News Release

Defense Advanced Research Projects Agency

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DARPA AWARDS CONTRACT FOR DETAILED DESIGN OF FRACTIONATED SPACECRAFT PROGRAM

The Defense Advanced Research Projects Agency (DARPA) has awarded a contract to Orbital Sciences Corporation for the second phase of the System F6 (Future, Fast, Flexible, Fractionated, Free-Flying Spacecraft United by Information Exchange) fractionated spacecraft demonstrator program. The contract, valued at $74.6 million, is for a year-long effort under which the Orbital Sciences team, which also includes IBM and the Caltech Jet Propulsion Laboratory (JPL), will develop a detailed system design, complete the majority of software development, deliver additional iterations of the hardware-in-the-loop testbed to include breadboard implementation of critical hardware, and conclude with a critical design review.

The System F6 program will culminate in a 2013 on-orbit demonstration of a fractionated space architecture, wherein a cluster of free-flying spacecraft modules wirelessly share resources and functionality to synthesize the capability of a much larger "virtual" spacecraft. The program's principal technology goals are two-fold: the development of safe, autonomous, efficient, and rapidly reconfigurable multibody cluster flight techniques; and the development of a real-time, fault-tolerant resource-sharing architecture operating over a packet-switched wireless network and capable of supporting multi-level security (MLS).

A series of on-orbit tests will demonstrate: the cluster reconfiguration to accommodate the insertion of new spacecraft modules, the addition of new components as network-accessible resources, rapid defensive cluster scatter and re-gather maneuvers, and the transfer of mission-critical processes throughout the cluster and to terrestrial network nodes. The program also has an explicit objective to supply infrastructure capabilities to one or more independent payload spacecraft supplied by a mission partner.

"Fractionating satellites is reminiscent of the migration from large, monolithic mainframe computers, produced by a handful of industry powerhouses, to ever-smaller ubiquitously networked systems, developed by thousands of industrial players and, in the process, changing how computing is used," said David Neyland, Director of DARPA's Tactical Technology Office (TTO). "F6 is a unique part of DARPA's space portfolio because it promises an analogous invigoration of the space systems industry across the spectrum of industrial capabilities, ushering in an era of creativity, adaptability, and economically resilient satellite systems."

Another product of this phase of the F6 program will be an F6 Developer's Kit, distributed under an open-source license, which will include definitions and reference implementation of all interfaces necessary to develop a new module for an F6 cluster, with source code, binaries, and documentation for the resource-sharing middleware and cluster flight algorithms.

"DARPA plans to develop an open architecture that enables a new way of building space systems that are inherently adaptable, responsive, and survivable," said Paul Eremenko, the DARPA TTO System F6 Program Manager. Much of the program is predicated on the development of design tools that enable adaptability—the ability of the system to change over its entire lifecycle in response to uncertainty—to be quantified and traded alongside traditional system attributes such as cost and performance.

In addition to disaggregating the functionality of large monolithic spacecraft across clusters of smaller, free-flying modules, the F6 architecture will enable the replacement or upgrade of failed or obsolete components such as processors

and star-trackers on traditional national security space assets—as long as they are equipped with an F6 technology package.

Ultimately a residual on-orbit infrastructure that supplies all traditional spacecraft bus functions wirelessly may be feasible, and all that a user would need to do is deploy a naked payload equipped with appropriate F6 interfaces to take advantage of the resources already on orbit.

“We are looking at dramatically decreasing the space industry’s barrier to entry and also radically simplifying the way large space systems are integrated and tested,” added Eremenko.

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