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A photograph of a tank firing a shell, with a bright explosion in the background. The tank is dark and positioned in the foreground, angled towards the right. The explosion is a large, bright orange and yellow fireball on the right side of the image. The background shows a hazy, outdoor setting with some trees and a field.

**Defense
One**

TANKS, NETWORKS & SPIDERS

The Future of Land Warfare

Foreword



Bradley Peniston

This fall, U.S. Army leaders have a grim message for their warfighters, especially those who have seen combat in recent years: you ain't seen nothing yet.

It's no secret that warfare moves faster and faster these days, thanks to technology that allows big militaries and small insurgent groups alike to evolve new capabilities at unprecedented rates. But here's the upcoming twist, Army generals from the chief of staff on down told audiences at the annual Association of the U.S. Army conference in Washington, D.C.: warfare is speeding up even as global peer powers rise, presaging battles that combine terrible violence and unprecedented speed.

The conventional power of Russia and China, mated with artificially intelligent, network-speed forces, are forcing the Pentagon to contemplate and prepare for "violence on the scale that the U.S. Army has not seen since Korea," said Maj. Gen. William Hix, who is the deputy to the Army's deputy chief of staff for operations, plans, and training. "A conventional conflict in the near future will be extremely lethal and fast. And we will not own the stopwatch."

By "fast," Hix was not predicting a quick end to hostilities. To the contrary, he explained, this vision of future war foresees American forces being ground up quickly. And that means one of the central challenges for the U.S. Army is learning how to keep its forces ready – and how to return battered brigades quickly to the fight.

In this ebook, *Defense One* explores several ways the Army is preparing for the deadly battles that may lie ahead. Tech editor Patrick Tucker looks at what U.S. forces are learning from Russia's use of drones and electronic warfare in eastern Ukraine. "What we found is we can use existing capabilities in a different way," said Gen. H.R. McMaster, the decorated tank commander who runs the U.S. Army's Capabilities Integration Center. To counter "low, slow, small" drones, the Army is eyeing software-programmable radar, directed energy, and next-generation electronic warfare gear – and "putting it on vehicles we already have and integrating it organizations that already exist."

The Army has also announced a new Rapid Capabilities Office to accelerate the development of cyber, electronic warfare, and position-and-timing gear – that is, equipment to stand up to the IT and EW prowess of adversaries like Russia.

There's more ahead – the Army's got some very interesting ideas about spider silk, for example. Read on.

Bradley Peniston
Deputy Editor
Defense One

 (Cover) [Flickr/Andrzej Ljah](#)

U.S. Army Racing to Catch Up to Russia On Battle Drones

After watching UAVs dominate eastern Ukrainian skies, the service is seeking counter-drone tech and new families of flying robots.

By Patrick Tucker

On the battlefields of eastern Ukraine, Russian-backed infantry and artillery units have used more than 16 types of drones to identify enemy positions and deliver fire, often within minutes. That's given Lt. Gen. H.R. McMaster, the decorated tank commander who runs the U.S. Army's Capabilities Integration Center cause for concern.

"Russia has established air supremacy over Ukraine from the ground" and in the process, exposed a gap in his own Army's ability to deal with drones, McMaster told reporters on September 28th.

But his service, which recently wrapped up a prolonged examination of Russian tactics, isn't sitting still. A little more than a year ago, the Army began what they call the Maneuver Fires Integration Experiment at Fort Sill in Oklahoma to speed next-generation anti-drone technology to soldiers.

"What we found is we can use existing capabilities in a different way," said McMaster. To counter "low, slow, small" drones, the Army is eyeing software-programmable radar, directed energy, and next-generation electronic warfare gear — and "putting it on vehicles we already have and integrating it organizations that already exist."

In October, troops continued to refine the strategy at the Army Warfighting Assessment wargame at Fort Bliss.

Now, they will be fielding counter UAS technologies "very quickly," says McMaster.

The Army will also soon publish its comprehensive Counter UAS Strategy, spelling out what they've learned and what they intend to do.



The Army wants drones that can be deployed from a vehicle and hover over a vehicle. We're experimenting with all of these capabilities."

LT. GEN. H.R. MCMASTER

But beating enemy drones is only the first part of a larger plan to win on tomorrow's battlefield. The Army wants to press the attack with its own small drones.

"This is a big area of focus. We're looking at a whole family of unmanned systems from the very low squad level. What I've talked about as a priority is the squad at a foundational level," said McMaster. "We need a number of platforms that we can deploy. We're interested in vertical-takeoff-and-push capability" as well as



📷 *Russian Prime Minister Vladimir Putin tests goggles with an electronic connection that allows him to see the view from an unmanned drone aircraft, during an exhibition of equipment displayed at Russia's Civil Defense Academy in Moscow's Khimki suburbs.*
AP/Alexi Nikolsky

drones that can fly autonomously, resist complex electromagnetic attacks. The Army wants drones “that can be deployed from a vehicle and hover over a vehicle. We’re experimenting with all of these capabilities,” he said.

Bits and pieces of that family are visible in several recent endeavors and experiments, such as the 18-gram PD-100 Black Hornet from Prox Dynamics, an autonomous tactical drone that the military is rushing out to special operations units and Marines.

The most recent budget request for the Rapid Innovation Fund seeks a “mission enhanced system based on collective UAS input.” The system should have an open architecture, be modular, and be able to handle “disparate-data-fused intelligence, surveillance, and reconnaissance (ISR),” data in an environment where “degraded position, navigation and timing (PNT), communications (dissemination of situation awareness information), and electronic warfare” effects are present.

That sounds fancy, but, decades ahead, will look quaint, according an unfinished draft of the U.S. Army Robotic and Autonomous Systems Strategy provided to reporters. The document describes how the Army will use drones in the near term (2016-20) the mid-term (2020-30), and the far term (2030-40).

In the near term, handheld drones like the Black Hornet would provide intelligence to dismounted troops. After 2020, that intelligence mission would switch to small swarms, according to the draft strategy document. “To increase situational awareness, the Army delivers swarms of multiple small robots to an area of operations in advance of close combat maneuver forces,” it says. “Delivery options range from using a simple shipping container to a special-purpose platform from which smaller craft or robotic systems are launched or maintained. Swarm robots will be fully powered, self-unpacking, and ready for immediate service.”

One vignette pictures squads and platoons in the year 2025

“equipped with small RAS in urban terrain make[ing] contact on their own terms, thus reducing the need for formations to maintain the traditional 6:1 attacker-to-defender ratio commonly associated with conventional urban combat operations.” Meanwhile, “UAS sensors loitering overhead work with UGS platforms on the ground to provide enhanced situational awareness to human teammates in order to create better tactical options for small unit leaders.”

On the 2030 battlescape, soldiers will command drones and receive their data via a linked-up “warrior suit” worthy of Tony Stark. The suit will feature “integrated displays that aggregate a common operating picture, provides intelligence updates, and integrates indirect and direct fire weapons systems.” Read that to mean firing for effect from your face.

The draft document also depicts armed ground units that become increasingly autonomous as 2030 approaches. It doesn’t mention arming them, but does feature pictures of “unmanned combat vehicles with advanced payloads” with large guns. Conflicting reports suggest Russia may have already fielded armed ground robots in Syria, or at least might be claiming to.

McMaster says he would consider arming future drones that work alongside soldiers, a big difference from the drones that the military uses today for precision strikes, or even the small reconnaissance drones currently flying over Ukraine.

“I do see an opportunity to arm,” said McMaster. “It’s one of the reasons we need an open architecture.” **D**



D A soldier of The Queen’s Royal Lancers launches a Black Hornet Nano UAV from a compound in Afghanistan during Operation QALB. **Sgt. Rupert Frere RLC**

How the Pentagon is Preparing for a Tank War With Russia

Reactive armor and cross-domain fire capabilities are just some of the items on the Army's must-have list.
By Patrick Tucker

When Lt. Gen. H.R. McMaster briefs, it's like Gen. Patton giving a TED talk — a domineering physical presence with bristling intellectual intensity.

These days, the charismatic director of the Army's Capabilities Integration Center is knee-deep in a project called The Russia New Generation Warfare study, an analysis of how Russia is re-inventing land warfare in the mud of Eastern Ukraine. Speaking recently at the Center for Strategic and International Studies in Washington, D.C., McMaster said that the two-year-old conflict had revealed that the Russians have superior artillery firepower, better combat vehicles, and have learned sophisticated use of UAVs for tactical effect. Should U.S. forces find themselves in a land war with Russia, he said, they would be in for a rude, cold awakening.

"We spend a long time talking about winning long-range missile duels," said McMaster. But long-range missiles only get you through the front door. The question then becomes what will you do when you get there.

"Look at the enemy countermeasures," he said, noting Russia's use of nominally semi-professional forces who are capable of "dispersion, concealment, intermingling with civilian populations...the ability to disrupt our network strike capability, precision navigation and timing capabilities." All of that means "you're probably going to have a close fight... Increasingly, close combat overmatch is an area we've neglected, because we've taken it for granted."

So how do you restore overmatch? The recipe that's emerging from the battlefield of Ukraine, says McMaster, is more artillery and better artillery, a mix of old and new.

Cross-Domain Fires

"We're out-ranged by a lot of these systems and they employ improved conventional munitions, which we are going away from. There will be a 40- to 60-percent reduction in lethality in the systems that we have," he said. "Remember that we already have fewer artillery systems. Now those fewer artillery systems will be



We spend a long time talking about winning long-range missile duels. But long-range missiles only get you through the front door. The question then becomes what will you do when you get there.

LT. GEN. H.R. MCMASTER



less effective relative to the enemy. So we need to do something on that now.”

To remedy that, McMaster is looking into a new area called “cross domain fires,” which would outfit ground units to hit a much wider array of targets. “When an Army fires unit arrives somewhere, it should be able to do surface-to-air, surface-to-surface, and shore-to-ship capabilities. We are developing that now and there are some really promising capabilities,” he said.

While the full report has not been made public, “a lot of this is available open source” said McMaster, “in the work that Phil Karber has done, for example.”

Karber, the president of the Potomac Foundation, went on a fact-finding mission to Ukraine last year, and returned with the conclusion that the United States had long overemphasized precision artillery on the battlefield at the expense of mass fires. Since the 1980s, he said last October, at an Association for the United States Army event, the U.S. has given up its qualitative

edge, mostly by getting rid of cluster munitions.

Munitions have advanced incredibly since then. One of the most terrifying weapons that the Russians are using on the battlefield are thermobaric warheads, weapons that are composed almost entirely of fuel and burn longer and with more intensity than other types of munitions.

“In a 3-minute period...a Russian fire strike wiped out two mechanized battalions [with] a combination of top-attack munitions and thermobaric warheads,” said Karber. “If you have not experienced or seen the effects of thermobaric warheads, start taking a hard look. They might soon be coming to a theater near you.”

Karber also noted that Russian forces made heavy and integrated use of electronic warfare. It’s used to identify fire sources and command posts and to shut down voice and data communications. In the northern section, he said, “every single tactical radio [the Ukrainian forces] had was taken out by heavy

📍 *Russian T-90 tanks drive through the Red Square during the Victory Day Parade, which commemorates the 1945 defeat of Nazi Germany in Moscow, Russia, Monday, May 9, 2011, with a display depicting the Order of the Victory in the background. AP/Alexander Zemianichenko*

Russian sector-wide EW.” Other EW efforts had taken down Ukrainian quadcopters. Another system was being used to mess with the electrical fuses on Ukrainian artillery shells, “so when they hit, they’re duds,” he said.

Karber also said the pro-Russian troops in Donbas were using an overlapping mobile radar as well as a new man-portable air defense that’s “integrated into their network and can’t be spoofed by [infrared] decoys” or flares.

Combat Vehicles and Defenses

The problems aren’t just with rockets and shells, McMaster said. Even American combat vehicles have lost their edge.

“The Bradley [Fighting Vehicle] is great,” he said, but “what we see now is that our enemies have caught up to us. They’ve

plates and explosives reacts. The explosive charge clamps the plates together so the rocket can’t pierce the hull.

But that’s only if the missile gets close enough. The latest thing in vehicle defense is active protection systems, or APS, which automatically spot incoming shells and target them with electronic jammers or just shoot them down. “It might use electronics to ‘confuse’ an incoming round, or it might use mass (outgoing bullets, rockets) to destroy the incoming round before it gets too close,” Army director for basic research Jeff Singleton told Defense One in an email.

The T-90’s active protective system is the Shtora-1 countermeasures suite. “I’ve interviewed Ukrainian tank gunners,” said Karber. “They’ll say ‘I had my [anti-tank weapon] right on it, it got right up to it and then they had this miraculous shield. An invisible shield. Suddenly, my anti-tank missile just went up to the sky.’”

The Pentagon is well behind some other militaries on this research. Israeli forces declared its Trophy APS operational in 2009, integrated it onto tanks since 2010, and has been using it to protect Israeli tank soldiers from Hamas rockets ever since.

Singleton said the United States is looking to give its Abrams tank the Trophy, which uses buckshot-like guns to down incoming fire without harming nearby troops.

The Army is also experimenting with the Israeli-made Iron Curtain APS for the Stryker, which works similarly, and one for the Bradley that has yet to be named. Raytheon has a system called the Quick Kill that uses a scanned array radar and a small missile to shoot down incoming projectiles.

Anti-Drone Defenses

One of the defining features of the war in Eastern Ukraine is the use of drones by both sides, not to target high-value terrorists but to direct fire in the same way forces used the first combat aircraft in World War I.

The past has a funny way of re-inventing itself, says McMaster.

“I never had to look up in my whole career and say, ‘Is it friendly or enemy?’ because of the U.S. Air Force. We have to do that now,” said McMaster. “Our Air Force gave us an unprecedented period of air supremacy...that changed the dynamics of ground combat. Now, you can’t bank on that.”



If you have not experienced or seen the effects of thermobaric warheads, start taking a hard look. They might soon be coming to a theater near you.

PHIL KARBER

invested in combat vehicles. They’ve invested in advanced protective systems and active protective systems. We’ve got to get back ahead on combat vehicle development.”

If the war in Eastern Ukraine were a real-world test, the Russian T-90 tank passed with flying colors. The tank had seen action in Dagestan and Syria, but has been particularly decisive in Ukraine. The Ukrainians, Karber said, “have not been able to record one single kill on a T-90. They have the new French optics on them. The Russians actually designed them to take advantage of low light, foggy, winter conditions.”

What makes the T-90 so tough? For starters, explosive reactive armor. When you fire a missile at the tank, its skin of metal



What's necessary is political accommodation, is what needs to happen, if we don't conduct operations and plan campaigns in a way that gets to the political accommodation. The most important activity will be to broker political ceasefires and understandings."

LT. GEN. H.R. MCMASTER

Pro-Russian forces use as many as 16 types of UAVs for targeting.

Russian forces are known to have "a 90-kilometer [Multiple Launch Rocket System] round, that goes out, parachute comes up, a UAV pops out, wings unfold, and they fly it around, it can strike a mobile target" said Karber, who said he wasn't sure it had yet been used in Ukraine.

Karber's track record for accuracy is less than perfect, as writer Jeffrey Lewis has pointed out in Foreign Policy. At various points, he has inflated estimates of China's nuclear arsenal from some 300 weapons (based on declassified estimates) to 3,000 squirreled away in mysterious tunnels, a claim that many were able to quickly debunk. In 2014, he helped pass photos to Sen. James Inhofe of the Senate Armed Services Committee that purported to be recent images of Russian forces inside Ukraine. It turned out they were AP photographs from 2008.

"In the haste of running for the airport and trying to respond to a last-minute request with short time fuse," Karber said by way of explanation, "I made the mistake of believing we were talking about the same photos ... and it never occurred to me that the three photos of Russian armor were part of that package or being considered."

No Foolproof Technological Solution

All of these technologies could shape the future battlefield, but none of them are silver bullets, nor do they, in McMaster's view, offset the importance of human beings in gaining territory, holding territory, and changing facts on the ground to align with mission objectives.

As the current debate about the authorization for the use of force in Iraq shows, the commitment of large numbers of U.S. ground troops to conflict has become a political nonstarter for both parties. In lieu of a political willingness to put troops in the fight, multi-sectarian, multi-ethnic forces will take the lead, just as they are doing now in Iraq and Syria.

"What's necessary is political accommodation, is what needs to happen, if we don't conduct operations and plan campaigns in a way that gets to the political accommodation," he said. "The most important activity will be to broker political ceasefires and understandings."

Sometimes that happens at the end of a tank gun. **D**



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The Futuristic Aircraft That May Replace the Black Hawk Will Fly Next Year

But don't expect the V-280 or SB-1 to hit battlefields until after 2030 – unless their builders find other customers first.

By Marcus Weisgerber

Next year will bring the first flights of the prototype rotorcraft vying to replace the Army's venerable Black Hawk and other helicopters. But don't expect the futuristic aircraft to hit battlefields for another decade and a half – unless their manufacturers find other customers first.

The prototypes are being built for the Army's Joint Multi-Role Technology Demonstrator project by Bell Helicopter and the competing Sikorsky-Boeing team, who touted their work in advance of the Army Aviation Association of America, or "Quad A," annual summit in Atlanta this week.

Bell is building the V-280 Valor, a tiltrotor aircraft that can take off and land like a helicopter, or rotate its propellers to fly fast like a fixed-wing plane. Sikorsky and Boeing are building the SB-1 Defiant, a high-speed coaxial helicopter with one rotor mounted atop the other. Bell officials say V-280 ground testing is scheduled for next April and first flight for September 2017; Sikorsky-Boeing reps said their SB-1 would fly next year as well.

The Army commissioned the demonstrator aircraft in 2013 – after talking about about replacing its helicopters for more than a decade – to prove various new technologies for a replacement for the UH-60. Combat in Iraq and Afghanistan's hot, high, and sandy environments pointed up various performance limitations, so the new rotorcraft are being designed to fly higher, farther, and faster while also carrying more. The project will feed into the Future Vertical Lift program, a vast effort to replace all Army helicopters – which include the AH-64 Apache, CH-47 Chinook, and the OH-58 Kiowa – at a projected cost of around \$100 billion.

Thanks to a decade of heavy wartime use, the Black Hawks are wearing out faster than anticipated. But the Army isn't planning



Our big push now is that, after we fly this and prove out that we can build this aircraft, that we are ready to go into engineering and manufacturing development.

VINCE TOBIN

to buy its first new rotorcraft until after 2030. That's because its acquisition budget – aircraft, armored vehicles, and so forth – has taken a major hit. The service has even been called out by a Dutch Air Force general for the project's slow pace.


So Bell officials want you to know: they could start cranking out battle-ready aircraft in 2024 or 2025.

"There's no real technology that needs to be further developed for us to be able to design and develop an aircraft that meets those requirements," said Vince Tobin, Bell's vice president of advanced



Based on the requirements that come out, **we can adapt** to their requirements **pretty quickly** and respond with a configuration that would support them.

DOUG SHIDLER

 An artist rendition of the Bell V-280 Valor. **Bell Helicopter**

tiltrotor systems. “Our big push now is that, after we fly this and prove out that we can build this aircraft, that we are ready to go into engineering and manufacturing development.”

The company is self-funding much of the project, mainly because the payoff could be so high if its V-280 is chosen by the Army, which operates most of the world’s 2,700 Black Hawks. But Bell is also pitching their tiltrotor as a replacement for other H-60 variants flown by the U.S. Navy, Marine Corps, Air Force, and militaries of 26 other countries.

“Our view is that if any of the services that are flying any form of medium-utility, whether that be a SH-60, UH-60, MH-60, that this aircraft can fill that role going forward,” Tobin said.

Bell is currently mating the wing to the fuselage of its V-280, after which “we’ll have what looks like a completed aircraft,” Tobin said. They will mount the tail in the fall and then put the engines at the tip of the wings. This final assembly work is happening in Amarillo, Texas, where the company builds most of its helicopters. Bell built the wing “almost from scratch” and Israeli firm IAI built “almost all of the parts” in the nacelles, Tobin said. Spirit Aerosystems built the fuselage in Wichita, Kansas, and GKN is building the tail in Alabama.

“Right now, we’re sticking to the schedule that we published when we started this effort a couple of years ago,” Tobin said.

The Sikorsky-Boeing team also is putting together their fuselage; final assembly will commence later this year ahead of first flight in 2017, said Doug Shidler, Sikorsky’s program director for its Joint Multi-Role tech demonstrator. Shidler also touted the company’s S-97, a smaller compound helicopter, on which the SB-1 is based. The S-97 has a max gross weight of 11,000 pounds; the SB-1, more than 30,000 pounds.

“That gives us a very broad range to demonstrate this technology and capability that this platform will bring to the warfighter,” Shidler said. “Based on the requirements that come out, we can adapt to their requirements pretty quickly and respond with a configuration that would support them.”

In the Middle East, the V-22 Osprey tiltrotor, which flies farther and faster than its traditional helicopter cousins, have been in demand. Last year, the United Arab Emirates asked the U.S. to base Ospreys closer to the fight against Islamic State militants, so downed pilots could be rescued quicker. Longer-range helicopters could also prove more effective in the vast Asia-Pacific region. **D**

To Counter Russia's Cyber Prowess, US Army Launches Rapid-Tech Office

The battle for eastern Ukraine shows how the pace of innovation in electronic warfare is picking up.

By Patrick Tucker

On Wednesday, Army Secretary Eric Fanning announced a new Rapid Capabilities Office to accelerate the development of cyber, electronic warfare, and position-and-timing gear. Read that to mean: outfitting troops to stand up to the IT and EW prowess of adversaries like Russia, according to one expert who spoke to Defense One.

"This office will address capability gaps that we're seeing in real time, right now from our commanders in the field," said a statement from Maj. Gen. Walter E. Piatt, who will direct operations for the office. "Our adversaries are modernizing at a rapid rate, and in some cases, our capabilities are inadequate to keep up. To maintain our edge, it's vital that we can evolve existing and new technology at a pace that keeps it relevant to today's and tomorrow's conflicts."

That rapid technological progression is on full display, for example, in eastern Ukraine, where Ukrainian soldiers have been battling Russian-backed forces since 2014. For example, Russian-backed separatists have used EW and GPS-spoofing to jam and misdirect the drones that Ukrainian troops use to scope out enemy positions. "Over the past several years we've learned from what we've seen from Russia and Ukraine, and later in Syria, and from the different capabilities they've brought to the battlefield. We've seen the combination of unmanned aerial systems and offensive cyber and advanced electronic warfare capabilities and how they provided Russian forces a new degree of sophistication," said Fanning.

Steven Pifer, a former U.S. ambassador to Ukraine, said there is much overlap between what soldiers in Ukraine are seeing and what the new capabilities office is focusing on.

"My guess is ... that after 15 years of doing largely counter-insurgency operations in the Middle East, the Army is now taking a look at how it would do large force-on-force conflict in a place like Europe. One of the things we have seen the Russians use fairly effectively is electronic warfare in eastern Ukraine. I think there are some lessons that the U.S. military is extracting from what the Russian military has done in the Donbass region."

Various training missions have given U.S. troops the chance to talk with Ukrainian soldiers about this new kind of battlefield. For example, members of the 173rd Airborne Brigade Combat Team deployed there last year for Operation Fearless Guardian.

"The U.S. Army has been doing this training program for the Ukrainian national guard and Ukrainian Army," said Pifer. "My guess is that the U.S. trainers are actually learning quite a bit from their



To maintain our edge, it's vital that we can evolve existing and new technology at a pace that keeps it relevant to today's and tomorrow's conflicts.

MAJ. GEN. WALTER E. PIATT



🇺🇦 *Russian-backed forces in eastern Ukraine are using rapidly innovating IT and EW tactics. Here, Ukrainian servicemen ride an armored vehicle near Krasnoarmiisk in eastern Ukraine in 2015. AP/Evgeniy Maloletka*

Ukrainian counterparts in terms of the sorts of tactics the Russian Army is now using.”

The pace of innovation in EW — in the form of novel new waveforms that can disrupt an adversary’s electronics, paint enemy stealth aircraft, etc. — has surprised many in the military. That’s because EW innovation has become less and less a hardware challenge and more of a software challenge. You can make a new weapon as quickly as your algorithm can pull together a new waveform from the spectrum. But the military, too often, still procures EW assets the same way it buys jets and boats. Slowly.

“The software [to defeat new waveforms] may take on the order of months or years, but the effectiveness needs to be programmed within hours or seconds. If it’s an interaction with a radar and a jammer, for example, sometime it’s only a microsecond,” Robert Stein, co-chair of the Defense Science Board’s 2013 EW study, said at an Association of Old Crows event last winter.

Service officials stressed that the new office is distinct from

the Rapid Equipping Force, which sends warfighters materiel needed “urgently,” such as new weapons and solar panels for powering remote bases.


“The goal of the Army Rapid Capabilities Office is not to procure systems to outfit the entire Army, but rather to use targeted investments to execute strategic prototyping, concept evaluation and limited equipping — especially in areas where technology progresses rapidly. It will help commanders and soldiers in the field today, while building an advantage for those who will follow in their footsteps,” Katrina McFarland, the Army acquisition executive, said in a statement.

“If we want to operate in an environment where we are leading and causing our adversaries to react to us, we need to take risks,” Rapid Capabilities Office Director Douglas K. Wiltsie said in a statement. “The Army Rapid Capabilities Office is designed to take those technology risks, and to give us the agility to incorporate disruptive capabilities quickly when they can make a difference for our soldiers.” **D**



The Army is Testing Genetically Engineered Spider Silk for Body Armor

Inserting spider DNA into silkworms yields a tough fabric that's far more flexible than Kevlar.
By Patrick Tucker

 Researchers inserted DNA from the golden silk orb-weaver spider (*Nephila clavipes*) into silkworms. Charlesjsharp via wikimedia commons

Spider silk is one of nature's toughest substances, similar in strength to the Kevlar plastic found in bulletproof vests but much more flexible. Kraig Biocraft, a company out of Ann Arbor, Michigan, genetically altered silkworms to produce a fiber that's similar to pure spider silk. Today, they announced an Army contract to test this so-called Dragon Silk for possible use in body armor.

There's a reason that silk from worms is cheap but you can't buy pajamas made from spider fabric: spiders are territorial and cannibalistic, which makes farming them for fabric production almost exorbitant.

Enter the brave new wonder that is genetic engineering. In 2000, researchers first isolated and sequenced the key proteins that create spider silk (ampullate spidroin-1, spidroin-2, etc.) That let scientists reproduce spider silk proteins in yeast, E coli bacteria, and other substances in somewhat the same way as pharmaceutical companies produce proteins for drugs. But these methods didn't yield a lot of spider fabric.

The technology behind Dragon Silk is based in part on the work of Malcolm J. Fraser, Donald L. Jarvis, and their colleagues. As they


explain in this paper, they introduce specific pieces of spider DNA into silkworm eggs, creating an entirely new type of silkworm that can spin spider silk.

Yeah.

The Army's Soldier Protection and Individual Equipment, or PM-SPIE office, will give Kraig \$100,000 to test a series of "shoot packs" to see how the material stands up to abuse.

"We are going to provide them a series of different thread counts, thicknesses, construction techniques that they will test against standard material performance specifications," said Kraig chief operating officer Jon Rice. If the material performs well, the Army may increase the award to \$1 million.

Rice doesn't anticipate that Dragon Silk will be a direct replacement for Kevlar, which has a strength of 3 gigapascals. Spider silk has a strength of 2 gigapascals, only about two-thirds as strong.

"But Kevlar has an elasticity of 3 percent," says Rice. "If you have a Kevlar fiber, it's not going to move at all. Our fibers have a 30 to 40 percent elasticity before they break." 



No, Social Media Isn't Hurting the Army

In a rebuttal to 'Unplug, Soldier!', one officer explains how online time builds bonds in more ways than one.

By Crispin Burke

If there's a topic sure to generate clicks, it's those damned Millennials and their cell phones.

To be fair, smartphones have undoubtedly changed military leadership and culture in surprising ways. Fortunately, 21st-century soldiers will still interact and bond with their comrades as they always have. More importantly, social networking actually benefits soldiers in many important ways.

First, the good old days of human interaction weren't always so great. We'd like to think our conversations were much deeper and more meaningful in our youth, but I distinctly remember my banter as a younger soldier — it's probably best there weren't smartphones everywhere. Frat-boy bonding games and off-color jokes are far less tolerable in today's military and that's for the best. (Ditto for the weepy nostalgia for dining-ins and officer's clubs)

Second, soldiers are bonding and keeping in touch with one another through their smartphones. They share links on Facebook and send each other messages on Snapchat. They even vent their frustration at Army leaders and bureaucracy through Internet memes — and they're very, very good at it. Leaders who haven't seen these meme masters in action may want to remember the old adage

from poker: "If you can't spot the mark at the table, you're the mark."

Third, social media helps soldiers build networks that include new civilian friends as well as fellow soldiers. Close relationships with civilians helps the American public understand our Army, and it allows our soldiers to understand the society they serve. Most importantly, it opens soldiers to contrary viewpoints. This past month, I encountered a journalist who repeated an old cliché about soldiers coming from poor backgrounds. Because I had encountered this viewpoint so often, I had no trouble offering a rebuttal filled with facts, figures, and hard data. Exposing soldiers to deviant viewpoints helps them think critically about our profession.

Finally, the military lifestyle forces soldiers to move every few years. Social media is one of the few ways comrades can keep in touch with one another as they shuttle across the world. Not to mention: though there's value in bonding with other soldiers, we need to maintain strong relationships with our friends in civilian life. We spent the first 18 years of our lives as civilians, and after a 20-year military career, we'll be civilians once again. Social media can make that transition much easier as we reintegrate with our civilian friends while staying in touch with our friends-in-arms. **D**

D U.S. Army Staff Sgt. Austina Knotek takes a photo with the United States Army Chief of Staff, Gen. Ray Odierno in Kabul, Afghanistan, February 7, 2014.
U.S. Army/Nate Allen