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Special Report

Changing World Blazes New Trails For Military Technology

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By National Defense Staff



A striking array of new challenges is reshaping the course of defense technology. The United States is entering what can be described as the “end of the post-Cold War era,” characterized by fiscal austerity and the rise of “non-state” actors as enemies of nation states. The national security community and defense industry are expected to innovate. They will need to develop and acquire a new generation of weapons and equipment that can be adapted to fight major wars, quell insurgencies and respond to natural disasters. Unlike the Cold War, the innovation in this new era will be dominated by commercial technologies, as civilian investments in research and development continue to dwarf government expenditures.

In this special report, National Defense identifies five key trends that will influence the industry’s approach to developing next-generation weapons and related systems.

One is the clash between citizens’ desire for security and also for privacy. As countries seek to combat terrorist groups, they will look to acquire technologies that, critics argue, infringe on individual rights to privacy. Pressure from both arenas will shape the future course of military research and development.

Another game changer in the defense technology world is Google, which is giving government agencies low-cost access to tech tools that in years past would have cost hundreds of millions of dollars. Technologies like Google Glass and Google Earth continue to be adapted into military programs, and engineers believe the potential is unlimited.

The ubiquity of mobile devices has had considerable impact on military investments in encryption and software. The mobile phenomenon is not about to slow down any time soon. More functions increasingly will shift from desktop computers to tablets and phones, and it will be up to industry to find ways to adapt commercial systems so they can meet stringent military requirements.

Another determining force in the defense sector will come from civilian investments in robotics technology. While the military leads in the development of aerial drones, it has lagged in other areas such as ground vehicles. New products being launched on the commercial side could spark innovation in military robots, experts predict.

The final item in this report is the rise of special operations forces. Special operations troops have been the go-to resource in the U.S. war against terrorist groups, and other countries are following suit. Countries will invest more resources in their special operations units and will call on their suppliers to provide innovative equipment that meets unconventional warfare needs.

Following is our analysis.



Security vs. Privacy

The U.S. government today has greater access than ever before to the private lives of citizens, but this snooping goes largely unchallenged because technology allows the intrusions to be almost imperceptible.

Though it has been brought starkly to light as a result of intelligence leaks, the government will likely peer ever deeper into the lives of all Americans in an effort to stave off future threats to national security, experts agreed. And technological advances could make this unprecedented surveillance nearly undetectable.

"It's never been so unobtrusive. It's never been so invisible," John Pike, director of the Globalsecurity.org think tank, said of the domestic surveillance programs revealed in recent months. "Most people just don't think about it, even though the reality has been broadcast far and wide. It's reassuringly amazing, that despite some people hollering about government intrusion, it doesn't feel oppressive."

As technology further develops and the government's capacity for collecting and storing metadata increases, privacy of communication likely will continue to erode — an undemocratic reality revisited often in literature.

In George Orwell's "1984," every room in every home was equipped with a "telescreen," a two-way television that broadcasted incessant pro-regime propaganda and captured video of citizens' daily lives for the government.

Though officials had unfettered access to their lives, Orwell's protagonists were at least temporarily able to subvert the "Ministry of Love" because there simply were not enough bureaucratic minds to review that much footage.

Technology has allowed the U.S. government to overcome that problem. Computers now have the ability to review every bit of data the National Security Agency vacuums from the airwaves and Internet, Pike said.

In the actual year of 1984, the German Democratic Republic's secret police, the infamous Stasi, had 10 percent of its entire population informing on their fellow citizens and they still had a hard time keeping track of subversives, Pike said. A dozen years into the nationwide program of information gathering that resulted from the 9/11 terrorist attacks, the United States has a degree of pervasive police surveillance that the Stasi or Orwell's Ministry of Love could never have achieved, Pike said.

The U.S. government has the tools to ferret out and counter almost any terror plot that is discussed on the telephone or in electronic communication, Pike said. Advanced algorithms and sensor technology will extend that watchfulness to public spaces and draw conclusions about an individual's intentions by identifying behavioral patterns.

The NSA is building a gigantic, 100,000-square-foot data storage center outside Salt Lake City. The \$1.2 billion installation includes another million square feet of infrastructure to operate the computers that some experts believe will be able to record all phone calls and electronic communications in the United States in their entirety as well as targeted surveillance overseas.

Benjamin Wittes, senior fellow at The Brookings Institution, said in an August podcast that personal liberty and national security are not necessarily at opposite ends of the spectrum of government power.

"I don't mean to say that liberty and security are not ever in tension with one another. They sometimes are," he said. "If you want to maximize liberty, the optimal amount of NSA surveillance is not zero, because NSA surveillance allows the government to protect us from all sorts of actors that want to threaten our liberty. People are too quick ... to set these two things up in real opposition to one another."

If liberty and security were inherently in opposition to one another, the freest and most secure places on Earth are less than desirable places to live, Wittes said. North Korea is very secure because there is very little liberty, while Somalia is very free because there is no rule of law, he said.

As technology progresses, a balance must be reached between the power and liberty of individuals and the security of the state as a whole, Wittes said. People must be able to walk in public and feel safe because the government is keeping an eye on bad guys, but not so thoroughly or broadly that people feel watched to the point of oppression.

"You will not be meaningfully free in that world if you fear attack from any point of the globe," Wittes said. "Similarly, you will not be meaningfully secure ... if you are not able to exercise safely the basic freedoms we expect."

The technologies that allow governments to spy on their citizens give individuals an unprecedented power to project threats. An individual can disseminate classified information that harms a state's national security, just as that government can mine personal data about the individual.

A potential terrorist is therefore "dramatically more powerful than individuals have ever been before — so powerful so as to potentially cause strategic threats to states," Wittes said.

The next phase of government information gathering will involve the proliferation of pervasive full-motion video surveillance of public spaces, Pike said. Facial recognition technology, which has become dramatically more sophisticated in recent years, will soon be able to pick out a suspected terrorist or criminal in a sea of pedestrians walking through Central Park in New York City.

If proven effective, that technology will eventually be extended to less-immediate threats, like drug dealers or petty criminals.

"At first it will be really useful against drug kingpins and terrorists, because if law enforcement has a photo of a suspect, that person will literally not be able to walk in public without being detected," Pike said. "But pretty soon it will be used to catch deadbeat dads because it's too useful."

Just as lethal drones were initially used explicitly to take out al-Qaida leaders and subsequently used against lower-rung terrorist operatives, surveillance technology will slowly creep outward and downward, Pike said.

"Both of these phenomena are merely commentaries on Moore's Law," he said. "Lethal drones are simply too good at what they do to not use them for killing terrorists in far-flung places. It is in the nature of Moore's Law that it is either too soon to tell or too late to change once questions arise about a technology."

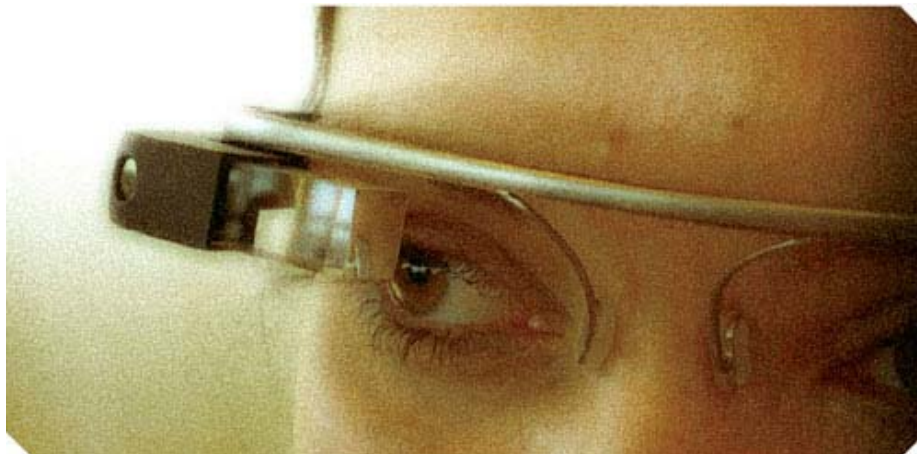
If technology reaches the point where conversations can be accurately classified as suspicious, pervasive government surveillance may be at least overlooked by Americans who feel safe and unburdened by Big Brother.

Even if the audio is monitored or recorded, it is extremely unlikely that a person's conversation with their grandmother about Christmas dinner plans, or an intimate chat with a spouse will be heard by another set of human ears. Technologies are being tested and developed that weed out only conversations that include specific keywords associated with terrorism or crime, Pike said.

Machines are listening, but only pass the information to human analysts if certain topics are being discussed, like purchasing a pressure cooker for use as an improvised explosive device.

That technology is imperfect, and concerns remain that it could flag two firearms enthusiasts discussing a day at the range as readily as two jihadists planning to blow up a building.

"We've got most of the government telling you, 'Don't worry, be happy,' and people seem to agree that that is the best course," Pike said. "Also, most people flatter themselves thinking they are worth listening to. They don't understand how profoundly disinterested the government is in what they do. Most people don't know how boring their lives are." — *Dan Parsons*



Google

The ubiquitous Internet juggernaut has its proverbial hand in several honey pots — from personal devices such as Google Glass, to tracking ships, to big data, and the company is poised to enter a number of industries in the coming years.

The company could make a huge splash in the defense industry. Already, a number of Google products are serving or being tested for military purposes.

At Arlington, Va.-based Thermopylae Sciences and Technology, a company that specializes in transitioning commercial products to the defense world, Google has opened many doors.

Debuting with much fanfare earlier this year was Google's Glass project. Glass is pegged as a revolutionary way to share information. It works by placing a prism on the frame of a pair of glasses, which allows wearers to see a screen in front of them. Users are then able to check email, take photos or videos and update social media accounts. While currently only able to complete basic tasks, Google earlier this year opened up the devices to select developers who are working to apply the technology to numerous industries.

At Thermopylae, company executives tasked engineers with finding new ways to use Glass in a military setting, said Chief Innovation Officer John Clark.

"It's just this cool idea of, 'What can be done?' and then, 'How can we apply it when the time is right?'" Clark said.

One engineer recently used Glass to steer a quadcopter unmanned aerial vehicle. The drone navigates by following the movement of the Glass wearer. A flick of the head to the right and the quadcopter turns. Raise the head and the craft lifts up. The wearer also can stream video from the UAV into the Glass display.

While just one example, the exercise shows that Glass could someday be used to help soldiers keep their hands free while carrying out valuable reconnaissance in the field, Clark said.

Still, Glass is far from being ready for the battlefield, and Google has no plans to turn Glass into a defense product.

"Google has absolutely no interest in selling Glass to the defense or military space at all," Clark said. "I think its real focus is on the consumer space."

But once Glass leaves its beta stage and becomes widely available, nothing is stopping a company from applying it to soldier needs, Clark said.

While the idea of using Glass on battlefields is promising, it's a hard sell, said Greg Giaquinto, a senior aerospace and defense analyst at Forecast International, a Newtown, Conn.-based market consulting firm.

"It's neat and it's a little gimmicky, but I don't think it's going to be a major player," Giaquinto told National Defense.

When it comes to heads-up displays, Google doesn't have the market cornered, he said. Other defense contractors are working on similar products, such as Oculus VR's Oculus Rift, a virtual-reality headset.

"I'm sure that there are other defense contractors who have ... similar technology, and would go to market with it when they thought it was viable business," he said.

Google recently came under fire after the company allegedly allowed intelligence agencies to snoop on user email accounts.

But Google is probably more interested in data collection than intelligence gathering, said Eric Wertheim, a U.S. Naval Institute consultant on naval and aviation issues.

Last year, Google made waves in the defense world after it announced that it was developing a program that would track all ships at sea — including Navy ships — by using data from the Automated Identification System. AIS tracks all passenger vessels and ships heavier than 300 tons. Smaller watercraft can voluntarily participate. The system not only tracks the location of a ship — though data may be up to an hour old — but also the type of ship, bearing, size and other details.

At the U.S. Naval Institute's annual Joint Warfighting Conference last May, Michael Jones, chief technology advocate for Google Ventures, created a media firestorm by saying Google could track ships better than the Defense Department.

"It angers me as a citizen that I can easily do this and the entire DoD can't do this," said Jones. "It's crazy."

Google at the time was working with countries such as Indonesia and Iceland to turn the data into intelligence software, he said.

Since the speech, further information on the program has mostly gone cold, Wertheim told National Defense. Regardless, the notion that Google, using freely available data from AIS, could create a system more powerful than what the military has is unlikely.

"Either it was misstated or it was just flat out wrong," said Wertheim. "I don't think there is any evidence since then that

[suggests] that was true. ... There was no follow up from Google, there was nothing saying that they are offering something that the capabilities of the naval intelligence communities of the world were not able to do.”

One problem with Google’s program is that it can only take information from compliant vessels, whereas the U.S. military can collect data on non-compliant ships using radar or other technical means. The Navy could decide to use Google’s program — should it come to fruition — alongside its own data, he said.

At Thermopylae, Clark said much of his company’s business growth comes from the use of Google Earth and Maps for its iSpatial program.

iSpatial takes information readily available from Earth and Maps and pulls in additional material, such as weather data and incidents of civil unrest, to create an interactive, layered map that can be applied to a number of different problem sets.

The end result allows users to get situational awareness and look at possible interruptions in supply chains. For example, before sending troops on a particular road in Afghanistan, Army officials could look at iSpatial and see that the route is prone to roadside bomb attacks and avoid it. On the commercial side, a company could use the system to assess how a hurricane clobbering the coast of Mexico would affect its supply chain, Clark said.

“Think of this as a wrapper around Google Maps and Google Earth that gives you all the little tools to ... put the data and do the functions over the map that are relevant to your mission or business,” said Clark.

A spokesperson for Google declined to comment for this article. —*Yasmin Tadjdeh*



The Promise of Mobile Devices

The average American relies on smartphones for voice and text messaging, sending photos and videos to family, and getting directions via the global positioning system. These handheld devices allow a person to check his work email or pass time at the doctor’s office by playing Angry Birds.

But while individual consumers have a handle on how to use smartphones to simplify their lives, the military is still figuring out how best to incorporate mobile devices in the office and in the field.

“Everybody is somewhat in love with their ... mobile devices on a personal level. We know how it can increase our personal productivity, our communication. You can look up anything anytime,” said Greg Eoyang, president of ID Apps, a subsidiary of Intelligent Decisions, an Ashburn, Va.-based information technology company. “People understand what the promise of the devices are, and yet when it’s transferred over to a business application, or in this case, a business of conducting war application, I think there has been a huge lack of ability to convert.”

Fearing that new platforms could introduce vulnerabilities to their networks, the Defense Department and service branches traditionally have been slow to pick up new smartphones and tablets. The military, led by the Defense Information Systems Agency, recently made changes that would allow swifter adoption of the latest mobile devices. The agency also plans to build a military-centric application store in the vein of Google Play or Apple’s App Store.

The use of applications is merely the tip of the iceberg. Dwelling below are endless possible ways the military can employ mobile technologies, said Mike Mikuta, senior technology director at DRC, an Andover, Mass.-based technology company.

“These smartphone platforms are the ultimate miniaturization of technology. So the things we’re carrying around are about as fast as a computer was about three years ago,” he said. “But you then also have all the other innovative capabilities: the GPS, cameras [and the] capability to run sensors.”

At this point, the phrase, “every soldier is a sensor” has become almost a military cliché, but Mikuta sees a future in

which mobile devices embedded in a soldier's uniform could act as the "brain" pulling together information from robots, unmanned aerial vehicles and sensors that detect chemical agents or acoustic signatures, he said.

This data could be used to warn troops on the ground of impending danger or to give directions on where to exit a building or village, he said.

Wearable devices, such as the one described by Mikuta, will be a huge driver in mobile technologies, industry officials agreed. In the commercial sector, all eyes are on Google's Glass, a lightweight, head-mounted computing system that shares many of the same functions as smartphones.

Although Glass may not find widespread use in the Defense Department, wearable technologies offer great promise for military applications — if officials can determine how to use them properly, said Jan Ruderman, Panasonic's vice president of business division strategy and operations.

"If the military is looking for something that would be used, for instance, in maintenance of aircraft, that's a great application for a wearable type device. ... Those types of things can be done today" using commercial-off-the-shelf products. Specialized wearable mobile devices, such as one that would allow a user to lock a target on an enemy, would most likely have to be purpose built to military specifications, he said.

Ultimately, the military will probably opt for devices that are embedded in a helmet or uniform, Ruderman said. This could incentivize industry to develop more flexible screens, such as a display that can conform to a soldier's forearm. It may also inspire advancements in tracking technologies that allow a person to control digital content using their eyes, he said. Those technologies are already being commercially developed today, but could be spurred along by military investment.

The Defense Department has yet to launch its app store, but early items are likely to focus on training, streamlining communications or reducing paper documents such as flight plans, said Scott Armstrong, chief strategy officer for INADEV, which has produced apps for civilian entities such as the Federal Emergency Management Agency.

Future apps could be used to crowdsource information in the same way Google uses cell phone data to track how much traffic is on roads, Eoyang said. "You can automatically be transmitting all kinds of information, [including] the position of people. You could also have the temperature or the altitude or the ambient light or all sorts of things that can be collected from the device."

The military will also need apps that help piece together situational awareness in a fast, easy-to-digest format. It already has sophisticated maps and databases of location information that could be leveraged to create an app much more advanced than Google Maps, Eoyang said.

"One thing that they [military services] have in abundance is information. But what they don't necessarily have is the right information at the right place at the right time," he said. The challenge is being able to quickly stream information to a particular soldier on demand because "if you're distracted using your mobile device and you're in the field ... that's not so good either."

Biometric capabilities such as facial recognition and the ability to translate foreign languages are other features that could be of interest to the military, Armstrong said.

In some cases, these are already being developed on a commercial level. For instance, the recently launched iPhone 5S is the first such device that uses fingerprint recognition to unlock the phone and to purchase music, videos or applications.

Powering devices for extended periods is an age-old problem for handheld battlefield technologies such as radios because additional batteries and cables add weight to already overloaded troops. As the military becomes a greater consumer of mobile technologies, developers will also contend with optimizing the size, weight and power of smartphones and tablets.

The commercial industry is steadily improving battery life, but in a decade it's possible mobile devices could also use advanced solar or energy-harvesting capabilities, Ruderman said. Panasonic currently is working on developing solar technologies.

Companies may also minimize the number of cables a soldier needs to power a device. "If we can remove an A/C adapter to charge whatever the device may be, that might save a few ounces or even a pound," he said.

In order for the military to use mobile devices to their fullest potential, officials will have to take some risks, Eoyang said. The traditional IT acquisition process — where it takes years to design, develop and test a product — is ill-suited for mobile devices and applications, which must be rapidly put into the hands of users.

"With the Defense Information Systems Agency, what I think they're trying to discover is how do you have kind of a marketplace or ecosystem where you say, 'Hey, I got an app that I want to build in 30 days. Which developer can do this for me?'" he said. Applications that take years to develop will be too outdated to run on the latest generation of devices. At that point, "you've kind of missed the boat." — *Valerie Insinna*



Robotics Revolution

Retired Army Lt. Gen. Rick Lynch stood before a room that was packed with military robot manufacturers and told them maybe it was time to move on to civilian markets.

Research, development, test and evaluation money to push Army, Navy, Air Force and Marine Corps ground robot technology forward was drying up, he said.

"Let's not stop and wait until money becomes available. Let's refocus on efforts where there could be opportunities and advance the technology," he said at a National Defense Industrial Association conference.

The past dozen years have seen a revolution in the way robotic systems have been employed by the U.S. military on the ground and in the air.

Concurrently, research continues globally on a host of non-military applications for robotics. Farmers are using automation on tractors and aerial drones for precision agriculture. Japan already has more than 2,000 unmanned helicopters applying pesticides and fertilizer to rice paddies. Automobile manufacturers and Internet giant Google are sinking millions into driverless car concepts. Consumers already have robot vacuum cleaners and lawn mowers. Lynch was well known before his retirement as a vocal advocate for robots on the battlefield.

He was unique in the military as a holder of a master's degree in robotics from MIT, who was also a combatant commander.

He has not lost his enthusiasm for robots on the battlefield. If he had his druthers, an automated machine would carry out every dull, dirty and dangerous task that is performed by a soldier or Marine.

It's just that he doesn't think the military is going to be on the cutting edge of research anymore.

"Rather than focus on military technology to pull commercial applications, why don't we focus on commercial applications that will pull military capabilities?" he asked.

"Maybe we don't have a choice given today's budget environment," he added. Lynch is now executive director of the University of Texas at Arlington Research Institute.

There, he wants to push forward the concept of "assistive robotics," he said. As a former general whose troops suffered serious injuries in Iraq, he is a strong proponent of helping wounded warriors, whether they are with bionic prosthetics or assistive robots that can help them do everyday tasks in their homes. The elderly, who may have disabilities but want to continue living independently, can also be a huge potential market for robot makers as the U.S. population ages, he said.

Further R&D is needed in human-robot interfaces, machine vision and control theory for these assistive robots, he said. For example, a paraplegic could control a drone by letting the machine track the movement of his eyeballs.

These technologies, when mature, can come back and help the military, he asserted.

Peter W. Singer, senior fellow at The Brookings Institute and author of the book, "Wired for War," which examines the impact of robots on the battlefield, said it looks as if the civilian side will be taking the lead when it comes to the technology.

"We've long thought of the military role in this space as spinning out technologies to the civilian side, but very soon it may be the military spinning in areas where the civilian side is in the lead. What happened in computers could very well play out with unmanned systems as well," he said.

"We are seeing the robotics sector take off on the civilian side, not merely in research and spending, but you also don't

have the kind of institutional resistance that can be a challenge for game-changing technologies," he added.

One example of "institutional resistance" is pushback against driverless military trucks.

As roadside bombs began to take their toll in Iraq a decade ago, research and development money flowed to the Army Tank Automotive Research, Development and Engineering Center to create kits for trucks that would allow them to follow in convoys without drivers. The fewer humans on the road, the less chance of fatalities, it was reasoned. Congress about that time mandated that one-third of all military vehicles be unmanned by 2015, which is a deadline that seems certain to be missed.

The technology was demonstrated, but officials at the conference had plenty of reasons why it couldn't be deployed. Among them was the cost-per-vehicle price for the kits.

Lynch, while still on active duty, railed against the delay, maintained that the technology was mature, and said this institutional resistance was costing lives.

Troops left Iraq without the technology ever being deployed, and it appears that will be the case in Afghanistan. Army officials at the NDIA conference had a laundry list of reasons why driverless trucks still couldn't be fielded.

Meanwhile, domestic and international automobile manufacturers, as well as Google, are proceeding with autonomous car technologies, including some related features like collision avoidance that are already making it into some models.

Lt. Col. Stuart Hatfield, branch chief of soldier systems and unmanned ground systems, Army G-8, denied that the window of opportunity was closing on driverless trucks. IEDs were the number one killer, but once the bulk of troops withdraw from Afghanistan, the number two killer — vehicle accidents — will move into the top spot. Such technologies can save lives, he maintained.

"The window is not closing. It is changing," he said.

Lynch said: "I want robots clearing routes. I want robots doing surveillance. I want robots doing all the dangerous tasks on the battlefield. And if we keep our focus there, we will get there. We just can't give up."

Military robots have perhaps made their biggest impact over the past decade in the skies, where unmanned aerial vehicles provided surveillance, and in the latter years, deadly force. This took place in nations where there were no regulations governing their use.

Domestically, the Federal Aviation Administration won't approve their widespread civilian or military use in unrestricted airspace without sense-and-avoid technologies that will automatically guide a drone clear of other aircraft or objects.

The military continues to look at this technology gap because it wants to train in domestic airspace and avoid collisions, but Singer said innovation may come from the civilian side as well.

"Sense and avoid is getting much better, as the technology advances, particularly on the software side. The move towards the opening up of the civilian airspace of course is helping push that even further, as it's a key nut to crack to opening it up for a much, much wider market." — *Stew Magnuson*



The Rise of Special Operations Forces

The members of the force known as the "quiet professionals" have stepped out of the shadows and into the global spotlight under the Obama administration.

Special operations forces are deployed in about 80 countries, and their budget has almost quintupled since 2001. U.S.

Special Operations Command is the only major component of the U.S. military that is growing in size and funding, although its 2014 budget request of \$9.9 billion was 4 percent smaller than its 2013 spending of \$10.4 billion.

A study by the consulting firm Deloitte in fact predicts a tectonic shift in how countries invest in their ground forces. A Cold War–era military that is highly dependent on general-purpose forces and strategic nuclear weapons will give way to “new structures” that are built around special operations capability and information technologies.

The Obama administration’s “Defense Strategic Guidance” said special operations forces will increasingly be relied upon to “help address national security threats and challenges on a global scale ... given their ability to operate in a wide range of environments and undertake tactical actions that produce strategic effects.”

Special operations forces are “really a model of a cost-effective defense solution,” said Linda Robinson, a SOF scholar.

While Navy SEALs have captured the public’s imagination since the Bin Laden raid, most of what SOF troops do day to day is more mundane. And the responsibilities are likely to grow.

The head of U.S. Special Operations Command Adm. William McRaven is seeking greater authorities to deploy SOF and launch operations across the globe.

Between 2001 and 2013, U.S. special operations forces grew from fewer than 40,000 to 66,000. Planned force additions include a fifth special forces battalion, increases in soldiers for the 75th Ranger Regiment, more civil affairs units, and additional troops assigned to Air Force, Navy, and Marine Corps special operations units. SOCOM officials cautioned that overly rapid growth would compromise the effectiveness of the organization.

As the United States adopts an expansionist view of special operations forces, other nations are following suit. The number of countries that are now funding special operations capabilities has increased by 40 percent from 2006 to 2012, Deloitte estimates. The largest increases appear to be in China, India, Iran and Turkey. Two-thirds of the countries adding SOF are lower-income nations, where many terrorist attacks occur. U.S. counterterrorism policy puts emphasis on SOF helping allies “build capacity,” predominantly in Africa and Southeast Asia. “This increased cooperation may spur further growth and development of SOF capabilities around the world,” said the Deloitte report.

It does not require a crystal ball to see how the rise of special operations forces could shake up the defense market. Much of the weapons-making industry — with its genesis in the Cold War — has not yet adapted to this rapidly changing reality. In the era of light-footprint, surgical-strike special operations, a Deloitte analyst predicted, government will shift investments in part from heavy armor and aircraft carriers to night-vision, electronic-warfare and encrypted communications technology.

At U.S. Special Operations Command’s industry conference in Tampa, Fla., last year, Lisa Sanders, SOCOM’s science and technology chief, offered a short list of must-have technologies that the command is seeking to buy: lighter and less cumbersome body armor, night-vision goggles for all weather conditions and cutting-edge spy gear such as biometric tools to keep track of enemy fighters. Sanders told contractors to think about how they could design a “tactical assault light operator suit” with embedded sensors and radio receivers so operators are less burdened by heavy gear and better protected from ambushes.

Reliable and easy-to-transport communications systems also are high on the SOF innovation wish list. When they deploy to combat zones, special operations troops today must bring along a multitude of electronic devices. Besides basic line-of-sight radios to communicate with their peers, they need devices to connect with other U.S. government agencies and allies. They also require satellite receivers, smartphones, tablets and custom terminals to upload streaming video.

At a time when special operations forces are seeking to expand their presence around the world, there have to be better ways to connect operators and allow them to share information in real time, McRaven said. In a “request for information” this summer, SOCOM asked vendors for ideas on how to make communications devices that can do more than one thing at a time — a single handheld and backpack size device that can simultaneously operate radio waveforms, receive and distribute encrypted video, imagery and telemetry. These radios also should be connected to Android or BlackBerry phones and tablets. Another priority for SOF is lighter and longer-lasting batteries to power their electronics.

A new way of thinking about defense technology will no doubt be needed in order to satisfy the SOF customer, industry analysts said. In fact the entire defense establishment has yet to fully understand how to use technology to combat emerging threats.

Microsoft’s former chief technology officer Nathan Paul Myhrvold got at the crux of the matter in a white paper called, “Strategic Terrorism: A Call to Action.” He wondered how long it will take for the U.S. military to adjust to a world where technology allows stateless groups to organize, recruit and fund themselves in an unprecedented fashion.

“Stateless groups are positioned to be lead players on the world stage, and traditional armies are no longer suitable to fight these threats,” he contends. “A different set of technology trends means that small numbers of people can obtain incredibly lethal power. ... Now, for the first time in human history, a small group can be as lethal as the largest superpower.”

Defending U.S. and allied interests from techno-savvy non-state enemies, he says, will require “rebuilding our military and intelligence capabilities from the ground up.”

More resources will have to be poured into special operations forces, Myhrvold says. "The years since 9/11 have seen an increase in the size and importance of special operations, but this increase appears to be a small down payment on the capabilities the future will demand," he says.

"We need to develop new weapons" that could help special operations forces combat bioterrorism and other threats that likely will come from non-state groups. "Troops involved in special operations — Rangers, Green Berets, Delta Force members, and so forth — have long been treated as adjuncts to the 'real' forces," Myhrvold wrote.

"This attitude is another holdover from World War II, when commandos did the prep work for conventional assaults." Such an approach is not going to help in future engagements, he asserted. "Attacks will often use special-operations units without involving any conventional forces. It may even make sense to unify all special operations under a separate branch of the armed services, one more on par with the Army, Navy, Marines and Air Force than SOCOM is today." — *Sandra I. Erwin*

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