The challenges our civilization has experienced on Earth will neither reduce nor vanish as we push the extent of our human footprint. Building and sustaining a space economy that one day will become a multi-planet endeavor will require thoughtful consideration of the threats posed to the systems we rely on across technically-challenging domains. Paramount to the success of executing this audacious adventure must be the highest standards of mission surety. Cybersecurity stands as a persistent critical threat to the systems we rely on today and for the future of humanity.

Traditionally, mission success is measured by the tenants and principles of the safety engineering discipline. This presentation challenges that traditional view, by providing a compelling case on the need for increased cybersecurity analysis to support sure system design. As our world becomes increasingly more complex, automated, and intelligent, it too becomes increasingly exposed to cybersecurity risks that threaten safe and expected system operations. Foundational systems engineering helps us build systems that will operate as intended across environmental conditions well understood by modern physics; yet, we are experiencing a growing collection of evidence that shows cybersecurity can undermine safe system design if not effectively considered against motivated adversaries with harmful intent. To ensure our systems can operate in the most critical conditions, we must consider both safety and security together.

Space, in particular, presents a unique challenge for the domain of cybersecurity. As a niche domain, computing operations may not be well understood, system architectures are not always designed to be cyber-defensible, and the time scale at which missions are executed across often differ significantly those Earth-bound. These traits pose challenge for both adversaries and system owners alike. From competitive advantage, desire to deny mission success, or generic intellectual property theft, the rewards for cyber adversaries operating in space will continue to grow as our economy does. Analyzing the cybersecurity implications on mission critical space systems, the infrastructure that supports them, and the population that relies on them, is critical to building a sustainable, prosperous, and sure civilization beyond Earth.

Our current design processes may be bound and challenged by our increasing understanding of the physics of our world. An engineering process for our assured future, however, must push past this boundary and consider the scope of human imagination.

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