Ma Deuce!

The Browning M2 machinegun is still the undisputed heavyweight champ going into its second century of service.

By Gary Paul Johnston

When John Moses Browning sat down to design a new gun, he must have felt the earth tremble from the ideas racing through his mind. Beginning with single-shot "buffalo" rifles, Browning graduated to lever action repeaters, self-loading rifles, shotguns and pistols, and finally to machineguns.

Called simply The Apparatus, the first machinegun invented by the legendary gun designer was a belt-fed .45-70 operated by what JMB called a "gas hammer" and a sprocket feed system.

The Apparatus served as the proof-of-concept for a host of machineguns to come. The Browning Models 1895, 1914, 1916, 1917 and 1918 machineguns were all derived from that first design, made by both Colt and Marlin.

Nicknamed the "potato digger," the Models 1895 through 1914 retained the gas hammer, which rotated downward from the gas port and would dig up dirt when fired too close to the ground. However, in 1914 the operating system was changed to a long-stroke gas piston.

As we know, all machineguns are gas operated, but the way the gas is used dictates the terminology used to describe the more specific system of operation. In 1917, Browning abandoned the sprocket feed system and the long-stroke gas piston operation in favor of a system now called the Browning short-recoil system.

In the Browning short-recoil system, the barrel and bolt remain locked while recoil causes them to move rearward a short distance before the bolt is unlocked to then continue to the rear, leaving the barrel to return forward under its own spring. In a short-recoil system, the length traveled is shorter than the overall length of the cartridge.

(As an aside, Browning also designed shoulder arms using the long-recoil principle, but all his pistols were of short-recoil operation.)

Browning's second-most famous machinegun is his heavy water cooled Model of 1917 (and 1917A1) which was first used during World War I. A belt-fed machinegun, the 1917 feeds via an oscillating arm that travels in an angled track in the top of the bolt as the latter moves back and forth. In doing so, the arm moves spring loaded feed pawls back and forth to feed the belt into the gun.

The Model 1917 evolved into the air cooled Model 1919, a more portable, light machinegun,

Ma Deuce THEN

and both were used with either cloth or steel link ammunition belts during World War II and the Korean War. However, immediately following the Model 1917 came JMB's most famous machinegun of all time, the Ma Deuce.

M2 HB.50 BMG

To meet the need for an even heavier machinegun, Browning first designed a completely new .50 caliber cartridge. This is the famous .50 Browning Machine Gun (BMG) or 12.7x99mm in the metric world. This cartridge is the result of Browning simply scaling up the .30-'06 rifle cartridge.

The .50 BMG round fires a 650 to 700 gr. bullet at up to 3,000 fps. Bullet types include full-metal jacket (FMJ) or "ball," tracer (red tip), armor piercing (black tip), incendiary (blue tip), armor piercing incendiary (silver tip) and armor piercing incendiary tracer (silver/red tip).

Armor piercing .50 BMG bullets will penetrate hardened armor plate and about an inch of cold rolled steel. All of these rounds have an effective range of over 7,000 yards.

Just as JMB scaled up the .30-'06 cartridge to create the .50 BMG round, so too did the world's most prolific gun designer also scale up his Model 1917 and Model 1919 to handle the behemoth new round with the addition of an oil buffer. The resulting machinegun was officially dubbed the U.S. Browning .50 M2 Machine Gun, which was quickly shortened to M2 and then, by troops grateful for the fire-power, to Ma Deuce.

Produced in three variations, the first was the Model 1921 water-cooled weighing 121.5 lbs. This version was intended for sustained fire and is largely encountered on an anti-aircraft mount. As such, it was used during much of World War II.

The second version of Ma Deuce was the lightweight aircraft gun. An air-cooled model weighing only 64 lbs., the aircraft gun fires at the high rate of 1,200 rounds per minute (RPM) and was used on most U.S. war planes during World War II and Korea. The aircraft BMG is fired electrically.

The third version of Ma Deuce is also the most famous and long-lived. It is the .50 M2 Heavy Barrel Ground Gun. The .50 M2 HB is also air-cooled and fires at the rate of from 400 to 500 rpm. It is the .50 M2 HB gun which continues in service approaching a century of uninterrupted use, and for one reason— it works! Let's take a closer look at what makes Ma Deuce tick.

M2 Firing System

Unlike more modern machineguns, which use push-through links and fire from an open bolt, the M2 fires from a closed bolt and extracts the cartridges out of each link from the rear before feeding it. There's a lot going on inside the ole Deuce.

To load the M2, an ammunition belt can be pushed into the feed tray (usually on the left side) or laid on top of it after first opening and then closing the top cover. In the first case, the charging handle on the right side must be pulled and released twice to half-load and then full-load the first round into the chamber.

If the belt is placed all the way onto the feed tray with the top cover open, the charging handle will only have to be pulled and released once. In this way the feed pawls do not have to pull the round into position like when it is merely pushed into the feed tray. Thus, when the charging handle is pulled once, the extractor pulls the cartridge out of the link on the pull and forces it down in into the chamber as it is released. The pivoting action of the charging handle provides leverage to remove the round from the tightly fitting steel link.

Once out of the link, the rim of the cartridge case enters a long vertical T-slot which controls it until the next round pushes it down and out of the bottom of the gun after it has been fired. The empty links disintegrate from the belt and are ejected out the side of the gun where they fall to the ground.

When the barrel and bolt travel to the rear under recoil, they are soon unlocked from each other by a cam inside the receiver causing a locking lug to drop out of engagement with the barrel extension, allowing it and the barrel to return forward. The bolt continues all the way to the rear during which a pivoting lever on top is rotated to cock the firing pin (or striker). When the bolt is stopped against the buffer, it begins its return trip forward.

During its rearward trip, the bolt cams the rear end of the feed lever in the groove in the top of the bolt. This causes the front of the lever and the feed pawls to move to the left to pick up the next round to be fed. At the same time, the extractor pulls the next round to be chambered out of its link.

As the bolt goes forward, the extractor is cammed down to push the round down in the T-slot while the feed arm pulls the next linked round into position

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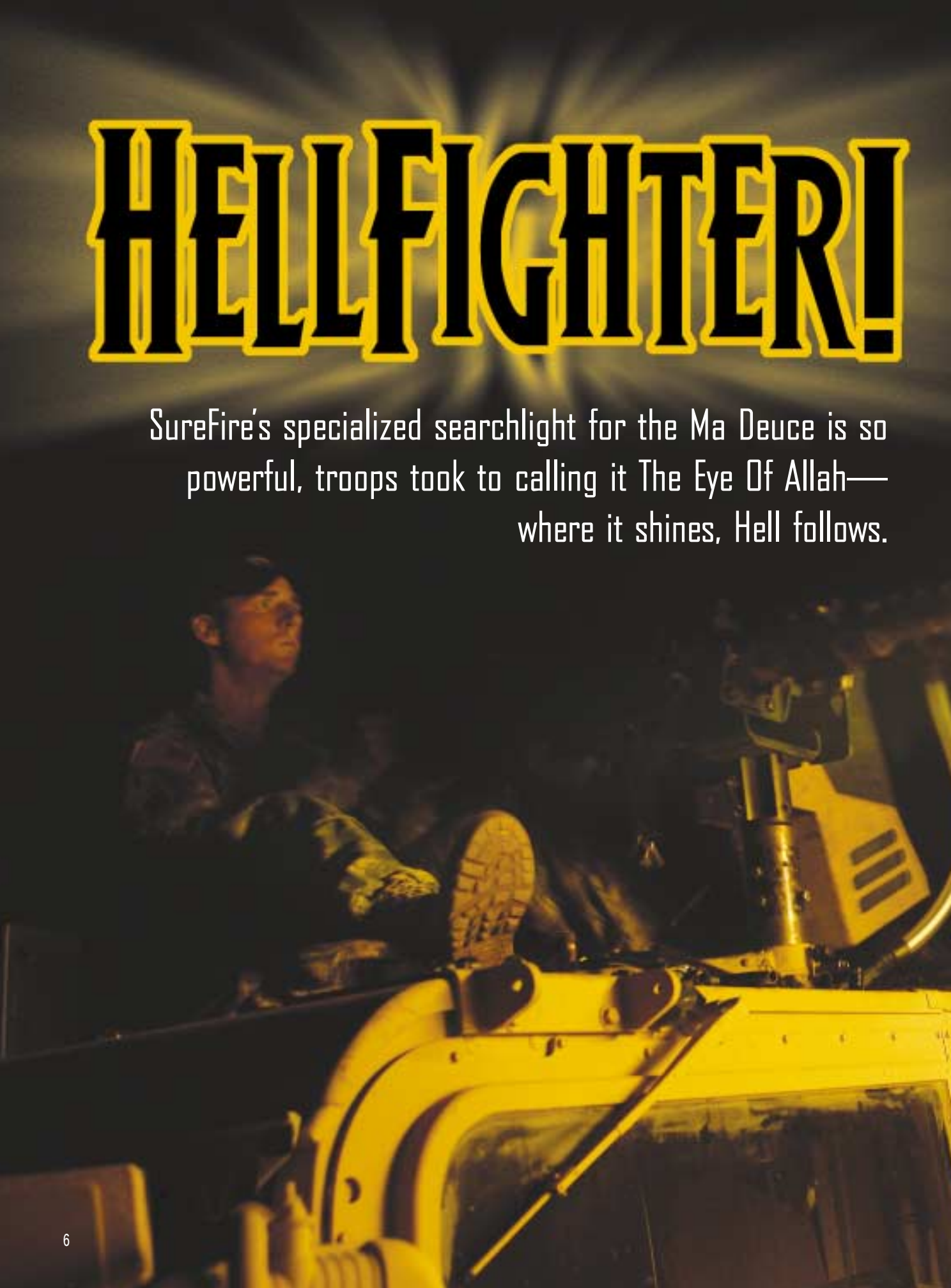
Ma Deuce has served in many roles, from anti-aircraft to naval, since it first entered service before World War II. Even today, the .50 Browning Machine Gun (BMG) is a fearsome weapon in alleys and warrens of war-torn cities. But the M2 can be "modernized" with such accessories as a SureFire HellFighter searchlight mounted on a special extension to protrude past the protective armor shields (see inset photos at right).

HELLFIGHTER!

SureFire's specialized searchlight for the Ma Deuce is so powerful, troops took to calling it The Eye Of Allah—where it shines, Hell follows.



By Sean Egen

Photos by Ichiro Nagata

The searing white light of HellFighter's 3,000+ lumen HID beam is nearly overpowered by the fireball from the Ma Deuce. Thanks to the HellFighter, troopers can quickly respond to nighttime ambushes, search for IEDs and identify friend from foe in the shadows of the night.

Good ideas have a tendency to give birth to more good ideas. Take SureFire's Beast®, a 2,300-lumen high intensity discharge (HID) light that, when introduced, was the most powerful battery-powered handheld illumination tool ever produced.

Good idea.

Then there was the day, back in 2004, when Paul Kim, SureFire's vice president of engineering, decided to take a Beast along to a meeting he had with some Special Forces guys at Ft. Campbell in Kentucky.

Another good idea.

The guys at Ft. Campbell were duly impressed by the Beast, especially by its beam— powerful and strong enough to reach out into the darkness yet with enough surround beam to accommodate their peripheral vision. A beam readymade for target illumination and patrol purposes. And then, an inspired suggestion: What if we mounted the Beast to the Ma Deuce?

Need Caption

Good idea number three.

What followed was a steady stream of good ideas from both SureFire and the Army, resulting in a series of prototypes and, ultimately, the SureFire HellFighter, a 3,000-lumen HID illuminator designed to mount on the M2 .50 caliber machinegun. It was an accessory the Ma Deuce had never before enjoyed, and a pairing that proved to be a natural fit.

"They [Ft. Campbell Special Forces] were thrilled to have a powerful light that could actually move with the gun," says Paul Kim. "It was just what they needed— a target illuminator with plenty of surround beam— and there was nothing out there even close to meeting that need. From the first prototype, I knew we had something good. There were minor changes and tweaks along the way, based on phenomenal feedback from the Army, but the basic design never varied too much from our original concept."

Some of those changes included optimizing the HellFighter's reflector for a bit more throw than the Beast's (without sacrificing its user-friendly surround beam), adding more gasketing and sealing to keep out condensation from the cool desert air, fortifying connector casings for increased strength and durability to endure brutal combat conditions, and finding ways to increase the light's thermal conductivity (to help dissipate heat), while cutting down on its overall size and weight.

Then there were the tweaks to deal with the M2's recoil— something

Kim couldn't fully appreciate until he actually got behind a Ma Deuce and fired off a few hundred rounds for himself.

"I couldn't believe the percussive wave coming back at me— literally through my body," he recounts. "It was unbelievable!"

This cacophonous recoil wasn't so much an issue for the HellFighter's shock-mounted high intensity discharge lamp, which has no filament to break. Unlike an incandescent lamp, which forces electrons through a thin tungsten filament to create light, an HID lamp generates light by superheating and ionizing gas, causing halide compounds to vaporize, which creates an intense, sustained plasma arc extremely efficient at emitting light.

But the Ma Deuce's recoil definitely presented challenges in mounting the HellFighter. Kim and his crew overcame these challenges by adding a urethane bumper to the HellFighter's mounting mechanism, which helps absorb recoil, and a sturdy stainless steel mounting lock for additional holding power and stability.

Powered by a 12-volt automotive battery or two standard 5590 military batteries (one, in an emergency), the HellFighter connects to either via a sturdy 10-foot cable featuring military 5590 connectors and a cigarette-lighter-style auto accessory plug.

HellFighter has a momentary/constant-on switch built into its hard-anodized aluminum-alloy body,

The HellFighter, like all SureFire WeaponLight systems, is a modular design with an array of interchangeable switches and cables. The master control switch for when HellFighter is mounted to a Ma Deuce (top) is a replacement for the "spade grip" with a switch ergonomically positioned for the operator to instantly access. The power cabling can either attach to a NATO slave jack, a cigarette lighter socket or a portable battery pack.

Below, the Hellfighter can be ordered with either a standard mount that does not extend past an armor shield or (in the Storm Case) with an extender mount along with the necessary cables.

A Ma Deuce stands ready for trying different mounting options in Tim LaFrance's engineering R&D shop at SureFire.

which is great for handheld use, but Kim intuitively knew (and operator feedback later confirmed) that a more ergonomic switching option was needed for powering the light while firing the weapon. So SureFire developed a proprietary grip design that actually replaces one of the M2's spade grip handles, allowing an operator to activate the light with one finger— without altering his grip or interfering with his ability to fire the weapon.

"I knew from the beginning that the switching needed to be integrated into the gun's grip," says Kim, a self-proclaimed obsessive/compulsive when it comes to design ergonomics. "We never want to alter the way operators use their gear with our designs. A tool has to work for you; you should never be working for the tool."

Blueprint To Battlefield

Today, the HellFighter is working hard in Afghanistan and Iraq, where it's being used as a target illuminator, for patrol purposes, and as a non-lethal escalation-of-force tool. That's right, it turns out that using a very powerful light designed to illuminate targets for a very powerful gun, in many cases, results in fewer shots being fired.

Apparently a searing, 3,000-lumen photonic blast to the eyes is quite effective in convincing an armed insurgent to lay down his weapon. A fact confirmed by Capt. Michael Taylor, who shared his personal experiences with the HellFighter in an e-mail to SureFire from Iraq:

"They [the 16 HellFighters his company use in Iraq] have been working great and serve as great escalation-of-force tools, among other things, allowing us to get our point across without firing any rounds."

But the HellFighter isn't just saving lives by keeping things from escalating to the point of rounds being fired. Its far-reaching beam (800+ yards, depending on conditions) cuts through the darkness and illuminates bad guys— oftentimes without them even knowing it, when used with its infrared filter and night-vision equipment.

This powerful illumination source enables fighting forces to efficiently identify and, when necessary, neutralize the enemy, helping preserve American lives. It also helps minimize civilian casualties and collateral damage, since operators now have enough light at their disposal to differentiate between threats and non-threats.

Beam Use

Because the HellFighter doesn't generate a narrow, cookie-cutter beam typical of many spotlights, operators are able to utilize its user-friendly surround beam to see more of what's going on around them— including what's in the roadway, where American forces in Iraq face one of their biggest dangers: improvised explosive devices (IEDs).

"The HellFighter is a good system, and, no BS, it has saved our asses more than once," wrote SSgt. Rob Numerick in an e-mail from Iraq. "We *never* roll without it mounted on the M2, and we always keep extra batteries in the truck… I have used this system dismounted, in a sniper position, and it has saved a few innocent civilians [who may not have been properly identified without the HellFighter] from being shot… The infrared filter has identified pressure switches [from IEDs] in the road from 100 meters away. When I say the HellFighter is a life-saver, I mean it!"

HellFighter testimonials don't just praise the light's effectiveness, either. In his e-mail, Capt. Taylor goes on to describe a catastrophic hit from an IED that obliterated a truck in his unit and sheared the vehicle-mounted M2 into two pieces. But the HellFighter mounted on the gun survived.

"After the explosion, we recovered the HellFighter, still attached to its mounting bracket, in one piece near the scene. When we got back to our FOB (forward observation battalion), we

attached a power cable from another HellFighter to see if the blown-up one would still work. To our amazement, it lit right up!"

The HellFighter comes standard with one filter—available in infrared, amber, or opaque— pivot mounted to the light's bezel. Infrared is the most popular choice for most units, as the ability to use night-vision equipment and illuminate targets without them even knowing it provides an incredible tactical advantage.

And, as SSgt. Numerick's words attest, being able to spot IEDs, without giving away your position with a visible light signature, truly can be "a lifesaver." The HellFighter's amber filter is useful in penetrating smoke or dust, two conditions prevalent in combat. Its opaque filter protects the HellFighter's window, and a unit's position, should the light ever be accidentally activated.

Initially used primarily by specialized units, as word of mouth of the HellFighter has spread, so too has its use, resulting in more and more inquiries about the light.

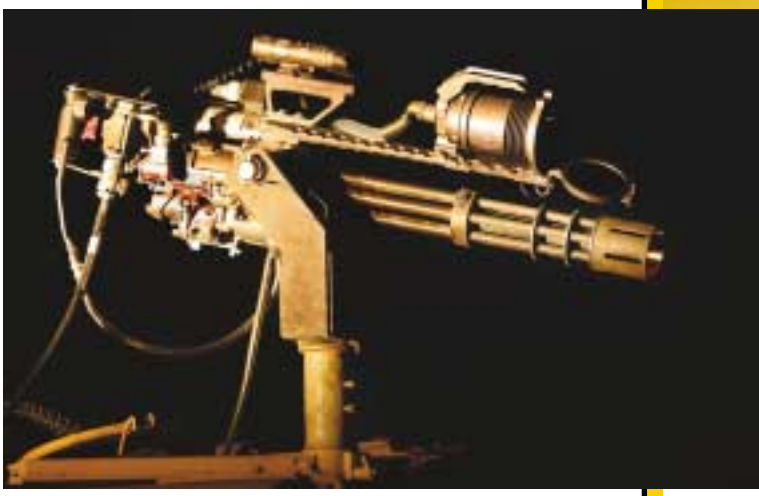
"Other units see our light and ask where they can get one," writes SSgt. Numerick, who obligingly lets them know where they can get one for themselves.

Growing Use

The number of HellFighters being used isn't the only thing growing; the way they're being used has also expanded, necessitating the development of different mounting options. The original mount for the HellFighter attached the light directly to the M2's heat shroud, a solid, reliable mounting configuration.

However, on a Ma Deuce equipped with a shield, the shield sits in front of the HellFighter, blocking its beam. (3,000 lumens is a powerful beam, but not powerful enough to penetrate a steel shield!) So

HellFighter on an aerial Mini Gun.



HellFighter also can fit on a Minigun.

SureFire developed a mount that attaches to the heat shroud but extends the light out past the shield, making the HellFighter easily mountable on shielded M2s.

Soon thereafter, Dillon Aero invited SureFire to develop a way to attach the HellFighter to their Minigun, and SureFire responded with a mount that extends the HellFighter out from the Minigun's receiver and out over its multiple barrels.

The HellFighter's latest mounting system, developed for the U.S. Coast Guard, slides and locks onto a pintle mount, enabling it to be used with the M240 machine gun on patrol boats. The system can be purchased as a complete kit that includes a cable assembly and even a watertight battery case to keep the batteries dry in a marine environment.

Additional mounting systems are sure to follow as the HellFighter becomes even more ubiquitous in military, law enforcement, and civilian applications. Yes, civilian applications. After all, if it can be mounted on a patrol boat, why not on a luxury yacht?

"The HellFighter continues to be a work in progress," says Kim, "and we'll continue to develop new ways to mount and improve it as its uses grow and we get more and more feedback from those using it in the field."

Given the HellFighter's growth so far, the steady stream of user feedback, and the realm of possibilities, it sounds like more good ideas relating to the HellFighter are definitely on their way.

SureFire engineers travelled to Ft. Campbell, Ky., to monitor a field test of the HellFighter during its developmental phase where able and willing soldiers "endured" the chore of firing belt after belt of .50 BMG in a test of the HellFighter's ability to soak up vibration and recoil.

to be extracted the next time the bolt goes to the rear.

Instead of the pistol grip and conventional trigger used on the 1917 and 1919 guns, the trigger on Ma Deuce consists of dual thumb pads, shaped like a pair of butterfly wings, hence the term butterfly trigger. These are depressed while both hands hold onto twin spade grips on the rear of the gun. As long as there is ammunition in the belt, the M2 will continue to fire with the triggers depressed, but short bursts are highly recommended.

At the rear of the M2 between the trigger paddles is a bolt latch, and on the rotating buffer tube sleeve that lies beneath it is a bolt latch lock. When the bolt latch is depressed and the buffer tube sleeve is rotated counterclockwise so that the lock holds the latch down, the M2 fires fully automatic.

However, by depressing the bolt latch and rotating the buffer tube clockwise to unlock the latch, the latch will hold the bolt to the rear each time it is fired, or retracted. In this case, depressing the bolt latch allows the bolt to go forward to chamber a round without firing it, which requires depressing one or both trigger paddles.

Thus alternately depressing the bolt latch and the triggers will fire the M2 one shot at a time, technically operating the M2 as a repeater. This mode works well when the M2 is used in a precision, sniping role.

Timing And Headspace

The timing and headspace of the M2 are critical adjustments best done with a combination gauge. Most important is the headspace adjustment, which must be done any time a new barrel is installed. This adjustment is made by hand-turning the barrel in or out of its extension.

In the field, this is done by screwing the barrel in until it stops against the closed bolt. Then pull back the bolt and release it and check to see if it goes completely into battery. If it does not, unscrew the barrel one click and try again, one notch at a time until the bolt closes with ease.

Raise the top cover, lift the extractor and pull the bolt slightly to the rear. If the bolt moves independently of the barrel extension it is too loose. Screw the barrel in one notch and repeat the test. With a dummy round or an empty case in the chamber there should be no move-

ment of the bolt independent of the barrel extension before unlocking takes place. In an emergency, screwing the barrel in all the way on a closed bolt and backing off two notches will usually suffice to run the gun.

Ma Deuce has very little felt recoil for one reason— its short-recoil operation. The gun alone weighs 84 lbs., and the barrel and bolt group weigh roughly 45 lbs. When the barrel and bolt group recoil within the stationary receiver, they soak up most of the felt recoil generated by the heavy .50 BMG slug.

Even when the bolt comes to a stop, it does so against an oil-cushioned buffer. In addition, the sharp return of the barrel and its extension to their forward position helps pull the gun back forward in the millisecond after firing. All this adds up to one of the most comfortable machine-guns to operate.

The M2 HB has been widely used as a ground gun on a tripod, in a variety of single and double mounts on tanks, vehicles, aircraft, boats, ships and buildings, and in an anti-aircraft quad mount holding four guns that are fired simultaneously. It has been fitted with a number of optical sight mounts and an endless array of optics including night vision scopes. It has even been equipped with special suppressors, which reduce the report to little more than that of a .22 Long Rifle cartridge. It has also been fitted with a specially designed SureFire WeaponLight nicknamed The Eye Of Allah (see accompanying sidebar).

In most situations the .50 BMG is reserved for hard targets. In one instance in Iraq some U.S. soldiers armed with M16 rifles were having difficulty killing a sniper who was firing at them from behind a pile of rocks. They then directed a .50 BMG to the target and a single round of AP went through the rock pile to kill the insurgent behind it, either by the bullet itself or with secondary projectiles from the breaking rocks. The big bullets reduce most stone masonry to rubble.

Although the Ma Deuce is an expensive gun to manufacture, it is very rugged and can be rebuilt many times, as evidenced by some of these guns that have been around since D-Day. What's more, the big fifty will likely remain in service for many years to come. There's just nothing to replace it.

THE GUN YOUR MA WARNED YOU AGAINST

Surely the Pentagon wouldn't be stupid enough to replace Ma Deuce with, of all things, a modified grenade launcher? Don't bet your big-bucks lobbyist against it.

Staff Report

Somehow X-ray Mike Three-Twelve just doesn't have the same ring as Ma Deuce, but if the Pentagon big spenders have their way, the XM312 will replace the legendary M2 machinegun. Despite its outstanding performance in the field, John Browning's beloved Ma Deuce has been upstaged by a high-tech wonder gun from General Dynamics.

The XM312 is reputed to be "lighter and more accurate" than the M2, but that might be because the chassis was originally built as a rapid-fire grenade launcher. General Dynamics had developed the XM307 grenade launcher, but the Pentagon brass wanted a .50 BMG, so the big defense contractor simply modified the XM307 to accept a machinegun barrel.

John Browning, on the other hand, designed the M2 specifically around the .50 BMG cartridge, tailoring everything from the 45 inch barrel to the weight of the receiver to match the cartridge.

The modern marvel weighs just 43 lbs., including tripod, much less than Ma Deuce's 128 lbs. with tripod. Its peak firing rate is only 260 rounds per minute, much less than the Browning's 600 rpm. The relatively slow rate of fire makes the new weapon ineffective against fast-moving ground or airborne targets.

Engineers at General Dynamics claim the XM312 has less recoil thanks to an open-bolt, out-of-battery firing mechanism. When firing, the gun barrel moves, not the bolt. Basically, the barrel and several other subsystems are being pushed forward by a powerful spring when the round fires. The General Dynamics propeller heads theorize that the recoil impulse must first overcome the inertia of these moving assemblies, then compress the spring, thus dissipating recoil. Good theory, but as they say in Missouri, show me.