Game Changer Cyber –
Towards new Economics of Space?

StratByrd CONSULTING
ralph.thiele@stratbyrd.de

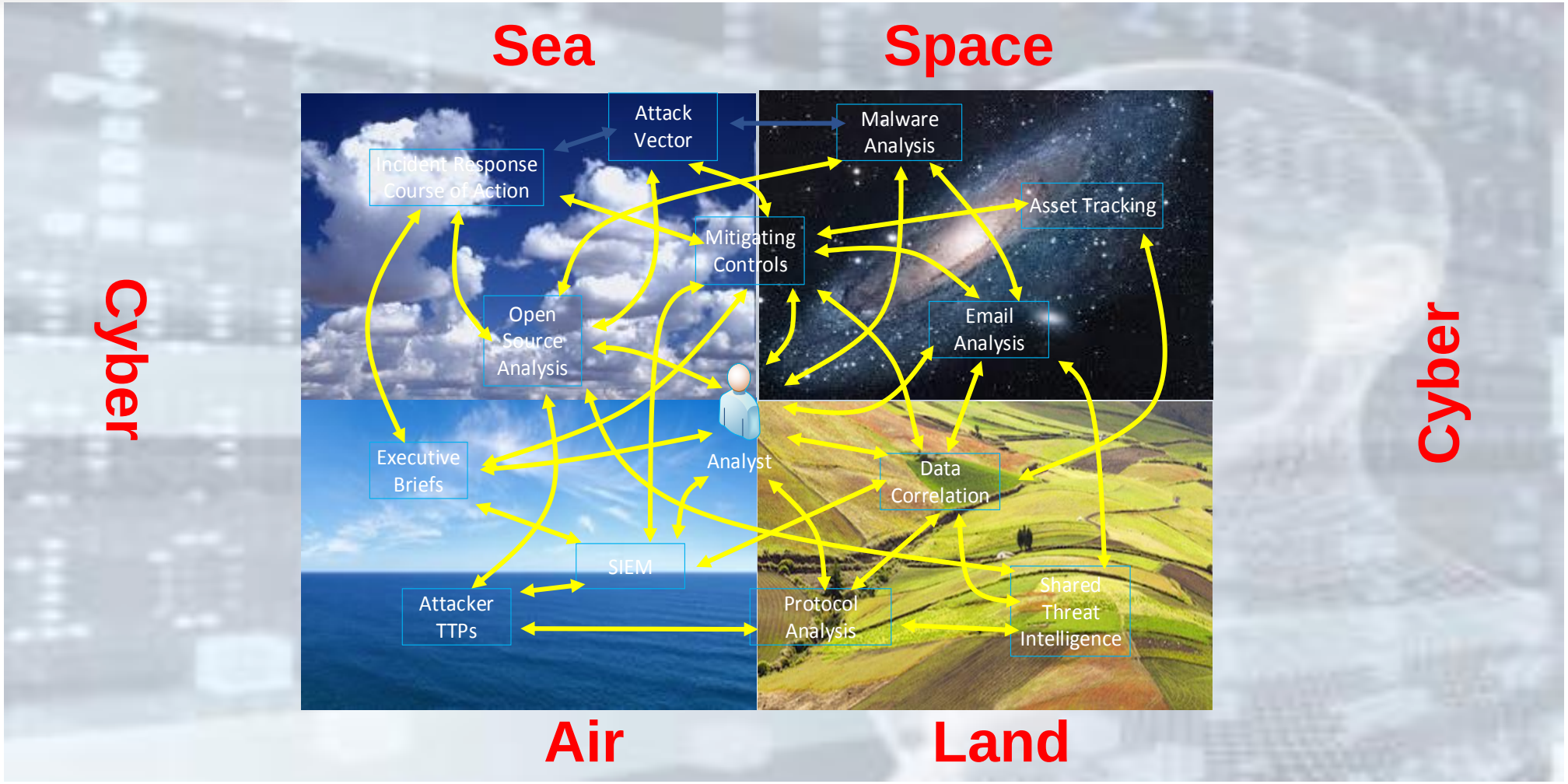
Luxembourg, 14 February 2019

1. Hybrid & Disruptive

- **Hybrid threats and disruptive technologies shape a diverse, fast developing strategic environment**
- **Hybrid hazards will rapidly expand and impact on prosperity, security, and defence to include space**

Hybrid & Disruptive

Cyber is Driver



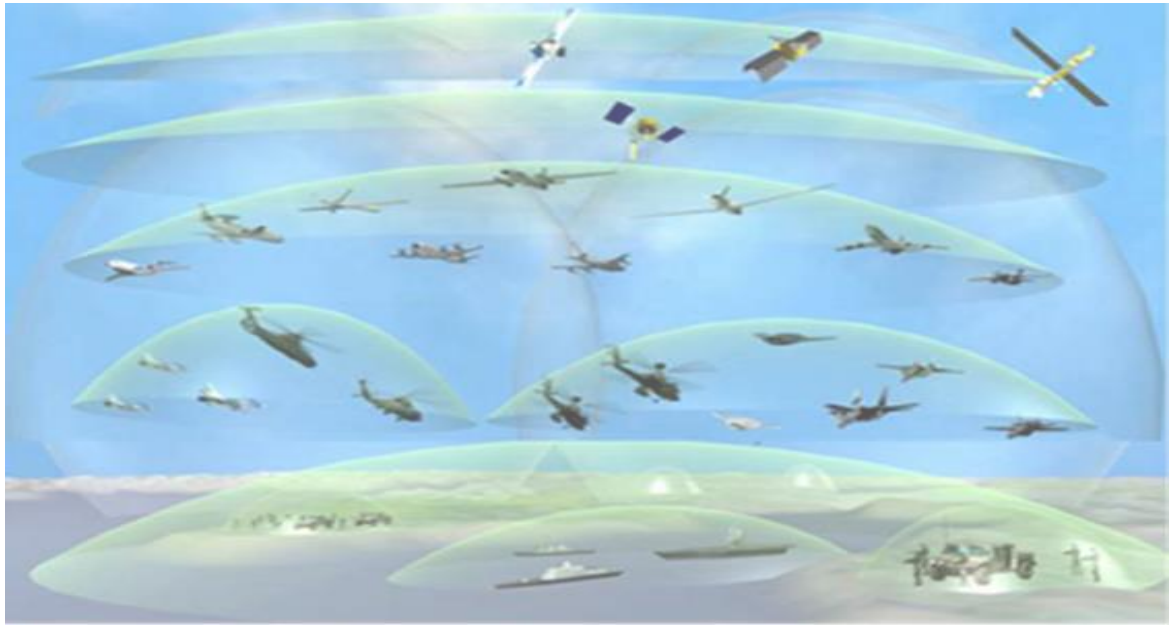
- Cyber has emerged as a game changer … the major enabler of hybrid threats … with significant impact on space

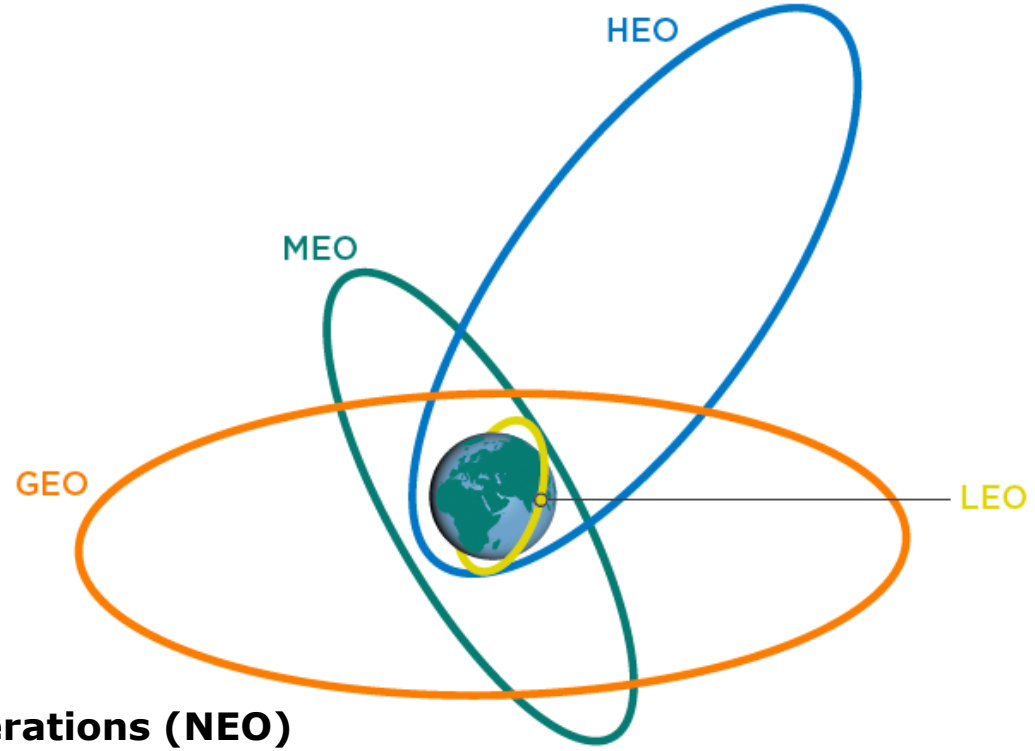
Hybrid & Disruptive

Anti-Access Area Denial – The Name of the Game

❖ The unhindered access to and freedom to operate in space is of vital interest

2. Neo & MEO



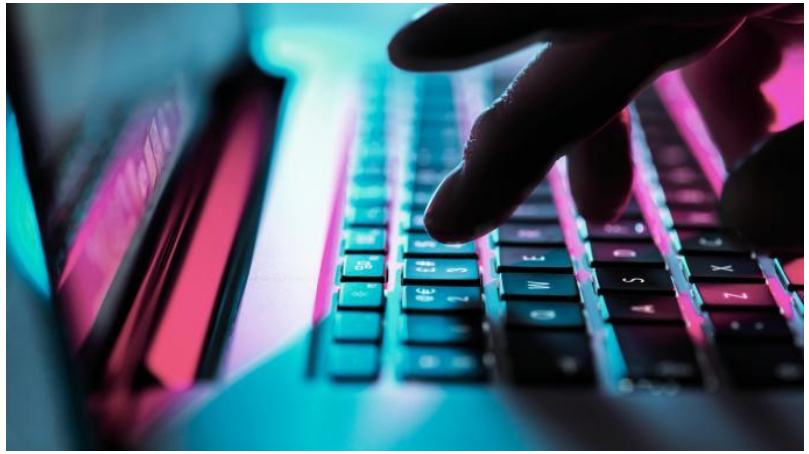


- **Digital Transformation provides for Network Enabled Operations (NEO)**
- **Space assets are a fundamental component of C4I … key enablers of NEO**

- **Digital Transformation of Industry and Economy is a growth driver**
- **Governments, Armed Forces, commercial enterprises and consumers appreciate the potential of medium-Earth orbit (MEO) and low-Earth orbit (LEO) satellites, bringing new capabilities to a variety of users**

- **Satellites systems support high mobility, quick deployment, wide geographical coverage, independence of terrestrial infrastructure and deliver secured high bandwidth and ubiquitous coverage to connect fixed and on-the-move 5G network sites as well as to enable highly scalable content distribution**

3. Actors & Vectors



A crowded Attacker Scene

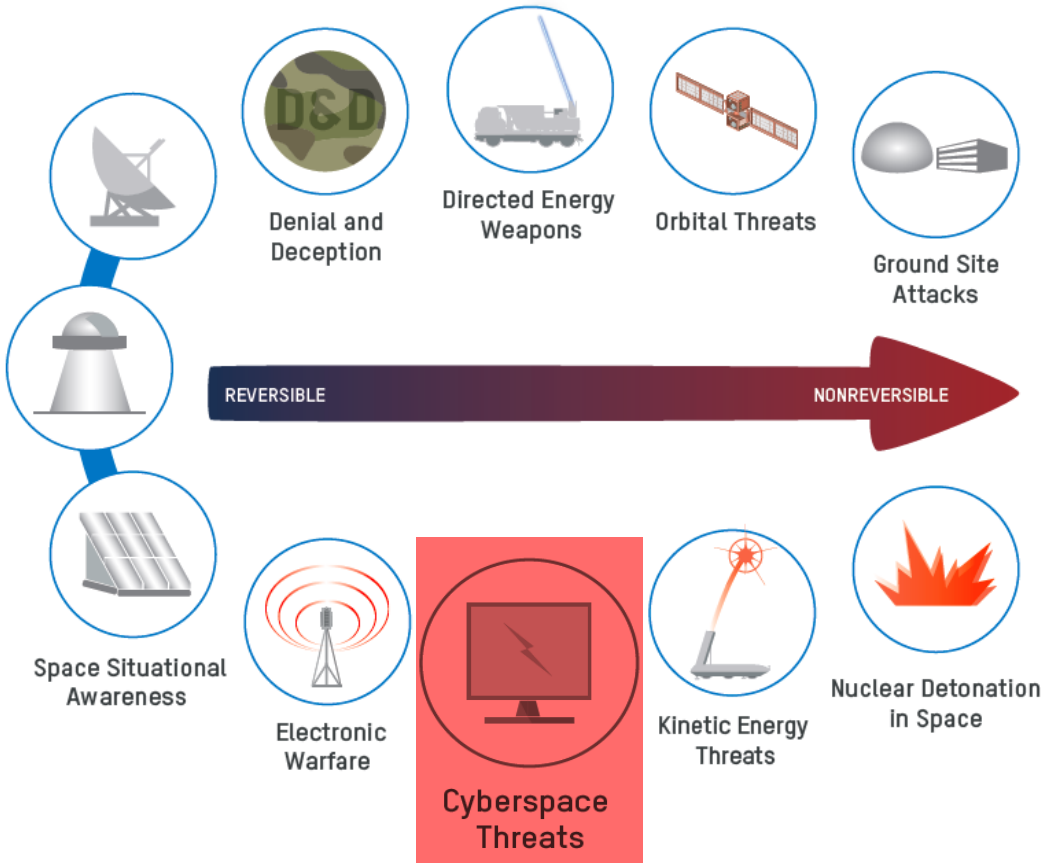
Chinese and Russian military doctrines view space as important to modern warfare and view counterspace capabilities as a means to reduce competitors effectiveness in business, security, and defence.

Iran and North Korea pose further challenges.

And there are more actors:
foes and friends, criminals and terrorists, individual hackers and hacker groups, self-inflicted and insider threats.

Actors & Vectors

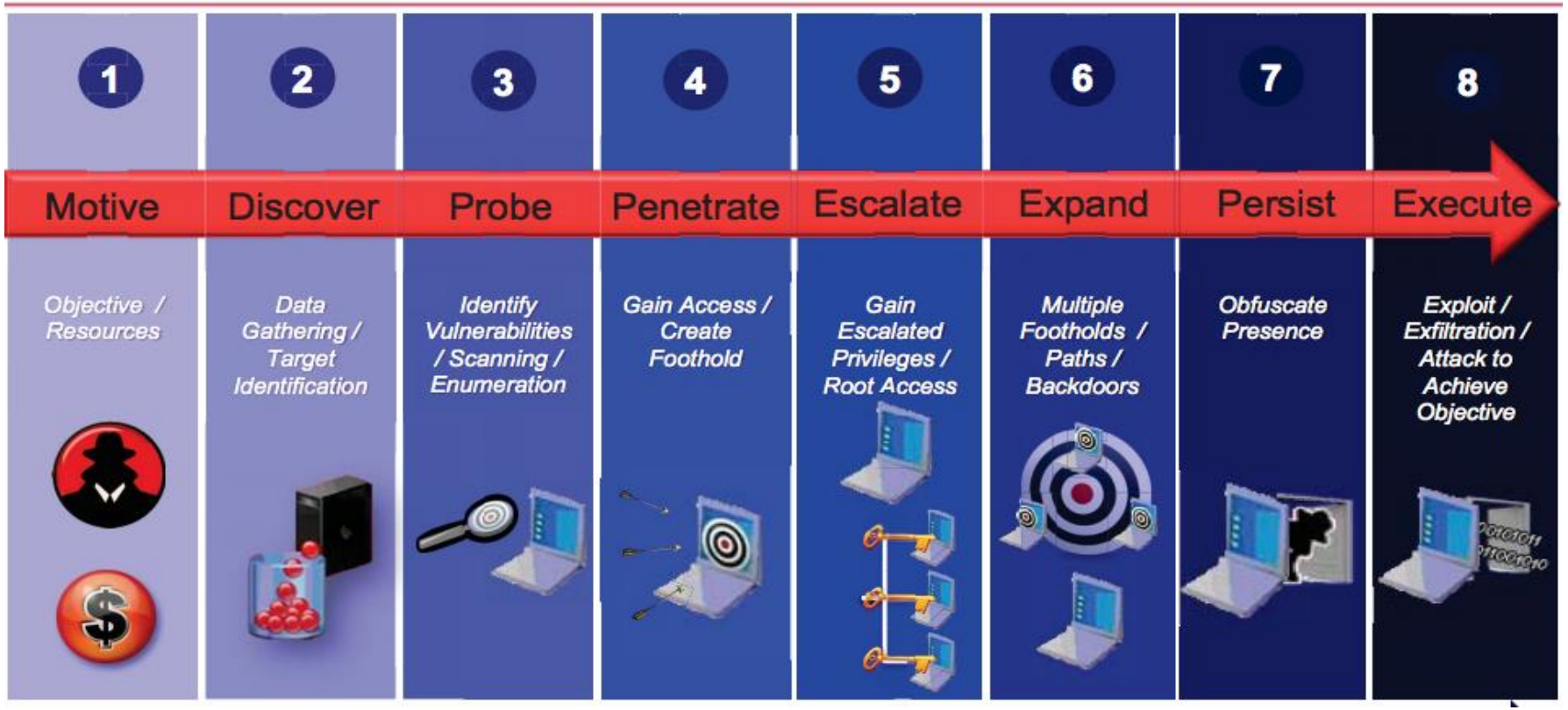
Space – a Challenged Domain



Cyberspace pervades all other warfighting domains, including space **Many space operations depend on cyberspace** and vice versa.

With sophisticated knowledge of satellite C2 and data distribution networks, **actors can use offensive cyberspace capabilities to enable a range of reversible to nonreversible effects** against space systems, associated ground infrastructure, users, and the links connecting them.

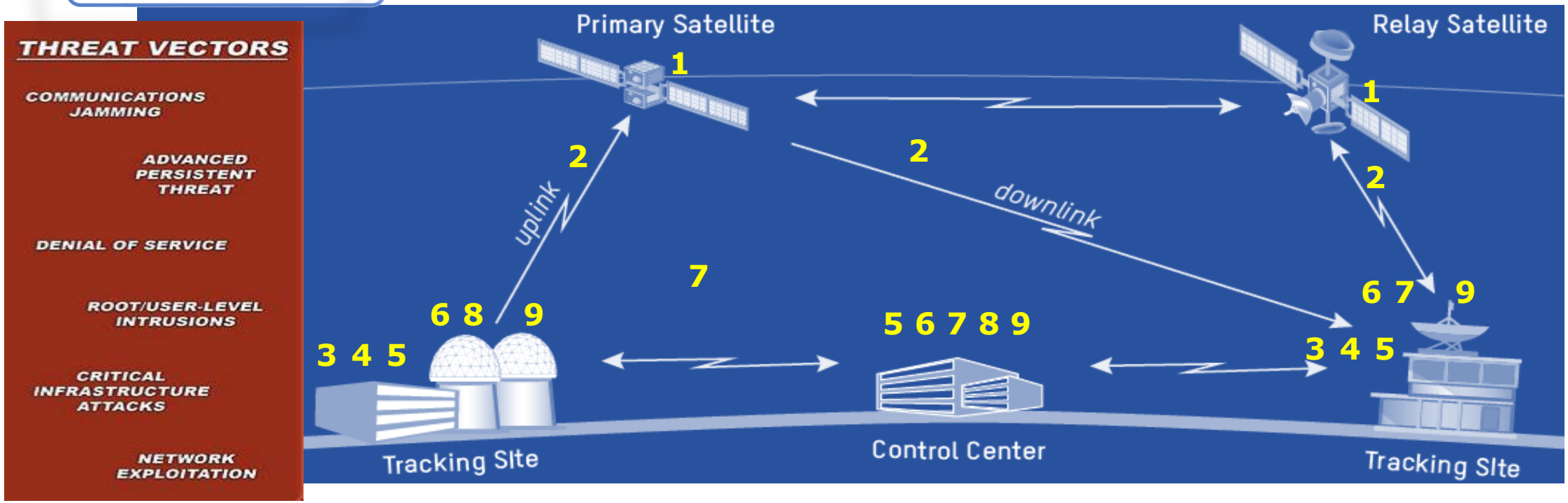
Cyber Kill Chain



… from discovery to probing, penetrating then escalating user privileges, expanding their attack, persisting through defences, finally executing their exploit to achieve the objective …

Actors & Vectors

Space related Cyberattack Vectors



1. **Spacecraft and its telemetry for command and control:** state of the art secured and encrypted telemetry
2. **RF signal stability:** jamming and spoofing; detection and resilience
3. **Ground infrastructure:** installation in secure areas; physical and technical access control
4. **Interface between RF and IP segment:** physical and technical access control; border protection devices; shielding, etc.
5. **Network connectivity:** firewalls; encryption; shielding ; access control, redundancy, etc.
6. **Server and client computers:** firewalls, physical and technical access control, shielding, anti-virus software, redundancy, etc.
7. **IP Network infrastructure:** Firewalls, DMZ (de-militarised zones, intelligent switches, physical and logical access control, redundancy, etc.)
8. **Wide-Area-Networks interconnecting different sites:** encryption, redundancy, KPI through SLAs
9. **Users:** background-checks and clearances, training, education, raising awareness, etc.

4. Cybersecurity beyond Earth

Reduce attack surfaces and Defeat the Kill Chain

Upcoming challenges cross-cut space and cyber domains. There is a **premium on disruptive and game-changing technologies** that are autonomous, reconfigurable, agile and adaptable.

Chinese Space based Quantum Key Distribution

These include:

- real-time, **multi-domain Space Situational Awareness**
- automated cyber forensics and analytics
- autonomous and automated space systems
- **on-board resilience and self-healing satellites**
- **new concepts in space ground operations**, i.e. enhanced predictive technologies or dynamic encryption and signal beaming based on mission needs etc.
- **artificial intelligence**
- Predictive and automated threat analysis
- advanced data analytics
- Technologies to advance **Quantum capabilities** in the areas of computing and cryptography

❖ **Build an ecosystem where Frogs & Eagles grow well**