



Space Security

Prof. Richard Crowther
Chief Engineer, UK Space Agency

Space is changing

Space is becoming more:

Congested, Contested, Competed



Space is changing

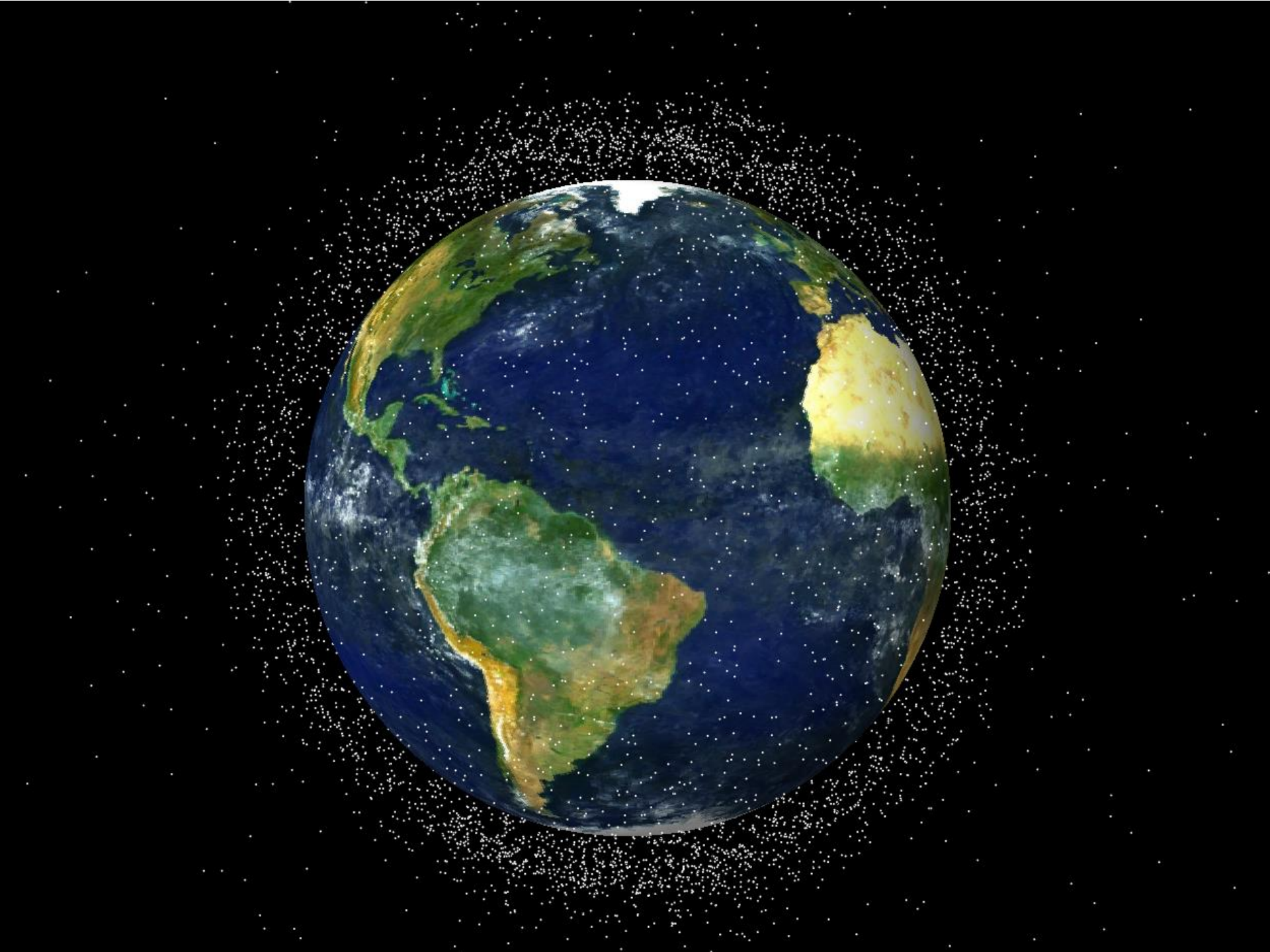
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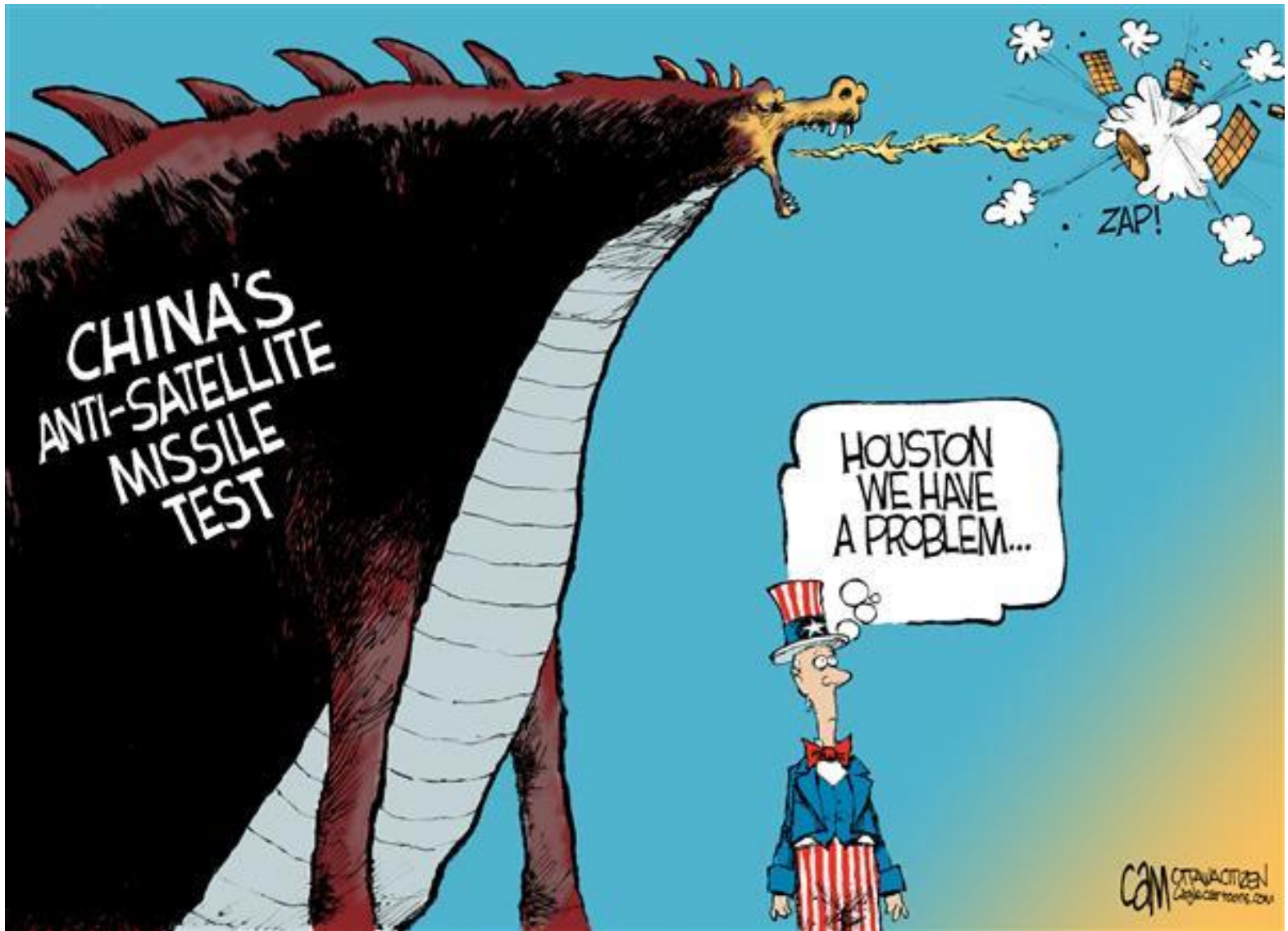
Congested, Contested, Competed

In response, we need to focus on:

Safety, Security, Sustainability







Dual Use Systems

- Dual Use systems can be used for either peaceful or military/security aims, or both
- Rapidly evolving technology has already broadened the scope of potential conflict from land, maritime and air environments to encompass cyber and space domains
- Appropriate consideration needs to be given to the potential of dual use space systems



Space services well established across sectors

Launch			
Communications			
Position, Navigation & Timing			
Remote Sensing			



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	Civil	Military	Commercial
Launch			
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Space services well established across sectors

	Civil	Military	Commercial
Launch	✓	✓	✓
Communications	✓	✓	✓
Position, Navigation & Timing	✓	✓	✓
Remote Sensing	✓	✓	✓



Governance Structures Controlling Export/Use of Dual Use Products

- Missile Technology Control Regime
- Hague Code of Conduct
- International Trafficking in Arms Regulations
- High Resolution Remote Sensing
 - Imagery dissemination policies



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	Civil	Military	Commercial
Launch	✓	✓	✓
Communications	✓	✓	✓
Position, Navigation & Timing	✓	✓	✓
Remote Sensing	✓	✓	✓



Space services well established across sectors

	Civil	Military	Commercial
Launch	✓	✓	✓
Communications	✓	✓	✓
Position, Navigation & Timing	✓	✓	✓
Remote Sensing	✓	✓	✓
Space Situational Awareness	✓	✓	✓



Space Situational Awareness

- Interdependence of congested, competed, contested space makes SSA critical across all domains
- Cannot afford to work in isolation intra/inter-State
 - Many sensors are military in nature
 - Primary mission not necessarily space surveillance
 - Global coverage requires significant resources
 - Opportunity for civil and commercial systems to supplement military sensors and networks



Space Situational Awareness

- Military requirements driven by air/missile defence/C4ISR and security related
- Commercial requirements driven primarily by mission assurance and reliability/availability/productivity and safety
- Civil requirements driven primarily by safety (in-orbit/re-entry) and treaty/regulatory compliance/monitoring



Governance Principles

- Rules and procedures for handling and distribution of:
 - Sensor data
 - Processed data
 - Cataloguing
 - Collision prediction
 - Manoeuvre reporting
- Tasking/availability of sensors/services

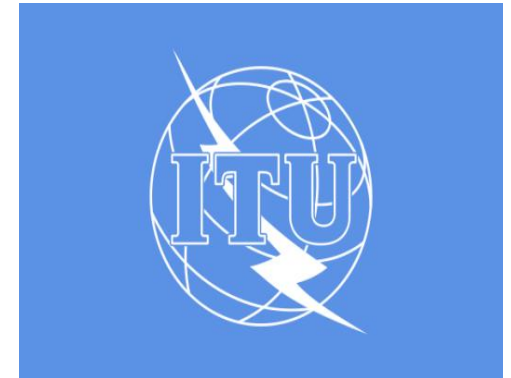
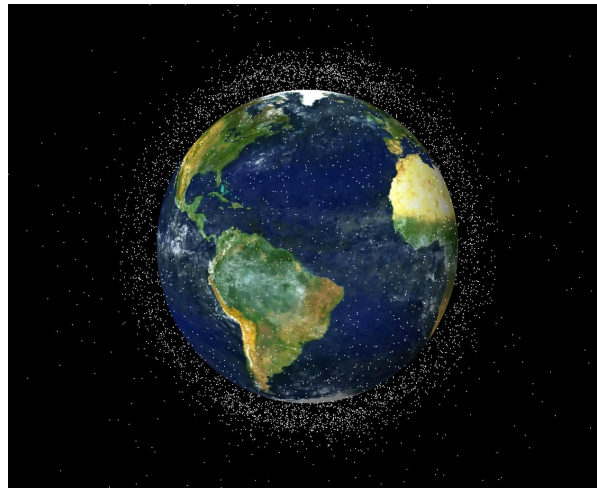


Governance Challenges

- **Security/Sensitivity**
 - Classified platforms
 - Sensor capability
 - Network coverage (spatio-temporal)
- **Reliability**
 - Calibration/cross-correlation
 - Verification/Validation
 - Standardisation/integration of data sets
- **Availability**
 - Tasking/prioritisation of sensors



Governance Forums



Committee on Peaceful Uses
Of Outer Space (COPUOS)

Conference on Disarmament
(CODUN)



Regulation of Space

OUTER SPACE TREATY



Regulation of Space

RESCUE
AGREEMENT

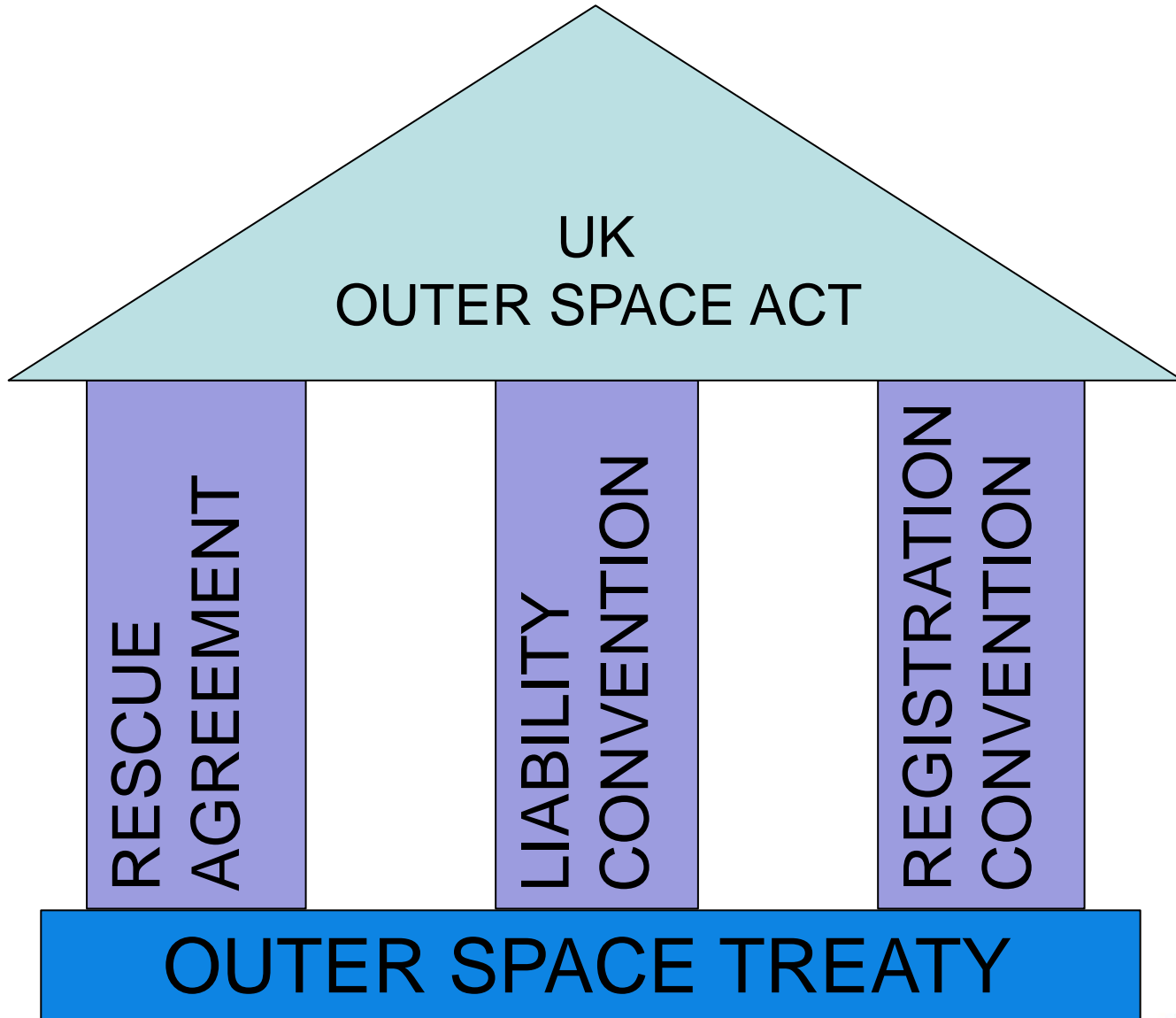
LIABILITY
CONVENTION

REGISTRATION
CONVENTION

OUTER SPACE TREATY



Regulation of Space



OSA LICENSING CONSIDERATIONS

WHO?

WHY?

WHEN?

HOW?

WHAT?

WHERE?



Estimated Orbital Population

<u>Size</u>	<u>Number</u>	<u>% Mass</u>
>10 cm	>17000	99.93
1-10 cm	>400,000	0.035
<1 cm	>35,000,000	0.035
<u>Total</u>	<u>>35,000,000</u>	<u>>6,000 tonnes</u>



Estimated Orbital Population

Size

Number

% Mass

Tracked objects >10 cm >17000 99.93 < 10% operational

1-10 cm

>400,000

0.035

<1 cm

>35,000,000

0.035

Total

>35,000,000

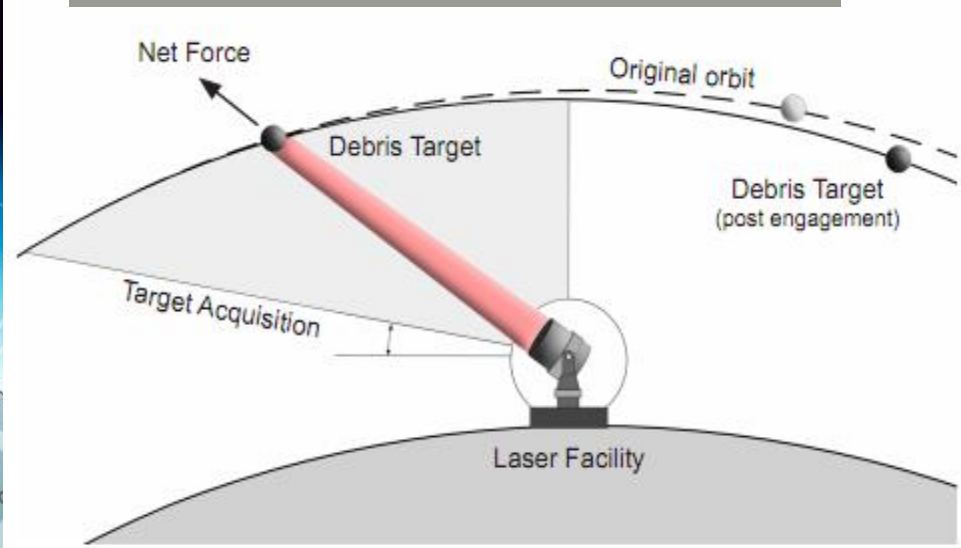
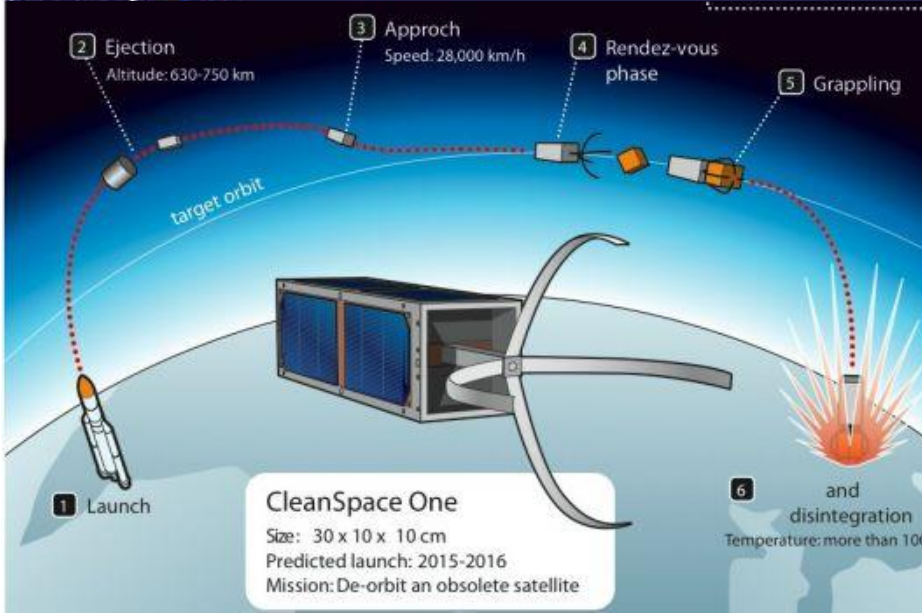
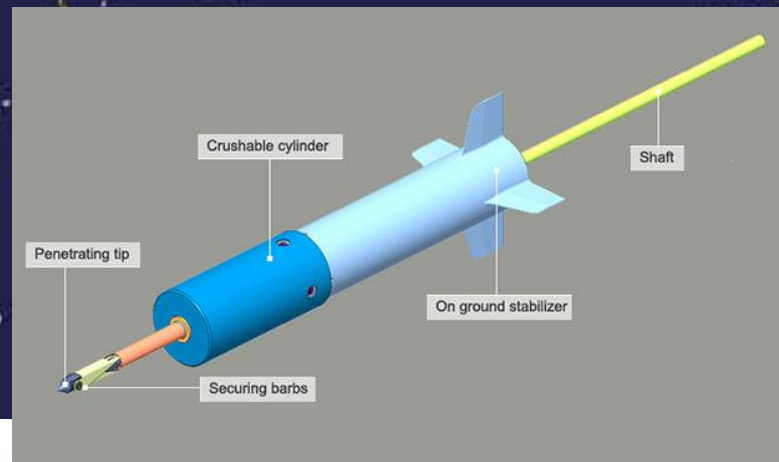
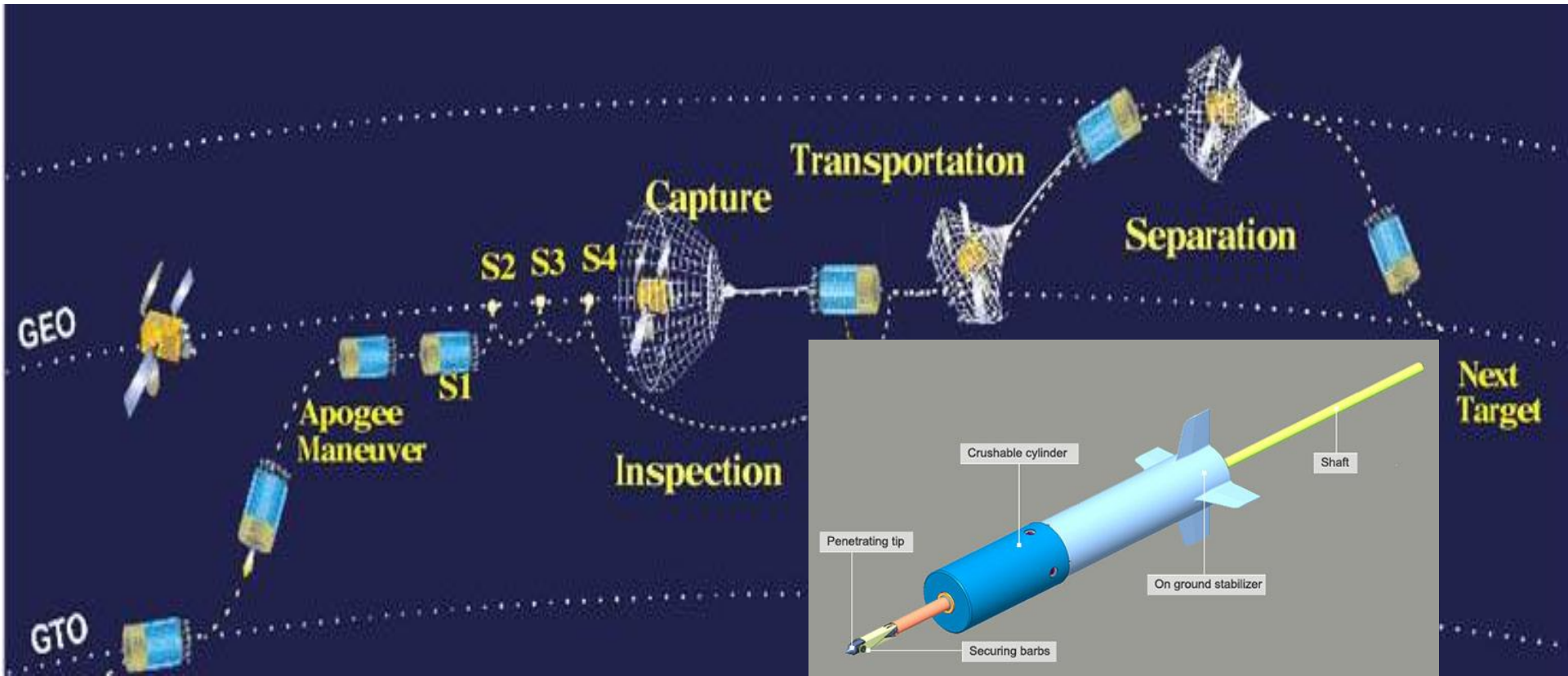
>6,000 tonnes



We can only “manage” a small proportion of objects through “mitigation”

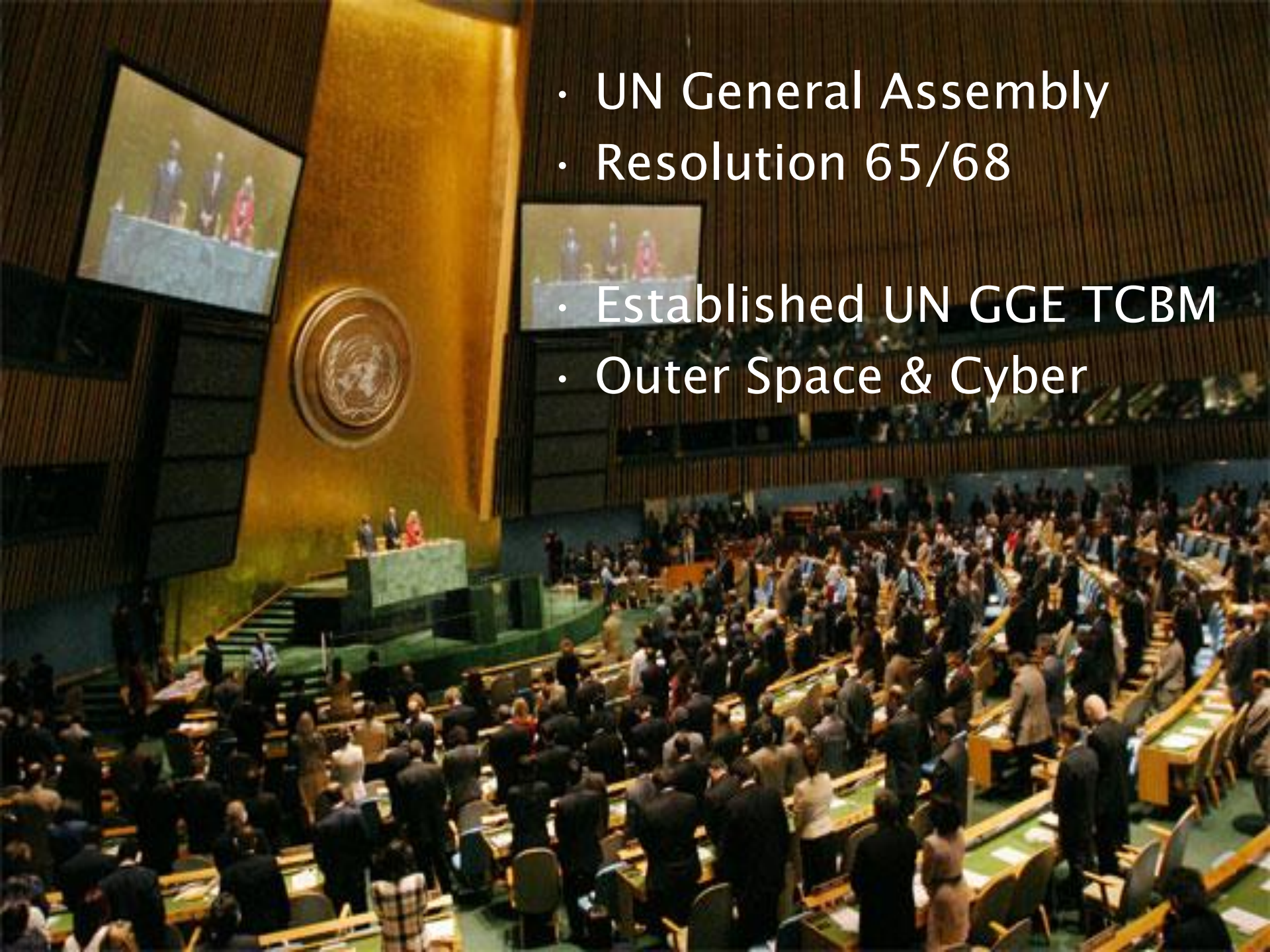
What is the answer?







- UN General Assembly
- Resolution 65/68
- Established UN GGE TCBM
- Outer Space & Cyber



UN GGE on TCBMs

UN: United Nations

GGE: Group of Governmental Experts

TCBMs: Transparency and
Confidence Building Measures

Aim is to remove potential for suspicion over
motives and escalation of hostilities



TCBMs

TCBMs include:

- Treaties (Anti-ABM)
- Forums (IADC)
- Codes of Conduct (Hague/EU?)
- Removal of capability (SORT)
- Inspections
- Workshops
- Exchanges





The Group of Governmental Experts on Transparency and Confidence-Building Measures in Outer Space Activities, United Nations, New York, 27 July 2012

From left to right: João Marcelo Galvão de Queiroz - Brazil, Chulmin Park - Republic of Korea, Richard Crowther - United Kingdom, Musthafa M. Jaffeer - Sri Lanka, Peter Martinez - South Africa, Andrii Kasianov - Ukraine, Frank Rose - USA, Victor L. Vasiliev - Russian Federation - Chairman, Augustine U. Nwosa - Nigeria, Gérard Brachet - France, Dumitru-Dorin Prunariu - Romania, Sergio Marchisio - Italy, Huaicheng Dai - People's Republic of China, Hellmut Lagos - Chile, Ruslan Amirgeryev - Republic of Kazakhstan

Tiered approach to security of space

- Aim is to deter potentially damaging activities in outer space through:
 - Establishment of norms of behaviour to identify irresponsible actions
 - Building of international partnerships to forge alliances and encourage inter-dependency
 - Development of resilient systems to mitigate consequences of impacts on systems
 - Enabling self-defence to respond to hostile actions/actors



Summary

Our goal is a stable space environment.

However, space is becoming more:

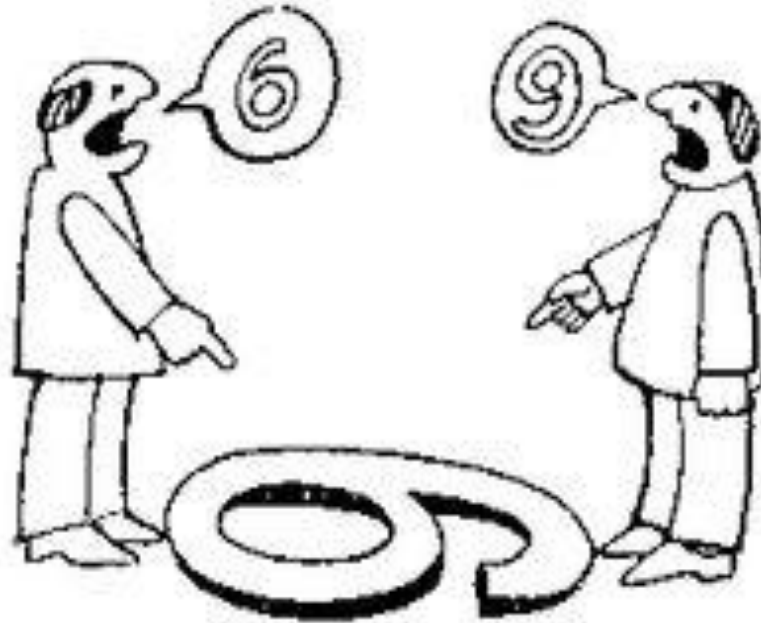
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In response, we need to focus on:

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Summary



Safety=Security=Sustainability

