The parts were then boxed up and shipped to Fort Riley, much like a dresser might be shipped to a customer with instructions on how to screw it all together. But unlike a dresser that might come with instructions that are hard to understand, the A1 parts came with highly trained armament technicians to do the conversions, Lucas said.

Besides doing the assembly of the upper and lower receiver and bolt carrier group, the team brought along a laser engraver to re-mark the setting nomenclature, he said. "Safe, Semi, and Burst" was changed to "Safe, Semi, and Auto." Also, the "A1" was added to "M4."

The A1 conversions will probably not be the last word on the carbine, said Maddi, who expects it to continually evolve.

Every Soldier qualifies with the carbine, or the M16A2 or M16A4, twice a year. Their feedback, along with that of Soldiers returning from theater, will continue to be monitored and tweaks to the system are always possible, he said.

The small-arms community — which includes Soldiers, special operators, and those from the other services — are discussing other performance enhancements like an extended forward rail, folding front sight post, match-grade triggers for designated marksmen, and integration of suppressors, he said, adding that at this time they're only "on the drawing board."

Maddi thinks Eugene Stoner, the designer of the M16 and its family of weapons, including the carbine, should be considered in the same august group as Colt, Smith & Wesson, and Browning.

The M4, which Stoner designed several decades ago, was "a pretty good idea," Maddi said.

"Soldiers trust in it," and it consistently ranks first among all weapons in Soldier satisfaction surveys, he added.

So, he said, "the big question is, 'how do you improve on something that's already pretty darn good?'"

(David Vergun writes for the Army News Service.)

Insect-Inspired Technology to Extend Situational Awareness

JENNA BRADY

Soldiers' missions frequently lead them to locations where they must assess the status of structures and where the presence of threats is not immediately known or easily detectable. These threats include ambushes and chemical and biological threats that could be lurking around every corner. Current technology assists Soldiers in detecting these possible threats by allowing them to assess structures and threats through the use of teleoperated sensing systems.

"Think of it as a camera on wheels, where Soldiers have a one or two-pound sensor that they can throw into a building to assess situational awareness," said Dr. Brett Piekarski, chief of the U.S. Army Research Laboratory's Micro and Nano Materials and Devices Branch within the Sensors and Electron Devices Directorate (SEDD); and cooperative agreement manager of the Micro Autonomous Systems and Technology (MAST), Collaborative Technology Alliance. "The Soldier controls it like a video game to complete the task."

Though successful in getting the job done, current systems have their drawbacks.

"In order for Soldiers to send a system into a building and guide it along the way, they must put their weapons down to do so. This creates the need for other Soldiers to stop what they are doing to protect the Soldier that is controlling the system," Piekarski said.

In addition, existing sensing systems do not have the ability to go everywhere the Soldier goes, as they are not very successful in rugged terrain and are too slow to keep up with the speed of the Soldier.

According to Piekarski, in terms of the future, sensing systems are desired that have the ability to find their own way in and out of a structure, instantaneously send back information to the Soldier from within the structure, hover to defend Soldiers' perimeters and perch to conduct surveillance, all

Photo by Doug LaFon

Dr. Joseph Conroy checks the vehicle operation of the microquadrotor, a platform for testing integrated sensing and processing on size-constrained robotic systems.

while being minimally monitored by the Soldier.

"The end result is to create a system that would be a true teammate for Soldiers, one that could keep up with their speed," Piekarski said. "We want these systems to be small, fast, lightweight, cost-effective, and have the ability to go wherever the Soldier needs to go."

These systems can come in the form of ground vehicle sensors, aerial sensors, and humanoid robots that would work hand-in-hand with Soldiers, creating what Piekarski calls a "bubble" around them for sensing and protection purposes.

The U.S. Army Research Laboratory (ARL) is working toward providing improved situational awareness capabilities for Soldiers through projects that involve small unmanned aerial vehicles and insect-scaled platforms.

Researchers are currently working with the ARL microquadrotor, which is a platform for testing integrated sensing and processing on size-constrained robotic systems.

The system is currently able to fly using a manual pilot control or within a test environment that utilizes an external visual tracking system, such as a Vicon system.

According to Dr. Joseph Conroy, research engineer in SEDD, the sensing integrated onto this iteration of the vehicle provides limited capabilities for sensing the environment.

"Methods currently used for control, navigation, and obstacle avoidance, such as laser range finders, are prohibitively heavy and expensive. We wish to use methods inspired by the neurophysiology of the insect visual system to provide these capabilities within the necessary payload," Conroy said.

Conroy noted that Soldiers have expressed a desire for general purpose squad-level intelligence, surveillance, and reconnaissance (ISR) capabilities that can be provided by flying robotic vehicles; however, they wish to minimize weight, training required, and time spent paying attention to the robotic system instead of the environment around them.

"For this reason, these vehicles must demonstrate a high degree of autonomy in a small package," he said.

In terms of insect-scaled platforms, ARL researchers are developing and testing millimeter-scale robotic leg structures.

According to Dr. Ronald Polcawich, team lead for Piezoelectric-Micro Electro-Mechanical Systems Technology at ARL, the leg structures consist of segments of piezoelectric thin film actuators and thin film copper sections that are designed to mimic the kinetics of a leg and have the ability to move, lift and resist impact.

Heading into the future, Polcawich says that these robotic platforms will be of great benefit to Soldiers on the battlefield.

"It is envisioned that robots and structures on this size scale can provide a unique set of advantages and capabilities to the Soldier. Their inherent size makes them useful to access difficult to reach areas such as in rubble for search and rescue, and behind closed doors for reconnaissance," Polcawich said.

Amidst the benefits that these future systems could offer, foreseen challenges do exist.

"One of the challenges of future systems in being a true teammate to the Soldier involves joint decision-making and the trusting of information," Piekarski said. "Soldiers can become fatigued after long hours on duty, whereas systems are more consistent, but Soldiers may be able to see better firsthand if something appears to be a threat or not. We are currently examining how Soldiers will ultimately make their decisions. Will they trust their instinct, the system, or a combination of both?"

Through the challenges to be faced and the development and testing of these future technologies, the goal of Army researchers remains the same, to extend the situational awareness of Soldier's in order to provide them with advanced protection on the battlefield that could help save their lives when they are put in risky and unknown situations.

(Jenna Brady works for the U.S. Army Research Laboratory's Public Affairs Office.)

Photo courtesy of ECBC

ECBC's Pyrotechnics and Explosives Branch detonates an HX smoke test grenade to evaluate its composition.

Army Develops New Smoke Screens

The U.S. Army Edgewood Chemical Biological Center (ECBC) is researching and developing smoke screen compositions to keep pace with the changing face of conflict.

ECBC is currently completing a multi-year effort to refine several smoke screen compositions that will allow troops to mask themselves from enemy fire.

A new formula will replace the World War II-era HC Screening Smoke Grenade.

"When people think of ECBC, they think of the great work in chem-bio defense equipment. Lesser known is the role ECBC plays in developing battlefield obscurants to protect the warfighter," said Nino Bonavito, Pyrotechnics and Explosives Branch chief.

Several potential smoke compositions are nearing the end of the decision cycle that will determine which composition goes into development to become the smoke composition of choice for the next century. Before deciding, the Army will consider performance, manufacturing cost, toxicity, environmental impact and the availability of materials.

Read more about the Army's development of smoke screens at www.army.mil/article/126407/Army_develops_smoke_screens_for_future_battles.