

Dr. Arthur A. Morrish

Director

Tactical Technology Office

Here be Dragons

Tactical Technology Office (TTO) programs seek to develop and demonstrate prototype systems and technology for unmanned systems, space operations, urban combat, and tactical multipliers—a category that includes technologies like high energy lasers, advanced propulsion, and novel weapons concepts that help our forces “punch more than their weight.”

These programs are framed by TTO’s mission: provide the warfighter the capability to dominate the fight, no matter where and no matter when they engage the enemy. This extends not just to the warfighter, because today it is just as likely that we’re asking our military personnel and a significant number of contractors to help us “win the peace.” Just as our warfighters are doubling as peacekeepers in many theaters of operations, so too is TTO working to serve both warfighting and peacekeeping roles.

To do that, we work closely with the end-user. Whatever the program, TTO’s goal is to give end-users the future capabilities they want, not simply to respond to today’s requirements.

Every program we pursue begins as a discovery process. We sit down in listening mode with a user, whether it’s the Army, Air Force, Navy, Marines, or a combatant command. Whether they’re fresh from the fight or addressing capabilities desired in the long term, we like to say

to the user, “You tell us ‘what’—and we’ll handle the ‘how’. You tell us what mission you need to accomplish, and we’ll figure out how to match that mission to the kinds of capabilities we can develop.”

Our job is to accomplish the revolutionary, not the evolutionary. Of course, revolutionary systems are by definition disruptive. They overturn existing paradigms and provide a sling-shot advantage to the individuals and organizations that are first to grasp their implications.

Revolutions don’t come with roadmaps.

Roadmaps are great for going from Point A to Point B. But for a revolution, you can’t just download driving directions from the web.

It’s not that there is something wrong with where you want to go. It’s just that, as a destination,

revolutionary ideas tend to live in the white spaces on the map, the places where the ancient cartographers used to write, “Here be Dragons.”

What sort of dragons is TTO in search of? Where are the white spaces on our maps, technology’s Terra Incognita? To give you some sense, let’s play some thought games. Suppose you’re one of our customers and you want an aircraft with a high-efficiency engine. You’d also like lots of speed. What you’re saying is you don’t want to trade efficiency for speed, which is another way of saying you don’t want to be bound by the entire



Here be Dragons



history of human flight. That's alright. Stick with the "what." Let us work the "how."

What if we didn't have to trade efficiency for speed? What if we could make aircraft that could fly in and out of an area at Mach 1.5 or better and still have tens of hours to days of loiter time? Now, what if we could equip that aircraft with a high energy laser? We'd have something like the equivalent of the old flying fortress bombers. A system that can fight its way into the theater, perhaps without an escort, and stay for a significant time. It doesn't matter if you can see it coming, you can't stop it.

Now we can start to trade speed, self defense, striking power, and stealth to form a completely new type of air vehicle. A vehicle that can get to fight quickly, fight its way in, and hang around for a substantial time. Think of what that could mean. Suddenly, it's our adversaries who are operating in a white space, completely unknown terrain, where the dragon is the US warfighter.

You can see that we are very interested in ideas like high-speed high-efficiency engines, tactical lasers with a large magazine depth, and new long-endurance air vehicle designs. The users have told us what they want; now we need to figure out how to build an aircraft like that. It also leads to another interesting question. If we had such a system, how would it change the way that we fight? New technology can, and should, change tactics and strategy. It can, and should, change the way we fight. And each new technology, each answer to one of today's problems, should pose new questions for what comes next. How we take that system to the next level or even leapfrog to entirely new approaches and applications.

And make no mistake: Our revolutionary ideas don't end with aircraft. Take our unmanned ground vehicle programs. I'll focus on one we call Spinner, a 6-wheeled platform. We were asked to develop an unmanned vehicle that could carry a weapon and move autonomously. You won't find Spinner on the car lot quite yet, but in terms of the standard package we envision, Spinner comes

Here be Dragons

“nicely equipped” as they say, with a neutral turning radius. It can climb. It can maneuver at speed. We are developing the software smarts necessary to allow it to learn from the terrain it crosses and to use that knowledge to decide its own path.

Spinner is big, about 7500 kg, big enough to carry a gun or a missile system. Maybe it’s armored. We are in the process of showing the user how to build a very capable, large, unmanned ground vehicle.

Now let’s go the other way: The users are saying that they would like a spinner-like robot that is small, something that would be carried by or move with the infantry. It can still traverse very rough terrain, move over rubble and up stairs. They are telling us the what; now we need to figure out the how. Does this platform have wheels or legs? Does it fly or hop or some combination of all the above? Is it smart enough to move on its own or remotely controlled by the user? Is it big enough for a person to ride in or small enough to be carried by one person? I certainly don’t know all the answers to these questions, so I am soliciting your help in figuring out how to do this.

Take another example, another thought experiment. Call it a multimodal missile. Of course, we’ve got good systems now: missiles that can shoot down aircraft, destroy a tank, missiles with variable fusing to open up a bunker. What we don’t have is one missile that can do it all: fast enough to hit an aircraft, a charge that can stop a tank, with flexible fusing for bunker busting. What if we could make one missile for all those missions?

Take this thought game one step farther, because each advance opens up new needs and poses new questions. What if it was small enough for a soldier to carry? Maybe they could carry several? How do I build something like that?

One last thought game. This one is about helping our force with the peace enforcement and counter-insurgency missions they are taking on. Based on conversations and reports from our forces coming

back and on discussions with troops from other countries that have conducted similar operations around the globe, there seem to be a couple of major themes that are developing.

The first is that what we would really like is the equivalent of a beat cop on every street corner. The legendary Officer Smith who knew everyone and everything going on his turf. Unfortunately, we simply cannot afford the number of troops that would require. Secondly, the word “troops” is important, since our forces are equipped to fight the “big war” and these new fights probably require different tools.

What would it take to give one of our Soldiers the ability to function like 5 or 10 Officer Smiths? We would certainly want to give him the systems and technology that will allow him to see and hear what’s going on in his neighborhood as if he were walking the beat. We want him to notice the blue sedan that has been circling the block for the last hour is so heavy it is sitting on its shocks. Should he check it out? How?

We want him to be able to scan that vehicle from a distance and determine if it is full of explosives, or if it is a guy moving his book collection, looking for a parking spot. It would be great if he could stop the car at 100 yards or so without permanently damaging the car or injuring its occupants.

Just to make it more challenging, we think it is important to make these capabilities as available to the individual trooper as possible. We don’t want all this gear to turn him into some unapproachable robo-trooper. One thing we have heard over and over is the importance of being able to interact with the local population and have them want to interact with our troops. There again, we have the what; now I’m looking to you folks to help me out with the how.

Lastly, maybe our trooper would like a weapon that could be both lethal and nonlethal with a flip of a switch. Another school of thought says that in many peace enforcement situations, it is critical

Here be Dragons

both sides know when or if lethal force will be employed. It's not clear how you do that with a weapon that can go from one state to another with a flip of a switch.

You know by now that this thought experiment has a caveat. A cautionary tale that tells us don't just ask, "What can I do with that?" because technologists always love a new widget. Ask what can they do with that? What can the warfighter do with it (or the peacekeeper in this instance); because at the front lines, they see nuances we cannot. If you think what we are asking for is a bad idea, tell us that as well. That's an important discipline in our discovery system, an important

check against the impulse to indulge in technology for technology's sake. It's something we never forget in TTO. Just because it flies, or rolls, or climbs, or crawls, or fires at the speed of light doesn't mean TTO will build it. Although I have to say, if it could do *all* of those things, I would definitely be interested in a white paper!

Thought experiments like these help us to better understand the needs and capabilities of our warfighters today, tomorrow, and many years into the future. They inform our effort to explore the unknown—to discover the dragons out there—and harness their power for America's men and women in uniform.