



## CT Cubed Inc.

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# CYBERSECURITY FUNDAMENTALS FOR SPACE

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## Course Overview:

This 5-day course provides a thorough introduction to space system cybersecurity, focusing on securing systems throughout their entire lifecycle. Students will gain practical skills through labs, covering architecture vulnerabilities, threat mapping, and tailored security controls, culminating in a capstone simulation where students will experience and “fight through” attacks in cyberspace against their own virtualized satellite.

## Target Audience:

- Engineers (i.e., Systems Security, Safety, Aerospace, Software, Controls, Electrical, Mechanical, etc.)
  - Cybersecurity Practitioners
  - Space Industry Professionals
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## Course Schedule:

Day	Topics	Labs
Day 1	Introduction to Orbital Mechanics Space Systems Architectures	Attack Surface Enumeration
Day 2	Cybersecurity Concepts for Space Systems Radio Frequency Fundamentals Threats to Space Systems	Heat Mapping of Threat Activity Team CTF: Orbital Shield
Day 3	Secure Design for Space Systems Defense in Depth for Space Systems Space System Risk	Space System Risk Assessments
Day 4	Security Controls for Space Systems	Security Controls Application
Day 5	Capstone Project: Satellite Defense Simulation	

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## Academic Lessons:

### 1. Cybersecurity Concepts for Space Systems

Explore foundational cybersecurity principles for space systems, including the CIA triad, network topologies, and secure communication protocols. Learn how to apply encryption, authentication, and regulatory frameworks to address the unique challenges of securing satellite and ground networks

### 2. Secure Design for Space Systems

Discover methodologies for building resilient space systems with a focus on secure design principles, risk management, and lifecycle security. This lesson highlights defense-in-depth strategies, verification processes, and supply chain protection to ensure system resilience against evolving threats

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### 3. **Space Systems Architectures**

Detailed exploration of space system components across ground, space, and user segments. This lesson also covers design decisions that impact security and the importance of lifecycle management in maintaining resilient systems.

### 4. **Radio Frequency Fundamentals**

Learn the basics of radio frequency (RF) communication for satellite systems, covering RF wave characteristics, modulation techniques, and environmental factors like interference and attenuation. Understand how cybersecurity integrates with RF systems to protect against threats such as jamming and eavesdropping

### 5. **Orbital Mechanics Fundamentals**

Introduces the foundational principles of orbital mechanics, including key concepts like orbital velocity, altitude, and inclination. Learn about the factors that influence satellite motion, such as gravitational perturbations, atmospheric drag, and solar radiation pressure, and explore how Two-Line Element Sets (TLEs) are used for satellite tracking and operations

### 6. **Threats to Space Systems**

Learn about the various types of cyber and physical threats targeting space systems, with an emphasis on identifying vulnerabilities. Real-world case studies are used to understand these threats, and the SPARTA framework is introduced to map and analyze them.

### 7. **Defense in Depth for Space Systems**

Understand how to apply layered security across space system components. Defense-in-depth strategies aim to reduce risks by combining multiple controls at the ground, link, and space levels.

### 8. **Space System Risk**

This lesson focuses on assessing and mitigating risks to space systems. Students will be taught how to calculate notional risk scores, determine system criticality, and apply risk management strategies that balance security with operational effectiveness.

### 9. **Security Controls for Space Systems**

Explore how security controls such as encryption, authentication, and access controls can be tailored to protect space systems. Learn how to apply NIST SP 800-53 controls to enhance system resilience.



To earn the Cybersecurity Fundamentals for Space Certificate, you must pass the summative course exam with a score of at least 75%.



The Cybersecurity Fundamentals for Space program is an ANAB-accredited certificate program delivered by CT Cubed, the accredited certificate issuer, in accordance with ANSI/ANAB E2659.

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## Labs:

### 1. **Attack Surface Enumeration**

Students will analyze a CubeSat's architecture to map out its vulnerabilities and potential attack vectors, learning how to assess exposure to cyber threats.

### 2. **Heat Mapping of Threat Activity**

This lab introduces the SPARTA framework to visually map and prioritize threats. Participants will create heat maps to assess the likelihood and severity of attacks on space systems.

### 3. **Space System Risk Assessments**

Participants will perform risk assessments to evaluate potential threats against space systems, using notional and tailored risk scores. They will also analyze system criticality and propose risk mitigation strategies.

### 4. **Security Controls Application**

Students will apply a set of space-specific security controls to a legacy system, learning how to tailor these controls to address vulnerabilities and bring the system up to modern security standards.

### 5. **Team CTF: Orbital Shield**

Student teams face off against a fictional adversary to defeat their space-based threat. By completing a series of challenges, students will learn firsthand the experience of performing attacks against satellite systems and seeing their effects in real time.

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## Capstone Project: Satellite Defense Simulation

In this immersive capstone, student teams must secure their satellite and ground station infrastructure against a series of attacks. With limited resources, teams will strategize how best to allocate defenses, using all knowledge from previous lessons and labs. Over several rounds, students will operate and monitor their virtual satellite for evidence of compromise. They must react in real-time to evolving threats, simulating both satellite operator and security analyst roles. This experiential exercise challenges students to think analytically and creatively under pressure to defeat sophisticated attacks.



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Learn more about the Cybersecurity Fundamentals for Space Certificate on our website  
<https://ctcubed.com/cybersecurity-fundamentals-for-space-certificate>