

MOCKSAT TESTBED

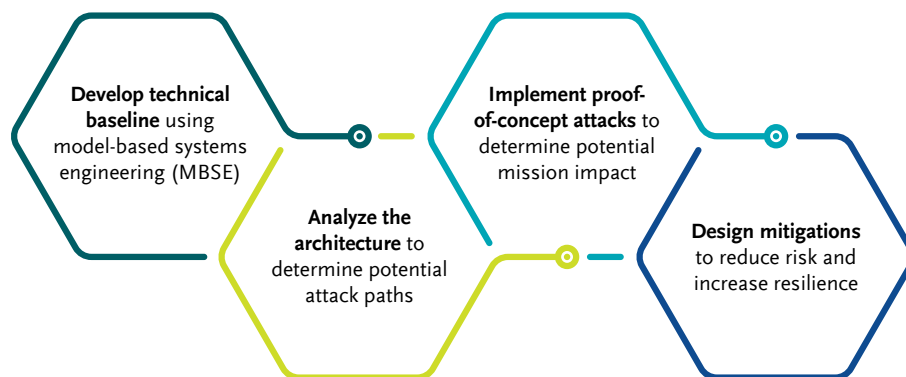
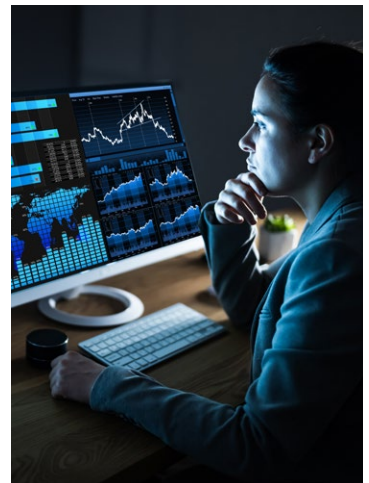
A SIMPLE SPACE SATELLITE CYBER-PHYSICAL TESTBED
FOR TRAINING, PROTOTYPE DEVELOPMENT, AND DEMONSTRATION

SECURING THE FINAL FRONTIER

Space systems are vast—including space-based assets (e.g., satellites) and ground systems (e.g., control centers, data centers, and other elements). This mix of traditional information technology (IT) and operational technology (OT) offers a large attack surface for adversaries to exploit while also presenting defenders with a complex domain to protect. Cybersecurity for space-based assets in particular has lagged behind ground systems, confronted with challenges due to lack of knowledge and tools, limited availability of high-fidelity test assets, and potential negative impacts of dynamic cybersecurity testing to flight units.

OUR APPROACH TO CYBERSECURITY FOR SPACE-BASED ASSETS

To address these challenges, Booz Allen provides an approach to cybersecurity assessments for space-based assets that enables cybersecurity activities without risking critical assets. We have applied this approach, as outlined below, to real-world systems such as the Global Positioning System (GPS) Block IIR satellites (see www.boozallen.com/markets/space/securing-space-with-digital-twin-technology.html).



Booz Allen's Approach to Cybersecurity for Space-Based Assets

INTRODUCING MOCKSAT

To demonstrate our approach in an educational and/or lab environment, we developed the MockSat (“Mock Satellite”) testbed. MockSat is a Booz Allen integrated hardware/software cyber-physical testbed based upon the ArduSat 3U cubesat hardware and software. It represents a simple mock environment consisting of a satellite with flight control software, communications link, and multiple sensor subsystems, as well as a ground-based control station with command and control (C2) capabilities. MockSat is used to support training, prototype development, and demonstration of cybersecurity methodologies that can be adapted and applied to deployed satellites.

USE CASE	BENEFITS
Training	<ul style="list-style-type: none">Cybersecurity Practitioners learn about space system’s engineering concepts, communication links, and the relationship between subsystemsSpace Systems Engineers build awareness of common cybersecurity attack paths, high-value targets, and how to defend against themProgram Managers can gain insights into how concepts may apply to larger, real-world endeavors
Prototype Development	<ul style="list-style-type: none">New ideas can be designed in a proof-of-concept environment prior to committing resources to more complex endeavorsUncleared practitioners (interns, students, academia) can participate in exploring concepts in an unclassified environmentExperiments can be conducted with no operational impact to deployed systems or high-value testbeds
Demonstration	<ul style="list-style-type: none">Vetted concepts can be demonstrated on a simplified platform without attribution to a specific space program or vendorEffects that cyber-attacks can have on hardware can be demonstrated on a simple, low-cost platform

MockSat Use Cases and Benefits

MOCKSAT SAMPLE DEMONSTRATION

Within the MockSat environment, we have developed a proof-of-concept attack through a full path on the system. Starting from an exploit of the ground station, we utilize the data link to command the satellite to misalign the solar panels from the light source, draining the onboard battery. Utilizing this attack, we can determine potential mitigations that could be applied to both the ground station and satellite to minimize risk to the system and the notional mission it supports.

APPLICATION TO REAL-WORLD SYSTEMS

We tailor our approach based on each client’s unique set of objectives, concerns, and constraints. Proof-of-concept attacks can be demonstrated at various levels of fidelity, from paper-based to model-based to software emulation to hardware-in-the-loop (HWIL) testing. Leveraging assets such as MockSat, our workforce brings the requisite knowledge to succeed in space cybersecurity and to develop low-cost rapid prototypes and demonstrations prior to expending significant time and resources.

About Booz Allen

For more than 100 years, military, government, and business leaders have turned to Booz Allen Hamilton to solve their most complex problems. As a consulting firm with experts in analytics, digital solutions, engineering, and cyber, we help organizations transform. To learn more, visit BoozAllen.com.

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