New mission, new techniques

Joint STARS tracking Taliban in Afghan mountains

The U.S. Air Force's E-8C Joint Surveillance Target Attack Radar System aircraft carries a large Doppler radar antenna underneath its fuselage to detect the movement of enemy forces on the ground.

NORTHROP GRUMMAN

BY WILLIAM MATTHEWS

Airplanes that were designed in the 1980s to spot Soviet tanks rumbling through central Germany, and used in Iraq to track forces moving under the cover of a sandstorm, now are being used in Afghanistan to spot Taliban fighters trudging on foot at night along rough mountain trails.

The planes are E-8C Joint STARS — Joint Surveillance Target Attack Radar System aircraft. "We're looking at some new applications for the radar," confirmed Col. William Welsh, operations group commander at the 116th Air Control Wing, which operates the U.S. Air Force's 17 Joint STARS planes and is based at Robins Air Force Base, Ga.

In Iraq, and especially in Afghanistan, the planes have proven useful in spotting and tracking "dismounted forces" — groups of Taliban and other fighters moving on foot.

The Air Force declines to say just how sensitive the Joint STARS radar is or whether it operates at its customary 35,000 feet. But Welsh put it this way: "It does not necessarily have to be a large group."

According to information published by the Air Force, Joint STARS crews flying over Afghanistan "are often looking for a single ground mover in an area of interest."

The planes are equipped with giant Doppler radars, which detect motion by aiming a radar signal to the ground and analyzing changes in the frequency of the signal that bounces back. "Everything in motion creates a Doppler shift, and the radar is set to detect it," Welsh said.

In the past, Joint STARS radars have been set to detect large, relatively fast-moving objects, such as tanks and armored vehicles. They also had limited ability to detect helicopters and slow, low-flying aircraft.

The Air Force is adjusting Joint STARS operating methods to match reality on the ground in Afghanistan, said Michael Isherwood, a senior analyst for Northrop Grumman and a former Air Force fighter pilot.

"There is a real lack of infrastructure," he said. "There are no railroads, no interstate [highways]. There is a culture of moving from place to place on foot, on horse, over trails, literally climbing up a mountain and down the other side. That's how they get around."

And that's what Joint STARS now must be able to detect.

The plane itself is big — a 153-foot-long modified Boeing 707 airliner. It has a 24-foot-long radar antenna that is housed in a 27-foot-long canoe-shaped radome attached to its belly. Inside, Joint STARS is packed with computers that analyze radar signals and with communications gear. It has 18 workstations that are typically manned by a mix of Air Force and Army radar and communications specialists.

The way it is traditionally used, the Joint STARS radar can look down over 19,305 square miles and detect moving targets as far away as 155 miles. But in Afghanistan, instead of maintaining that sweeping view, the radar is being focused on up to 14 separate target areas that are each 10 kilometers square.

In this configuration, a Joint STARS plane can simultaneously watch the area around several U.S. outposts to warn of approaching enemies, monitor convoys, support combat operations and conduct surveillance along key roads and borders, according to Northrop Grumman, which installed and maintains the equipment that turns a 707 into a Joint STARS.

To make the Joint STARS radar spot fighters on foot rather than tanks on the move, "you adjust the parameters," Isherwood said, "adjust the sensitivity."

Welsh makes it sound not quite so simple. "The bottom line for us is that we're still evaluating what our capabilities are when we start looking at low radar cross-section targets," he said. How small can it be and how slow can it go? The Air Force doesn't yet know, he said. And "it will be classified when we do."

A report written and released by the Air Force describes Joint STARS operations: "On one particular mission, Crew 2 traced movement departing the location of a suicide bomb attack at an Army post and maintained surveillance until the movement stopped. They called a UAV equipped with a Hellfire missile to the position." UAV cameras revealed Taliban planting an improvised explosive device (IED). The missile "destroyed them," the Air Force said.

Since the Doppler radar can detect only things that are in motion, Joint STARS also has a synthetic aperture radar for targets that have stopped. That radar collects multiple images of a target as the plane passes overhead and uses a computer to merge them into a single sharp image.

Isherwood said Northrop is planning more improvements to the reconnaissance capability of Joint STARS. Next year, the company expects to install SYERS-3 infrared and electro-optical sensors in a Joint STARS as a test. SYERS-3 (which stands for Senior Year Electro-optical Reconnaissance System-3) is an advanced version of the camera system used on U-2 spy planes. Joint STARS would use it for target verification.

For now, when the Joint STARS radar detects a target, the plane's radar operators "see moving dots," he said. Based on size, speed and other characteristics, experienced operators can identify the targets with a fair degree of certainty, he said.

But to know for sure what they have spotted, Joint STARS depends on other aircraft, UAVs or ground forces for positive identification. SYERS-3 would enable Joint STARS to do that for itself. ∎