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DARPA Space Activities

Hello. Today I'm here to discuss DARPA's space activities, past and present, and our vision for future space activities in support of national defense. First, I'd like to show a video that chronicles DARPA's past space legacy.

(V I D E O)

And now DARPA's current vision for future space operations and technology development: In part in response to the historic report of the "Commission to Assess United States National Security Space Management and Organization," which was chaired by now-Secretary of Defense Donald Rumsfeld, DARPA—under the leadership of Director Dr. Tether—defined a conceptual framework for space project development in support of future Warfighter operations in space. The "Space-Ops Venn Diagram" consists of access, space situational awareness, space-based engagement, space mission protection, and space mission denial.

Robust tactical exploitation of space requires, first and foremost, assured rapid and affordable access to space. DARPA has projects underway in this area (which you'll hear about later in this session) and has identified some unique opportunities for directly and indirectly addressing this issue. Stay tuned!

Situational awareness in space presents unique challenges. In addition to one's own spacecraft state, knowledge of potential adversarial activities and capabilities is critical. DARPA is investigating both space-to-space and ground-to-space technologies, an example of which will be described shortly in the talk by Dr. Timothy Grayson on space situational awareness, or SSA .

Space-based engagement refers to "down-to-earth" technologies, literally. These are sensing, communication and navigation systems that support terrestrial operations from space and often provide "deep-look" into potentially denied areas, as well as early warning. Examples include intelligence, surveillance and reconnaissance (ISR) satellites such as space-based radar (or SBR) and space-based imaging. You'll be hearing more about innovative DARPA activities later in this session.

Until recently, space was arguably the exclusive domain of an elite club of developed nations and military superpowers. Access is becoming increasingly possible for potentially hostile entities. Consequently, there arises a need for both space mission protection, to protect against jamming or other potential antisatellite threats, and space mission denial, technologies to prevent others from exploiting space to do harm to us or our allies.

There is little debate over the fact that rapid and affordable "access" to space is the key to warfighter dominance. As a consequence, DARPA is focusing on a number of innovative technologies and approaches to "skin the access cat." For example, innovative launch vehicles are examples of direct access technologies. Novel spacecraft and payload materials and designs that allow for multiple satellite launches in a single rocket faring, or even "deploy-on-demand" concepts such as payloads stored in GEO, are examples of indirect access.

In the direct access category, DARPA has initiated the novel RASCAL Program, which stands for Responsive Access, Small Cargo, Affordable Launch. Smaller than a Pegasus, RASCAL will be launched from a high-altitude, high-speed aircraft that essentially eliminates the large and expensive first stage inherent to all other rocket systems. It is designed to potentially place small payloads in low earth orbit on a moment's notice. You will be hearing more from the RASCAL Program Manager, Preston Carter.

It is important to realize that tactical access to space can also be achieved indirectly. For example, if satellites can be made smaller, cheaper, and lighter, the number of spacecraft per unit launch is effectively

increased, thereby indirectly addressing the access issue. Also, if satellites can extend their life, or even "change" their orbits and/or functions, this would also be an "access multiplier." DARPA's Orbital Express Program is an example of such a system. Envisioned as an on-orbit servicing infrastructure, it would consist of fuel-holding orbits launched via far lower cost (and, thus, potentially higher risk) launches, and an autonomous space transfer and robotic orbital (or ASTRO) vehicle that would rendezvous with a multitude of satellites to provide fuel, repairs, upgrades, and possibly orbital adjustments. You will be hearing more about Orbital Express later in this session from Maj James Shoemaker.

Micro- and even pico-satellites continue to be an exciting new development pioneered by DARPA. Launched as secondary, piggyback, or ultimately RASCAL payloads, they are enabled by a confluence of space-qualified miniaturized technologies. Microsats undoubtedly will play a ubiquitous role in enabling many of the space ops functions previously described.

Many current and future space functions will require large space structures; for example, large apertures for electromagnetic sensing and solar collection. Exciting new developments in highly compressible space structures such as rigidized inflatables, coupled with advances in lightweight and flexible electronics, have made it possible to design extremely large structures that nonetheless fit into relatively small rocket fairings. You will hear more about these technologies in the talk on DARPA's Innovative Space-Based Antenna Technologies Study Program.

It has been my pleasure to share with you this brief sojourn through DARPA's space legacy and vision. Next, you will have the opportunity to hear directly from some of the program managers who are creating the space systems of tomorrow.