



Los Angeles Section and □  
Space Systems Technical Committee

# **Responsive Space Launch with the Scorpius Family of Low-Cost, Expendable Launch Vehicles**

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**CONFERENCE TRACK: LOW-COST  
RESPONSIVE GROUND SYSTEMS  
AND OPERATIONS**

Track Topic: Low-Cost, Responsive Ground  
Systems and Operations

Title: Interoperable Scheduling Concept

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Thesis: Low-cost and responsive satellite  
ground systems previously unattainable, are  
now possible.

**Background:**

The evolving government satellite control network has the requirement to meet an integrated government satellite control network concept by 2015 as stipulated by the National Security Space Architecture (NSSA). The NSSA, a "Collaborative Team to Define Unified Space Capabilities," causes us to address several problem areas in the immediate future. Specific to the areas of low-cost responsive ground systems, our company has begun addressing interoperability across support systems as it relates to the control network, the schedule system, and orbit analysis support.

Presently, the satellite scheduling function manages government resources. Critical to an evolved integrated network is scheduling heterogeneous ground resources, and interoperation and integration across multiple scheduling systems, and ground

networks. We are addressing this function as part of our low-cost total integrated system concept. Our evolved scheduling engine will be capable of ingesting other satellite operators' scheduling information, and making appropriate adjustments, thus allowing the satellite network schedulers to rapidly continue their function with full knowledge of the extraneous systems needs.

With the legitimate concerns of the military and commercial operators of satellite C3 systems resulting from 9/11, there evolved the requirement to assess and respond to capability needs not seen since prior to the fall of the former Soviet Union. Heretofore, only highly critical functions were deemed necessary to survive and endure a surprise nuclear attack.

Today we face a more severe problem: that of potentially undetectable terrorist activities against these C3 systems, and others. Our present-day facilities, while located on military installations, are fairly vulnerable to localized attacks from an intentional and rigorous terrorist action. Twenty years ago survivable systems cost billions of dollars, were system-unique in design, had enormous life cycle costs, and required highly trained personnel to operate. Today we have software and processors capable of providing these capabilities at considerably lower cost, and are obtainable in shorter acquisition times.

**Areas of discussion:**

The integrated network concept causes us to focus on all aspects of low cost COTS/GOTS utilization for processing data, plus control and status information into accurate, conflict-free schedules with timely, integrated satellite control products.

Architectures and information strategies are evolving to provide COTS-based solutions as the basis for developing interoperable systems. New technologies are required to correlate, access, retrieve, segregate, and disseminate the volumes of information that are collected and processed. An example is methods for deconflicting of support requirements among differing ground- and space-based systems. One goal is to provide seamless information across the various scheduling engines.

Particular areas of interest include:

(1) Preparation and correlation of information required to map, plan, schedule, understand and execute space operations in integrated environments. This information includes entries such as: what minimum contact times are required for a certain spacecraft and what drag model characteristics are used in its vector calculations which are used to build the visibilities tables. This information should be automatically prepared and rapidly provided with little or no action on the part of a systems operator.

(2) Concepts, technologies, and technique are needed that allow a steadily decreasing satellite control workforce to provide information to integrated satellite operations personnel. Additionally, these concepts, technologies, and techniques should decrease the computational times, while increasing the integrated support

capabilities. Higher order/object order developed software, such as the utilization of JAVA and XML code, allows for cross-platform utilization of applications along with DLLs for computationally intensive requirements. These approaches did not exist fifteen to twenty years ago, and were partially responsible for the high cost of systems.

Today, we utilize these techniques not only to lower costs, but allow cross-platform implementations. Software Engineering Institute (SEI) and the International Organization for Standardization (ISO) have driven software and hardware manufacturers to implement standards of consistency in form and function. Combined, these components result in systems that are drastically less expensive than twenty years ago, and are significantly more capable and robust.

(3) Intelligent agent COTS tools and techniques that integrate various information, which provide near real-time and anticipatory network scheduling demands, status, and resource management, are required in the near-future scheduling environment. This new approach to scheduling virtually takes the operator out of the picture. As such, every changing aspect affecting the schedule decision normally performed by a human must be dealt with by smart software. These changes require moving a scheduled user to another site because his/her scheduled site has an antenna outage problem. This could also shuffle all previously scheduled satellites for the down site. This scheduling reshuffle would have to be done automatically, and each user notified of the change.

(4) Rapidly deployable, low cost ground facilities that replicate their fixed counterpart may be a concept of the future.

Unique, purpose-built systems are largely becoming things of the past. ISO containers and Object-Oriented (OO) software are responsible for a revolution in the way systems are engineered, and implemented. Network Centric Enterprise Services (NCSE) allow us to move away from the client-server infrastructure world into one that enables multiple, diverse users to utilize

software, and data in ways never before available. Future survivability of ground-based systems will be partly be enabled by architectures that are built to fully utilize NCSE approaches, which is a type of “move, plug-in and play” approach. The only requirement would be distributed terminal locations to plug into.

1. Joint Requirements Oversight Council Memorandum for Integrated Satellite Operations. Capstone Requirements Documents, 14 January 02 USSC.