

IRON BRIGADE ARMORY LTD.
U.S. MILITARY AND LAW ENFORCEMENT EQUIPMENT

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23 September 2006

DARPA Equipment Test
Data Analysis

For over 20 years, Iron Brigade Armory has been an industry leader in conducting advanced research and development of Precision Sniper Rifles. This research and development has resulted in the constant evolution of the Iron Brigade Armory Precision Sniper Rifle technologies. Since their inception, Chandler Sniper Rifles have set the industry standard of excellence in all areas as precision, long range, tactical weapon systems. The weapons precision capabilities evolve by incorporating the findings of our meticulous research and development into actual end products. Iron Brigade Armory also applies the leading edge in modern ordnance technology, projectiles, powder, loading techniques. Iron Brigade Armory master gunsmiths and program managers consistently refine and update production processes and the use of advanced, new materials. These manufacturing processes result in the production of the most accurate and dependable weapon systems. The weapons precision is directly attributed to the IBA state of the art manufacturing techniques.

DARPA WEAPONS TESTED DURING CONTRACT

- DARPA XM-1 Rifle: 20" 1:12 Twist Fluted Barrel w/ Gemtech thread mount suppressor @ 5/8-24 thread, with thread protector.
- DARPA XM-2 Rifle: 20" 1:10 Twist Fluted Barrel w/ Surefire Quick Attach suppressor w/ internal flash hider.
- DARPA XM-3 Rifle: 18" 1:10 Twist Fluted Barrel w/ Surefire Quick Attach suppressor w/ internal flash hider.

DARPA XM-3 RIFLE SPECS



- Weapon - Darpa M40XM-3
- Barrel - 18" 1:10 Twist
- Weight -
 - Rifle with scope and UNS mount- 12lbs 7oz
 - Rifle with scope, UNS mount and Suppressor- 13lbs 10oz
 - Rifle with Scope, UNS mount, Suppressor and UNS- 15lbs 10oz
 - Rifle with all above, loaded with 5 rounds, bi-pod, Sling 17lbs 8oz
- Day scope - Nightforce NXS 3.5-15x50 Mil-Spec w/ Zero Stop
- Night Vision - OSTI Universal Night Sight AN/PVS-22
- Suppressor - Surefire FA762SS Quick Detach
- Length of weapon without suppressor - 38.250"
- Length of weapon with suppressor - 44"

<u>Weapon Component</u>	<u>Manufacturer</u>
• Receiver- M700, Clip-Slotted by IBA, Stainless Steel	Remington Arms
• Stock- McMillan A-6, 13" LOP	McMillan Stocks
• Barrel- 18" OAL, 416R Stainless Steel, Twist Rate 1:10"	Hart Rifle Barrels
• UNS Mount- BCM22H 6061 Aluminum, Anodized	IBA Inc.
• Trigger Guard- M4 Carbon Steel	Badger Ordnance
• Sling Swivels- One Piece, Permanently Installed	Wichita Arms
• Recoil Lug- Titanium @ 1.070" .313"	Badger Ordnance
• Scope mount- Titanium Picatinny Rail, 20 MOA, Lugged	IBA Inc.
• Scope Rings- .885 Ultra-lite, Aluminum / Titanium	Nightforce Inc.
• Fire Control- M700 Trigger Re-Built and Adjusted	Remington Arms
• Magazine- Internal W/ Modified Milled Follower	Remington Arms
• Bipod- BRM-S with Pod-Lock	Harris Engineering
• Sling- All Weather Sling, OD Green	Turner Saddlery

D-Kit

Bore guide, Cleaning Rod, .075" Allen wrench, T-15 wrench, T-30 take-down wrench, Seekonk Torque Wrench w/ ½" Socket & T-30 Adapters, Hardigg Storm Case Fitted

NOTE: The DARPA XM-3 Rifle with Suppressor and Night Vision weighs less than current issue USMC and USA sniper rifles that do NOT have Suppressors or Night Vision attached. See Weight Comparison Report at end.

1.2.1 TEST FIRE PLAN -TESTS AND RESULTS

Test Date: June 9-11, 2006

- Blackwater Training Center, 1200 Yard known distance (KD) Range
 - Initial Testing of Performance
 - DARPA XM-1 Rifle (20" Barrel w/ Gemtech Suppressor) Fired by Chris Roma
 - DARPA XM-2 Rifle (20" Barrel w/ SureFire Suppressor) Fired by Russ Overly
 - This initial test was performed during a Precision Rifle class being taught at Blackwater USA by Iron Brigade Armory.
- XM-1 Weapon system was built to use a Gemtech thread mounted suppressor. Until recent advancements by Iron Brigade Armory and Surefire, Inc., the thread mount suppressor was in fact the best method of suppressing a precision weapon system. This was due to the consistency by which a thread mount

suppressor could be installed and removed. It was found that the first and second shot were slightly off zero while the thread mount suppressor tightened under recoil and heat (Far tighter than human ability). Once the threads tightened completely the zero was consistent enough to make precision shots at long range. In a combat environment the installation and removal of the suppressor would ideally be done in the rear. Additionally, the impact shift of a thread mount suppressor varied by 3 MOA. Once again, this normally would not be a concern, as the weapon system would be zeroed in the rear. In the past, the above method was the best and most consistent.

- XM-2 Weapon system was built to use the new SureFire suppressor and attachment technology. The SureFire FA762 Sniper Suppressor is the most consistent and user-friendly piece of suppressor equipment available. It incorporates advanced lightweight materials, a fast attach/detach system. Additionally, the impact shift of the SureFire technology was minimal, approximately .5 MOA. This minimal impact shift would allow for the suppressor system to be attached or detached in the field without need to zero the weapon in the rear.

Test Date: July 15, 2006

- Blackwater Training Center, 800 Yard KD Range
- Testing of Accuracy at 100-800 yards
- DARPA XM-2 Rifle (20" Barrel w/ Surefire Suppressor) Fired by Russ Overly
- DARPA XM-3 Rifle (18" Barrel w/ Surefire Suppressor) Fired by Steve Reichert
- Targets were pulled, noted, scored and removed by Norm Chandler III

- Initial testing was to fire a total of 15 rounds (Five 3 shot groups) at each firing line with each of the following setups:
 - 18" Rifle without suppressor 20" Rifle without suppressor
 - 18" Rifle with suppressor 20" Rifle with suppressor

- Due to the day temperature and heat index, firing five three shot groups was not possible. DARPA was briefed and approved the modification to the test plan. We reduced the number of groups to 3 making the total fired rounds with each setup 9 vs. the originally planned 15. The heat mirage from the barrel and suppressor was a marked factor that reduced the overall accuracy. Interestingly enough, the overall accuracy was approximately 1 MOA. It has been Iron Brigade Armory's experience that an overall average such as the ones listed below, are generally 2-3 times greater than the weapons actual accuracy capability. That is due to the heat mirage causing distortion between the shooter and the target. The DARPA XM-3 weapon systems are capable of firing 1/3 MOA groups out to 800 yards with the SureFire suppressor attached. In combat conditions the volume of rounds fired in a short amount of time would be minimal. If in fact the volume were increased, the accuracy of the system would still be 1 MOA.

- Test conditions were clear and sunny; air temperature averaged 97 degrees with a heat index of 114. The wind was shifting at 5-7 MPH.

- The data was recorded with the cleaning of the barrels between each of the firing yard lines.

THE FOLLOWING DATA WAS RECORDED

XM-2 Shot by Steve Reichert		Group 1	Group 2	Group 3	Overall Average
100 Yards	unsuppressed	1.125"	1.125"	.875"	1.08"
	suppressed	.875"	.625"	1.0"	.83"
200 Yards	unsuppressed	1.875"	2.0"	1.375"	1.75"
	suppressed	2.0"	1.75"	2.75"	2.17"
300 Yards	unsuppressed	4.0"	3.125"	3.0"	3.38"
	suppressed	5.0"	2.5"	3.5"	3.67"
400 Yards	unsuppressed	1.5"	3.5"	2.25"	2.42"
	suppressed	1.75"	2.375"	3"	2.38"
500 Yards	unsuppressed	5.375"	4.5"	2.5"	4.13"
	suppressed	5.5"	6.375"	3.125"	5.0"
600 Yards	unsuppressed	9.375"	7.25"	8.375"	8.33"
	suppressed	3.25"	6.625"	8.75"	6.21"
700 Yards	unsuppressed	7.375"	5.75"	6.5"	6.54"
	suppressed	4.375"	6.5"	9.75"	6.88"
800 Yards	unsuppressed	8.25"	5.125"	10.750"	8.04"
	suppressed	10.625"	11.0"	12.25"	11.29"
Unsuppressed Avg.		1.02 AVG MOA	144	Total	Rounds
Suppressed Avg.		1.08 AVG MOA			

XM-3 Shot by Russ Overly		Group 1	Group 2	Group 3	Overall Average
100 Yards	unsuppressed	.875"	1.625"	.50"	1"
	suppressed	1.5"	.875"	.875"	1.08"
200 Yards	unsuppressed	2.0"	1.875"	2.625"	2.17"
	suppressed	2.375"	3.0"	3.0"	2.79"
300 Yards	unsuppressed	2.0"	3.625"	3.5"	3.04"
	suppressed	5.625"	3.875"	4.0"	4.58"
400 Yards	unsuppressed	2.25"	2.5"	2.25"	2.33"
	suppressed	2.875"	4.75"	3.0"	3.54"
500 Yards	unsuppressed	1.0"	3.75"	3.0"	2.58"
	suppressed	6.625"	4.75"	5.375"	5.58"
600 Yards	unsuppressed	4.5"	1.75"	6.75"	4.33"
	suppressed	5.625"	3.375"	3.5"	4.16"
700 Yards	unsuppressed	5.5"	9.375"	8.0"	7.63"
	suppressed	8.0"	9.25"	6.875"	8"
800 Yards	unsuppressed	3.875"	6.5"	6.75"	5.7"

	suppressed	9.0"	5.375"	9.625	8.0"
Unsuppressed Avg.	.80 AVG MOA		144	Total	Rounds
Suppressed Avg.	1.04 AVG MOA				

Test Date: July 26-27, 2006

- Cripple Creek Ranch, Texas
 - Chamber Pressure and Down Range Velocity
 - Darpa XM-2 Rifle with and without Surefire Suppressor
- This test was performed by a Ballistician Jimmy Sloan in the company of IBA Machinist Jack Field. The attachments (Oehler, Oehler001, Oehler002, and Oehler003) show the data with both Black Hills and Lake City .308/7.62MM ammo. Additionally, the testing was done with and without the suppressor attached.

Test Date: July 28, 2006

- Blackwater Training Center, 1200 Yard KD Range
 - Testing of Accuracy at 900-1200 Yards
 - DARPA XM-3 Rifle w/ Surefire Suppressor
- The purpose of this test was to determine the accuracy of the suppressed SWS beyond 800 yards. This was the first time Iron Brigade Armory had ever fired a suppressed 18" rifle beyond 800 yards. No other data has been obtained in the past from any other source with an 18" barrel. To confirm previous zero recorded at 800 yards the group in attached picture (Picture900YD) was fired. The results were 5 rounds under 5" fired by Steve Feinberg. That represents less than 2/3 MOA accuracy. We confirmed the come up of elevation to 900 yards was 8 MOA. Several groups were fired at 900 yards producing marginal groups, no images were recorded. The average group size was 11", which is approximately 1.2 MOA. At the 1000 yard line we confirmed the come up of elevation was 9 MOA and several groups were fired. The best group was 6 rounds under 7", see attached picture (Picture1000YD). Originally 5 rounds were fired. From the concrete bunker only 4 shots could be seen. One extra round was fired to confirm 5 rounds were on paper. When the target was pulled down 6 total shots were seen as in the picture. At the 1100 yard line the come up was confirmed at 8.25 MOA. Several groups were fired in full value wind conditions of 8-12 MPH. The best group was fired by Phil McCotter as seen in picture (Picture1100YD). This group was 12.7", which represents about 1.1 MOA accuracy. The group was enlarged by windage. The maximum group size, in regard to elevation, was less than 3.5", which is under 1/3 MOA. That proves the elevation was held ultra precisely. Windage is a condition that doesn't promise results but the elevation being held to a minimum helps by eliminating one of the variables. The come up to 1200 yards was confirmed at 10 MOA. No Sub MOA groups were recorded. While the projectile was entering the target somewhat stable the energy was minimal. The average group size was 17", which is about 1.4 MOA. This is considered the maximum effective range of the XM-3 SWS.

Test Date: July 29, 2006

- Blackwater Training Center, 800 Yard KD Range
 - Testing of Accuracy and Consistency (Day Zero vs. Night Zero)
 - DARPA XM-3 Rifle w/ Surefire Suppressor
- The daytime zero was confirmed at the 300, 600 and 800 yard lines during normal daytime hours. The weapon was then cleaned and allowed to cool for a night fire evaluation. Once dark, the 300 yard line zero was applied and two different shooters fired ten rounds. See attached pictures (NightImage1 and NightImage2). The white pasties represent a 1" square section for reference only. The same procedure was used at 600 yards and 800 yards with data book entry only. Group sizes for ten rounds at 600 yards averaged 7.2" between both shooters. Group sizes at 800 yards (Maximum Effective Range) averaged 12.15" between both shooters. This was the furthest we have tested accuracy at night with any SWS using the Universal Night Sight. No other Night Vision Unit has been found to test beyond 600 yards due to the inability to see the target.

DARPA SNIPER OBSERVATION EQUIPMENT SPECS

Several technologies were used in support of the DARPA XM-3

- LEICA 10X42 GEOVID LASER RANGE FINDER
- UNIVERSAL NIGHT SIGHT ANPVS-22
- LEUPOLD SPOTTING SCOPE WITH MILDOTS AND TRIPODS
- MIRAGE 1200 OPTIC DETECTOR

LEICA 10x42 GEOVID BRF BINOCULAR LASER RANGEFINDER



The Leica 10x42 Geovid BRF is ruggedly built and generously protected by rubber armor. Rigorous use is no problem for this battle proven laser rangefinder. For this evaluation the Leica 10x42 is considered the best available.

Features of Leica 10x42 Geovid Binocular Range Finder

- High optical performance in low-light
- Leica HDCTM-coating
- Aluminum housing
- Soft-touch rubber armor
- Watertight to a depth of 5m or 16.4 feet.

- Perfectly balanced for fatigue-free viewing
- Separate diopter setting for LRF and binocular
- Removable eyecups with two click stops

Specifications for Leica 10x42 Geovid BRF

Exit pupil:	4.2mm
Twilight factor:	20.49
Field of view at 1000 yds.:	331' (110 m at 1000 m)
Objective angle of view:	6.3°
Close focusing distance approx. :	5.6m
Diopter compensation:	± 3.5 dpt
Range:	10 yds to approx. 1,300 yds (50 ft to approx. 3,936 ft)
Distance measurement Accuracy:	± 1 m/yds up to 350 m/380 yds ± 2 m/yds up to 700 m/763 yds ± 0,5 % beyond 700 m/763 yds
Distance measurement Readouts:	4-digit LED display
Adjustable interpupillary distance:	56-74mm
Focusing:	Internal focusing via central focusing drive
Prism system:	Roof prism with phase correction layer
Watertightness:	Watertight to a depth of 5m/16.5 ft
Housing:	Die-cast aluminum, nitrogen-filled
Dimensions (W x H x D):	approx. 120 x174 x 65mm / 4.7x6.9x2.6 in
Weight:	approx. 900 g / 32 oz incl. batteries
Laser:	Eye-safe invisible laser according to EN and FDA class 1
Laser beam divergence:	2.5 x 0.5 mrad
Measuring time max.:	Approx. 1.4 s
Measuring mode:	Scanning mode
Battery lifetime:	Approx. 500 measurements at 20 °C (68 °F)

ANPVS-22 UNIVERSAL NIGHT SIGHT



Optimized for Medium-Range Sniper Weapons, Assault Rifles & Machine Guns Including the MK11, M16, M240 & 300 WinMag. Effective on All Weapons From Carbines to Barrett .50 Caliber Sniper Rifles

Designed, developed and prototyped by Optical Systems Technology, Inc., the Universal Night Sight™ (UNS™) incorporates Optical Systems Technology's *proprietary and patented* technology to maintain *permanent boresight retention* for the life of the unit. The UNS™ is much smaller and lighter than units of similar performance.

Detailed Specifications:

Length: 7.08 in
Max. Height Above Rail: 2.95 in
Weight: 32.2 oz (<2.1 lbs)
Controls: ON/OFF/GAIN, Focus
Batteries: 2 AA
Battery Life: >60 hrs @ 25°C
Weapon Interface: MIL-STD 1913
Submersible: 66 ft for 2 hrs

LEUPOLD TACTICAL SPOTTING SCOPE



Actual Magnification	12.7x – 38.1x
Linear Field of View	16.8 – 5.2 Feet @ 100 Yards
Angular Field of View	3.2 – 1.0
Weight	37.0 Ounces
Length	12.4 Inches
Objective Aperature	60 MM
Twilight Factor	26.8 – 48.9
Exit Pupil	4.8 – 1.5 MM
Eye Relief	30.0 MM
Interpupillary Distance	N/A
Close Focus Distance	36.0 Feet

DISCUSSION OF:

- **NIGHT VISION TECHNOLOGY**
- **RIFLE TECHNOLOGY**
- **SUPPRESSOR TECHNOLOGY**
- **DAY SCOPE TECHNOLOGY**

- **SPOTTING SCOPE TECHNOLOGY**
- **RANGEFINDING TECHNOLOGY**
- **COUNTER SNIPER TECHNOLOGY**

NIGHT VISION

The world has been held hostage with less than acceptable Night Vision since the Viet Nam war. A large device was attached to a weapon and the Armed Forces attempted to adjust their sights accurately enough to hit a man at 100 yards. Peacetime after Vietnam didn't bring much forward motion. Despite better night vision, poor accuracy continued.

UNIVERSAL NIGHT SIGHT (ANPVS-22)

- A DARPA funded project circa 1999-2000 was conducted to improve the situation and in less than 3 years a DARPA Program Manager working in conjunction with OSTI solved the problem and brought the UNS to the attention of the U.S. military. The UNS [ANPVS-22] is an in-line night sight that attaches to the rifle in front of the day scope. While using the same sight setting with the day scope, the night unit casts enough light through the objective to allow target acquisition on a no moon night out to 600 yards and 800 yards when there is some ambient light or more moon illumination.
- During our testing, we were able to shoot as far out as 800 yards. This was on a night with some ambient light; that of a star lit sky or the first bit of a quarter moon. The day scope options of "powering down" (3.5 - 5 X [Power]) allowed more light to be transmitted through the objective. This provided a clear sight picture, contrary to the grainy view offered by previous devices. The Nightforce scope also has a lighted reticle as a standard feature, which makes shooting at night almost facile. Other night illumination units are over priced and have a high profile when mounted on the weapon. The UNS has a low, in-line profile that makes it easier to maneuver especially in a heavy built-up area. To test this concept we conducted night operations in Blackwater's Urban City and found conclusive results. The weight of the UNS is equivalent to other night vision units, however it is more compact; and due to its location on the rifle, makes the weapon feel more balanced, hence lighter. There is no other inline sight currently available that equals the capability of the UNS.

RIFLE TECHNOLOGY

For over 20 years it has been thought and taught that for premium long-range accuracy a longer barreled heavy gun is better. We have found through testing on the range that this is not always the truth, there are several factors that determine barrel length requirements for premium long-range accuracy. The following is what we have determined to be a baseline for what we think works best for Military Combat use.

BARREL TWIST

- An 18 or 20" Barrel with 1 complete twist in 10 inches, or 1:10.
- Due to the powder burn rate and the ability to guarantee internal barrel dimensions the velocity necessary to accurately fire long range can be obtained

with a shorter barrel. The projectiles used today are also superior to those of the past which also helps increase range and accuracy. With the 175 Grain Sierra BTHP we were able to shoot beyond 1000 yards with Sub MOA accuracy in all temperature ranges.

WEAPON SIZE AND WEIGHT

- The overall size and weight of a field grade SWS (Sniper Weapon System) is important for the end users' ability to accomplish the mission. While heavy is sometimes good, and lighter is not always ideal, there certainly is a 'happy medium'. A rifle that weighs close to 20 Pounds without Night Vision or suppressed capability provides no benefit for the operator. It is acceptable on a prepared training site firing line where the rifle can be carted up to the FFP (Final Firing Position). In the field, that luxury is never the case. The attempt by Iron Brigade Armory to develop the current state of the art SWS produced a system that weighs less than currently issued weapons even with the addition of Night Vision and a Suppressed fire capability.

USE OF LIGHT WEIGHT MATERIALS

- Weapons weight has been a concern of the warrior for decades. The more new technology we introduce — the more gear we feel is needed to do the mission, hence more weight. An objective of this baseline study was to enhance capability and reduce weight—with the goal being a 50% weight reduction. In order to start down the weight reduction road light weight weapons grade materials had to be used. Titanium is known for its strength yet it is only 60% of the weight of an equal mass of steel. We used titanium for the recoil lug, the scope mount and the scope rings. Titanium can be finished to a smooth surface and can be colored with epoxy bake on paint that gives it a subdued, non-reflective look and while adding additional durability to an already durable metal.
- We used a known epoxy paint on both the titanium and steel parts that delivers resistance of up to 500 hours of salt-water exposure. We did not use aluminum due to surface corrosion when exposed to harsh weather conditions, especially salt water. Titanium has no known corrosive problems in any environment. For this test we also used as much stainless steel as possible, while not lighter weight, it has superior corrosion resistance when compared to carbon steel. Coupled with the epoxy bake-on paint, we were able to achieve a very durable weapon with no evident problems during our testing and field trials.

MCMILLAN A1-3 FIBERGLASS STOCK

- At the request of Iron Brigade Armory a new stock was developed by McMillan for use with the UNS (Universal Night Sight). The original USMC M40 A1 stock was ideal, however, the front portion was too narrow to allow installation of the UNS Mount also designed for this SWS. The current USMC issue M40A3 stock (McMillan A4) is too heavy and cumbersome and was not considered an option for this baseline study.

COLLATERAL EQUIPMENT

- Operator maintenance has been an ongoing debate in the Sniper world for 3 decades. The Army does it one-way—the Marines another. Iron Brigade's approach to weapon maintenance dictates the following: snipers should be

taught to adequately maintain the weapon system without having to evacuate the weapon from the field to a higher level echelon of maintenance. The two DARPA XM rifles built were provided with the cleaning gear and tools required for user maintenance and repair. [See weapons spec sheet for details]. These weapons were built to withstand massive close-range IED blasts and extended field conditions. They are designed to be used and maintained with a minimum of care yet still function as a fully capable weapons system. While the current war in Iraq and Afghanistan is focused on desert sand and heat, the DARPA weapon systems will also be operational at 25 degrees below zero due to design and maintenance capabilities offered the user through the toolkit provided. The Sniper assigned the DARPA XM-3 rifle was preparing for a deployment to Iraq and was fully trained to maintain and repair his weapon in 2 days.

SUPPRESSOR TECHNOLOGY

- Hollywood has ruined everyone's concept of what a suppressor/silencer really does. The black magic seemingly associated with choosing a suppressor is usually in the eye of the beholder. Marketing and free samples seem to encourage further use and sales. We sought to find out which brands do work and interestingly enough, some vendors just ignored us—even though we agreed to buy the unit[s]. We took that to mean that they wouldn't participate because they didn't want their product to be found lacking. Some vendors just didn't want to answer the phone. After an industry search we went with 2 vendors who were very pro-active and supportive, Surefire and Gemtech. Both of these companies have good potential for future sales due to their initiatives and apparent ability to produce quantities of suppressors upon request. Both companies have active R&D programs and modify and upgrade products as needed. Both are interested in customer feed back—no matter how disoriented or misguided it may be.
- Durability was excellent and both units tested were adequately quiet. We did not test with a DB meter—because we did not care how quiet they were because the tactical reason for using a suppressor is to mask the firing location and be tough enough to stand up to daily combat use for years. We believe the units tested are extremely durable if not indestructible short of intentional damage. Many suppressor companies with ads in various 'pulp-fiction' type magazines regularly announce how quiet their suppressor is over a competitor's model, we were UNIMPRESSED by the information offered. We doubt anyone in the writer's world has fired more than 20 shots through a 'gift' suppressor before conclusions were drawn. We shot our chosen suppressors out to 1200 yards and have fired 2000-2500 rounds through each suppressor—all with good accuracy. We were fortunate to be able to shoot in hot weather as it is the most difficult condition due to the extra heat from exposure to sunshine.
- The Gemtech suppressor is attached by use of a threaded barrel end and the Surefire suppressor must have an adaptor installed on the end of the barrel. In our tests we found the Surefire model was less susceptible to heat [due to design] generated by firing and the hot gases expelled at the muzzle, than the Gemtech model. This may be somewhat subjective due to the amount of testing time available for this base line study. The cost of the Surefire is about twice the cost of the Gemtech model but with the heavy mirage rising up from a hot suppressor making it difficult to aim the extra cost of a Surefire should not be an issue. As a consideration, snipers don't shoot long strings of shots so the issue of mirage and heat rising from the suppressor, may not be a key factor due to rate of fire, but the heat of the current operating environment with daily temperatures of 100 to 140 degrees Fahrenheit is an issue.

- Training conducted by the Marine Corps Warfighting Lab for the distributed operations platoon that deployed to Afghanistan provided combat after-action reports that validate that a suppressor does significantly reduce visual and audible signature, but the signature reduction is dependant on terrain and weather. Marines in the platoon operated with suppressors mounted on M-16's and were able to communicate verbally during operations. DARPA provided suppressors were also used in the MOUT facility at Blackwater and also demonstrated a clear edge over unsuppressed weapons in the urban and in room to room shooting, ear protection was not required and voice commands were clear and easy to understand.

DAY SCOPE TECHNOLOGY

- All Sniper rifles need superb rifle scopes. Fortunately, Naval Special Warfare has conducted extensive testing and evaluations since 2000. Using their findings, we were able to purchase a similar model for our test. Unofficial results from the SEALS matched what we found to be true with the scopes purchased for our evaluation. In summation, there is not much new with day scope technology EXCEPT to run the gauntlet and find a model that works despite the information both good and bad from the world of marketing and sales. By narrowing down to 'WHAT WORKS, the military is left with two very good options, Nightforce and Leupold, both U.S. companies. We used the Nightforce NXS 3.5-15 X 50 model for our work because this scope is a known commodity and functions well in the aforementioned battlefield conditions. This scope matches up with the requirements for use with the UNS/AN-PVS-22 night vision unit [SEE NIGHT VISION SECTION FOR MORE DETAILS]. We used the Mildot reticle versus a conglomeration of other choices that serve only to confuse the operator.
- Most tests we have seen and read about have been conducted with lesser equipment and with low quality shooters; sometimes in a cornfield with estimated ranges. We used professional shooters and chose our location to test at Blackwater USA's 1200-yard rifle range configured for military style shooting and evaluations. Of note is the fact that Lake City Army Ammunition Plant uses Blackwater for their testing for similar reasons. The details above are mentioned for background as we wanted to test the rifle and not equipment. All the attached components had to function in harmony with each other and the lynch pin for all of this is the day scope. Without a reliable aiming device, the best rifle could not hit the target, without a reliable day scope the night vision unit is worthless. We did not have these problems.

SPOTTING SCOPE TECHNOLOGY

- The Services are still attempting to use a 1949 vintage [WWII technology] M49 spotting scope and M15 stand for sniper team observation. These scopes are not air tight [no o-rings] and consistently fill with moisture after exposed to the elements. Current supplies of these antiques must be non-existent as many teams do not have working spotting scopes. However, if an industry search were conducted for a current up to date well built spotting scope you would find the model we chose to provide, which was a Leupold Tactical 12-40x60 with built in MILDOT reticle for emergency range finding. The stand we provided is of quality aluminum construction and used by many target shooters throughout the U.S. This combination met the immediate needs of the teams and provided us with a

quality rig to obtain baseline evaluations. Authors note: This baseline study has proved difficult yet very important. It was difficult because in many cases we couldn't find any 'issue' equipment actually in use to draw a conclusive baseline from. If we did find the equipment, it was degraded, not functioning at all, or missing due to a Table of Equipment (T&E) deficiency. [Examples: the current M49 spotting scopes we saw or didn't see, fit all three categories and the rifle scope for the Marines M40A3, the Unertl 10X, was in many cases so worn out and degraded that it was only useful as an observation device. DARPA funded 30 Nightforce rifle scopes to a handful of Marine Sniper teams so a baseline could be achieved. Future work with spotting scopes should entail studies and work with an integral laser for ranging and wind reading.

LEICA RANGEFINDER TECHNOLOGY

- History records the military's inability to achieve a man portable range finder [under 2 lbs-until now] as an initiative, necessary for ground warfare. Leica has been a leader in this particular area for the past 15 years. A DARPA baseline evaluation discovery was the unsung and not generally available LEICA GEOVID 10X42 BRF Binocular Rangefinder. While the Marine Corps was attempting to install a range finding Mildot reticle in the first focal plane of their experimental, foreign made scope the world sailed right past them with off the shelf purchases of the Geovid Binos. The US Army was first to order quantities of this item probably due to the fact that DoD wide there is a huge deficiency in basic binocular availability, and the Geovids accomplished both observation and range finding functions. [The troops regularly buy their own because of availability problems]
- The next step might be for a DARPA program manager to combine the ranging functions of the Leica into a spotting scope so a sniper team would have a similar ability but with a much higher-powered magnification.

MIRAGE 1200 COUNTER SNIPER TECHNOLOGY

- The concept of being able to see a lens looking back at the shooter/observer has been known for about 5 years. The Russians had/have a piece of gear known as SAMURAI with a reported range of 2000 meters. Four of these systems were lost in the late Chechnyan conflict and one of these units was reportedly captured in and around Fallujah, Iraq a year or so ago by U.S. forces. They didn't know what it was, but it eventually was passed along to those who could evaluate the system. Interestingly, a company in the U.S. was advertising that they had a similar technology called a MIRAGE. We included this in our baseline as the technology was known—just not widely used. The concept is intriguing in that this unit detects EVERYTHING [optically] looking back at you and will show you where the observer is by a pulsing dot of light. We have received one of these units to date and are still waiting on the second to be delivered—estimate 10-15 more days.
- We have delivered one unit and it is currently deployed in IRAQ. During the delivery phase the Marine who deployed with the unit was extensively drilled and instructed on the uses of the MIRAGE 1200. Various weapons related scopes, sights and optics devices were placed in front of the MIRAGE, day and night to test its ability to 'see' enemy. We used all available honeycomb like filters and the usual selection of cloth veils and shrouds with no combination of devices being able to deceive the Mirage. Later in the month, the Marines did another field test using well-hidden sniper teams at ranges from 100 to 1200

yards in all types of terrain. The MIRAGE was able to accurately locate all optical devices—100% of the time and at all ranges out to 1200 yards.

1.2.2 EQUIPMENT TEST PLAN

IBA developed a test plan for U.S. Military unit(s) to evaluate the technologies associated with this DARPA program. As of October 2006 no Department of Defense units have been able to participate in the planned tests at facilities located in the United States but have been given instructions to report back via both classified and unclassified nets on who equipment is functioning in combat. It was anticipated the U.S. Military units would be available to participate in test activities, but it is understood that U.S. Military units are focused on activities in Iraq and Afghanistan and will not be available to participate in the near term for the data collection.

As of October 2006, there are ongoing field tests being conducted in Iraq with the DARPA rifle technology and support equipment-Leica 10X42 GEOVID LASER RANGE FINDER, LEUPOLD SPOTTING SCOPE AND TRIPOD, MIRAGE 1200 OPTIC DETECTOR.

It is anticipated that U.S. Military units deployed to Iraq and Afghanistan with the DARPA rifle technology and support technology will provide after action reports on the effective use of the equipment. It is anticipated this data will be provided directly to DARPA.

TASK 3. State of the Art Rifle Build, Test and Delivery

IBA has designed, built and delivered to DARPA two state of the art sniper weapon systems in .308 caliber. Marine Corps Warfighting has signed for both systems and has currently deployed one system and has the second in an extended field evaluation at Weapons Training Battalion Quantico Va. The systems delivered include a day scope, a UNS night sight, a suppressor and all associated mounting hardware.

TASK 4. Test Data Analysis

IBA has compiled the shot placement Test Data. This consisted of 100-1,200 yard data. DARPA is managing the relationships with the U.S. Military units who will conduct additional data collection. It is anticipated this data collection will be conducted overseas and that all data collected will be provided to DARPA directly in the form of After Action Reports and Field Technology Analysis Reports.

The reports from U.S. Military Units will include data collection on the XM-3 and all support technologies.

TASK 5. Evaluation of the MIRAGE 1200

DARPA has provided the MIRAGE 1200 to a US Military Unit operating in Iraq. It is planned that the Military Unit will be providing After Action Reports directly to DARPA on its effectiveness on the battlefield. A second MIRAGE 1200 unit will be delivered to Special Operations Training Group Camp Pendleton Ca. for an extended field evaluation and deployment.

The MIRAGE 1200 has performed well. It can identify optics hidden on the test range, and has done so 100% of the time. There were no circumstances that the MIRAGE 1200 was unable to find ANY both U.S. and foreign made optic that was aimed in its

general direction within its operational range of 1200 yards. This includes all attempts to mask fielded optics with shades, skirts, material, veils etc. It is anticipated the use of the MIRAGE 1200 in Iraq will provide sufficient battlefield data for an appropriate analysis by DARPA and drive further technologies in that area. IBA is standing ready to assist DARPA in the evaluation of the yet to be compiled After Action Reports that will be generated from the current deployment of the MIRAGE 1200 based in Iraq.

From the AAR's that are attached the overall points are as follows:

- The UNS ANPVS-22 is the most effective Night Vision Unit that has ever been fielded. The UNS allowed a Marine to target and kill an Iraqi sniper at 700 yards.
- The UNS should be standard issue for Designated Marksman Rifles and Sniper Observer Rifles.
- The UNS should be standard issue for all Sniper Weapon Systems
- Integrating any of the below would make Sniper/DM employment easier:
 - Night Vision Sight
 - Day Sight

 - Or

 - Night Vision Sight
 - Day Sight
 - Laser Rangefinder
 - Wind Reading Device (Laser)

 - Or

 - Spotting Scope
 - Laser Rangefinder
 - Wind Reading Device (Laser)
- Suppressor Technology helps the individual troop as well as the overall team effectiveness. During an encounter with insurgents along the Syrian border use of suppressors were credited with saving the lives of the Marines that were engaged in room to room fighting.
- Having a suppressor attached to each individual weapon system in a platoon allows: Reduced Signature (Noise and Flash) / Reduced Hearing Loss / Increased rate of well aimed fire vs. sporadic impact, due to felt recoil / Increased communication amongst team members

WEIGHT COMPARISON REPORT

Mark 11 Mod 0 as used by the Marine Corps



10.94 lbs. + Iron Sights
14 lbs. + Scope & Mount (3.05 lb.)
15.85 lbs. + Sound Suppressor (1.96 lb.)
16.85 lbs. + Bipod & Mount
18 lbs. + 20-Rds M118LR (1.16 lb.)
20lbs. + UNS night sight(2lbs.)

Darpa XM-2



10lbs 13oz
13lbs 0oz +Scope & mount (2lbs 3oz)
14lbs 3oz + Surefire FA762SS suppressor (1lb 3 oz)
15lbs 13oz +Bipod and Sling (1lbs 10oz)
16lbs 1oz + 5rounds of 175 grain Black Hills ammo (4oz)
18lbs 1oz + UNS night sight (2lbs)

Darpa XM-3



10lbs 4 oz
12lbs 7oz +Scope & rings (2lbs 3oz)
13lbs 10oz +Surefire FA762SS suppressor (1lbs 3oz)

15lbs 4oz +Bipod and Sling (11lbs 10oz)
15 lbs 8oz + 5rounds of 175 grain Black Hills ammo (4oz)
17 lbs 8oz +UNS night sight (2lbs)

M40A3 current issue to Marine Corps Snipers



Weight of rifle (w/ scope) 19 lbs
Weight of rifle w/ day-night scope 24lbs

M24 current issue to Army snipers



12.1lbs Rifle weight with Sling
13.85 lbs+ Day optic with rings (1.75lbs)
Source is the Remington operators manual