with direct impingement is that propellant gas blows directly into the action parts. In the dusty and sandy locales of Iraq, there is higher potential for contamination of moving parts which could potentially cause malfunctions. The hot gas hitting pins, springs, the ejector, and other parts can dry out their lubrication and forces soldiers to clean their weapon more frequently.

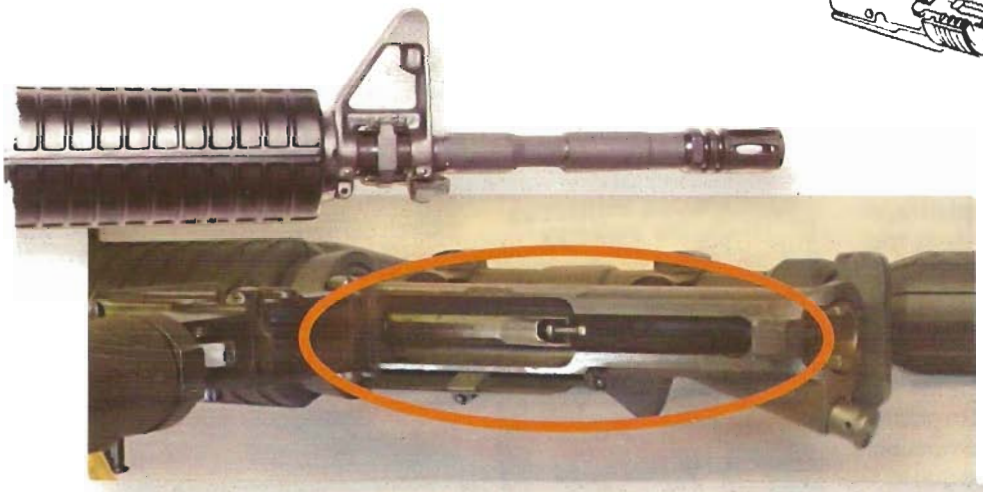
An alternative to direct impingement gas systems is to employ a piston mechanism to move the bolt carrier. Here gas routes to the face of the piston which, in many designs, is affixed directly to the bolt carrier. Thus gas never touches the action parts. Moreover, such systems can often be designed so the mass of the piston rod augments the momentum of the bolt carrier during casing extraction and ejection.

Particularly in settings characterized by a lot of sand and dust, there is an advantage to keeping cartridge gas away from the working parts. The down side is that the moving parts make the rifle's center of balance change somewhat during the action cycle.

The Army has levied no specific requirement for any particular style of gas system as part of the carbine competition. "Companies can submit any weapon they want. It is an open competition," remarked Col. Doug Tamilio, the head of Project Manager Soldier Weapons, during a recent interview.

rifle





The M4 uses a direct gas impingement system similar to that depicted in this diagram of the M16 gas impingement system from that rifle's manual. Gases act directly on the moving parts. The accompanying image shows the gas tube termination in an AR-15, the civilian version of the rifle. The gas systems in both rifles are identical. The main difference between the two is in the bolt which in the M16 is designed for automatic firing.

Though the carbine competition will commence this year, the Army is considering upgrades to the existing M4, among them a piston gas system. Some in the industry say the change likely wouldn't affect the accuracy of military shooters. "The weight of that piston pushing back and forth is pretty minute," says Sabre Defence Industries LLC general manager Charlie

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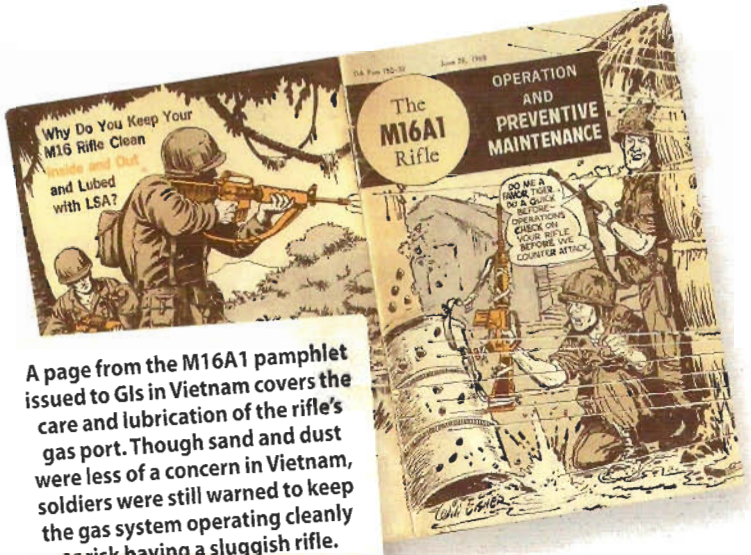
Shearon. Sabre Defence makes M16s for the military as well as rifles that employ gas piston systems. "Experienced military shooters might adjust a bit for this but it would be unlikely to affect the performance of less experienced shooters," he says. "Some people say you might lose a half-minute of accuracy because of the piston slinging back and forth. If you are a smooth operator you are still going to hit any group of targets the military normally has."

In both the carbine competition and the Army's proposed changes for the M4, the gun's rails are getting attention. Rails are metal pieces (typically aluminum) that let soldiers easily add and remove attachments such as flashlights and night-vision scopes, One of the chief requirements for a rail system is that it not flex as the gun heats up from repeated firing.

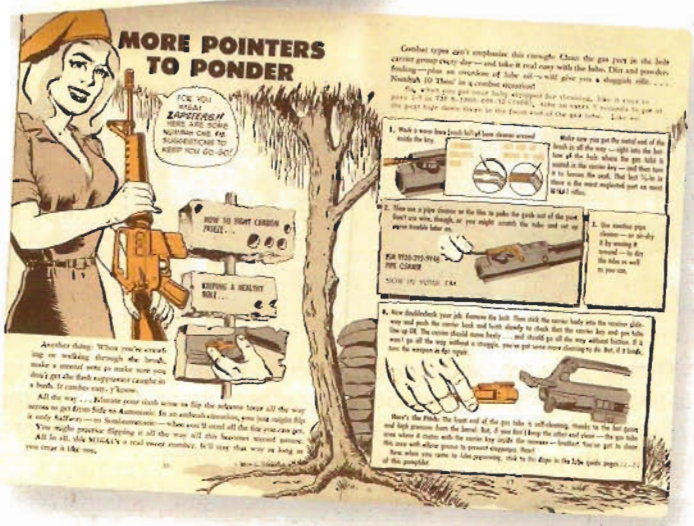
But proposed improvements for the M4 include a redesign of its Picatinny rail to give it more strength. And for the carbine competition, "Among the goals is lightening up the gun as much as possible and devising a rail that can accept a lot of attachments," says Shearon. "It's possible to come up with a rail system that is relatively hollow and which weighs little. Through use of alloys and processing, there are several ways of adding stiffness while keeping the pieces themselves light."

The Army also wants a better trigger. Improved trigger pull is on the list of proposed M14 enhancements and is one of the items spelled out in the carbine competition. "Different companies have come up with different ideas here," says Shearon. "There is an angle between the trigger and the hammer that can be adjusted to change the trigger pull weight. Right now the spec is three to seven pounds. The Army wants to tighten that spec and keep it toward the lower end of the range. I think you will see companies addressing this with both the trigger angle and with tolerances on the hammer and trigger."

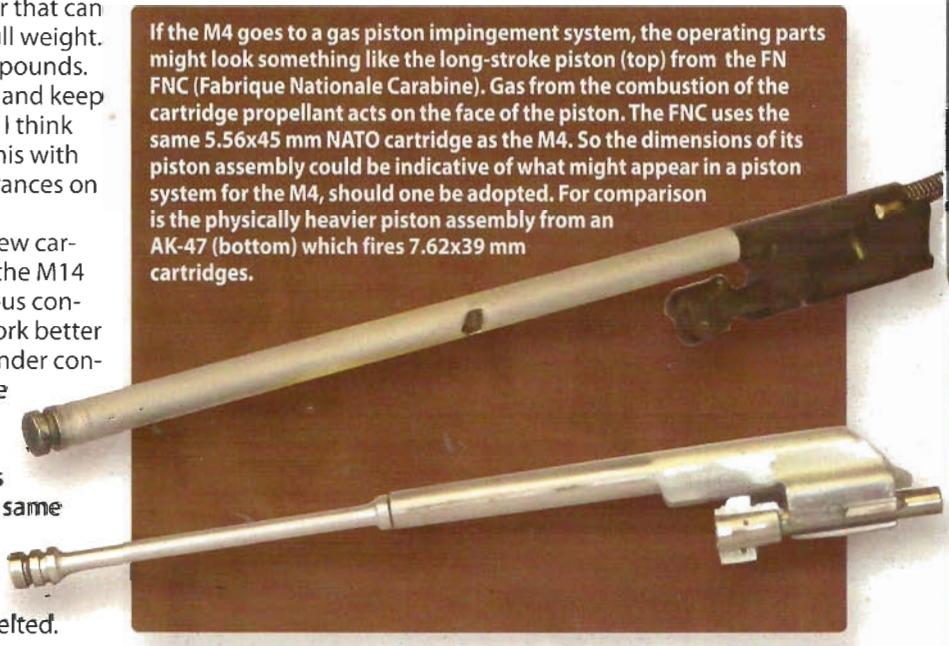
While the Army is deciding on a new carbine, other alterations proposed for the M14 include a round counter, ambidextrous controls, and a heavier barrel that will work better during high rates of fire. The barrel under consideration is used on the M4A1, a rifle designed for special forces. Reports are that in one rapid-fire test, the M4 barrel warped after firing 540 rounds in a little under three minutes. In the same test the heavier M4A1 barrel handled 930 rounds in four and a half minutes with no discernible problems though the gun's heat shield melted.



A page from the M16A1 pamphlet issued to GIs in Vietnam covers the care and lubrication of the rifle's gas port. Though sand and dust were less of a concern in Vietnam, soldiers were still warned to keep the gas system operating cleanly or risk having a sluggish rifle.



It looks as though M4s carrying such improvements will be in the field for some time to come. Col. Tamilio says it will take about two years to put new carbines in soldiers' hands. **MD**



If the M4 goes to a gas piston impingement system, the operating parts might look something like the long-stroke piston (top) from the FN FNC (Fabrique Nationale Carabine). Gas from the combustion of the cartridge propellant acts on the face of the piston. The FNC uses the same 5.56x45 mm NATO cartridge as the M4. So the dimensions of its piston assembly could be indicative of what might appear in a piston system for the M4, should one be adopted. For comparison is the physically heavier piston assembly from an AK-47 (bottom) which fires 7.62x39 mm cartridges.