Dr. Peter Highnam
Information Exploitation Office(IXO)
Tactical Targeting Network Technologies (TTNT)

In the networked forward theaters of the near future, U.S. forces must exploit distributed sensor platforms to rapidly and precisely locate tactical targets and support real-time fire control processes. The Services and DARPA have a number of thrusts involving these time-critical targeting and strike areas.

Two example projects developing systems for real-time fire control and distributed tactical targeting are the DARPA Affordable Mobile Surface Target Engagement (or AMSTE) and Advanced Tactical Targeting Technology (or AT3) programs. Tactical data links are essential to achieving the full potential of distributed tactical targeting; tactical data links that are flexible, dynamic, low latency, and high capacity.

If we consider the turmoil of the battle space, we cannot and must not constrain the roles of friendly platforms. Thus, when designing tactical networks, we must support specific applications and provide flexibility, low latencies, and high throughputs to support as strenuous a set of demands as possible. The technology to do that is being developed within the program that is the topic of this presentation: tactical targeting network technologies (or TTNT).

Current tactical data links, such as Link 16, form static preplanned networks with highly constrained participation and use. Projected growth in the use of these tactical data links is expected to result in an increasing demand for capacity. The problem is that the growth will quickly outgrow that which can be provided by current systems.

TTNT is aimed directly at helping the Services achieve the full potential of networked tactical targeting. In the near term, to support DARPA and Service technologies that are currently in test, the TTNT Program is making inexpensive investments to improve the Link 16 infrastructure that we rely on.

The main thrust of the TTNT Program is the exploration of advanced data link technologies to enable the rapid reconfiguration, low latency, wide-band modes that will be required. Of course, a key requirement of the TTNT Program is that the technologies produced should operate completely transparently with existing data links. More on this topic a little later.

I am now going to discuss characteristics of the communication infrastructure needed for airborne networked tactical targeting. I will use one of the future users, a system called AT3, to provide my examples because I know it well; there are others.

First, let me give you a quick description of AT3, which is developing technology to quickly and precisely geolocate enemy air defense radars from standoff ranges. The goals of the AT3 program are 50:50:10; that is, locate the enemy radar to within 50 meters, from 50 nautical miles away, within 10 seconds from when the emitter turns on. AT3 systems achieve these goals by networking observations made by multiple airborne radar receivers. Once a threat signal's presence has been determined, several air platforms coschedule listening periods, reporting their observations to a single platform, which is given the temporary role of the geolocation processor. After a small number of these listening periods, the location of the threat can be determined and reported to a fire control authority. The AT3 Program is moving into final flight tests. AT3 has been designed to use Link 16, as the only generally available airborne tactical data link.

As you can imagine, it is very important for an AT3 system to be able to move data quickly between platforms. There are two types of messages that need to be communicated as part of the system. For alert messages that "tip off" other collectors, after a threat is first noticed, there must be minimal latency. For the longer observation messages, based on observations during a listening period, the delay in transmitting the information is proportional to transmit rate. TTNT has both latency and throughput as key goals.

Communication flexibility provides important operational flexibility, including for AT3. Suppose we are forced to statically allocate our communication resource across the entire theater. Suppose we discover that the threats are not distributed as we expected. Using today's tactical data links, we cannot reallocate the communications capability in real time. This means that AT3's ability to react to high priority pop-up threats would be constrained. TTNT has real-time reconfiguration and flexibility as key goals.

TTNT's goals are both quantitative and qualitative. The numerical goals derive from the needs of the applications to be built upon it, from the laws of physics, and from our emphasis on supporting tactical targeting. Let me give an example of what this means. We want to move high priority messages with as low latency as possible; the TTNT goal is 2 milliseconds for a platform 100 nautical miles away. This is a tough goal! About one-third of this time is propagation delay due to the speed of light. We also want platforms further away to receive the message, but our tactical emphasis allows us to back off this latency requirement, permitting a wider set of technology solutions.

Two of TTNT's qualitative goals deserve mention here. First, TTNT will not in any way disturb or perturb Link 16 communications. A Link 16 net will be set up and operated as though TTNT does not exist. However, TTNT will employ the Link 16 J-Series message set and, thereby, allow the two systems to interoperate seamlessly at the message level. Second, TTNT should have minimal Group A cost; i.e., the costs to install TTNT within an airframe should be very low. In fact,we've adopted the catchphrase "no new holes, no new cables."

To achieve the TTNT goals, we must address four key areas.

- System control and media access—how to establish and maintain the "dial tone" for users who ingress/egress this mobile ad hoc network. We want to provide something significantly better than a civilian cell phone network. That's a challenge, because cellular networks generally benefit from fixed-base stations, slow-moving users, and the lack of jammers. TTNT cannot have base stations, fixed or otherwise. TTNT's users will pull high-g turns and be supersonic with respect to each other. Our enemies will actively try to disrupt the TTNT network.

- Interoperability with existing data links, particularly Link 16. We are investing heavily in this area.

- Spectrum availability. The Department of Defense continues to lose prime spectrum property to civilian users. TTNT must find and secure a location that is likely to remain a good choice. The Joint Spectrum Center has been an integral part of the TTNT team from the outset.

- Inexpensive installation into target platforms. For example, as a modular digital insertion into a Link 16 terminal already installed on the platform.

At this point, the TTNT Program has had contractors working for almost 15 months. The first phase ended in June, with the feasibility of TTNT established. We are in the second phase with a smaller number of contractors, aiming to build hardware systems for laboratory testing. In the third phase, we will build and test 20 or more units. This testing is budgeted to cover a mix of fast and slow air platforms.

The Phase 1 contractor mix included some prime contractors and a selection of smaller research groups, the Joint Spectrum Center, and the Asian Technology Information Program (for monitoring state-of-the-art wireless technology research overseas).

In summary, the TTNT Program is aimed squarely at providing the communications infrastructure to support tactical targeting by airborne platforms. The program has delivered technology in use today. The program has built a strong case for certain technical approaches to meet TTNT goals. From the outset TTNT has been concerned with transitioning the technologies that are produced.

Thank you for your time.