GROUND-BASED AIR DEFENSE AND GROUND/AIR TASK-ORIENTED RADAR

BY SCOTT R. GOURLEY

Next-generation radar and missile defense capabilities continue moving forward under the PM GBAD-G/ATOR long-term strategic view.

Northrop Grumman photo

As with many other offices within the Program Executive Officer Land Systems Marine Corps, the Program Management (PM) office for the Marine Corps Ground/Air Task-Oriented Radar (G/ATOR) has experienced growth in its system portfolio over the past year. And, as in many other areas, that growth is bringing with it synergies that position the office to better support Marines today, tomorrow, and well into the future

The cornerstone of the office is G/ATOR, a three-dimensional short- to medium-range tactical radar designed to detect, identify, and track low-level cruise missiles, manned aircraft, and unmanned aerial vehicles as well as rockets, mortars, and artillery fire.

Developed by prime contractor Northrop Grumman Electronic Systems in Baltimore, Md., G/ATOR will replace legacy radar systems to perform air surveillance, cue air defense weapons, determine hostile indirect fire firing locations, and provide data to air traffic controllers.

"This is the one system that will do everything from tracking that hostile UAV to vectoring the friendlies around the sky to observing rockets, artillery, and mortars so you can direct the counterfire," explained Program Manager for G/ATOR Lee Bond.

Placing those capabilities against a backdrop of the current legacy systems that G/ATOR will replace, he added, "There are threats out there today – like small hovering UAVs – that were not envisioned when our legacy radars were developed and fielded a generation ago. So the performance of our legacy radars against those emergent threats on the modern battlefield is spotty at best. The smaller and slower the target gets and the lower to the ground it flies, the trickier it is for the traditional radar to find it. G/ATOR absolutely wipes out those limitations and gives you complete situational awareness of everything in the sky.

"One of G/ATOR's ultimate capabilities is to serve as a fire control system and support ground-based air defense in the form of advanced missiles," he said. "It is a single hardware solution that delivers multiple mission capabilities by adding software."

Bond characterized the program news surrounding G/ATOR as "all good." "Northrop Grumman has recently delivered the first system to us after a couple of years of hardware and software development integration and test at the factory in the Baltimore area," he said.

In late July 2012, Northrop Grumman announced the delivery of its AN/TPS-80 G/ATOR system to Surface Combat Systems Center (SCSC) Wallops Island in eastern Virginia for the government to begin its first and second phases of Developmental Testing (DT). The final phase of DT and the Operational Assessment for G/ATOR will be conducted in Yuma, Ariz., early in 2013.

Describing Wallops Island as "primarily a NASA facility," Bond pointed to the fact that "the Navy is a tenant command there and basically does 'testing on the beach,' since all their shipboard radars have to be able to look out over the ocean. It's proven to be a good place for them to do open air tests for their advanced radar systems. So we're going to take G/ATOR down there, park it on the beach, and have all that Navy infrastructure that's there support us in testing it over the course of the next six months or so.

"Following that Wallops Island testing, we'll move out to Yuma, Ariz., for some additional testing with desert and mountains in the background as compared to the seashore boundary that we get at Wallops Island," he added. "And all of this will culminate in sufficient performance characterization so that a year from now [summer 2013] we can start low-rate production and begin making G/ATORs for delivery to Marine operating forces.

"Thus, the program has achieved a significant milestone in terms of graduating out of the contractor's factory and moving into this period of formal testing by the government – all in anticipation of entering production next year," he said. "And all of that is in accordance with the master schedule that we have been held to for the past three years. So that's also good news: It's not just that we are making progress, but we are also on schedule and living within our budget.

"The other piece of good news that takes us a little bit further into the future is that because we are executing well, the service has agreed to support us in future budget cycles in transitioning from our current gallium arsenide [GaAs] semiconductor technology to the next-generation semiconductor technology, known as gallium nitride [GaN]," he continued, explaining that GaN will make G/ATOR "cost less and/or work better, along with weighing less and consuming less power.

"It is why your cell phone is now slightly smaller than a deck of playing cards when it used to be a brick," he said.

"When we get some of that same semiconductor technology into G/ATOR it truly makes us state of the art," he continued. "It gains us a lot of efficiencies. And it will save money because we just won't need as much physical mass in the radar to get the same performance out of it. That's also why it weighs less and consumes less power. Moreover, it brings us into line with our sister services and their next-generation radar requirements."

Acknowledging that "today's G/ATOR isn't quite what they're looking for," Bond asserted, "it does have the potential to go there.

"If we move G/ATOR into that next-generation gallium nitride semiconductor technology, it becomes very similar to what they're looking for," he said. "Now, I'm not ready to predict that they will join the program. But certainly we can say with confidence that, when looking at the other services' next-generation radar requirements, that transition into GaN technology not only makes our program better by saving us cost, weight, and money, but it also gives us a greater potential to meet the needs of the other services on their next-generation radars."

Moving into GaN technology will also expand the expeditionary envelope for G/ATOR.

According to Bond, the current system design requires a full 60 kilowatts (kW) of power from the system generator. Since the carburetion changes on that generator when the air thins at higher altitudes, the net result is that the generator fall slightly short of spec power output.

"What that means is that our system currently needs every bit of 60 kW to deliver its desired performance," Bond explained. "If you take it high enough in altitude to where the generator is only providing 55 kW, G/ATOR's performance is going to start to fall off. And we're still looking at how graceful that degradation will be as we go up in altitude."

Bond noted that the current operational threshold is 4,000 feet in elevation but that the objective operating elevation is 10,000 feet. "But get us into GaN technology and we will only need about 50 kW out of a 60 kW generator. Plus it's a lighter weight system so it can be moved around even easier. And suddenly we might be operating at 10,000 feet and contemplating 12,000.

"That's a very specific example of how going to the lighter and more power-efficient technology increases our operational envelope," he said. "It's no secret that right now we are in Afghanistan where there is plenty of terrain over 4,000 feet. And you would like to put your radar high up, where it has views as far and as wide as possible. At some of those higher elevations, the performance might be a little bit compromised in our current GaAs technology. But you get us into GaN and those restrictions pretty much go away."

With all going well on the G/ATOR program itself, the biggest change in the program office over the last year has been an expansion of related program responsibilities.

// **Lee Bond, program manager, G/ATOR, PEO Land Systems, updates senior Department of Defense leaders on the G/ATOR program during G/ATOR days at the Pentagon, October 2011.**

Photo coutesy of Northrop Grumman Corporation

"Back in January 2012, Secretary [Sean] Stackley [assistant secretary of the Navy for Research, Development and Acquisition] issued an Acquisition Decision Memorandum that brought some additional program work into this office," Bond related. "It's a collection of projects known as GBAD – ground-based air defense – and basically it starts with the man-portable Stinger as it is currently deployed by the Marines in our [Low Altitude] Air Defense [LAAD] battalions. Along the way we will modernize that capability somewhat, evolving it towards a more automated system and G/ATOR will be the fire control radar that directs it all."

Cautioning that the long-term project vision was still being formulated, he offered, "The 10-year strategic view is that downstream these programs will intersect. G/ATOR will continue to evolve, and in parallel, we will bring forward the missile defense capability beyond the current 'Stinger on the shoulder of a Marine' concept. The result is that five to 10 years from now we will get to a more automated, more capable system in which G/ATOR will be the eyes and the next-generation weapon will be the teeth."

Asked about future challenges, Bond was quick to cite the universal focus on demonstrating program cost efficiencies to safeguard precious taxpayer dollars.

He also acknowledged the fact that planned movement to GaN technology does come with some risk.

"Moving into that new technology is not risk free," he said. "If it was already out there, we would be using it today. Instead it's a move that we have tried to time to where the risk is a little down and the potential gain is very much up.

"One of the things that will bring the risk down further is that the other services are also making some basic investments in the GaN semiconductor technology," he continued. "It's not just the Marine Corps, but the Navy and Air Force specifically are also making investments in GaN, somewhat in anticipation of their next-generation sensor systems. So we have the opportunity to come into that technology right behind their efforts to exploit the fact that they have reduced some of the risk and driven the cost out of it.

"But even having others go first does not mean that it will be totally risk free when we go there," he cautioned. "There will be some inherent risk in the transition. But we are trying to mitigate that risk by letting some of these other explorations go first, and be our 'canary in that gallium nitride coalmine' if you will."

Although not a programmatic challenge, Bond also admitted to harboring some concerns stemming from an unstable world and the possibilities that some might want to exploit the impressive capabilities of G/ATOR more quickly than originally planned.

"The first time I was asked the question was by representatives from Central Command," he recalled. "They said, 'You've made a couple of radars that are looking really good – so if we got into trouble, could we have one?' Of course my first thought was that they were ripping up my developmental program by taking a system only half done and betting their mission on it. That's not necessarily prudent. But it did force me to sit down with the engineers to explore how long they would need to test it before they could stand to let it go forward. They asked if they could send some of their people with it if that happened, and I told them that they absolutely could for its first deployment.

"Their answer came back sooner than I had anticipated," he continued. "And so that answer got us thinking about other smarter ways to do the program to achieve the efficiencies that I have been talking about. So

// **Marines with Marine Medium Helicopter Squadron 268 (Reinforced) low-altitude air-defense detachment shoot down an unmanned aerial vehicle using a Stinger weapon system.**

U.S. Marine Corps photo by Staff Sgt. Chance W. Haworth

recognizing that there is always that potential need out there to 'operationalize' the system ahead of schedule in response to an emergent challenge to our Marines elsewhere in the world has been part of what has motivated us to find more creative ways of doing things."

One of the "unintended consequences" of this sort of contingency planning was the realization that expediting the program would bring additional cost benefits while placing improved capabilities more quickly into the hands of Marines.

According to Bond, one acceleration option showed that the production program could be completed three years sooner than originally planned.

"We would be done," he said. "We could get it out of the factory and stop paying any corporate overhead for production. More importantly, for our Marines, we could retire all the old stuff three years earlier. And many of those legacy radars are not in the best of shape – otherwise we wouldn't be buying their replacement. So that too is an opportunity we are in a position to realize as a result of being asked to look at that potential real-world contingency."

Summarizing the advantages that G/ATOR will bring to those Marines, Bond pointed to "extraordinary improvement in situational awareness," adding, "It provides that information completely [in] real time and with high enough quality that you could give it to everyone else on the joint battlefield, sharing that picture and giving them the same situational awareness as the Marines who are right there with that radar. With our legacy systems, the data rates are slower, the data quality is less, and the basic ability to see some of the more challenging threats is dramatically less. As a result, we didn't work as hard on sharing that picture with everybody in a joint expeditionary task force. But with G/ATOR there's so much more situational awareness that is so much more ready to be shared with all of the players on the joint battlefield."

Bond was quick to credit "the entire team effort" for program success to date, as well as the identification of possible future direction.

"I'm very proud of this team," he noted. "Every time we are given one of those challenges we go off and think about it together and end up identifying ways to do the program even better. That's been our hallmark to this point and I would certainly expect it to continue to go that way in the future."

In his own case, Bond brings a personal commitment to the team, with the former career U.S. Navy officer acknowledging that his passion for the job stems from the fact that his son is a Marine officer serving in Afghanistan.

"And everyone here has a story like that," he said. "They may not have a child in Afghanistan today but they are all that connected to the Marine operating force and feel that same passion and commitment to give those young people the very best capability we can and to do it as responsibly and cost effectively as we can.

"We pursue excellence in acquisition because of the excellence achieved by the Marines' service out there every day," he concluded. "The least we can do is to try to live up to their example."