you will soon find that you are not only unwanted and but also distrusted. You will be amazed at what you can learn, but please don't do anything so dumb as trying to enter restricted areas or peek at files. You are not a spy; your interest is in developing a mission essential task list for your host unit.

Travel when you can. In your leisure time you should do as much traveling as possible in your host country. This will give you something else to talk about with your counterparts and will also broaden your own horizons. And you never know when the knowledge you have gathered during such travels will be useful. For example, in the fall of 1989 I would never have guessed that my knowledge of the Eastern Province of Saudi Arabia would be useful for more than party conversation.

Accept all invitations, if you can. The only way you will ever gain true acceptance from your counterparts is to socialize with them. If you're invited to lunch or dinner, by all means go. Find out as much as you can about the particular function and the protocol that may be involved. If you are invited to a function that will make a serious dent in your work or leave plans, make an honest excuse. Then reciprocate, if possible, either in your quarters or at a local establishment. There may be some among your counterparts that you want to avoid as much as possible; do so, but not at the expense of denigrating your position.

Remember that you have no command authority. Many U.S. officers seem to feel that an advisor is the de facto commander of his counterpart's unit. That may have been true during the Vietnam War, but it is no longer true. The fastest way to alienate your counterparts is to use your command voice with them. As a general rule, the only time you should jump up and down and start directing people is when safety is being compromised and people are about to be killed or maimed. In short, if you come on too strong you will accomplish absolutely nothing and may as well go home.

Like it or not, you must be "Mister Nice Guy." Offer suggestions in terms of "here is a technique you may want to think about." If a counterpart does something stupid, say that you have done the same sort of thing in the past and explain what steps you took to keep from doing it again. Advise and correct where you can, but don't keep hounding your counterparts about their mistakes. The worst thing you can do is to take an approach that seems to say, "I am an American and I'm the expert. Do it this way, therefore, because I said so and I know more than you do." At the same time, be prepared to defend your rationale.

Don't become one of them. Maintain your dignity at all times, as well as your own counsel. Do not become a source of supply. And don't think you have to follow all of their customs. After all, a respect for another's customs goes both ways.

At the same time, you are expected to know everything about the United States. You will get questions about all sorts of things. To many of my counterparts, the U.S. was a fabulous land of riches and wild women. Our dating customs were by far the most popular subject among the junior officers in my host unit. But expect almost any kind of question about our country; this comes with the territory.

In summary, I enjoyed my tour as an advisor. I was able to get a close and personal look at a fascinating foreign culture and to work with a good group of people at the same time.

Although the work was sometimes frustrating, its attractions far outweighed its faults. If you can be patient and maintain a sense of humor, you'll do all right, and if you're offered an opportunity like this, don't let it pass you by.

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Advanced Combat Rifle
A Commonsense Approach

MAJOR RODNEY W. JOYE

Small arms design rarely departs much from the status quo. Historically, it has evolved gradually, and significant advances have come only every few decades at best. For example, before our war for independence, the most influential firearm design was the flintlock musket. Over the years, rifled barrels were added to it, and in the early 19th century the percussion cap was invented. The percussion cap permitted the invention of the revolver, and by the end of our Civil War metallic cartridge arms were in use. The breech loading cartridge arm hastened advances, but it still took

many decades for the Gatling gun, the Mauser bolt-action rifle, and the machinegun to appear.

World War II was the first time the submachinegun and the gas-operated infantry rifle were widely used. The United States fielded the M1 Garand and the Soviets introduced the early Kalashnikov design, and both are still in use throughout the world. The U.S. later fielded the M14 rifle, which was basically an M1 with such improvements as a detachable box magazine, reduced weight, and a selective fire capability.

Our first radical departure from the steel and wood rifle was the M16 series, and in 30 years it has gone through three principal fielding variations. From its beginning, it caused controversy with the traditionalists and continues to do so. But many soldiers, no doubt, have scorned new advances at each stage of firearm development. Surely, the percussion rifle caused arguments, and we continue to hear this with today's debates over the "best choice" either in rifle or in ammunition.

In the history of firearms ammunition, the clear trend over the past 200 years has been toward smaller caliber ammunition. Two centuries ago, most muskets were about .75 caliber, and by World War I most nations used ammunition close to .30 caliber. Today, many nations are using the 5.56mm. This development was possible because of scientific improvements in ballistics and weapon technology.

Although I do not want to fuel the arguments over what ammunition is best, I will say that the 5.56mm NATO and the 7.62mm NATO rounds are both well suited for specific missions. There is nothing wrong with either round when it is used properly, but both can stand some ballistic improvement. I want to focus on the new 5.56mm bull pup weapon designs, however, and at the same time offer some ideas about ballistic improvements that I believe can easily make any 5.56mm weapon more effective. (It is not my intent to advocate any particular rifle manufacturer. Except for manufacturers of equipment now being used, I will not use manufacturers' names or model designations.)

As I began testing the bull pup rifle, it became clear that if I was to assess the limits and capabilities of the design, I would need to know what it could do with the most favorable ammunition as well as with standard issue ammunition. To give it a fair test, I also had to use the most favorable ammunition in the comparison rifle, the M16A2. (Although space prevents me from giving the full details of the various tests I conducted, I am willing to make the details, including test conditions and ammunition loads, available to anyone who wants to see them.)

I do not believe there is much to be gained from going to ammunition smaller than .22 caliber. Regardless of whether the ammunition is caseless or conventional, with the technology available in the foreseeable future, projectiles of smaller bore will not be able to retain enough energy at longer ranges. Small bore projectiles generally rely on speed to generate the energy needed for reliable target damage. At short ranges, any 5.56mm NATO round will perform well, but at long ranges, light projectiles do not retain energy. The M193 5.56mm NATO round has always suffered from this problem. Even the improved M855 5.56mm NATO round can still stand some ballistic energy improvements.

There are two ways to increase bullet weight with the objective of increasing energy retention in a projectile. First, the diameter of the projectile can be increased from .22 caliber to .28, .30, or more, with a corresponding increase in bullet length and weight. The second method is to increase the length of the .22 caliber projectile.

An increase in length and weight of ammunition, when combined with the proper rate of rifling twist in the weapon, will dramatically improve penetration, accuracy, and energy retention at long ranges. These improvements can be achieved through properly designed ammunition without other changes to a weapon design. The only trade-off is a slight reduction in projectile velocity when heavier bullets are used. This approach was used in the product improvements in the M16A2 rifle when M855 ammunition was developed and fielded.

The key to obtaining better accuracy, range, and terminal bullet performance with small bore weapons is to strike the right balance of bullet weight, bullet speed, bullet shape, and rate of rifling twist. Therefore, before considering which rifle design is best for military use, the desired caliber and ballistics must be identified.

Projectiles generate target damage with energy. Terminal projectile energy is generated from a combination of speed and projectile weight. A feather that leaves the firing line at 10,000 feet per second does not have enough mass to retain its energy and may travel only a few feet. If it strikes a target, it is unlikely to do any damage. Conversely, if a two-pound stone is tossed at a speed of only five feet per second, it is also not likely to do any serious damage. But if that same stone is thrust at a target at 3,000 feet per second, it is likely to do tremendous damage and will retain a significant amount of energy for long distances.

If tactical and logistical reasons dictate that the 5.56mm NATO round continue as the small arms chambering, that may be a wise decision, but I believe the round can still stand some ballistic improvement. For purposes of this article, the assumption is that the 5.56mm NATO will continue to be the caliber of any new combat rifle.

In its original configuration, the M193 5.56mm NATO cartridge relied on pushing a light bullet (55 grains) at high speed (3,250 feet per second). This principle worked fine at close ranges (under 200 meters), but at longer ranges it left much room for improvement. The 55-grain full metal jacket boat tail (FMJBT) military bullet was too light to retain its energy at long range, and it was not accurate enough when used in the M16A1 with a rifling rate of twist of 1:12 (one revolution in 12 inches of travel).

The M855 5.56mm cartridge is an improvement, but it is still not the ideal projectile weight for the .224 bore weapon. This cartridge weighs only seven grains more than its predecessor

yet yields noticeable improvements for ballistics and accuracy when used in the proper barrels. I believe my tests indicated that when used in barrels with either a 1:7 twist (like the M16A2) or a 1:9 twist (like many other military rifles), the ideal bullet weight for this caliber was 68 or 69 grains.

The 68-grain bullet that I used for the tests greatly improved the rifle's accuracy. It provided vastly improved wind-bucking characteristics and improved the level of terminal energy expended on targets at all ranges. The proper selection of bullet shape also has a strong positive influence on down range speed and energy retention. Thus, a bullet with a high ballistic coefficient moves through the air more efficiently, thereby reducing the rate of loss for both speed and energy. Generally, FMJBT bullets have a high ballistic coefficient.

Another major factor that must be considered for any .22 caliber military rifle is the speed at which the projectile is driven. Frequently, the best accuracy will be obtained when the cartridge travels at moderate speeds. Like a toy top, a bullet spinning at low speed gains some stability but may still wobble. As the speed increases, it becomes more stable until at some point the increasing speed provides less stability (based on the bullet's size, weight, and shape). In the case of the 5.56mm NATO cartridge, my tests with heavy bullets indicated clearly defined parameters for projectile stability at around 2,800 to 2,900 feet per second.

Finally, we should look at the rate of twist for the rifling in the barrels. After testing several 5.56mm chambered weapons, each with a different rate of twist, I found the absolute best for the 5.56mm NATO round was 1:9. This twist stabilized all bullet weights better than either the 1:7, the 1:10, or the 1:12.

Additionally, the 1:9 twist provided the best accuracy with the older M193 55-grain ammunition. This can eliminate the logistical problems we now have with greatly reduced performance when the M193 ammunition is used in the M16A2 or the M855 ammunition in the M16A1.

Specifying a 1:9 rifling twist would be a no-cost option if done through new weapon procurement. For such a minor specification, it would be foolish not to use the twist that is best suited to the bore size of the projectile. Barrels with 1:9 rifling will provide longer barrel life, thus extending their serviceable periods and saving money.

Through careful selection of ammunition and rifling specifications, we can obtain less than minute of angle (MOA) groups from combat rifles at 100 meters, thus making the 5.56mm a true long range round. (My tests with the M16A2 and the tested bull pup rifle yielded one-half inch groups and three-eighths inch groups respectively.) These are commonsense modifications that will improve our soldiers' ability to use their weapons more effectively in any environment.

ERGONOMIC WEAPONS

With the present small arms technology, and without developing efficient caseless ammunition, the greatest innovation that has occurred is the development of ergonomic weapons. One of these weapons, the ergonomic rifle, is commonly known as a bull pup.

Currently, several bull pup rifles are in use throughout the world, and most designs appear to be coming from Europe.

The British Army has adopted one, as have the Austrian, Australian, and New Zealand armies. Even the United States Customs Service has fielded more than 1,800 bull pup rifles in the past three years and it reports great success with them.

Although these rifles differ in design detail, they share some basic characteristics. For instance, they have synthetic material stocks that provide great strength with little weight, and the stocks are hollow to allow such working mechanisms as the hammer and trigger groups to be placed in space that is unusable on conventional rifles. Usually, the detachable magazine and working mechanisms (like bolts and hammer mechanisms) are located inside the butt of the weapon—well behind the trigger.

Some bull pups have a modular design that permits rapid interchangeability of such components as barrels, optics, and operating groups. Quality bull pups are designed to improve the performance of conventional rifles, but in a much more compact and durable package. Most important, they are well-thought-out designs that fit the human body better than conventional weapons.

Because I was testing at my own expense, I tested only two versions of one bull pup rifle design, which I will refer to as the generic bull pup (GBP). They were tested as they came out of the box, without any modifications.

The GBP I tested offered many innovations that are valuable for military use. It had a 20-inch barrel with a 1:9 twist, was shorter than M16 rifles, and featured interchangeability of all its major components through a modular design. It was extremely accurate and durable and could be reconfigured rapidly for any conceivable military small arms mission.

The barrel options included 14-, 16-, and 20-inch barrels and a 24-inch bipod heavy barrel (BHB) for the light machinegun configuration. Equipped with a 20-inch barrel, the GBP was 31 inches long, as opposed to the M16A2, which is 39.62 inches long. (I tested all but the 14-inch barrel.)

I found that the rifle's ergonomic design placed all safety and firing controls in locations that simplified their operation for any shooter and were in positions that a firer could reach naturally with either hand. It was a truly ambidextrous rifle. (For left-handed shooters, the bolt and ejection port can be reversed so that expended brass will be ejected from the left side of the rifle, thus eliminating any need for brass deflectors.)

The standard bull pup rifle is equipped with a 1.5-power optical sight with a combat loop reticle mounted in the carrying handle. For specialized use, a GBP equipped with a special receiver can accept night observation devices, sniper optics, or any STANAG mount sighting equipment. The system will retain its zero when removed and reinstalled, which means that one rifle can have several pre-zeroed sighting

systems instantly available. All components, except for the optics, are interchangeable between the various models.

The GBP has an enlarged trigger guard that permits a shooter to fire the weapon while wearing arctic mittens. (The entire hand is placed inside the trigger guard for firing.) Stocks are available in any camouflage including olive drab, black, white, and tan. All weapon configurations (except for the 14-inch barrel) have a retractable vertical front pistol grip for the nonfiring hand. This grip provides an exceptionally steady firing position for semiautomatic fire and tremendous control for automatic fire. The GBP does not have a selector switch, being equipped with an ambidextrous two-stage trigger and a positive cross bolt safety.

When firing in the semiautomatic mode, therefore, the shooter operates the trigger as he would on any semiautomatic weapon. When he wants full automatic fire, he pulls the trigger back to the second stage and the weapon will fire at a cyclic rate of about 700 rounds per minute. The hammer pack can be changed to provide a three-round burst capability.

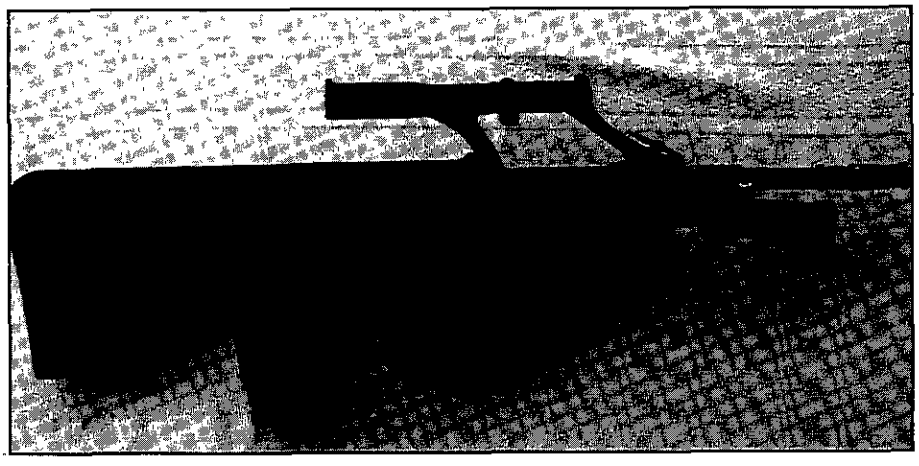
Within 20 seconds, the weapon can be disassembled into six modular groups (stock, barrel, receiver, bolt carrier group, hammer group, and magazine). When disassembled, all operating systems are easy to reach for inspection and maintenance, including all locking lugs. The locking lugs, unlike those on the M16, are fully exposed and easy to clean.

Aside from maintenance, the modular system offers a tremendous tactical advantage for an infantryman. If any weapon is damaged, by battle or accident, it can be restored to operational status in seconds by using spare modules or by cannibalizing another weapon in a squad. Barrels can be changed in about the same time it takes to change an M60 machinegun barrel and without heat protection.

The GBP design allows an M203 to remain in operation even when it is not actually mounted on a rifle. Since the M203 is mounted to a detachable barrel (by using a snap-on plastic butt plate on the rifle barrel chamber), the grenade launcher is not dependent on the basic rifle. The two can be used together as we now use the M16/M203 combination, or they can be used separately the way the M79 was used in the past.

This weapon offers distinct advantages over conventional military rifles because it can be configured to fit any special mission. Tank crewmen may want their GBPs equipped with the 14-inch barrel, while mechanized and airmobile infantrymen may want them equipped with the 16-inch barrel to permit more freedom of movement inside armored personnel carriers and helicopters. Light and airborne infantrymen could be equipped with the 20-inch barrel. For special operations units that need other capabilities, the GBP can be converted within seconds to a 9mm NATO configuration by changing the bolt and barrel. None of the reconfigurations require tools or armorers.

No matter how well designed a rifle may be, it is worthless if it cannot reliably deliver a lethal round to any target within its ballistic range. I conducted extensive live fire tests with the GBP in two configurations — the standard sighted rifle with a 16-inch barrel and a special receiver rifle with a 3.5x10.5 power sniper scope and 20- and 24-inch barrels. Both rifles were



Standard bull pup rifle with 16-inch barrel.

Standard bull pup disassembled into six major groups: Stock group, hammer/trigger pack, bolt group, barrel group, receiver group, and magazine.

amazingly accurate. (All GBP barrels have a 1:9 rifling twist except for the 24-inch bipod heavy barrel, which has a 1:7 twist like the M16A2.)

Throughout my tests, all of the ammunition (2,000 rounds) functioned flawlessly, but the 68-grain match bullet and M855 ammunition produced the best accuracy.

I found the GBP superbly reliable and accurate. This particular rifle is so well designed that I was hard-pressed to find anything to criticize. The tested weapons performed flawlessly with live ammunition. Any soldier armed with a bull pup rifle that incorporated the tested design features would certainly have a significant edge on the battlefield. The weapon did have some difficulty feeding and ejecting blank ammunition, but this is a minor problem that can easily be corrected with slight modifications to the blank adapter.

For many years, the United States had an aversion to using weapons that were designed overseas. In recent years, that attitude has changed. Currently, our military uses an Italian designed pistol (the M9) and a Belgian designed squad automatic weapon (M249). But the United States Government has wisely insisted that these weapons be produced in the United States under license of the original firm.

Perhaps we should continue that wisdom when we select a new battle rifle. If there is an ideal rifle already in production, we should use it — not reinvent it. This will result in a superb weapon for our troops and a tremendous saving in developmental costs for the taxpayer.

Major Rodney W. Joye has had assignments as a mechanized infantry platoon leader, a weapons platoon leader, and a battalion and brigade assistant operations officer in the 3d and 24th Infantry Divisions, and as a rifle company commander in the 30th Separate Infantry Brigade (Mechanized). He has served on the staff of the National Guard Bureau and is currently the Army National Guard Force Modernization Officer for First U.S. Army.

Javelin: A Leap Forward

CAPTAIN JOHN T. DAVIS

The Javelin, previously known as the Advanced Antitank Weapon System-Medium (AAWS-M), is being developed as a replacement for the aging and much maligned wire-guided M47 Dragon.

The Javelin is a strategically deployable, man-portable, medium antitank weapon system. It can be dropped by parachute from an aircraft, carried over short distances, and employed by one soldier. Javelin technology, which is effective under obscured battlefield conditions, also enables a soldier to kill any enemy tank at ranges out to 2,000 meters. The Javelin features an integrated day/night (thermal) capability and is effective in countermeasure environments.

Although the Javelin is not as light as we would like, at 49.5 pounds it compares favorably to a Dragon (73.2 pounds) that is similarly equipped (with a four-hour day/night capability).

The Javelin consists of only two components — a command launch unit (CLU) (which weighs 14.1 pounds with battery and carrying case) and a round of ammunition (which weighs 35.4 pounds). The Dragon, by contrast, consists of three components — a day tracker (8.6 pounds with carrying case), a night tracker (32.8 pounds with one battery, one coolant bottle, and carrying case), and a round of ammunition (28.8 pounds) with its limited countermeasure effectiveness.

Unlike the Dragon night tracker, the Javelin launch unit does not require coolant bottles to operate. The Javelin's expendables include one standard BA5590 lithium (SINCGARS) battery (2.5 pounds), which will function for four continuous hours. To operate for four hours in a limited visibility environment, the Dragon requires two nonstandard batteries at 1.5 pounds each and two coolant bottles at 1.5 pounds each.

The Javelin provides the soldier and his leaders with significantly more flexibility in both fire planning and employment. Thus, the launch unit can be attached to the missile for an antitank capability, or it can be used alone for day or night surveillance.

The survivability of the infantry antitank gunner has been significantly improved through the combination of greater standoff, the Javelin's fire-and-forget technology, reduced launch signature, and the ability to fire from enclosures.

With a standoff twice that of the Dragon, the Javelin enables a soldier to engage tanks effectively beyond the effective range of machineguns, thereby negating the weapon of choice for suppressing antitank fire. This advantage is further improved by the soldier's ability to engage targets from virtually any firing position.

The weapon's smart-missile technology releases the soldier from the requirement to track the target. With the Javelin, he needs only to identify