THE DEADLIEST TRUCK YOU'LL EVER MEET

How an Air Force unit comprised of Ph.D. scientists, combat infantrymen and machinists invented a revolutionary IED-killing machine and then deployed to the deadliest corner of Afghanistan to test it

Abstract
This is the story of an AFRL team that worked tirelessly for three years on a secret program to defeat the threat posed by improvised explosive devices. An estimated two-thirds of all American casualties in Iraq and Afghanistan were caused by roadside bombs, according to the Department of Defense. By 2012, the team finally found the key to disabling IED's before they could detonate and kill or maim anyone: high-powered microwave technology. They called the weapon they built to harness this power MAX POWER, and it was an IED killing machine.

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How an Air Force unit comprised of Ph.D. scientists, combat infantrymen and machinists invented a revolutionary IED-killing machine and then deployed to the deadliest corner of Afghanistan to test it.

The first thing they noticed was the ground shaking.

Staff Sgt. Guill Marez stumbled out of the white 20-foot metal container on Camp Leatherneck and into the darkness of a fall evening in southern Afghanistan. A huge firefight was underway in the distance. He heard the sharp thunder of explosions and small arms fire. The horizon was erupting with detonations, lighting up the sky. He guessed it to be about two miles away, which was surprising because after each dull crack he could feel a prickly heat spread across his face and arms.

Something was burning. Something big.

Marez's boss, Maj. Jeff Heggemeier had come out too. Together the pair climbed a set of metal stairs to the second floor of the container village to get a better look. Thick smoke roiled across the sky. The base's warning sirens had begun to wail—long piercing howls that confirmed what they already suspected—they were under attack. From the roof, they saw the source of the heat they felt: exploding fuel depots that plumed into balls of orange and red, zippering along the flight line at the airfield.

It was mid-September 2012. Marez and Heggemeier had only been in Afghanistan for a week. Marez and Heggemeier had a specific mission here in Helmand Province. The goal was to save American lives by deploying an exciting new piece of technology. If it worked it might help shift the tide in the fight against the Taliban.

They were assigned to a trailer camp on the edge of Camp Leatherneck, a sprawling British and American base in the sparsely populated desert of Helmand Province, where intense combat operations were being conducted against the Taliban. Leatherneck was massive, nearly two miles wide in parts. Its multiple barracks and zones held U.S. Marine, Army and British forces, and aircraft that included Marine Corps AV-8B Harriers, British Apache helicopters and Marine SuperCobras. Adjacent to Leatherneck was Camp Bastion, a smaller base where the airfield was located. That was where the most intense fighting was now occurring.

As they watched the firefight unfold over the next two hours, the men girded themselves for what they knew was going to be the challenge of their lives. The sirens continued to howl. Apache attack helicopters rose into the airspace over the base, darting and circling over the airfield and along the eastern fence line. Instead of banking and departing the base for a mission elsewhere, the choppers fired directly down into the base itself. Marez, who had served two infantry tours of duty in Iraq, had seen this kind of thing before and knew what it meant: Taliban fighters had breached the base perimeter.

Here we go again, Marez thought. He began mentally preparing for the nerve-bending tension and stress that came from working in a combat zone.

But all of that would depend on making it through the rest of this day alive.

Beginnings

By the time Heggemeier and Marez arrived in Afghanistan they had already been working side by side for several years. Their offices weren't in Afghanistan, or any other combat zone, but in the bowels of a scientific laboratory in the deserts of New Mexico. They were part of the Directed Energy Directorate at the Air Force Research Lab at Kirtland Air Force Base.

Since 2009, the pair had been part of a program to help neutralize the threat of improvised explosive devices, or IEDs. The threat to U.S. Soldiers, Marines and Airmen posed by IEDs had been growing worse since the war in Iraq had begun in 2003. An estimated two-thirds of all American casualties in Iraq and Afghanistan were caused by roadside bombs, according to the Department of Defense. The numbers are stark: more than 3,100 dead and some 33,000 wounded, many of them maimed or suffering from traumatic brain injuries. In 2006, the Department of Defense formed the Joint Improvised Explosive Device Defeat Organization or JIEDDO (now known as Joint Improvised-Threat Defense Organization, or JIDO, as of 2016), to help devise solutions. But the menace posed by the bombs persisted, as insurgents in Iraq and Afghanistan devised more elaborate ways to construct, hide and detonate them.

Aided by several millions of dollars in research and development funding from the federal government, Heggemeier's team worked tirelessly for three years to hone in on a technology that could defeat the bombs. By 2012, they finally found the key to disabling IED's before they could detonate and kill or maim anyone: high-powered microwave technology.

They called the weapon they built to harness this power MAX POWER, and it was an IED killing machine.

MAX POWER looked like a monster truck creation presaging the movie *Mad Max: Fury Road*. It was imposing and physically clunky but the science behind it was elegant. Both quirky and revolutionary; MAX POWER melded high-end physics, mathematics, last minute DIY, or do-it-yourself, innovation and rote machine-shop craftsmanship into a semi-truck sized weapon that rolled on wheels and fired an invisible spectrum of microwave energy.

The weaponized portion of MAX POWER was a large antenna mounted on the cab of the biggest truck the Marines had, the U.S Marine LVSR, or Logistics Vehicle System Replacement, a 22-ton, 600-horsepower behemoth. It was protected in front by several large barrels of milk cartons. On the bed were two jet engines, including a rebuilt 1,500 horsepower Caterpillar and a Titan 230 horsepower auxiliary jet.

Unwieldy as the truck appeared at first glance, the powerful, invisible waves emanating from the antenna were lethal to IEDs. That was the idea, anyway. MAX POWER worked by directing an intense blast of microwave energy toward areas in the road or desert where IEDs had been buried. From a distance, this directed energy would essentially "cook" the rudimentary wires and switches that served as the bombs' detonators.

MAX POWER had been years in the making. The scientists had been forced to adapt continuously along the way, as the threat and deployment posture of U.S forces evolved.

Despite these challenges, the program moved forward. Combat was continuous and frequent, and U.S. Soldiers continued to die as a result. Senior defense officials from U.S. Central Command Commander Gen. James N. Mattis on down were eager to see some progress.

By 2012 Heggemeier got word: Prepare the weapon for deployment to Afghanistan.

Microwaves As Weapons

Devising new and creative ways to improve a Soldier's odds on the battlefield was what the scientists at the Air Force Research Laboratories did best. AFRL is divided into eight technical directorates, including Aerospace Systems, Directed Energy, Information, Munitions, Materials & Manufacturing, Sensors, Space Vehicles, and the 711th Human Performance Wing. The lab has some 10,000 military, civilian and contract personnel as well as facilities in eight states. And its contributions to science and weaponry include a "Sodium Guidestar" an artificial "star" that helps open up larger portions of the sky for adaptive optics, ground-based space imaging that uses a 3.5-meter telescope in New Mexico and a 3.6-meter telescope in Hawaii, and the Counter-electronics High-powered Advanced Missile Project.

Jeff Heggemeier, who joined the Air Force as a lieutenant in the National Guard, is one of the lab's innovators. Trim and fit, with black hair and a boyish face, he took on his new challenge with enthusiasm. On long trail runs in the New Mexico desert, he had already started thinking about the possibilities of directed energy, and tinkering with some early ideas. "We wanted to get it built as quickly as possible," he said, "to save people's lives."

While the potential applications of high-powered microwave technology were the subject of speculative discussions since the 1970s, their function in a military context was limited. In 2004, as the IED threat in Iraq grew more acute, Heggemeier and several other leading scientists began working on extended lab trials, testing microwave technology and radio waves. They were anecdotally familiar with the effects of phone signals and other electronic devices on explosives. Heggemeier remembered seeing signs outside blast sites that required CB radios to be turned off, lest they remotely detonate explosive devices. Was there a military application buried somewhere in there? A fellow Kirtland scientist named Kirk Hackett seized on the idea and urged his colleagues to pursue the concept for the IED threat.

"We exploited that [idea]," Heggemeier says.

There was only one problem: he didn't have the budget. He spent a couple of years requesting funds, but got nowhere. Then in 2007, as the IED threat in Iraq peaked, he went to JIEDDO with a proposal. It was the worst year for American casualties in Iraq, and the bulk of them were a result of roadside bombs. A sectarian civil war was spiraling out of control and U.S. forces were often caught in the middle. Iranian-made explosively formed penetrators (EFPs), which were armor-tipped directional IEDs that detonated on contact, were wreaking havoc on U.S. military units across the country. JIEDDO awarded Heggemeier a $20 million grant to help find a solution.

Building A Team

Heggemeier assembled his team. As the chief scientist, would do much of the big science thinking. He was accompanied by Marez, a machinist by training and combat veteran with two previous

combat deployments; two in Iraq, in 2004-5 and 2007-8, where he earned a Bronze Star and a Combat Infantry Badge.

Marez worked as a military contractor for 18 years and was part of a security mission in the 1990s patrolling the no-fly zone in Kuwait. He spent seven years with air defense and 13 with the infantry.

Then there were the "two Mikes." Capt. Mike Anderson was a technician with a background in ICBM maintenance who helped build and test MAX POWER and then deployed with it to Afghanistan. Capt. Mike Gifford was a Directed Energy Safety Specialist who helped ensure the system was safe for its handlers, as well as any civilians who might encounter it in theater. There were also a number of support staff that handled things like logistics, labor and construction. The project was overseen by Mary Lou Robinson, the deputy branch chief for the Air Force Research Lab's high power electro-magnetic research, a section that employed about 80 researchers developing a cadre of high-powered electromagnetic systems for military use.

The lab itself was not particularly high tech. There were two semi-permanent facilities, each with a dozen or so offices. They knocked down a wall to fashion a makeshift conference room, just big enough to cram the whole team of 10 or so inside. Next-door was a special "anechoic chamber" -- a completely sealed room with absorbent cones on the walls that soaked up energy and prevented electronic signals from escaping -- where they would integrate and test equipment as it was developed.

And down the road was the White Sands Missile Range, where the team would eventually find out how the technology held up under real life desert conditions.

You Don't Know Where The IED's Are Buried

The challenge the team had to address was simple enough: how to design and build a piece of weaponry that would neutralize the IED threat. They also wanted to build something that wouldn't lead to more loss of life; a non-lethal weapon that could neutralize the bombs would be an elegant solution.

From previous scientific work, they knew they could theoretically use microwaves to disrupt the IED detonation process because it relied on radio frequencies. But how, exactly? And on what scale? A growing number of researchers believed that microwave energy could permanently disable the bombs, and change the battlefield equation.

Heggemeier's task was to make that vision a reality in a live combat environment.

First, they needed a device that would convert a steady stream of electrical power into microwave energy. But what kind of microwave source would be most effective against IEDs? And what piece of equipment would best work as a delivery system? Research told them that some waves, such as MM waves, which were generated by gyrotrons, were better for human impact. But the penetration was ultra-thin, roughly the same thickness as three sheets of paper stacked together, not enough to be effective against buried IEDs.

Ultimately, they settled on magnetrons, which have deeper penetrating electromagnetic waves and are very efficient at turning electrical power into microwaves. The science behind a magnetron

is complex. When configured correctly with other pieces of technology, the waves created by the breadbox-shaped device can be made to interfere with radio frequency signals.

Getting it to work was called conditioning.

"It requires some massaging of that basic prime power," says Robinson," You have to time all the capacitors which provide power to magnetron, so that once they're firing that signal comes out constantly. It has to be input in a special way."

The team then turned to the question of how to deploy the weapon. They toyed briefly with the idea of an airborne device, but it quickly became apparent that to tackle the IED threat, they had to be on the ground, as close to the bombs as possible without actually stepping on them. They needed something on wheels.

Then there was the actual weapon, which in this case would be an antenna. It wasn't all that big, but it required a tremendous amount of energy to power.

"We needed a lot of power continuously because you don't know where the IEDs are buried," Robinson said, "You need to be able to fire the system constantly, because you don't want to miss one."

The only source powerful enough to provide the sustained energy to keep the antenna working full-time was a jet engine. The team looked at Rolls Royce and Kawasaki, but settled on a 1970s era Caterpillar. It was powerful, cheap and worked especially well in austere environments. When powered up, the engine let out a deafening whine, the same grinding blast you hear from one revving up on an airfield.

With these pieces in place, Heggemeier and his team set to work figuring out the puzzle.

They had eight rectangular gold-colored magnetrons with white ceramic strip that all fired at different rates. The team had to synchronize the wave streams into a unified beam of microwave energy that could then be pushed into the antenna, and made ready to fire.

"The peaks had to align," Heggemeier says, "Otherwise, you get nothing." It was a tricky physics problem, as well as thorny mechanical issue. The team had already tried to engineer the system using a technique called phase locking. This was a way of making sure that when the magnetrons fired, the peaks and troughs of the resulting waves matched as closely as possible.

They had been working for several weeks and thought they had solved the problem. But when Heggemeier fired up the magnetrons one morning, the waves failed to line up, even after phase locking. Troughs and peaks were intersecting all over the place. The signal was jumbled and weak.

"We turned on the transmitter and got zero power. Zero," said Heggemeier, "It worked exactly opposite to how it was supposed to work."

Four million dollars. Weeks of work. Nothing. "This was scary," Heggemeier says.

They spent the next two weeks working 18-hour days trying to fix the problem, but made little headway. One day, Heggemeier approached Marez. If they were going to get out of this problem, they needed to improvise.

In order for the waves to reach the antenna, they had to flow through a rectangular metal tube called a wave guide. Heggemeier mused: Why not simply alter the configuration of the wave guide? He turned to Marez.

"Hey, Guill, why don't you take a hacksaw to this thing?"

A machinist by training, Marez thrilled at the idea of going to town on the tubing. He knew that if this invention was going to work at all, it would need a lot of massaging. He waited for the scientists to go home that day and then got to work.

"We had all these scientists treating this as a delicate piece of equipment. I got a Sawzall and I kind of got after it," Marez said, "I would not have felt comfortable doing that during the day."

He spent the next several hours cutting the transmitter apart with a bright yellow Sawzall and restructuring the wave-guide's attachment to the magnetrons. He designed his cuts with precision, re-aligning the physical tubing to ensure a smoother flow of the microwaves from the magnetrons.

He was relying on intuition, but he had a good feeling about it. After all, machines were still machines, even very expensive ones. Sure enough, when the team fired up the magnetrons the next day, the signal came back loud and clear.

"It worked!" said Marez.

The workaround was so successful that Heggemeier's team patented the idea. There was more massaging and finessing in order to get it in tip-top shape: the capacitors had to be timed and the wave oscillation needed tweaking. But the heavy lifting was done.

"That was the major achievement," said Robinson, "The ability to get those eight magnetrons to generate one coherent signal we could use."

The process also brought Marez and Heggemeier a much deeper understanding of how the weapon was evolving under their care. Working 18-hour days, sometimes sleeping at the lab, they came to know every inch of the huge contraption.

"Flying by the seat of your pants, I know what that means now," Marez said, "We built up an intuitive sense of how the system works, which was really helpful once we went overseas."

One major hurdle had been overcome. But others soon arose.

Heggemeier and his team spent months, and millions of dollars, perfecting an antenna -- the delivery system for the weaponized microwaves -- that would be suitable for the Iraq theater, where bombs were buried in trash or under debris by roadsides. Heggemeier's first antenna looked like a ray gun—

it could be swiveled with a joystick inside the truck's cab to target IEDs. In the spring of 2011, the team tested it at the White Sands Missile Range with great success. It was ready, but it was too late.

That summer, U.S. forces began to draw down in Iraq. After eight years, U.S. involvement was ending. Suddenly, there would be no need for MAX POWER.

"That left the program in kind of a lurch," Heggemeier said, "We had the system designed for the threat in Iraq, and now no place for it to go." The money had dried up, too.

Another Threat Grows

Instead of coming home, many U.S forces began moving to Afghanistan, where the war was heating up again. And as in Iraq, IEDs would soon become a major threat. Funding ramped up again. General Mattis, head of CENTCOM at the time, relayed a message through to another general that Heggemeier's project should move forward.

For the Air Force scientists, the Afghan threat was different, and required significant tweaks. IEDs were buried deeper in the ground, and right in the middle of the road. The roads were dirt, not paved. Once again, Heggemeier adapted on the fly.

That slight change cost time and money for the Air Force researchers, who were working with incredibly delicate and sensitive technology.

"Rip that off," he told Marez one day, pointing to the antenna they had painstakingly devised for Iraq.

It had cost upwards of $2.5 million to perfect, and Heggemeier wanted to start over. "We're going to use a 20-year old antenna instead."

Air Force officials watching this unfold from the sidelines started calling Heggemeier a "cowboy." Some questioned why the Air Force was involved in a project like this in the first place—it wasn't their traditional battleground and was consuming resources. It was in these moments of doubt that Heggemeier and Marez would go for long trail runs in the desert. Sometimes in the morning hours before work, they loaded their combat backpacks with 70 pounds of weight and hoofed it off into the hills to blow off steam and prepare for their eventual deployment.

They tweaked their machine for nine months. The antenna transformed into an immobile stationary device that would fire its ray closer to the ground in front of the truck, which was where the IEDs would most likely be in an Afghan scenario. They tested again, this time on the dirt roads at Kirtland. They constructed fake IEDs with pressure plates, simulated explosives and complex radio frequency detonating devices. They ran MAX POWER over the devices and, sure enough, the makeshift bombs were neutralized. The MAX POWER microwaves were working well.

The microwave energy was very effective at coupling into electronic circuits at a high speed. "You can disrupt and sometimes damage the electronic circuits in the target," Robinson said, "And if we could damage that, then we could get them to pre-detonate or not detonate at all." In short, MAX POWER was frying the buried IED circuitry from a safe distance.

People on the ground would have to watch out. MAX POWER's antenna was so effective that when activated and simply pointed at the hard ground, the dirt began to smoke. "This was a weapon, like an M4 [assault rifle], but with microwaves." Heggemeier said, "If a person stood in front of the antenna while it was firing, that would be a bad thing."

One day BG Austin Miller, the Deputy Director of JIEDDO, came to check on progress.

He asked Marez if he could ride in MAX POWER during a test run.

"Sure," said Marez. "Climb up in here; you just have to take your pants off." Miller unleashed with a full-throated laugh. He had been an early supporter of the technology and had kept up with progress along the way.

It was a beast of a machine by now. With everything assembled, the whole contraption weighed in at 100,000 pounds. "The truck and system on the back was utilizing every capability of that chassis," says Beth Nader another member of the team.

As the team began readying for deployment to Afghanistan, it was also Miller who asked them if they knew what they'd be getting into on the frontlines. MAX POWER would be riding ahead of the convoys. That was where the IED threat was strongest. Their lives would be in danger. That was to be expected among frontline combat infantry units. But scientists?

Heggemeier and his team were insistent: they would follow through and make sure the tech worked in theater. American lives depended on it.

Deployment

In early September, the team was told to get ready to deploy. Heggemeier's wife Katie was due to give birth to their third child soon. Heggemeier wouldn't be around to witness the birth.

The director of JIDO, Lt. Gen. Michael Barbaro, visited Kirtland the week before the team left. He wanted to spend some time with them before they hit the ground running in Afghanistan. He said he wanted to see them off personally.

The day finally came in early September 2012. The ten-member team loaded their dismantled system onto a C-5 plane bound for Afghanistan and climbed in. Marez boarded the plane, then turned around and ran back to his girlfriend to say goodbye. *Everything is going to be different when I get home*, he thought to himself.

The plane stopped briefly at Dover Air Force Base in Delaware. While there, another plane ferrying two U.S. Army Rangers who had been killed in Afghanistan landed. Heggemeier went out to the tarmac to observe the ceremony. With a lump in his throat, he watched the coffins, the flag presentation, the solemn familial acceptance of death in the service of country. It left him moved, shaken and more determined than ever to get MAX POWER into the battlefield.

They flew on to Ramstein Air Base in Germany and finally landed at Camp Leatherneck one night in the middle of September.

Camp Leatherneck

A week later and, as the Taliban assaulted the base, they were already in the thick of it.

Marez and Heggemeier stayed on the second floor of their container unit for a long time watching the firefight that night. American and British planes were being destroyed, along with fuel depots. Apache helicopters fired long arcs of green and orange tracer fire as gunners sprayed the Taliban using 30-millimeter guns.

When it was all over, two U.S. Marines were killed and eight aircraft were destroyed. All the Taliban were ultimately killed or captured. Subsequent reports would state that it was the worst U.S. materiel loss since the 1982 attack on the Marine barracks in Beirut.

And still, the real work -- the culmination of years in the lab at Kirtland -- hadn't yet begun.

How Soon Can We Get This Operational?

MAX POWER's first fully operational mission got off to a shaky start.

The truck rolled along on a still Afghan morning, headed toward FOB Spin Boldak, a base nearby. Marez drove, as Heggemeier tried to figure out why MAX POWER wasn't working. The fans weren't on and none of the electronics were firing. He dug through the circuitry of the truck's control system, in the cab. Why wasn't the computer communicating with the fan, the engine or any other component of the power source? He prodded with his multi-tool searching for the source of the problem. Marez, who was trying to keep his eyes on the road, used his non-steering hand to poke and prod at the dash.

Meanwhile, a whole base of Marines was waiting for them, eager to see what this new piece of technology was about.

Heggemeier feared violence of the type they'd seen on MAX POWER's first trip outside the wire. It had been a simple reconnaissance mission a few days earlier. They were part of a convoy of 26 vehicles. Heggemeier was driving. The commanding officer didn't want to activate the weapon out of concern for nearby civilians. The convoy proceeded into an area where the unit had encountered hostile activity before. Most of the vehicles made it through when suddenly…

BOOM...

Marez's heart sank. He waited for word on the radio and it came soon enough. The second to last vehicle hit a pressure plate IED. A Marine had been hit. He was alive, but injured, and would have to be evacuated. Marez was frustrated. So many years in the lab back at Kirtland, perfecting the technology, and now he was unable to use the weapon he'd been sent to use because the team hadn't been given the green light.

Soon enough, the lieutenant came back to Heggemeier. "How soon can we get this operational?" he asked.

After that, they tried a few missions with a logistics unit, but soon discovered that MAX POWER would be of more utility among frontline combat units, who were the frequent targets of IEDs.

Heggemeier had seen data showing that this corner of Helmand had more IEDs than anywhere else in Afghanistan. U.S. Marine units encountered them virtually every time they left the wire. Eventually, the MAX POWER team got hooked up with Weapons Company of the 2nd Battalion, 7th Marines: a 1,200-strong light infantry battalion.

Their first mission would be a run from FOB Spin Boldak, a tiny forward operating base 9.3 miles from Camp Leatherneck, into the surrounding areas where the Marines suspected multiple IEDs had been placed.

That's where they were headed as they fiddled with the control panel. When they reached FOB Spin Boldak, it still wasn't working. Heggemeier asked the lieutenant for time to fix it.

"We're not leaving without you," the lieutenant said. As young Marines stood and watched, Heggemeier dug into the bowels of the truck, searching for the problem.

Fortunately, it didn't take too long. Some tinkering in the rear control panel revealed two blown fuses. Fortunately, a team member back at Kirtland had taped two spares to the door panel. Heggemeier breathed a sigh of relief and quickly replaced them.

The fans and engine powered right up. They were fully operational. It was time to hunt for some IEDs.

Dead IEDs Are Silent IEDs

The sergeant in charge of that day's mission gathered Heggemeier and his team around a small wooden table where some area maps had been laid out. A cigarette dangled from his mouth and he had another one tucked behind an ear. He was gruff, to the point: the IED threat here was severe. The base was basically surrounded by bombs. His units encountered them on a near daily basis.

They'd identified seven locations where the Taliban were believed to have laid IEDs, all within a few miles of the base. The Marines were finding IEDs and getting hit so often that it was almost a foregone conclusion once troops left the gates. If they could get out of the wire, run this mission and return to FOB Spin Boldak without getting hit, the day would be a success.

One of the oddities of MAX POWER was that its success was difficult to measure. IEDs that failed to detonate wouldn't reveal themselves after the fact. When MAX POWER fried their wires, the melted explosives would simply remain where they were buried. Thus, the more routine and uneventful a patrol with MAX POWER was, the more likely it was that the weapon had been used with lethal effect.

As the team rolled out through FOB Spin Boldak's gates, Helmand's deserts greeted them. It was "desert like you've never seen desert before," Marez said. No cactii. No coyotes. Just endless ribs of scrubland dotted by small hamlets and dry riverbeds, called wadis. Inhabitants seemed accustomed to watching

IED explosions. Marez saw children covering their ears as convoys rolled by – perhaps anticipating the detonation of bombs.

Heggemeier directed MAX POWER to hit the suspected IED targets. Some were in bare patches of road. One was a small mound of dirt by the side of the road where a white flag had been planted. The Taliban sometimes signified the locations of IEDs to their fellow Afghans with small markers and coalition forces had caught on to it.

On this day, they hit all seven spots and returned to base without incident. The Marines, so apprehensive that morning, seemed relieved to have this additional measure of protection.

Three Months of Missions

Other days presented complexities on the battlefield that MAX POWER couldn't resolve. On one mission out of FOB Spin Boldak, the team was driving in a convoy when a motorcycle appeared, going the other direction. The rules of engagement at the time prohibited the team from deploying MAX POWER around people or villages, for fear of inadvertently detonating a device and accidentally injuring or killing innocents. So as the motorcycle drove by, they turned the system off. They were nearing a compound when…

BOOM…

A command wire IED hit a vehicle behind MAX POWER. The blast struck a Marine truck commander, broke his M4 rifle and shredded his feet. The explosion pinned him inside the vehicle, and while the Marines (and some MAX POWER team members) tried to get him out, they started taking sniper fire. A medevac helicopter soon arrived, but also came under fire.

Only after they were back on base did they realize that the Taliban fighters only struck when they knew the motorcycle was safely out of range and wouldn't be harmed by a blast. But Heggemeier and his team also knew that if MAX POWER had been activated the whole time, the IED would have failed.

Over the next three and a half months, Heggemeier, Marez and the other MAX POWER team members went on 13 missions. Some took them out with units doing route clearance, one of the most dangerous jobs for coalition troops in Afghanistan, because they not only had to find the IEDs, they also had to neutralize them. MAX POWER helped them do that job.

Others were with the frontline Marine units like the one based out of FOB Spin Boldak. Sometimes they had to go out on missions without MAX POWER activated, and on these occasions, they had some close calls. Heggemeier saw an 80-pound IED go off under a truck, wounding a specialist and totaling the vehicle.

Heggemeier came within a hundred yards of five different IED blasts during his time in Afghanistan. It's impossible to know exactly how many IEDs the device diffused, and while the account of their success rate remains classified for security purposes, Heggemeier and Marez estimate that they found at least three IEDs on every mission, which amounts to nearly forty neutralized bomb blasts over a roughly 100-day period, and countless lives saved.

"It's all the ones that didn't go off that we found behind us that make the hair on my arms stand up," Marez says, "It's the 'what ifs' that get me."

"If MAX POWER wasn't effective, Guill and I would be dead," says Heggemeier. "We went to places where there were more IEDs than anywhere else."

Heggemeier, Marez and the others returned stateside in the spring of 2012. Another measure of their success could be measured in a very simple way: on every single mission where MAX POWER was deployed and engaged as a weapon, not a single IED detonated.

Epilogue

The Air Force turned MAX POWER over to the U.S. Army, who will conduct further testing, research and development and eventual deployment, as long as the IED threat remains potent in places where American Soldiers' lives are on the line.

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