




Generic and Cost effective framework for Space Threat Assessment for Emerging Space Economies


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Abstract: Modern-day satellites can be considered mini-computers orbiting the earth, with their own operating systems, customized software, navigation and processing units, in-built memory, and other optical and communication capabilities. Gone are the days when satellites were huge in size, with systems and sub-systems taking several months to a few years to be manufactured, assembled, tested, and launched depending on the mission. A wide variety of technological developments in the past decades, including miniaturization of systems and subsystems, availability of space-qualified and commercially-off-the-shelf (COTS) components, and the advent of application-specific integrated chips (ASICs) have paved the way for an increase in quantity and quality of space-based systems, thereby enabling a wide variety of missions even for emerging space economies.

With the growing number and complexity of satellites, there have been multiple recorded instances of attacks that have happened on space and ground-based systems over the last three decades. For example, in 1986, the Galaxy I satellite uplink was disrupted by a suspicious person from Florida under the pseudonym "Captain Midnight". In 1997, computers belonging to the X-ray astrophysics section of the Goddard Space Flight Center campus were compromised. In 1998, the ROSAT X-RAY satellite co-owned by the United States and Germany was hacked. One of the satellites from the military communication system Skynet - owned and operated by the UK's Royal Air Force was hacked.

As we enter the space age, it is important to note that many countries, including underdeveloped nations, utilize satellites for various earth-based and space-based applications, military recon missions, interplanetary missions, and all other types of space exploration. Given the extent of utilization, it is crucial to tackle the threats facing space-based and ground-based systems. Some developed and space-faring nations like the USA, Russia, China, the UK, etc., have counter-space capabilities at present to tackle a wide variety of threats. On the other hand, countries like India, Iran, Australia, New Zealand, and UAE, which are still new or emerging players in the new space industry, are still developing their systems to be robust enough to tackle space-based and ground-based threats. At the farther end are countries like Mongolia, Nepal, Sri Lanka, Cambodia, Norway, etc., which are still developing their space capabilities.

In this concise abstract, we present an overview of the myriad security threats encountered by both space-based and ground-based systems. Additionally, we introduce a generic and cost-effective threat assessment framework designed to evaluate these threats across diverse scenarios. This mission-agnostic framework, along with its brief methodology, serves as a foundational tool for identifying security vulnerabilities and formulating comprehensive risk mitigation strategies tailored to specific missions. In the subsequent full-length article, we delve deeper into the complexities of space security, exploring real-world examples, emerging challenges, and innovative solutions.

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2. Biography

Ramesh Kumar V: Ramesh Kumar V, an accomplished entrepreneur, serves as the Founder and CEO of Grahaa Space. With a background in electrical engineering and an MBA from Manipal University, he brings a wealth of expertise to his role. Over the course of his illustrious 16-year career, Ramesh has successfully established three startups, two in India and one in Singapore, amassing a combined revenue exceeding half a million dollars. Furthermore, his contributions extend beyond entrepreneurship, as evidenced by his co-authorship of five technical books utilized in distance learning programs at numerous universities.

Loganathan Muthusamy: Dr. Loganathan Muthusamy, an ex-ISRO professional, boasts a rich career spanning all phases of space missions, from ground segment applications to spacecraft mission planning, launch pad systems, space control stations, and payload processing centers. Currently serving as the Director of SRMSat at SRM University and the Director of Space Program at NMIT, Dr. Muthusamy is a seasoned leader contributing significantly to satellite technology and space exploration. His background in the Indian Space Research Organisation (ISRO) adds a valuable dimension to his expertise in advancing space-related initiatives.
