

# **THE RULE OF LAW IN AN EXTREME ENVIRONMENT:**

## **THE GROWING CHALLENGES TO THE RULE OF LAW IN OUTER SPACE**



**Deb Housen-Couriel, Adv.**

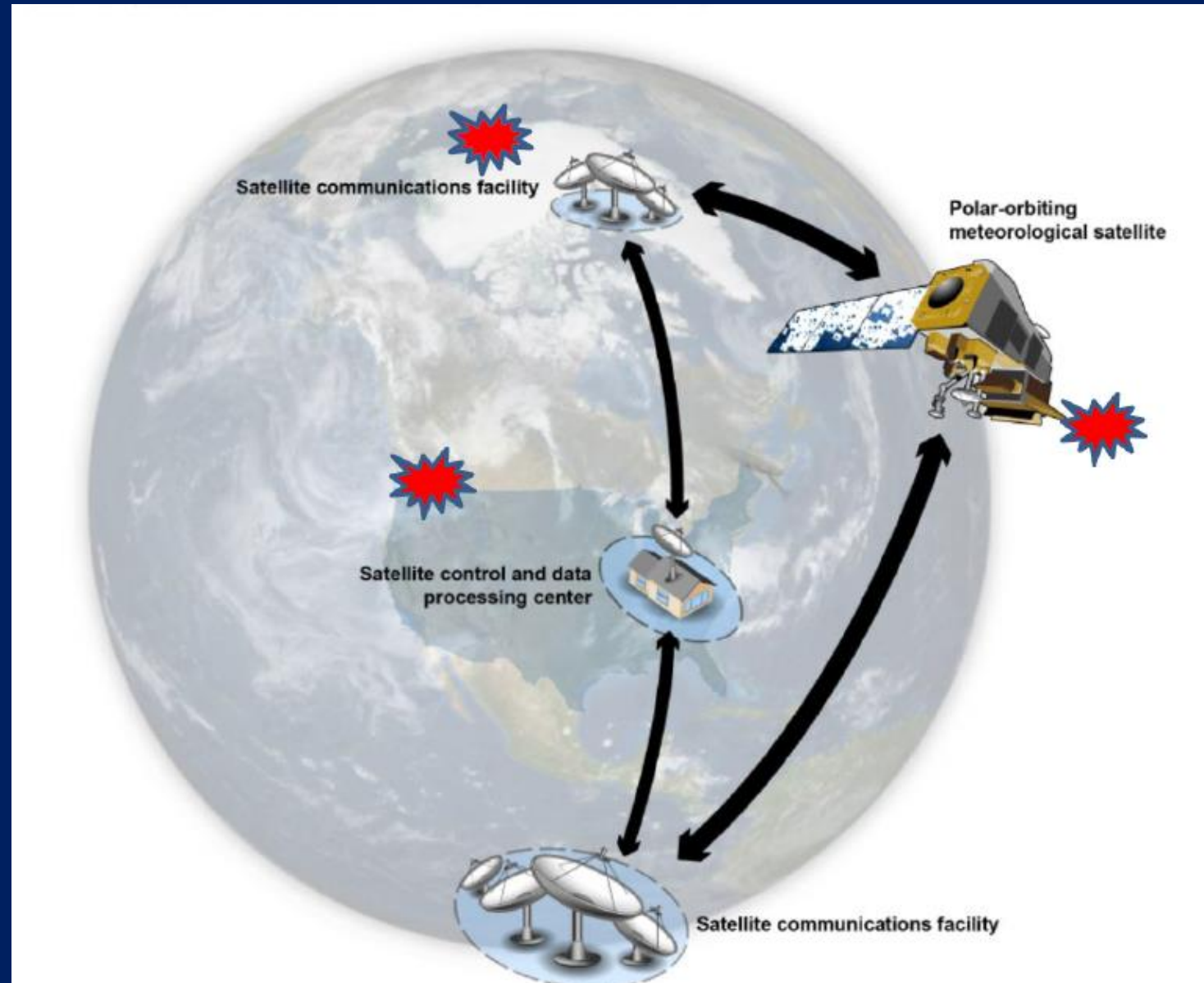
## GAO: Hackers penetrating national weather satellites

By RUDY TAKALA (@RUDYTAKALA) • 5/19/16 11:40 AM

U.S. weather satellites were breached 10 times over the course of a year, according to a congressional agency.

The hacks of the Joint Polar Satellite System took place between August 2014 and August 2015, according to the report published by the Government Accountability Office. The incidents were classified as ranging from medium to high severity, and included "hostile probes, improper usage, unauthorized access, password sharing and other IT-related security concerns."

## SPACE / GROUND SEGMENTS



# SATHACKS ARE NOT NEW / UNIQUE

- RIGHT NOW – **KUWAIT-BASED AL-JAZEERA** SAT BROADCASTS AND TRANSMISSIONS BEING HACKED “systematic and continual”
- ONGOING **NASA** HACKS – GROUND SEGMENT
- 1997 UNTIL PRESENT - **TURLA** SAT INTERNET HACKING GROUP
- SUMMER 2015 - INTERFERENCE WITH **GLOBALSTAR** TRACKING SYSTEMS



# TYPES OF CYBER-ENABLED DISRUPTIONS TO SAT COMM (via EM SPECTRUM)

**DISTORTING**

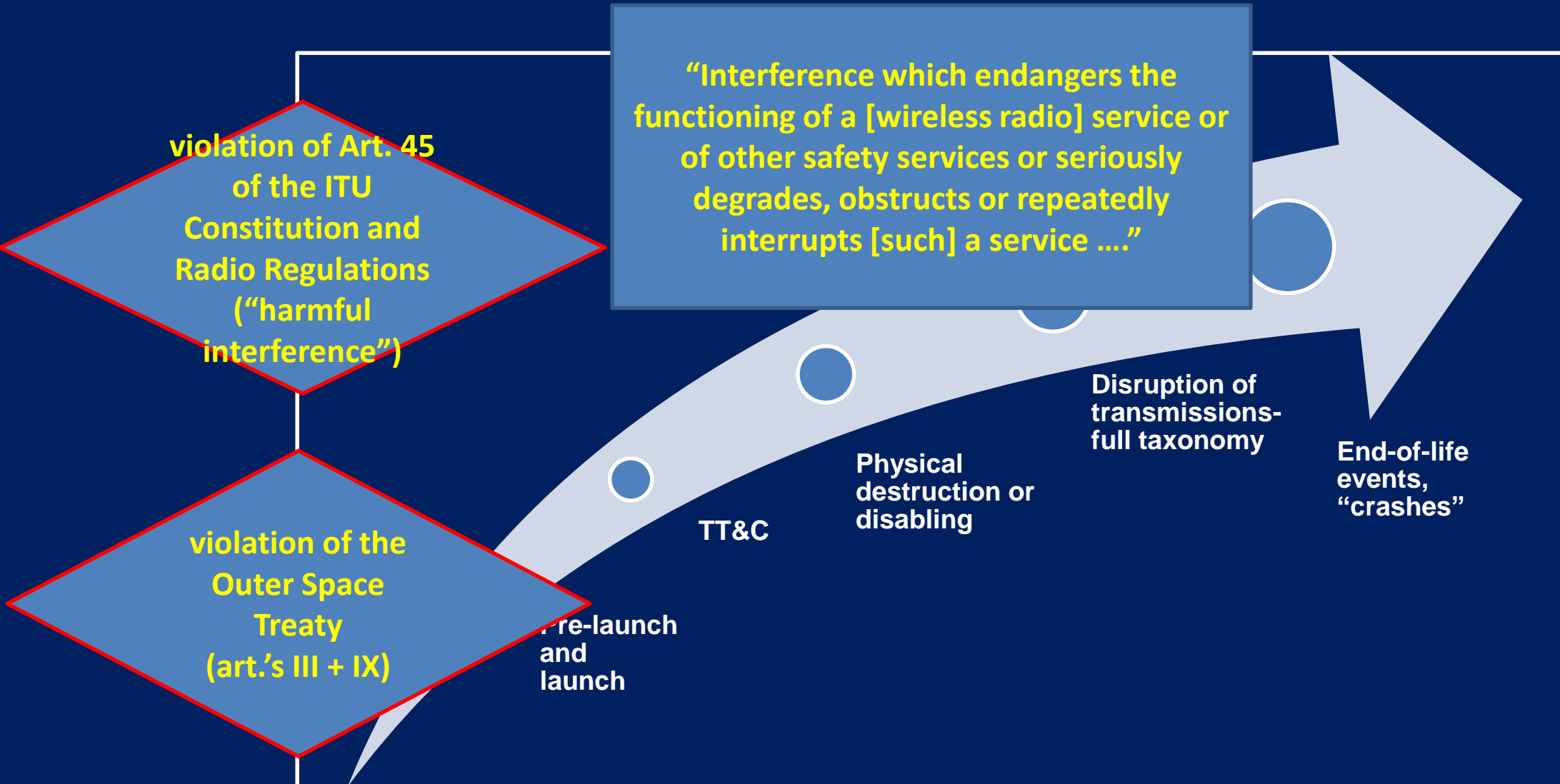
**MORPHING**

**HIJACKING  
TT&C >>  
COLLISION**

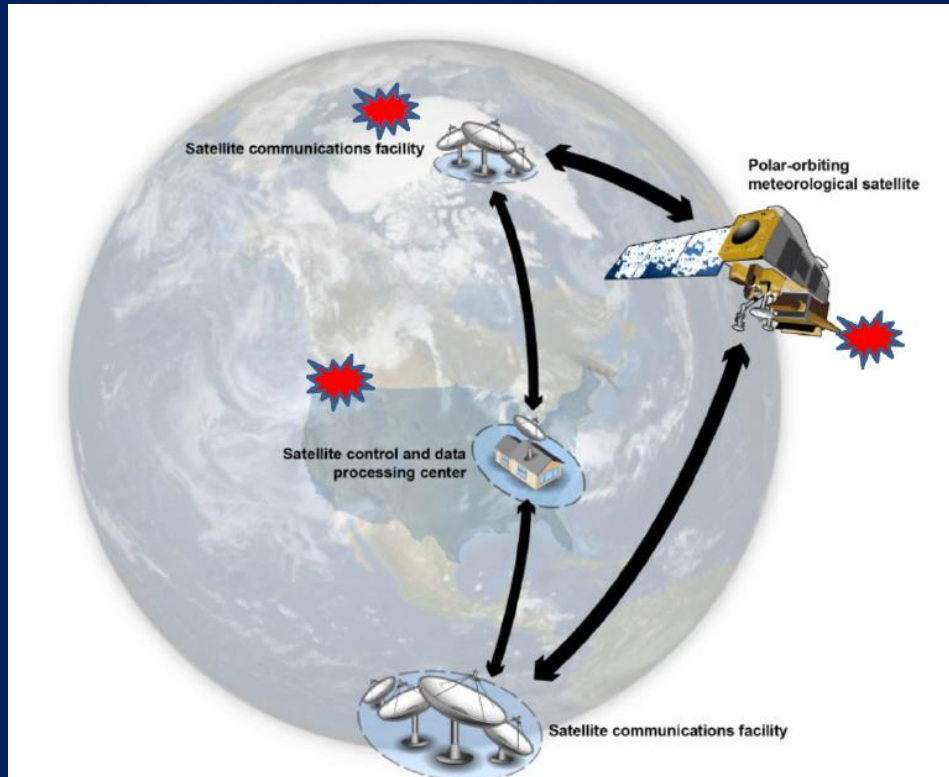
**JAMMING**

**SIGNAL RE-  
ROUTING**

# VULNERABILITY THROUGHOUT THE SATELLITE LIFESPAN



# THESE ARE HIGH-RISK SCENARIOS



“Because of the criticality of satellite data to weather forecasting, the possibility of a satellite data gap, and the potential impact of a gap on the health and safety of the U.S. population and economy, **we added this issue to GAO’s High Risk List in 2013 and it remained on the list in 2015.**”

**\*\*[also 2017]**



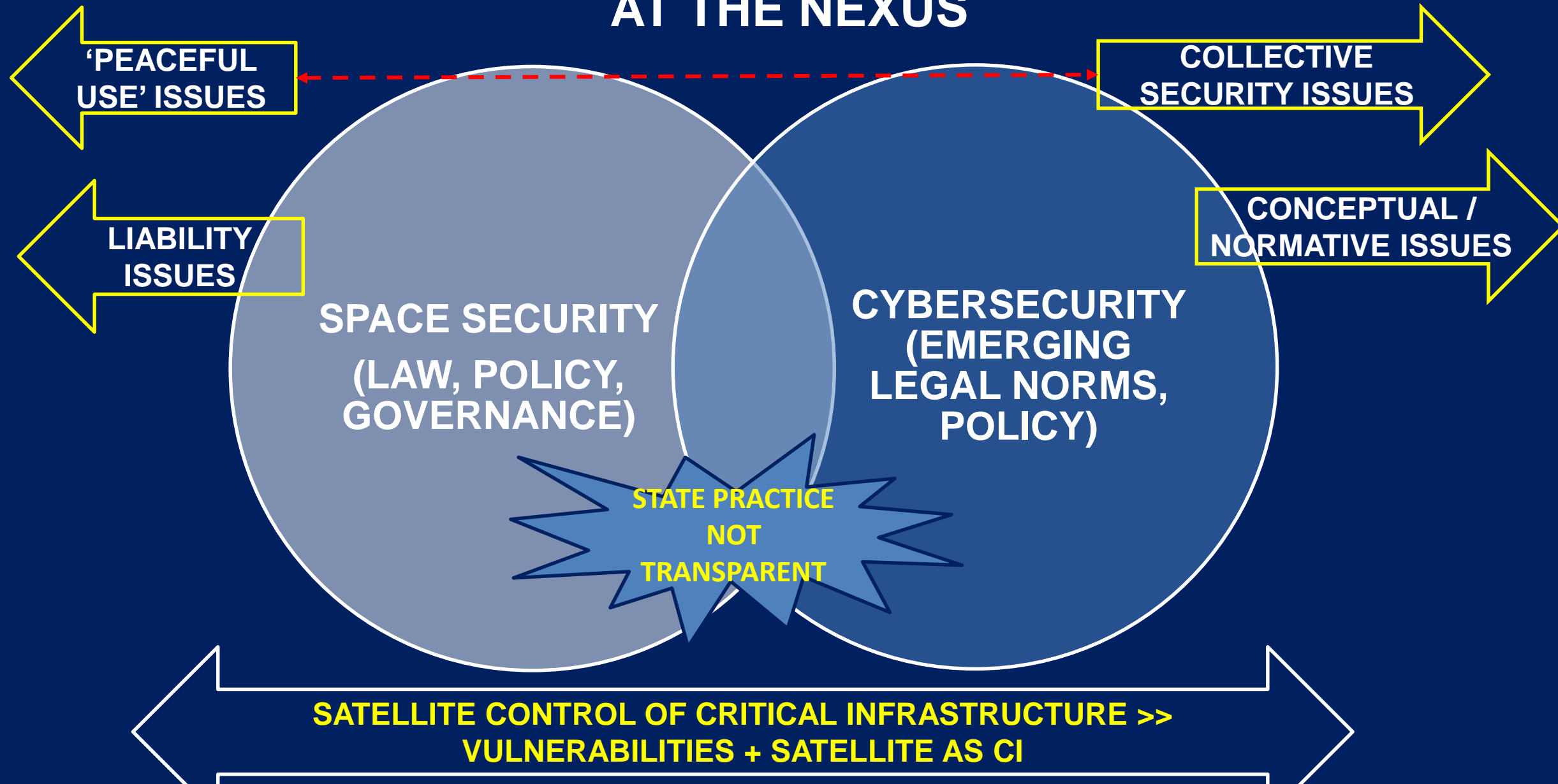
# EXTRAPOLATING > LOSS-OF-LIFE SCENARIOS



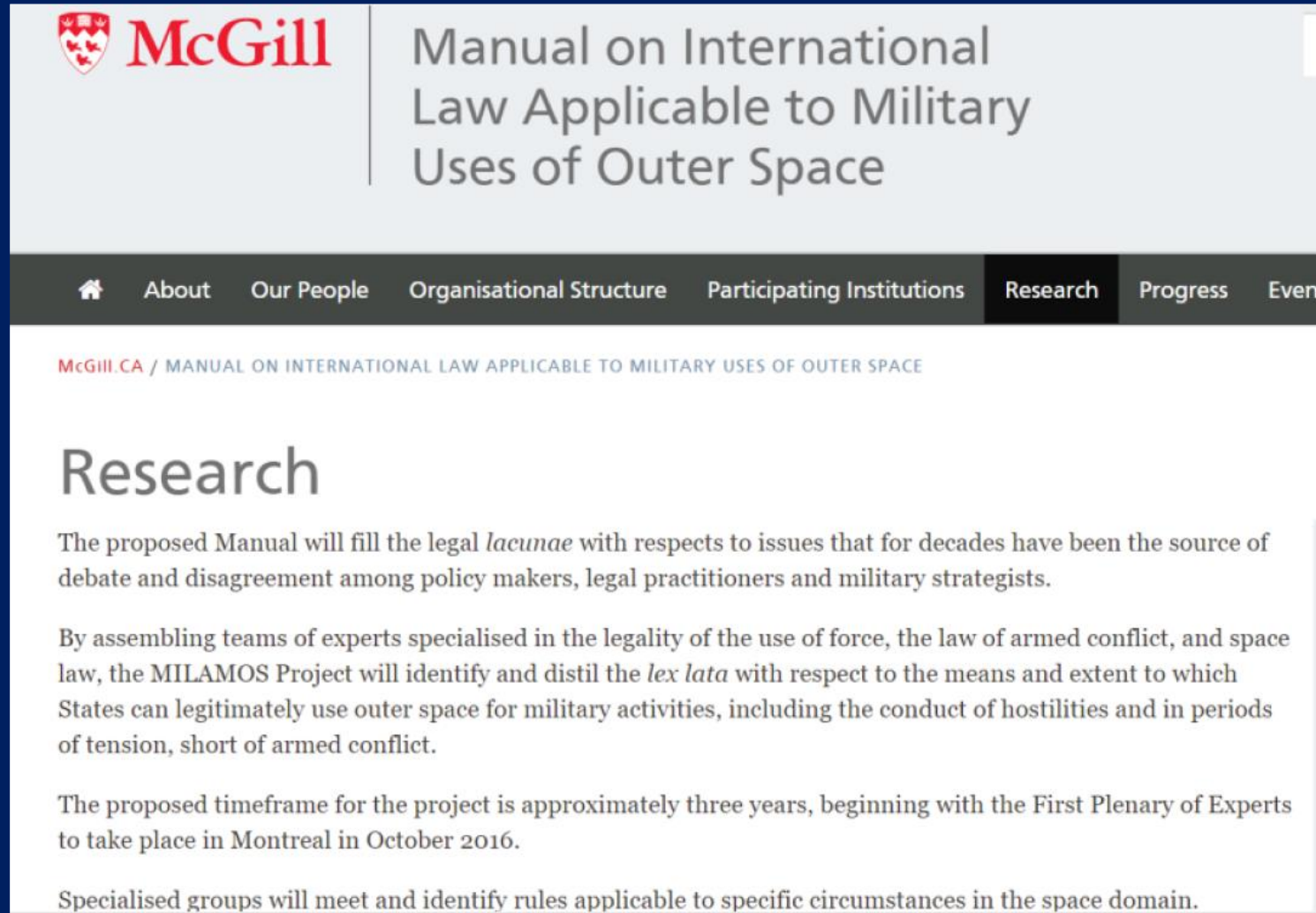


**How are international law scholars and practitioners meeting this challenge at the nexus of two regimes – one governing outer space and the other, cyberspace?**

# BROADER RESEARCH: THE GROWING CRITICALITY AND URGENCY OF THE PROBLEM AT THE NEXUS



# TODAY - MILAMOS



 **McGill**

## Manual on International Law Applicable to Military Uses of Outer Space

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McGill.CA / MANUAL ON INTERNATIONAL LAW APPLICABLE TO MILITARY USES OF OUTER SPACE

### Research

The proposed Manual will fill the legal *lacunae* with respects to issues that for decades have been the source of debate and disagreement among policy makers, legal practitioners and military strategists.

By assembling teams of experts specialised in the legality of the use of force, the law of armed conflict, and space law, the MILAMOS Project will identify and distil the *lex lata* with respect to the means and extent to which States can legitimately use outer space for military activities, including the conduct of hostilities and in periods of tension, short of armed conflict.

The proposed timeframe for the project is approximately three years, beginning with the First Plenary of Experts to take place in Montreal in October 2016.

Specialised groups will meet and identify rules applicable to specific circumstances in the space domain.

► MILITARIZATION

► COMMERCIALIZATION

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## **"NEW SPACE"**

► OPERATIVE  
DEVELOPMENTS

► CYBER DEPENDENCE

THE CURRENT  
**NORMATIVE  
FRAMEWORK** AND  
THE RULE OF LAW

**DEVELOPMENTS AND  
DILEMMAS**  
(WITHIN MILAMOS)

**(1) “NEW SPACE”**



COURTESY U.S. AIR FORCE



Photograph by Getty Images/Brand X

COMMERCIAL SPACE

## Luxembourg to Invest \$227 Million in Asteroid Mining

David Z. Morris  
Jun 05, 2016



On Friday, the tiny European nation of Luxembourg announced that it would open a 200 million Euro (\$227M U.S.) fund to entice companies focused on mining asteroids to locate there. Luxembourg's economy minister said that the fund's budget could expand if needed, and that it is aimed at making the country, which is about the size of the Dallas metro area, a global leader in space.

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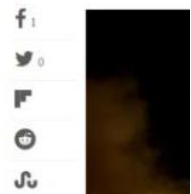


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By Mike Wall, Space.com Senior Writer



MISSION NEWS TIMELINE GET INVOLVED GALLERIES

JULY 4 2020

### SAMPLING BENNU

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by Sean O'Kane | @sokane1 | Sep 27, 2016, 1:49pm EDT



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### NOW TRENDING



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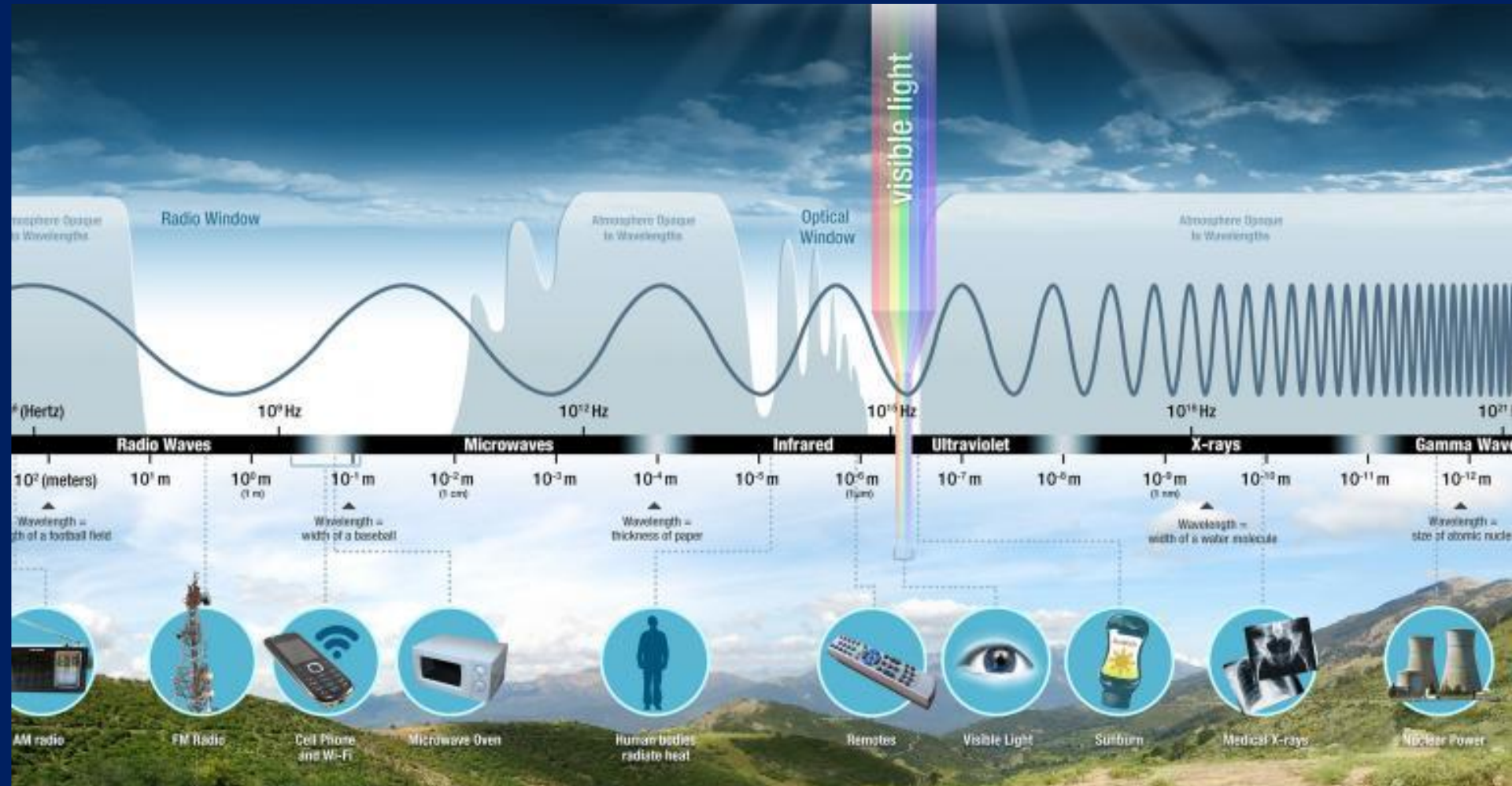






As the space and cyberspace domains are linked **operationally—space cannot exist without cyber and cyber, in some cases, without space**—and they permeate all other warfighting domains (i.e. land, air, and sea), cyber-related vulnerabilities of space assets are a major concern. Global effects would be virtually instantaneous.

# ALL SPACE COMMUNICATIONS ARE VIA CYBERSPACE



**(2) THE CURRENT  
NORMATIVE FRAMEWORK  
AND THE RULE OF LAW**

# SCOPE + NORMATIVE HEIRARCHY OF OUTER SPACE LAW




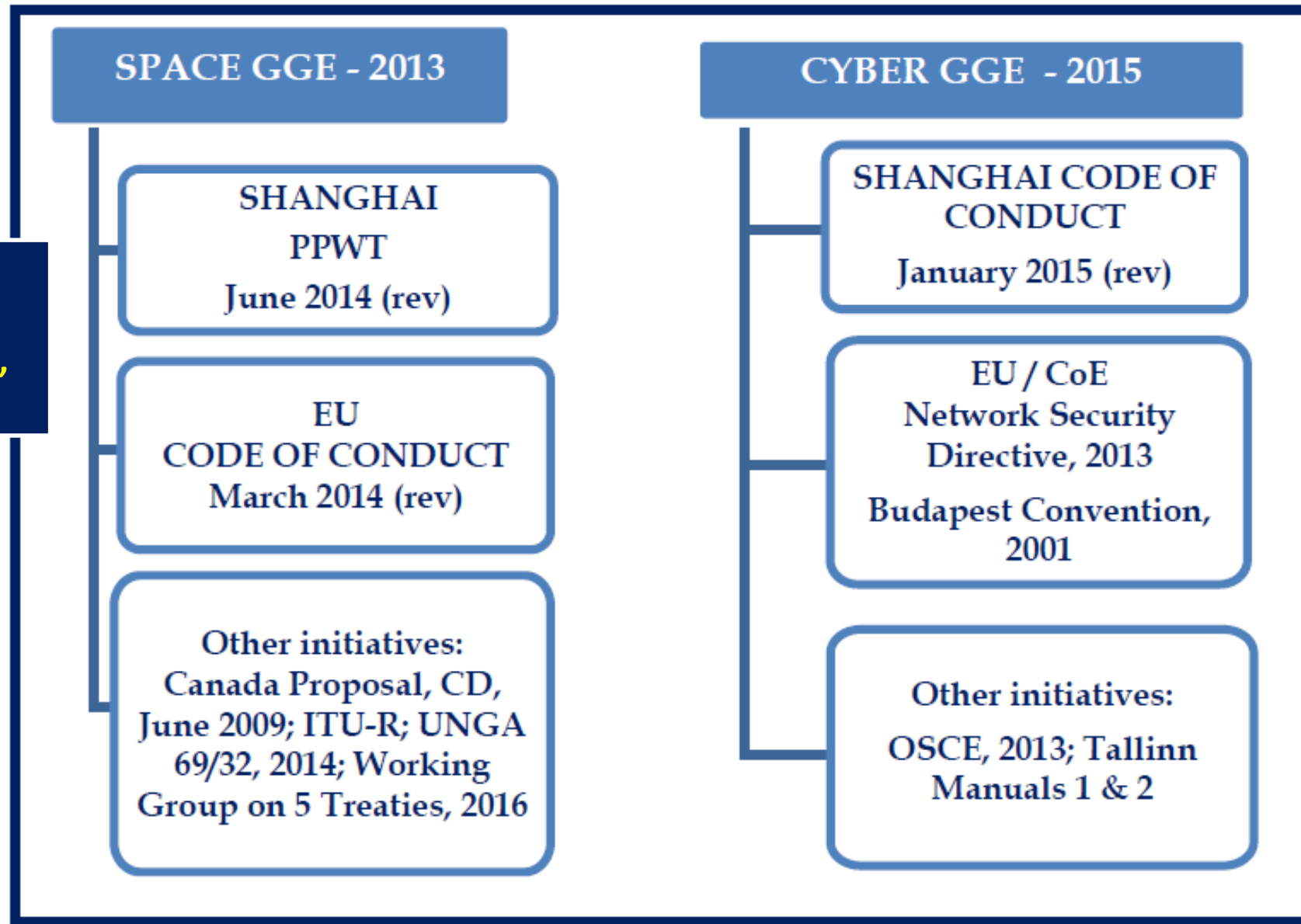
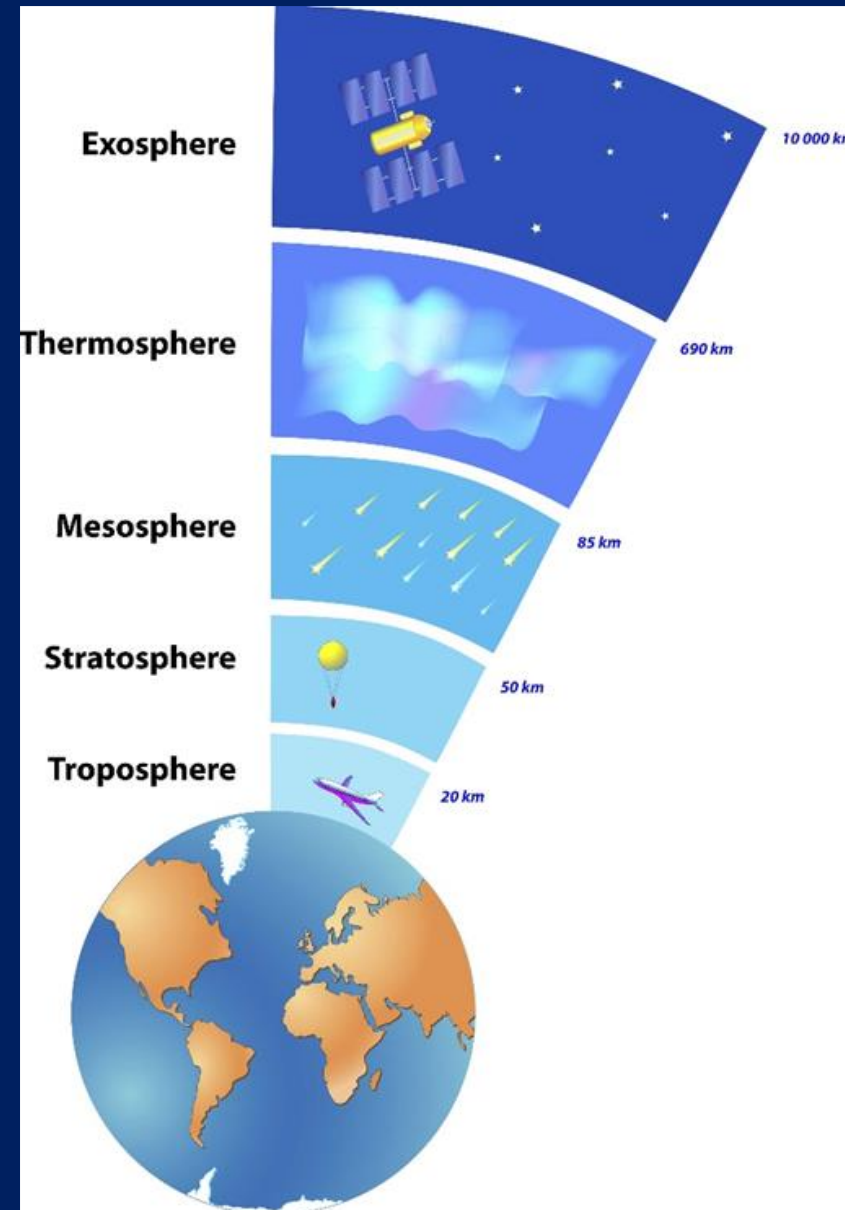
- **The "Outer Space Treaty" – OST, 50 year anniversary, Cold War, 127 signatories**
  - Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, entered into force on 10 October 1967 
- **The "Rescue Agreement", 92 signatories**
  - Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space, entered into force on 3 December 1968 
- **The "Liability Convention", 111 signatories**
  - Convention on International Liability for Damage Caused by Space Objects, entered into force on 1 September 1972 
- **The "Registration Convention", 63 signatories**
  - Convention on Registration of Objects Launched into Outer Space, entered into force on 15 September 1976
- **The "Moon Agreement", 21 signatories**
  - Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, entered into force on 11 July 1984.



Figure 2: Initiatives on outer space security and cybersecurity



# “OUTER SPACE”



# OST, ARTICLE I

The exploration and use of outer space, including the moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be **the province of all mankind**.

Outer space, including the moon and other celestial bodies, shall be **free for exploration and use by all States without discrimination of any kind, on a basis of equality and in accordance with international law**, and there shall be free access to all areas of celestial bodies.

There shall be **freedom of scientific investigation** in outer space, including the moon and other celestial bodies, and States shall facilitate and encourage **international co-operation** in such investigation.

# ARTICLE II

Outer space, including the moon and other celestial bodies, is **not subject to national appropriation** by claim of **sovereignty**, by means of **use or occupation**, or **by any other means**.

# ARTICLE III

States Parties to the Treaty shall carry on activities in the exploration and use of outer space, including the moon and other celestial bodies, **in accordance with international law**, including the **Charter of the United Nations**, in the interest of maintaining international peace and security and promoting international co-operation and understanding.

## ARTICLE IV – Raison d'être

States Parties to the Treaty undertake **not to place in orbit around the Earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction, to install such weapons on celestial bodies, or station such weapons in any other manner.**



היינו  
כחולמים.

The moon and other celestial bodies shall be used by all States Parties to the Treaty **exclusively for peaceful purposes.** The **establishment of military bases, installations and fortifications, the testing of any type of weapons and the conduct of military manoeuvres on celestial bodies shall be forbidden.** The use of military personnel for scientific research or for any other peaceful purposes shall not be prohibited. The use of any equipment or facility necessary for peaceful exploration of the moon and other celestial bodies shall also not be prohibited.



# **(3) DEVELOPMENTS AND DILEMMAS**

**▶ MILITARIZATION**

**▶ COMMERCIALIZATION**

# **MILITARIZATION OF OUTER SPACE**

**militarization  
dilemma**

**On the one hand, OST  
establishes “province of  
all mankind”, no  
sovereignty or nat’l  
appropriation, no WMD**

**On the other, OST  
provides for application  
of international law,  
Charter collective security  
regime, IHL (Milamos)**

For decades the United States has enjoyed unimpeded freedom of action in space. This **benign environment** allowed us to operate satellites for intelligence collection, missile warning, weather monitoring, communications, and precision positioning, navigation, and timing in support of all military operations for all of the services, without thinking about how to protect these systems. **That environment no longer exists. Space will be contested in any conflict.** Our potential adversaries understand the advantage we derive from space and view our reliance on space as a vulnerability they can exploit. Near-peer competitors will effect any U.S. military

**A contested space domain is a relatively new and dynamic problem set.**

degrade or destroy them.

Clearly, freedom to operate in space is not guaranteed. In fact, **space is now a warfighting domain**, similar to the more familiar air, land, and maritime domains our

# BRIEF CASE STUDY

AT WHAT THRESHOLDS DO HOSTILE SATCOMM  
DISRUPTIONS BECOME



AN ILLEGAL USE OF FORCE IN OUTER SPACE AND  
CYBERSPACE UNDER INTERNATIONAL LAW?

## UN 2(4)

ALL MEMBERS SHALL **REFRAIN ...FROM THE  
THREAT OR USE OF FORCE** AGAINST THE  
TERRITORIAL INTEGRITY OR POLITICAL  
INDEPENDENCE OF ANY STATE...



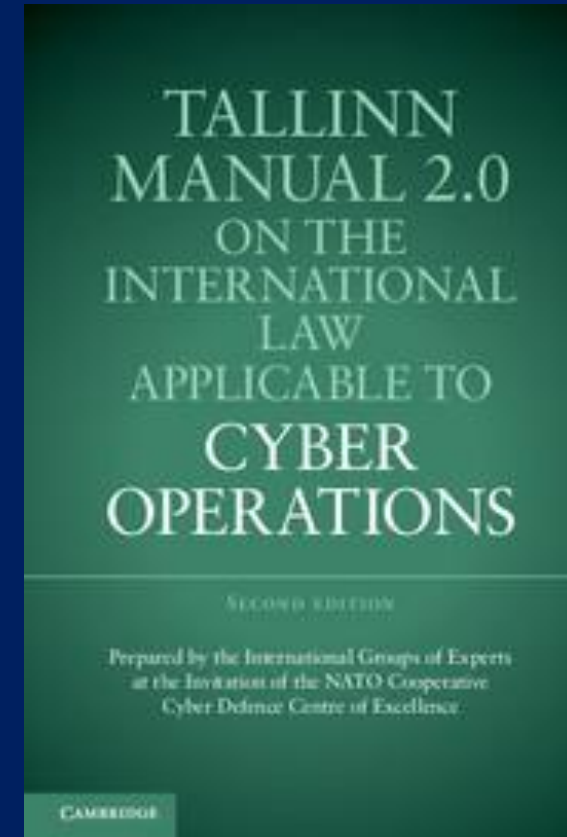
# UN 51

NOTHING IN THE PRESENT CHARTER SHALL IMPAIR  
THE INHERENT RIGHT OF ...**SELF-DEFENSE IF AN  
ARMED ATTACK OCCURS** AGAINST A MEMBER OF  
THE UN...

- ▶ **PRE-EMPTIVE** (CUBA, OSIRAK)
- ▶ **SECURITY COUNCIL ACTIONS UNDER CHAPTER VII**

2017

- *LEX LATA*,  
RESTATEMENT
- “APPLIED  
SCHOLARSHIP”
- **INTERNATIONAL LAW  
AND COLLECTIVE  
SECURITY APPLY TO  
CYBERSPACE AND  
OUTER SPACE**
- STATES’ *DE FACTO*  
ACKNOWLEDGEMENT



# Tallinn 2.0, Rule 58 – Peaceful purposes and uses of force [in outer space]

- (a) Cyber operations on the moon and other celestial bodies may be conducted **only for peaceful purposes.**
- (b) Cyber operations in outer space are **subject to international law limitations on the use of force.**

## RULE 92: DEFINITION OF CYBER ATTACK

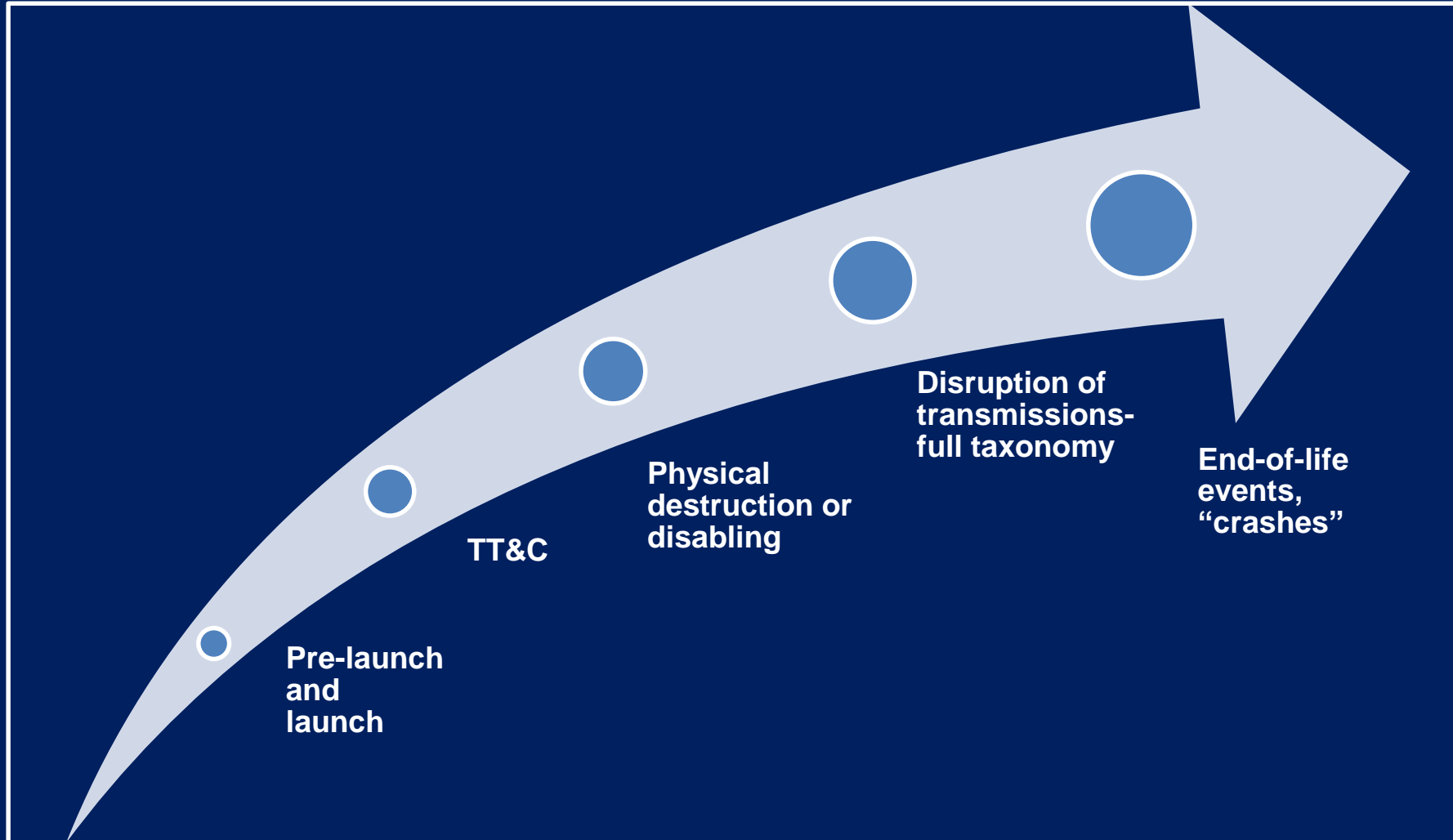
**A CYBER ATTACK IS A CYBER OPERATION, WHETHER OFFENSIVE OR DEFENSIVE, THAT IS REASONABLY EXPECTED TO CAUSE INJURY OR DEATH TO PERSONS OR DAMAGE OR DESTRUCTION TO OBJECTS.**

## RULE 69: DEFINITION OF USE OF FORCE

A CYBER OPERATION CONSTITUTES A USE OF FORCE WHEN **ITS SCALE AND EFFECTS** ARE COMPARABLE TO NON-CYBER OPERATIONS RISING TO THE LEVEL OF A USE OF FORCE.

(ICJ NICARAGUA 1986)

# HARMFUL DISRUPTION VULNERABILITIES: CYBER ATTACKS ON SATELLITES / DATA **MAY CONSTITUTE PROHIBITED USES OF FORCE**





- A decision as to when a cyber attack would lead to the invocation of **Article 5** would be taken...on a case-by-case basis.
- Cyber attacks ... could be as harmful to modern societies as a conventional attack ... **cyber defence is part of NATO's core task** of collective defence.

# COMMERCIALIZATION OF OUTER SPACE





Space.com > Tech

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OSIRIS-REx

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FORTUNE | Tech



Photograph by Getty Images/Brand X

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### BUSINESS INSIDER

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## Article VI OST

States Parties to the Treaty shall bear **international responsibility for national activities in outer space**, including the moon and other celestial bodies, **whether such activities are carried on by governmental agencies or by non-governmental entities**, and for assuring that national activities are carried out in conformity with the provisions set forth in the present Treaty.

The activities of non-governmental entities in outer space, including the moon and other celestial bodies, shall require **authorization and continuing supervision by the appropriate State Party** to the Treaty.

# American Space Commerce Free Enterprise Act of 2017

## A BILL

To amend title 51, United States Code, to provide for the authorization and supervision of nongovernmental space activities, and for other purposes.

1 *Be it enacted by the Senate and House of Representa-*  
2 *tives of the United States of America in Congress assembled,*

3 SECTION 1. SHORT TITLE; TABLE OF CONTENTS.

4 This Act may be cited as the “American Space Com-  
5 merce Free Enterprise Act of 2017”.

(1) The United States, through existing authorization and supervision mechanisms, satisfies and is in conformity with its obligation under the Outer Space Treaty to authorize and supervise nongovernmental space activities to assure such activities are carried out in conformity with the international obligations of the United States under the Outer Space Treaty.

(2) The United States has a robust and innovative private sector that is investing in, developing, and placing into outer space, spacecraft and payloads.

(3) Authorization and supervision mechanisms as of the date of enactment of this Act could be improved to relieve administrative burdens on new and innovative nongovernmental space actors.

(4) It serves the national interest to address misperceptions of legal uncertainty through the establishment of a general authorization and supervision certification authority for nongovernmental outer space activities.

# Article VII and the Liability Convention

Each State Party to the Treaty that launches or procures the launching of an object into outer space, including the moon and other celestial bodies, and each State Party from whose territory or facility an object is launched, is **internationally liable for damage to another State Party to the Treaty or to its natural or juridical persons** by such object or its component parts on the Earth, in air or in outer space, including the moon and other celestial bodies.

# Tallinn 2.0, Rule 60 – Supervision, responsibility and liability

- (a) A State **must authorize and supervise** the cyber 'activities in outer space' of its non-governmental entities.
- (a) Cyber operations involving space objects are **subject to the responsibility and liability regime of space law.**

**On the one hand, OST  
establishes an outer space  
regime on the basis of  
State actors exclusively**

**commercialization  
dilemma**

**“New space” includes an  
increasing number of non-  
State actors, and increased  
monetization of outer  
space and its resources**

**MILITARIZATION  
IN THE  
BACKGROUND**

**WRAPPING UP**



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### **"NEW SPACE"**

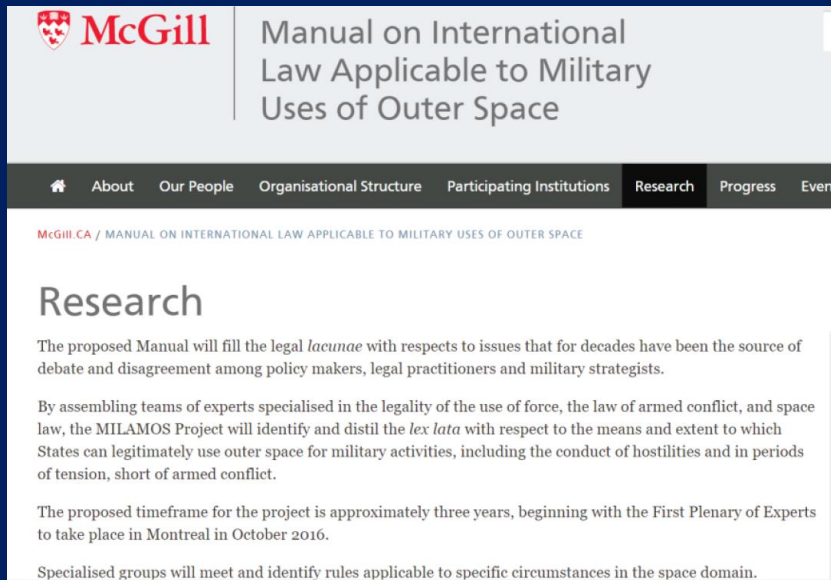
- ▶ OPERATIVE DEVELOPMENTS
- ▶ CYBER DEPENDENCE

### **THE CURRENT NORMATIVE FRAMEWORK AND THE RULE OF LAW**

### **DEVELOPMENTS AND DILEMMAS (WITHIN MILAMOS)**




# THE MILAMOS NORMATIVE PROJECT



1. Re-thinking the **applicability** of the existing space treaties and the associated customary law
2. **Tension** between aim of restatement / *lex lata* and “new space”
3. Esp. – applicability to **non-state actors**
4. **A new OST?**

# SOME DIRECTIONS FOR DISCUSSION

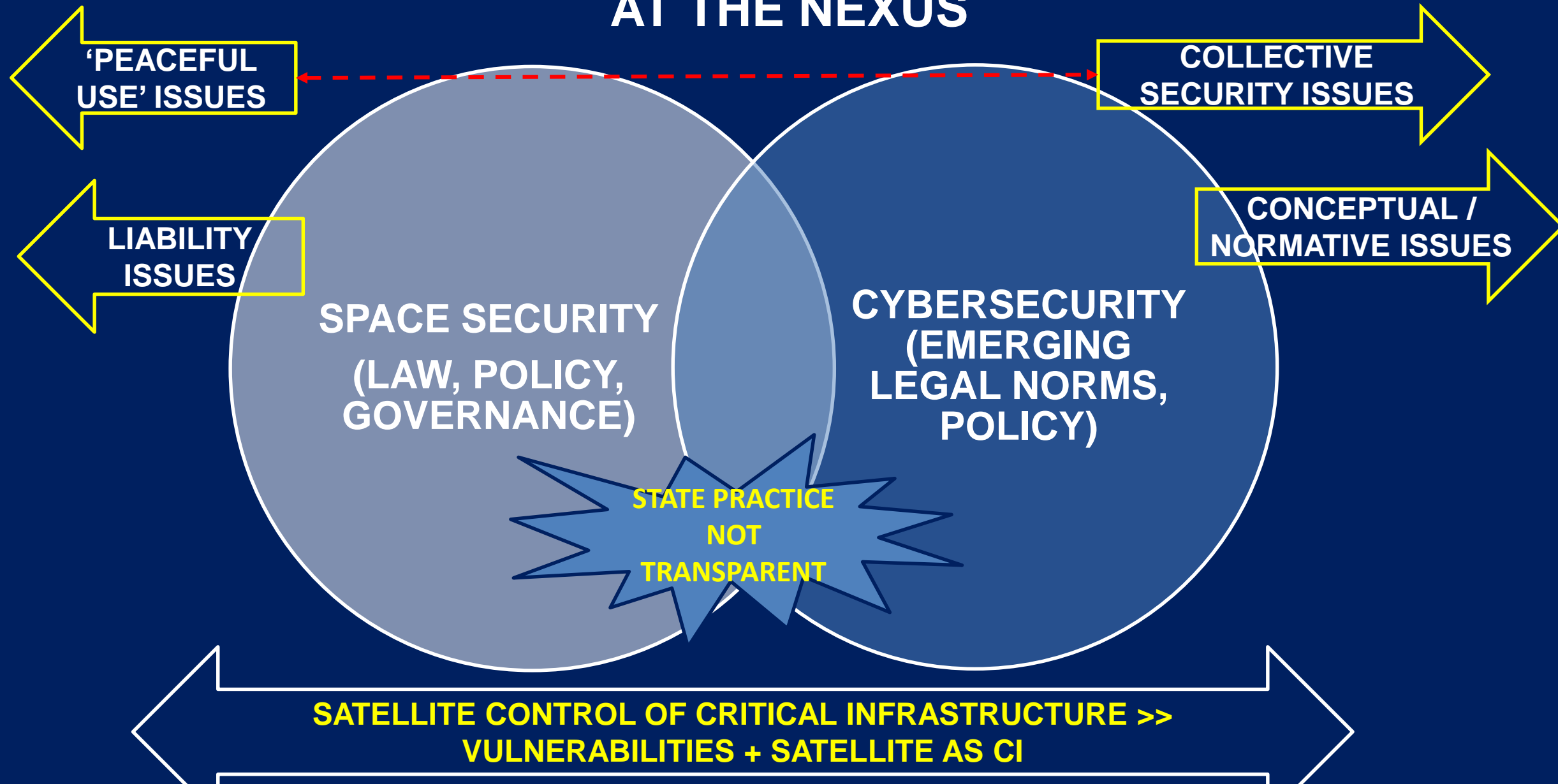
- There's nothing special about outer space any more – **no need for *lex specialis*** - international law as a whole should apply
  - Domestic law, i.e. for critical infrastructure
- New treaty regime to **replace OST**
- Rely on the **State practice** that's evolving, as



MUST CO-  
DEVELOP WITH  
INTN'L CYBERLAW  
NORMS

**THANK YOU.**

# BROADER RESEARCH: THE GROWING CRITICALITY AND URGENCY OF THE PROBLEM AT THE NEXUS



# EXTRA SLIDES

# משבר החלל הישראלי

- תוכנית חלל ישראלית 2011 + סוכנות החלל במשרד המדע
- ישראל פעילה ואף [מובילה](#)
- המשבר בקשר ללויני תקשורת (עמוס)
  - עמוס 5 (מערכת החשמל נותקה ואבד הקשר)
  - עמוס 6 (התפוצץ לקראת שיגור בספט' 2016)
  - עמוס 2 מסיים תיפקוד בקרוב, 3 ו-4 מתפקדים
- לויני אופק – ניטור, surveillance and espionage
  - שיגור לכיוון מערב (בניגוד לסביבת כדור הארץ) + nano
- תוכנית החלל הנוכחית – בהמשך לביקורת מבקר המדינה
  - לויני תקשורת
  - השקעות במגזר הפרטי, 4 לויני תקשורת כדי לספק צרכים לאומיים (2 כבלים תת-ימיים אינם מספיקים)

# THE SPACE GGE, 2015

The mandate :

Pursuant to General Assembly resolution 65/68, the Secretary-General established the [Space GGE]... with the purpose of conducting **a study on outer space transparency and confidence-building measures**, making use of the relevant reports of the Secretary-General

- General measures to increase **availability of information** on states' outer space policies
- **Information exchange** regarding development programs for new space systems and existing satellites and other space objects
- Transparent articulation of **states' space law and policy**
- Measures establishing **behavioral norms for promoting spaceflight safety**, such as launch notifications

# Normative development

- CBM's
- Registration and verification of space assets
- Clarity for the application of norms
- Critical infrastructure in outer space