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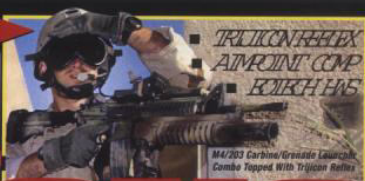
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ARMS TECH'S COMPAK-16 5.56mm

Smaller and more accurate than the M4 carbine—it's a revolutionary new operating system!

By Al Paulson

Arm's Tech's Compak-16 introduces a radically new operating system and barrel that solve the problems that have plagued operators going in harm's way with short-barreled variants of the M16

such as the CAR-15, M16A2 Commando, and M4 carbines. "Early timing" problems create a host of gremlins such as extraction problems and parts breakage, excessive cyclic rates, unacceptable barrel life, and bolt failures, along with less than stellar accuracy and reliability. Another problem with short-barreled carbines is that they generate excessive blast and flash, which is a significant tactical liability. Arms Tech's patented new gas system solves the aforementioned problems. Arms Tech barrels feature gain twist, polygonal rifling and a new steel alloy that together provide improved velocity and accuracy for a barrel of a given length, along with at least four times the barrel life. Rather



Arms Tech's Compak-16 (below) is about the same size as the Bulgarian "Krinkov," but the Compak-16 delivers much better velocity and effective range.

*Arms Tech Compak-16
with QD-223 sound
and flash suppressor.*



Arms Tech Compak-16, QD-223 sound and flash suppressor with mount open and ready for installation, and Arms Tech's very affordable double magazine mounting system.

than putting Band-Aids on chronic problems, Arms Tech goes to the systemic level to eliminate the root causes of these problems. The "Big Truth" to be found from the following hands-on evaluation is that Arms Tech has accomplished far more than making a reliable and durable short-barreled M16. These same innovations make weapons of conventional barrel length far more combat effective, as well. One can argue that these changes are not evolutionary but revolutionary. They represent a paradigm shift, a fundamental theoretical shift, in modern small arms design. Best of all, the system can be retrofitted economically to existing weapons, and it can be adapted to any caliber or barrel length compatible with the M16/AR-15 platform.

Such innovation, a fundamental shift in small-arms design, only seems to occur once or twice in a generation. Arms Tech innovations incorporated in the Compak-16 and its longer-barreled siblings provide interesting alternatives

to concept weapons developed with grants for possible adoption by the US Army. The M16 and its variants are battle proven. Their only liabilities relate to the gas system and barrel. These problems become increasingly significant as barrel length drops below 16 inches. Compak-16 technology cures the relatively small number of gremlins that have belonged to the M16 family of weapons.

Whether or not one likes the XM8 carbine (being developed with grants from Picatinny Arsenal as a direct development of the separable OICW [XM29] KE or Kinetic Energy module), a responsible observer must ask several fundamental questions:

Would the Arms Tech system provide the performance characteristics necessary in a military rifle for Fourth Generation Warfare in the 21st century?

Would American taxpayers be better served by upgrading the US military's existing inventory of M16 and M4 weapons, or developing and acquiring a new weapon to replace everything in the inventory?

Is the Arms Tech system something individual operators and grunts will find handy and a real improvement over existing weapons in the Real World? Or is this a design that only bean-counters and bureaucrats will love?

Since the 14.5-inch barreled M4 variant of the M16 manifests more



The Compak-16 barrel is made from a new stainless steel alloy that delivers at least four times the barrel life of an M4 carbine.

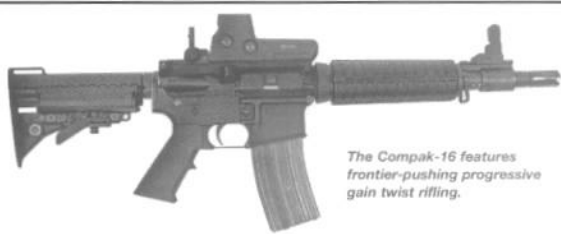
gremlins than the M16A2, and Arms Tech's Compak-16 is intended to replace the M4 variant of the M16, the Compak-16 seems to be the optimum Arms Tech variant for evaluating their new technology.

Operation Details

While Gene Stoner's basic gas-impingement operating principal is retained and no change to the bolt or bolt-carrier is required, Arms Tech employs a vastly improved gas management system inspired by the gas-trap prototypes of Garand's M1 rifle, from more than a half century ago. The principle in Arms Tech's gas trap system is simple. Gas vents very close to the muzzle into a relatively large chamber called the "gas trap." The gas trap delays the combustion gases vented from behind the bullet and lowers their pressure before the gases vent into the gas tube. Placement of the gas trap near the muzzle means that the pressurized barrel (temporarily "corked" by the bullet) is uncorked well before extraction begins, allowing the gas pressure in the bore to drop from a high to low pressure environment.

This accomplishes a number of useful things, which are especially important in shorter-barreled variants of the M16 like the M4.

Back pressure inside the cartridge case pushing the case walls tightly against the chamber walls is significantly reduced when extraction begins, so extraction from the chamber requires considerably less force. This eliminates chronic extractor breakage and occasional torn case heads seen in short-barreled variants such as the M4. These are catastrophic failures during a firefight.



The Compak-16 features frontier-pushing progressive gain twist rifling.

Another critical benefit is that lower pressure gas from the gas trap provides a softer, slower extraction, ejection and reloading sequence. Not only are extraction problems and related parts wear and breakage reduced, the magazine has a bit more time to properly present the next cartridge to the bolt. Bolt-over stoppages are significantly reduced. In one informal test by military personnel, they took a quantity of issue magazines that no longer functioned with their M4A1 carbines and tried them in a Compak-16. All of the otherwise unserviceable 30-round magazines functioned without a hiccup when used with the Arms Tech upper receiver.

While gas impingement pressure is lower, the gas trap provides enough gas volume so that the energy delivered under the time/pressure curve is the same. Since the time/pressure curve is more rounded than a spike, perceived recoil is less.

Then there is the interesting phenomenon that the cooling generated by the gas trap system causes unburned particulates to continue out the barrel rather than taking a 180-degree turn to enter the gas system. This means a

huge reduction in soot available to clog the gas tube and foul the receiver and action components.

Significantly less cleaning of the action is required. This makes the weapon more reliable and thereby more combat effective during wartime. Routine cleaning during training requires less time, something special operators prize, since maintenance cuts less into their "Miller Time," as some are fond of saying.

The Arms Tech system also features "progressive" gain twist polygonal rifling combined with a new steel, which makes the barrel a quantum improvement over previous M16/AR-15 barrels. "Progressive" means that the rate of gain twist changes constantly throughout the length of the barrel right to the muzzle. The short barrel is notably stout and stiff, which enhances accuracy. The alloy is a newly developed stainless steel specifically designed for sustained automatic fire. The concept of gain twist rifling is nothing new, but examples are few and far between over the last century.

Rifling in the modern sense dates back to the 15th century, when Vienna gunmaker Gaspard Kollner apparently

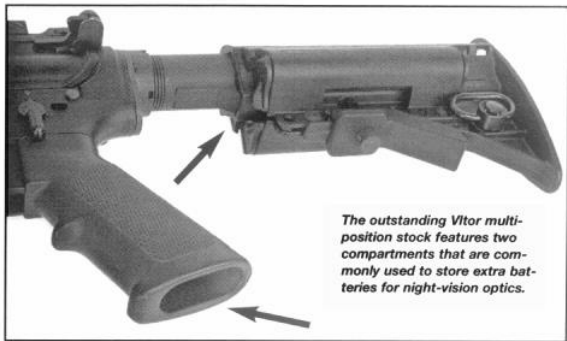
fabricated the first rifled musket barrels. The gain twist style of rifling became popular with the American "freed bore" rifles of the early 19th century. With the advent of cartridge arms in the mid-19th century, the practice of using gain twist rifling fell out of favor with a few notable exceptions. Within the last hundred years, the most notable use of gain twist rifling is the 6.5mm Carcano Models 1891 and 1941, which served Italy through two world wars. Whitworth developed polygonal rifling in the 1850s, and the introduction of the McMillan M89 sniper rifle in the late 1980s revitalized the use of polygonal rifling more than a century later. Progressive gain twist is novel. It's practical, thanks to new computer technology.

As far as I know, Arms Tech is the first company to produce military weapons combining the use of both progressive gain twist and polygonal rifling. The timing is right. The short barrel of the M4 carbine only has a 14.5-inch barrel in a 1:7-inch twist rate to stabilize a projectile. This twist rate stabilizes standard 62-grain M855 ball and the outstanding new 77-grain, MK 262 MOD 0 5.56mm Special Ball, Long Range developed by Black Hills Ammunition for the military to deliver better effective range and penetration.

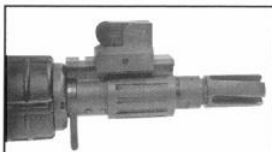
Since the Compak-16's rifling is optimized for the length of 52-69-grain projectiles of conventional construction, the Arms Tech weapon will not quite stabilize the new 77-grain, MK 262 MOD 0 5.56mm Special Ball Long Range projectile. Since bullet stabilization relates directly to the length of the bullet engaging the rifling, a 77-grain high-performance projectile with less bearing surface could provide penetration and long-range accuracy equal to MK 262 MOD 0 and MOD 1 ammunition. Using a rebated boat tail, different ogive, or blended metal technologies are several possibilities that immediately come to mind for making a heavy bullet with minimal bearing surface.

The M4's 1:7 twist rate over-spins 55-grain bullets, which may deliver unacceptable accuracy, or even self-destruct as they leave the bore, depending upon bullet construction.

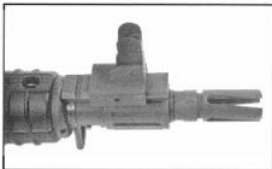
The inability to use 55-grain M193 ball or its foreign equivalent may be a serious liability in the 21st century, as the US military focuses on 4th Generation Warfare in an effort to combat threats to our national security from sub-national organizations such as al Qaeda and Abu Sayyaf Group (ASG). More peacekeeping missions, such as our presence in Kosovo, can also be



The outstanding Vitor multi-position stock features two compartments that are commonly used to store extra batteries for night-vision optics.



Arms Tech's gas trap features integral M1913 rail and Vortex (TM) flash hider.



GG&G Tactical Modular Flip Up is attached to the gas trap's integral M1913 rail.

expected. Frequently, such efforts are conducted side by side with differing mixes of coalition or local forces that may not use 5.56mm rounds with heavy projectiles such as M855, SS109 or C77 ball.

What happens if US forces are conducting a joint op or peacekeeping mission in conjunction with troops from Poland or South Korea who use 55-grain rounds, and US units begin to run low on ammunition? With the standard mil-spec 1:7 twist barrel, U.S. forces cannot be resupplied with 55-grain ammunition. With Arms Tech's progressive gain twist polygonal barrel, U.S. troops can use the ammunition from local or allied forces working with them. One of the big lessons from the intense fighting in Afghanistan is that individual soldiers cannot carry enough ammunition

for a sustained fight. When small units must operate far from their resupply points, the ability to use 55-grain ammunition would provide a useful ace in the hole in the coming decades.

Gain twist also provides a much gentler transition for the bullet into the rifling, which has no rate of twist at the throat. The gain twist bore gradually accelerates the rotational rate of the projectile with much less energy loss due to frictional heat. The use of polygonal rifling further reduces energy loss from friction, increases velocity and barrel life, and enhances the barrel's ability to stabilize a wide range of bullet lengths. This pays substantial dividends. More energy is available to accelerate the bullet. Less energy is available to heat the barrel and thereby adversely affect accuracy and throat life.

So much for the patented Arms Tech design in general. How do these features come together in the specific details of the Compak-16 weapon?

Gun Details

The Compak-16 features a 9.5-inch, heavy profile barrel with 1:9-inch, progressive gain twist polygonal rifling, which is optimized for 52-69-grain projectiles. The weapon is 30.25 inches long with the stock full extended and 26.88 inches with the stock retracted. The Compak-16 weighs 6.5 pounds without magazine or optic. The small size of the Compak-16 and its novel design make this weapon a compelling choice for entry, CQB, vehicle and air crews, as well as for other established mission-essential needs currently being filled by the M4A1 and M16A2 Commando, which have barrel lengths of 14.5 and 11.5 inches respectively.

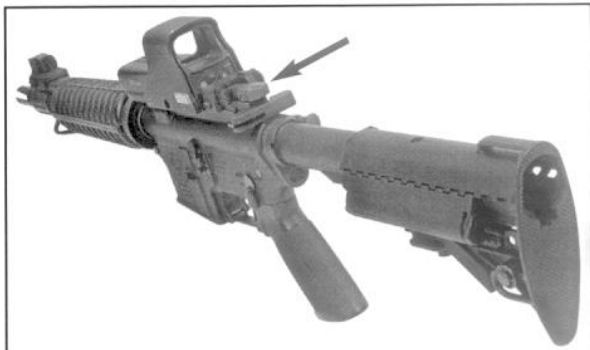
ARMS TECH'S COMPAK-16 5.56mm

Let's compare a few salient features of the Compak-16 and M4A1 that become evident when the weapons are used side by side.

The patented gas system of the Compak-16 provides a cyclic rate in this short-barreled weapon of just 550-650 rounds per minute (rpm), depending upon ammunition. A new M4 has a cyclic rate of circa 750 rpm, while an M4 barrel nearing the end of its service life may have a cyclic rate of circa 1,100 rpm. The slower cyclic rate improves hit probability and magazine reliability.

In terms of accuracy testing, the M4 should shoot 1.5 minute of angle (MOA) (1 inch at 100 yards) groups when new, but accuracy degrades to about 5 MOA by the end of the barrel's nominal duty life (8,000 rounds). A recent military study that I have on file reports that M4A1 carbines currently in service with a particular unit averaged 3-5 MOA. Special operators commonly replace their M4 barrels every 3,000 rounds or so.

Contrast the preceding accuracy data with the Compak-16, which gave



EOTech's Model 550 HWS HOLOGraphic Weapon Sight projects what appears to be an illuminated reticle on the target. If the batteries die, the folding iron sights can be viewed through the EOTech sight. Note the GG&G MAD BUIS flip-up rear sight.

me 1 MOA groups with both 55-grain M193 and 62-grain M855 at 100 yards. Independent testing overseas showed that the Compak-16's accuracy only degraded by MOA after 24,000 rounds.

That test included dumping 5,000 rounds through the barrel as fast as possible. In other words, after lasting eight times as many rounds as a special operator typically gets from his M4,

the Compak-16 delivered the same accuracy as a shiny new M4.

In terms of velocity, a pristine M4 with 14.5-inch barrel produced a muzzle velocity of 2,697 feet per second (fps) with SS109 ball at 98 degrees Fahrenheit, while the Compak-16 with a 9.5-inch barrel yielded a MV of 2,703 fps. I'm told that the Arms Tech rifle with 14.5-inch barrel delivers comparable velocities to a standard M16A2 with 20-inch barrel.

None of the chronic extraction and feeding problems exhibited by the M4 carbine appeared during the testing of the Compak-16. No Compak-16 yet fielded has required the replacement of broken extractors or bolt carrier keys, which are two common problems with the M4 series.

How It Shoots

This is all impressive, but what is the weapon like to shoot? Being more compact than the M4, the Compak-16 provides very user-friendly handling and rapid target acquisition. Less felt recoil makes the speed of follow-up shots faster than the M4 series. Accuracy is better, too. The relatively low cyclic rate and reduced felt recoil make the weapon far more controllable and accurate than the M4A1 fired full-auto. It is easy to keep a burst of any length on target at 25 meters, since bullet impact oscillates about the point-of-aim rather than climbing out of it until captured. Effective range of full-auto bursts could probably be quadrupled, however, by the simple replacement of the standard M4 recoil buffer with the CS MkII Cyclic Rate Reducer from Advanced Armament Corp. The improved buffer would smooth out weapon cycling even more and probably drop the Compak-16's cyclic rate to perhaps 550 rpm, which I find about ideal for full-auto fire with a compact 5.56mm carbine.

In terms of sound signature, the Compak-16 delivered an average sound pressure level (SPL) of 162 decibels (dB) with M193 and M855 ball, and just 161 dB with SS109 ammunition. The Colt M4 averaged 164 dB with each of these rounds. This means that the Compak-16 is 2 to 3 dB quieter than the M4 carbine.

Suppressor Details

Arms Tech's Compak-16 is designed to accept Arms Tech's outstanding QD-223 sound and flash suppressor. This exceptional sound suppressor features one of the best quick mounts in the

Specifications: Arms Tech Compak-16

Caliber: 5.56mm
Barrel: 9.5 inches, heavy profile, 1:9 polygonal bore
Overall Length: 30.25 inches (stock extended), 26.88 inches (stock retracted)
Weight: 6.5 pounds empty
Stock: Telescoping polymer
Sights: Integral MIL-STD-1913 rails on upper receiver and gas trap
Operation: Gas trap operating system
Cyclic Rate: 550-650 rpm

business and reduces sound and flash signatures of the weapon remarkably well. A full test of the QD-223 suppressor is beyond the scope of this discussion and will be published separately in the near future. Suffice it to say for now that the QD-223 sound and flash suppressor equals the quietest 5.56mm muzzle can that I've tested to date.

This brings us back to the three questions we asked at the beginning of the study:

Would the Arms Tech system provide the performance characteristics necessary in a military rifle for Fourth Generation Warfare in the 21st century? This present study suggests the answer is yes.

Would American taxpayers be better served by economically upgrading the US military's existing inventory of M16 and M4 weapons, or spending the money to develop and acquire a new weapon to replace everything in the inventory? Answering that question is beyond my pay grade. I can only offer the following observations.

Upgrading to the Arms Tech system is easy. Individual operators can simply swap out existing uppers with a comparable Arms Tech upper receiver with matched bolt and carrier. Or military armorers at the company level can simply swap barrels (of appropriate length featuring Arms Tech's superior metallurgy and gain twist polygonal rifling along with the new gas system) and install an Arms Tech gas tube to effect the transformation of unit M16s into a more combat-effective weapon that is well suited to current and foreseeable mission-essential needs.

There would be no need to retrain individual troops or unit armorers, no need to scrap existing stores of spare parts, no need to replace the tens of thousands of M16 rifle magazines in the system. Even ignoring development and procurement costs, as well as life-cycle cost analyses, the savings in

training and supply would be significant. Furthermore, it is generally easier to secure funding for replacement parts such as an Arms Tech upgrade kit than it is to secure funding for an entirely new weapon system.

Finally, is the Arms Tech system something individual operators and grunts will find handy and a real improvement over existing weapons in the Real World? Or is this a design that only bean-counters and bureaucrats will love? Individual operators and grunts, who have handled the system, like it. The technology is ready to go now, proven, and available off the shelf, with no requirements for research funding with its attendant delays. Bean-counters should like that, as well as life-cycle costing. One question remains to be answered. What will the bureaucrats think? Only time will tell.

Final Notes

Meanwhile, individual military units, government agencies, or law-enforcement departments can purchase complete weapons or upper receivers with matched bolts and carriers from Arms Tech Ltd. I would strongly advise budgeting to add the purchase of a QD-223 sound and flash suppressor with any complete Compak-16 or Recon Rifle or weapon upgrade kit. Together, the Arms Tech weapon and sound/flash suppressor provide a system of synergistic excellence worthy of the most demanding armed professional. I give Arms Tech two thumbs up. ■

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