

Lecture Five

The State of Things

Critical Infrastructure?



- Is space critical infrastructure?
- GPS?
- Comms?
- Its all about time.
- Does it need to be to drive policy?
- It should be next year (in the US)
 - Until that happens...no DHs / CISA focus

Hosted Payload Providers



Bus Vendors



- AIRBUS
- Blue Canyon
- Honeywell
- Lockheed Martin
- Loft Orbital
- Northrop Grumman
- Thales



Honeywell



Launch Vendors



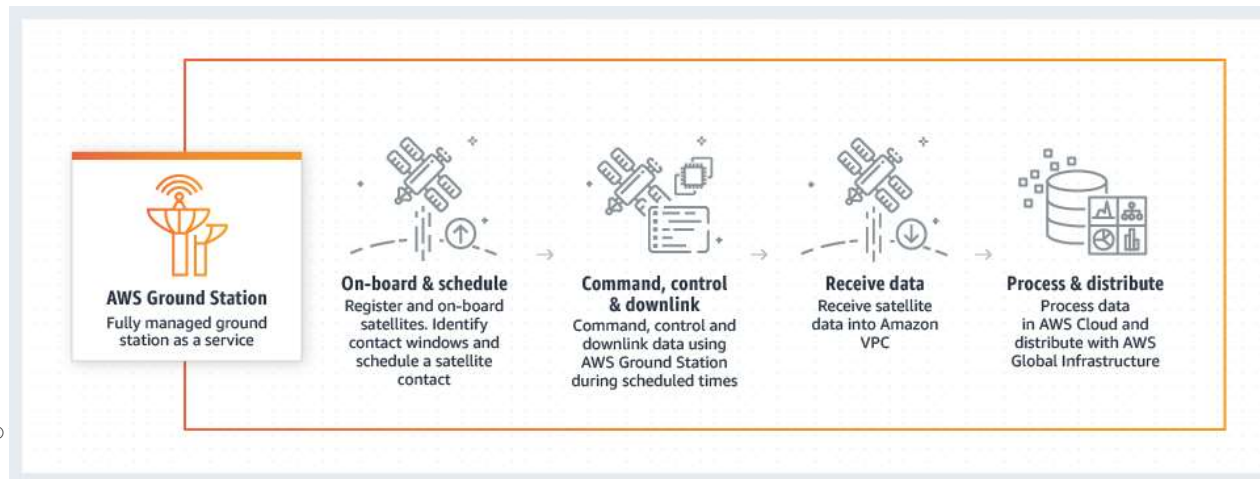
- Arianespace
- Blue Origin
- Rocket Lab
- SpaceX
- United Launch Alliance



GSaaS & GEPs



- Ground Station as a Service & Ground Entry Point Vendors
 - Satellite As A Service - AWS Ground Station
 - Azure Orbital Ground Station as Service
 - KSAT Global Ground Station Network



Non-Cyber Concerns



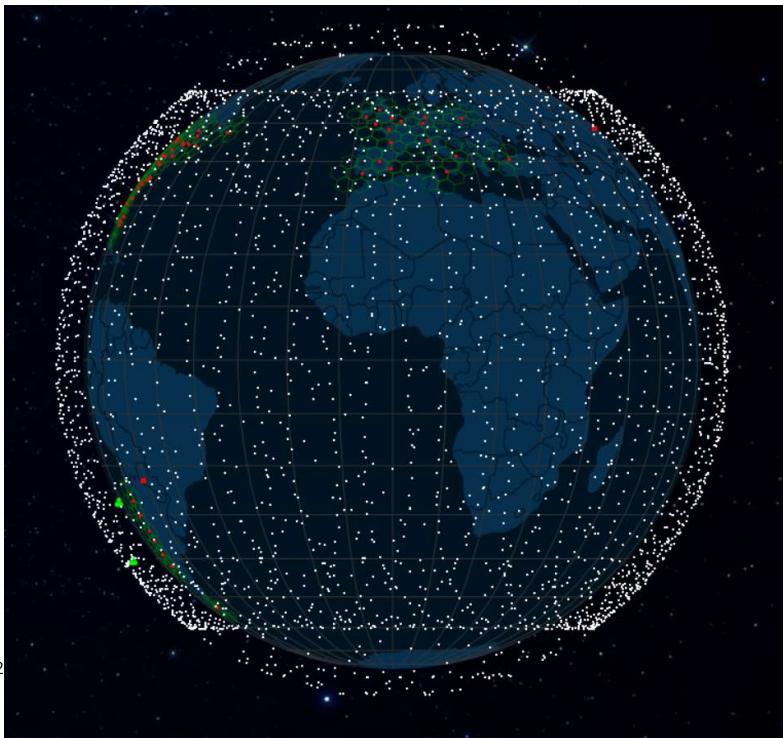
- OSINT Satellite Tracking
- Lasers
- Missiles

OSINT Satellite Tracking



- <https://satellitemap.space/>

<https://www.n2yo.com/>



N2YO.com Tracking **28222** objects as of 16-Nov-2023
HD Live streaming from Space Station
1,707 objects crossing your sky now

ISS will cross your sky
in 3h 14m 0s

Find a satellite... Search
N2YO.com on Facebook Advanced

Home Most tracked Just launched Satellites on orbit Alerting tools More stuff Sign in

SPACE STATION

NORAD ID:	25544
LOCAL TIME:	13:19:03
UTC:	19:19:03
LATITUDE:	-6.13
LONGITUDE:	-57.62
ALTITUDE [km]:	420.00
ALTITUDE [mi]:	260.98
SPEED [km/s]:	7.66
SPEED [mi/s]:	4.76
AZIMUTH:	140.3 SE
ELEVATION:	-20.6
RIGHT ASCENSION:	22h 27m 25s
DECLINATION:	-53° 34' 30"
Local Sidereal Time:	17h 15m 08s

The satellite is in day light

SATELLITE PERIOD: 93m

10-DAY PREDICTIONS FOR SPACE STATION

Make A Donation

Resources

- [IP2Location IP Geolocation](#)
- [Find your Magnetic Declination](#)
- [Space Station HD Live!](#)
- [Last Minute Stuff!](#)

Lasers



- US Army successfully tested the TRW-built Mid-Infrared Advanced Chemical Laser (MIRACL) at the White Sands Missile Range, New Mexico, on 17 October, 1997
 - <https://www.flightglobal.com/anti-satellite-laser-test-is-successful/17857.article>
- Russia and China are attacking US satellites with lasers
 - <https://www.independent.co.uk/space/russia-china-attack-us-satellites-lasers-b1972406.html>



Guidance / Standards / Policy



- Standard software: NASA Core Flight Executive (cFE), COSMOS, Cesium
- NIST – system overlays
- IEEE - secure by design principles
- CCSDS – Architecture framework for space system design



IEEE SA STANDARDS
ASSOCIATION



Law and Regulation



- International Heritage Laws
 - The Outer Space Treaty
 - The Rescue Agreement
 - The Moon Agreement
 - The Liability Convention
 - The Registration Convention
- National Information Assurance Policy for Space Systems Used to Support National Security Missions - CNSS 2012
- National Space Policy Directive 5 – Whitehouse 2020
- NIST Satellite Ground Segment: Applying the Cybersecurity Framework to Assure Satellite Command and Control – NIST 2022
- IEEE Standards Association's Space System Cybersecurity Working Group (S2C WG)

Academia / Resource Organizations



- Capitol University - PhD in Space Cybersecurity
- Embry-Riddle – Bachelors in Space Operations
- John Hopkins Engineering – Space Systems Cybersecurity Course
- Cornell – Space cybersecurity programs being developed and courses taught
- Space ISAC
- Aerospace Corp [Aerospace.org](https://aerospace.org) / SPARTA
- NASA
- The Aerospace Village
- HackSpaceCon
- CyberSatGov

Hack-a-Sat



- Hack-a-Sat is a CFT style competition funded by the United States Department of Defense.
- It consists of a thirty-hour qualifying round and a final competition that takes place yearly at Las Vegas during DEFCON. The top eight teams receive \$10,000 each.
- To receive qualification event cash prizes, the top eight teams must submit technical papers to describe how they hacked the satellite.
- Winning teams take home prize money in the ranges of \$20,000-\$50,000.
- To take home prize money, a technical paper must be submitted to describe the entire approach to winning the game.



Customer Base



- Military
- Intelligence
- Other government (weather for instance)
- Commercial
 - Space-based services
 - Space as a Service
 - Hosted payloads
 - Satellite builders / operators

<https://sagroups.ieee.org/3349/the-project/>



IEEE SA
STANDARDS
ASSOCIATION

P3349 - Space System Cybersecurity Working Group

Home

The Project

Meetings

Members

Meeting Agenda &
Minutes

News

Contacts



THE PROJECT

[Home](#) ▢ [The Project](#)



The IEEE Effort

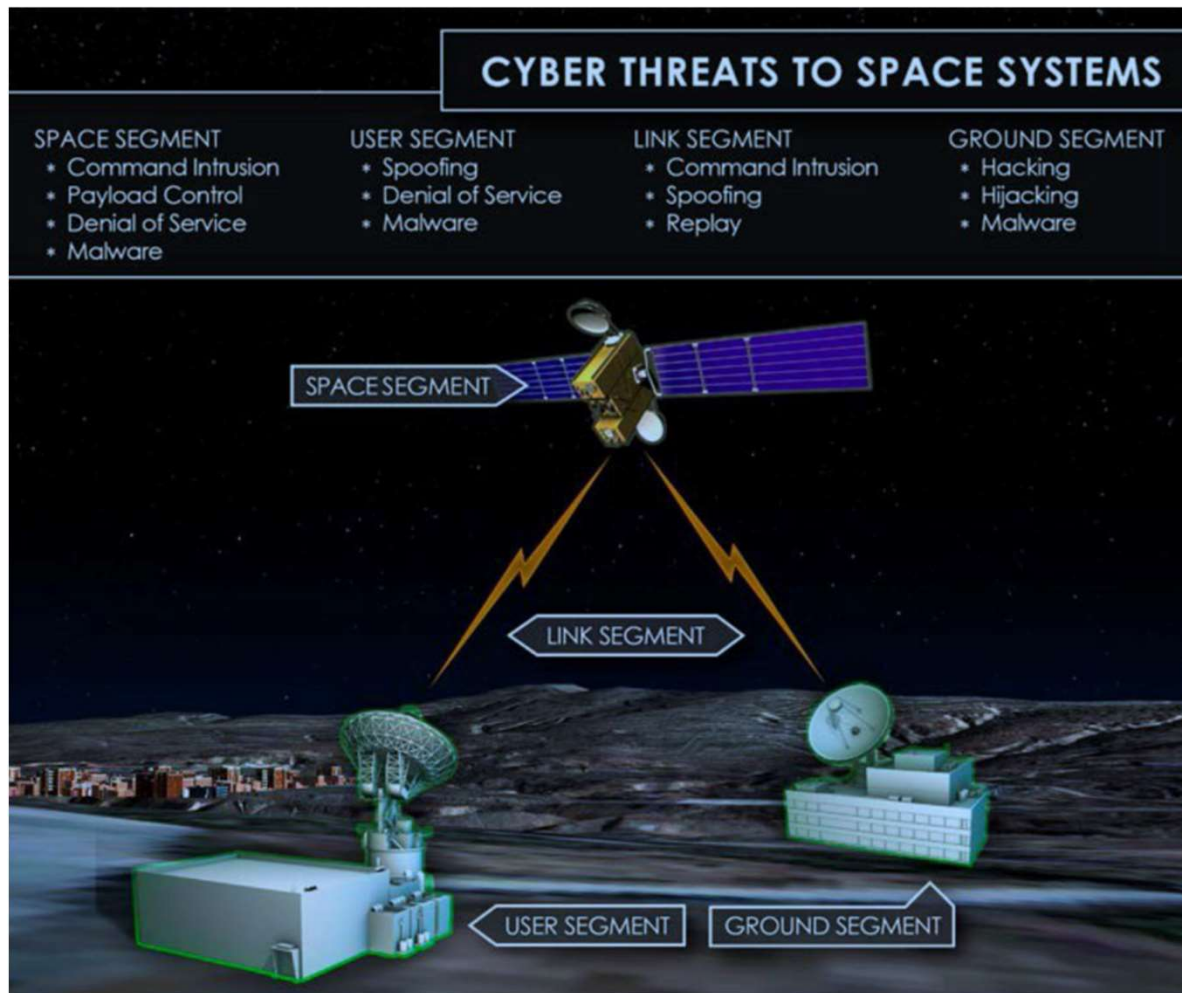


- Intention: Secure by design
- Based on security design principles, not technical implementations
- CCSDS & architectural concerns vs IEEE
- Not a regulation or standard but an international guideline
- Papers
 - Minimum Requirements for Space System Cybersecurity - Ensuring Cyber Access to Space
 - Secure-by-component: A System-of-systems Design Paradigm for Securing Space Missions

The IEEE Effort

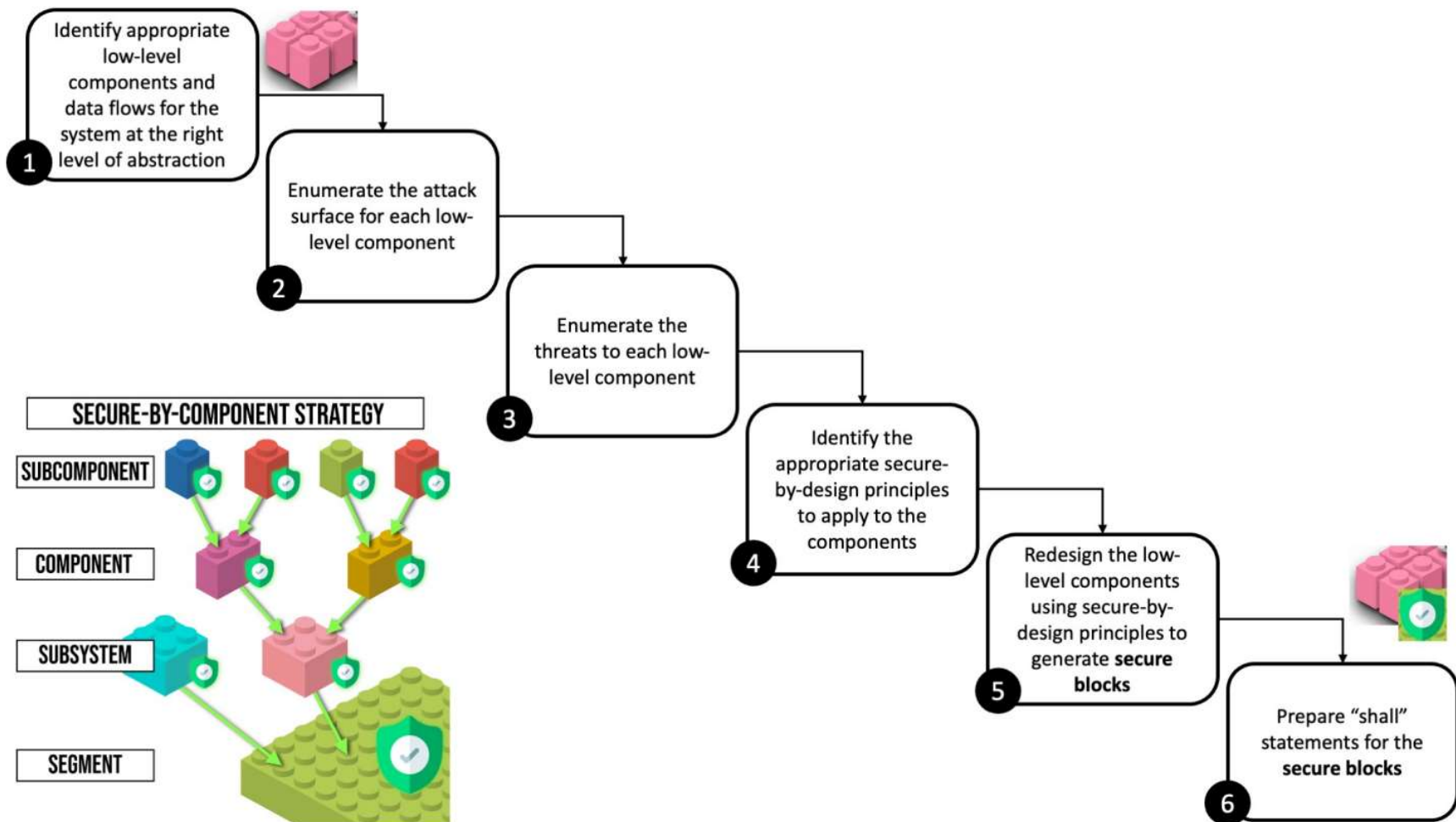
- Ground segment
- Link segment
- Space segment
- User segment
- Integration segment





- From CISA
Recommendations to Space
System Operators for
Improving Cybersecurity

The IEEE Effort



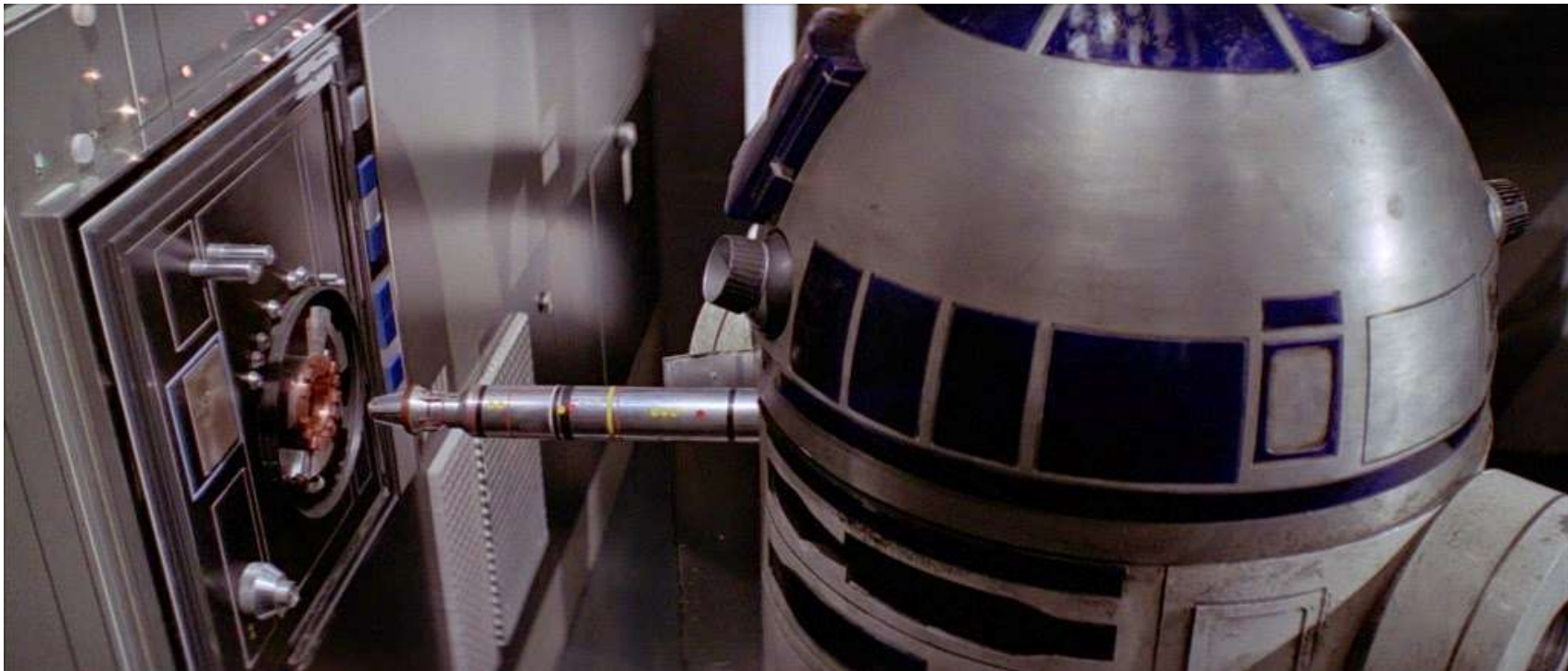
Rich Purnell Maneuver



- Misnamed file bypasses security filters
- Hides from people noticing



Beep boop



Star Trek TNG Contagion



- Responds to a SOS
- Finds a partially destroyed ship and a disabled enemy ship
- Downloads ships log from damaged ship
- Starts having malfunctions
- Determine that a probe from a long gone but very advanced civilization scanned and began reprogramming the damaged ship's computer and the enemy computer in its own image
- May seem ridiculous but....FPGA's are a thing
- And post quantum compute makes brute force probably trivial

