



Promoting Cooperative Solutions for Space Sustainability

Secure World Foundation and Small Satellites

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Promoting Cooperative Solutions for Space Sustainability

Secure World Foundation

Secure World Foundation *is a private operating foundation* that promotes cooperative solutions for space sustainability

- **Our vision:** The secure, sustainable and peaceful uses of outer space contributing to global stability and benefits on Earth
- **Our mission:** To work with governments, industry, international organizations, and civil society to develop and promote ideas and actions to achieve the secure, sustainable, and peaceful uses of outer space benefiting Earth and all its peoples



Promoting Cooperative Solutions for Space Sustainability

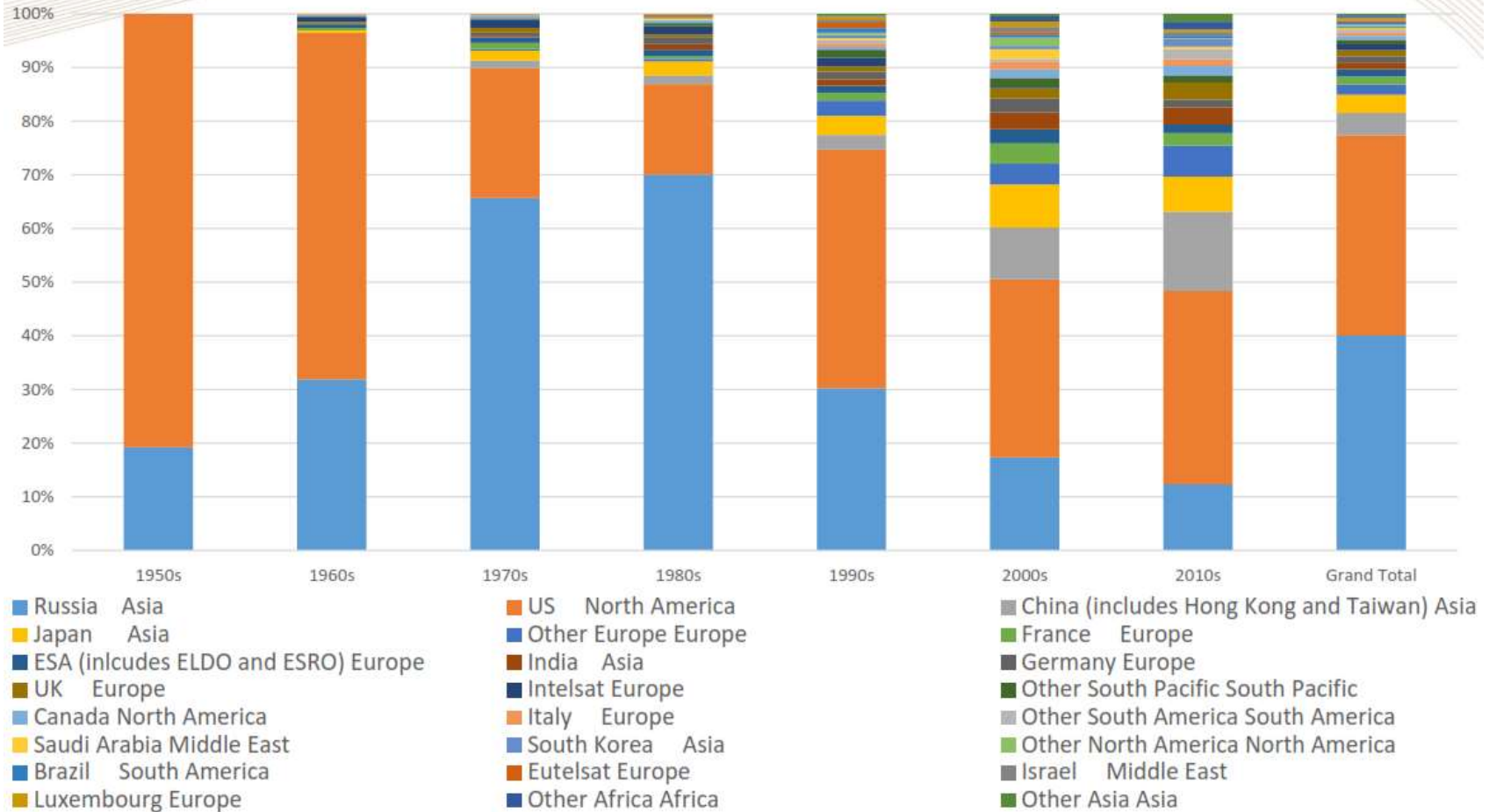
Trends in space

- Space is becoming more **globalized**
 - Growing access to space technology
 - Growing interest by many countries in utilizing space for national benefits (socioeconomic development, prestige, national security)
- Space is becoming more **commercialized**
 - Space began as part of competition between governments (US and USSR)
 - Influx of technology, talent, and capital from other sectors (IT)

How do we manage the influx of new actors and growth in space activities to ensure long-term sustainability of space?

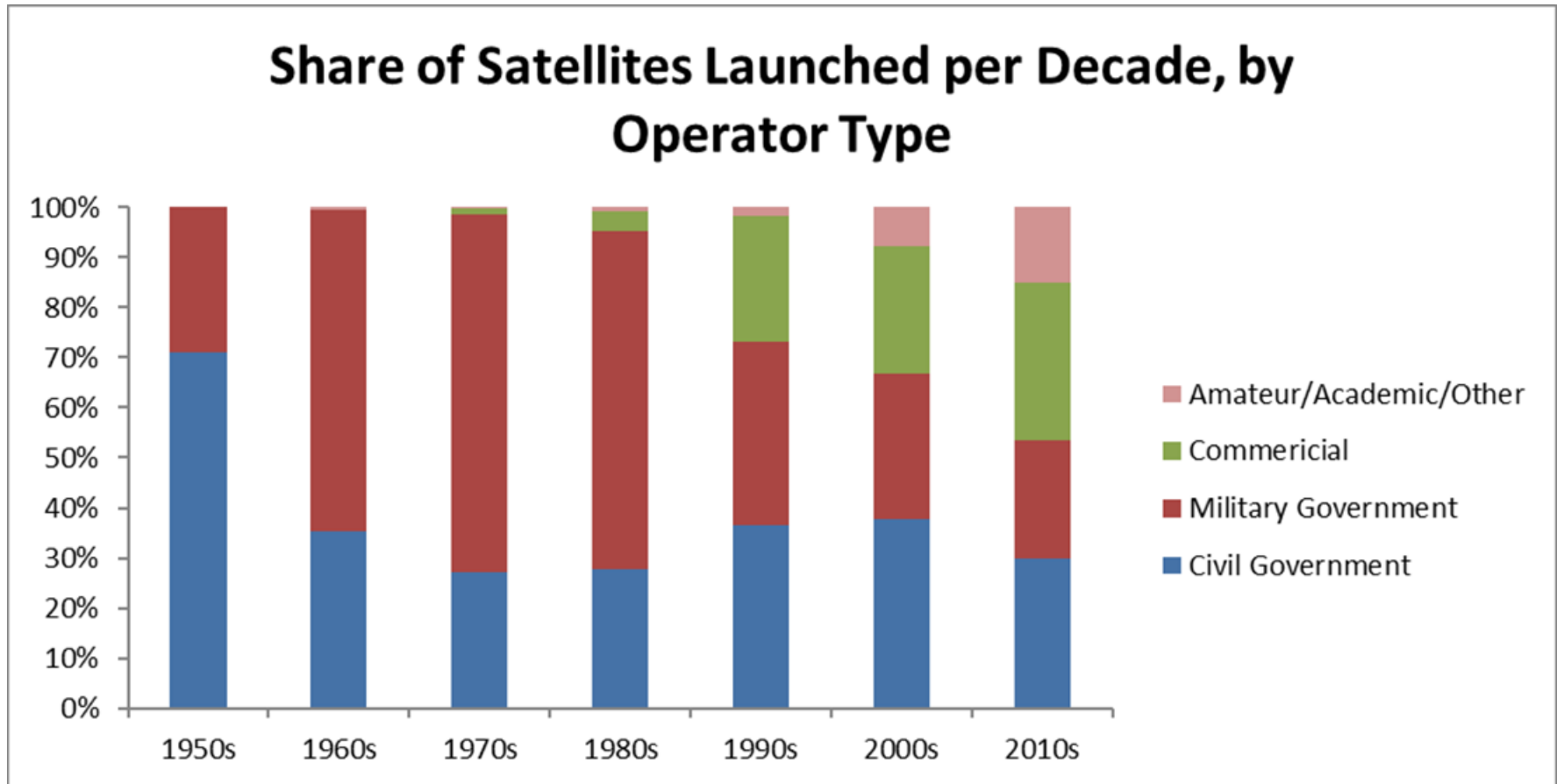
Space is becoming more international

Satellites by Owner Country -1950s-today



Adapted from [IDA Global Trends in Civil and Commercial Space Study](#)

Space is becoming more commercial

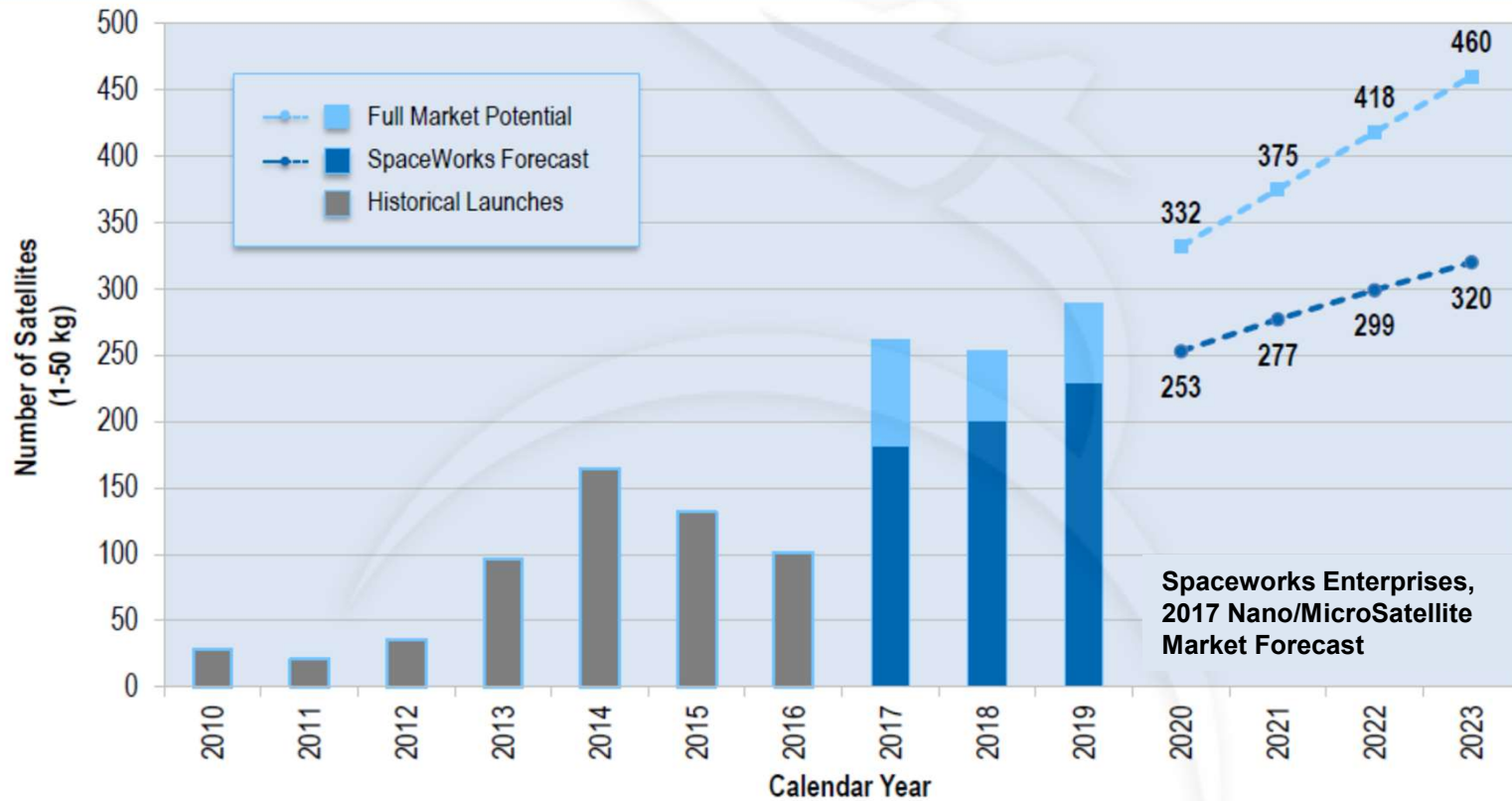


Source: McDowell, Jonathan C, 2017—*Satellite Statistics*
http://www.planet4589.org/space/log/stats2/own_categ.txt



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Small Satellites



Spaceworks Enterprises,
2017 Nano/MicroSatellite
Market Forecast

As of December 2016: Total number of operating satellites: 1,459

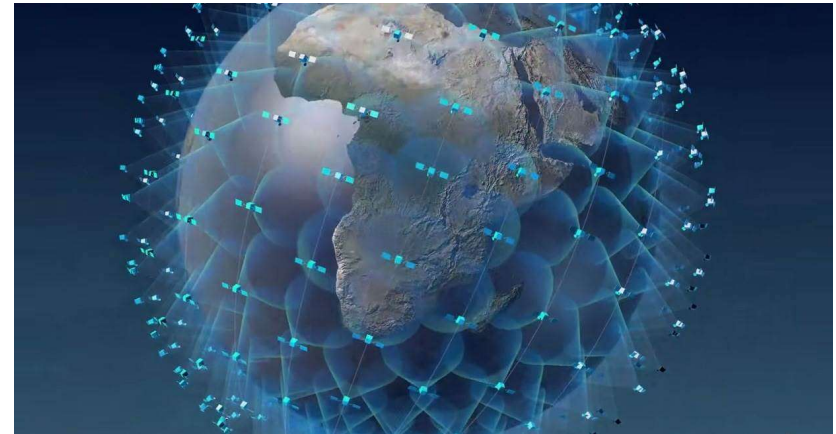
Forecast: Up to 2400 micro/nanosatellites to launch by 2023

Mega-constellations: 16,000+ planned satellites, many not included in above

Congested, Competitive and Invested

In an increasingly competitive orbital environment, how can operators cooperate to develop norms of operations?

How can operators work with government(s) to ensure safety of operations for all users of the space environment?



* Satellites not to scale

- Satellite tracking capabilities
- Satellite “transponders” or beacons
- Adequacy of space debris guidelines
- Spectrum management & coordination
- Information sharing and transparency
- Norms / best practices for operations



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Regulatory Fit & Efficiency

What is the proper governmental posture & policy context for small satellite driven applications?

How can industry and government collaborate to provide an appropriate & effective regulatory context?

- Pace of innovation vs. pace of government
- Government's role as a customer
- Regulatory authority and knowledge base
- Industry awareness of regulatory requirements
- Balance of national security & economic development objectives

These issues are not unique to small satellites, but the small satellite community may have unique viewpoints on them



SUSTAINABLE DEVELOPMENT GOALS



How do small satellites fit into a variety of international efforts?



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Considerations moving forward

Opportunities

- Lower costs of access to space technology
- Lower technical and scientific barriers
- Broaden and diversify actors and users
- Enable new (and innovative?) applications and services
- Provide increased societal benefit

Challenges

- Regulatory fit, efficiency, and scale
- Diverse, heterogeneous set of actors
- Few standards for operations
- Spectrum, SSA, and potential space debris implications

What can industry be doing now to address these challenges?



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SWF Handbook for New Actors in Space

- **Goal:** Create a publication that provides an overview fundamental principles, laws, norms, and best practices for safe, predictable, and responsible activities in space
- **Two specific audiences:**
 - Countries developing space programs and/or having to oversee and regulate their first satellites
 - Universities and start-up companies that are developing/operating satellites





Promoting Cooperative Solutions for Space Sustainability

Chapter 1 – International framework

- Freedom and Responsibility
- Registration of Space Objects
- International Frequency Management
- Remote Sensing
- International Standards
- International Export Control
- International Liability
- Dispute Settlement
- Environmental Issues
- Advanced Issues
- International Organizations

Part A: Information provided in conformity with the Registration Convention or General Assembly Resolution 1721 B (XVI)		
New registration of space object	Yes <input type="checkbox"/>	Check Box
Additional information for previously registered space object	Submitted under the Convention: ST/SG/SER.E/ <input type="checkbox"/>	UN document number in which previous registration data was distributed to Member States
	Submitted under resolution 1721B: A/AC.105/INF. <input type="checkbox"/>	
Launching State/States/international intergovernmental organization		
State of registry or international intergovernmental organization	<input type="text"/>	Under the Registration Convention, only one State of registry can exist for a space object.
Other launching States	<input type="text"/>	
Designator		
Name	<input type="text"/>	
COSPAR international designator	<input type="text"/>	
National designator/registration number as used by State of registry	<input type="text"/>	
Date and territory or location of launch		
Date of launch (hours, minutes, seconds optional)	<input type="text"/> <input type="text"/> hrs <input type="text"/> min <input type="text"/> dd/mm/yyyy <input type="text"/> sec	Coordinated Universal Time (UTC)
Territory or location of launch	<input type="text"/>	
Basic orbital parameters		
Nodal period	<input type="text"/>	minutes
Inclination	<input type="text"/>	degrees
Apogee	<input type="text"/>	kilometres
Perigee	<input type="text"/>	kilometres

UNOOSA International Registry Form

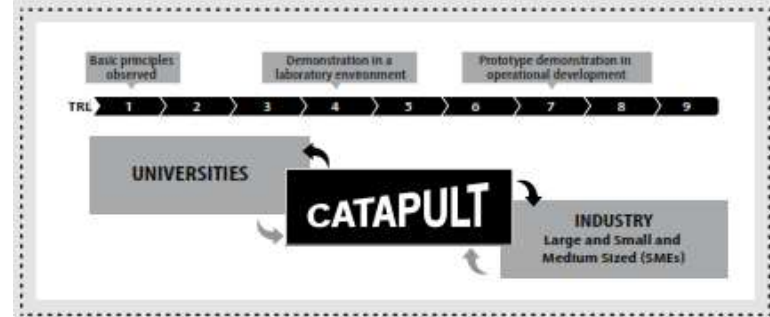
Chapter 2 – National policy and administration

- Public Policy
 - Rationales, objectives, principles
 - Government roles and responsibilities
- Public Administration and National Oversight
 - National regulators and licensing
 - National frequency administration
 - Export controls
- Case Study: Remote Sensing Policy and Administration

Case Study:

The United Kingdom Satellite Applications Catapult

The United Kingdom Satellite Applications Catapult was established by the government of the United Kingdom (UK) in May 2013 with the goal of creating economic growth in the UK through supporting the development, commercialization, and use of satellite applications. According to its Delivery Plan 2015–2020, the Catapult (Figure 8) aims to promote satellite application and technology development and to help domestic industry “bring new products and services more rapidly to market.” The Satellite Applications Catapult is one of 11 “Catapults” operating in the UK, each focusing on different technologies and application areas. The Catapult operates as a private, not-for-profit research organization. It is governed by a board, which includes representation from the United Kingdom Space Agency (UKSA) and from Innovate UK—a government agency focused on fostering technology and economic development.



*UK Satellite Applications
Catapult*



Chapter 3 – Responsible space operations

- Pre-launch
 - Licensing
 - Launch vehicle selection and integration
 - Insurance
- Launch
 - Safety considerations
- On-orbit
 - Orbit determination, propagation, and tracking
 - Conjunction assessment and collision avoidance
 - Anomaly response
- End-of-life

Examples of CA Screening Volumes					
Orbit Regime	Orbit Regime Criteria/Definition	Predict/ Propagate/ Time	Radial Miss (km)	In-Track Miss (km)	Cross-Track Miss (km)
GEO	1300min < Period < 1800 min Eccentricity < 0.25 & Inclination < 35°	10 days	12	364	30
HEO 1	Perigee < 2000 km & Eccentricity > 0.25	10 days	40	77	107
MEO	600 min < Period < 800 min Eccentricity < 0.25	10 days	2.2	17	21
LEO 4	1200 km < Perigee ≤ 2000 km Eccentricity < 0.25	7 days	0.5	2	2
LEO 3	750 km < Perigee ≤ 1200 km Eccentricity < 0.25	7 days	0.5	12	10
LEO 2	500 km < Perigee ≤ 750 km Eccentricity < 0.25	7 days	0.5	28	29
LEO 1	Perigee ≤ 500 km Eccentricity < 0.25	7 days	2	44	51

Examples of close approach screening volumes



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Handbook Next Steps

- The Handbook was officially released in February 2017
- Electronic copies are available through the SWF website, free of charge: www.swfound.org/handbook
- Printed copies are also be available
- Feedback is welcome!
- SWF plans to curate an electronic library of resources to accompany the Handbook and is looking for interested partners to help with sponsorship or contributions
 - Companies
 - Governments
 - NGOs
 - Universities



Promoting Cooperative Solutions for Space Sustainability

Previous Events and Materials

Events

- Held workshop on “[Space Sustainability and Small Satellites](#)” during the 12th Annual Ilan Ramon Conference in Herzliya, Israel in January 2017.
- Participated in [Small Satellites Tech, Business & Regulatory Industry Workshop](#) in Noordwijk, Netherlands in April 2017
- Presented on “[Small Satellite Technology and Space Capability](#)” at the United Nations/United Arab Emirates High Level Forum in November 2016
- Held side event on [SSA challenges and small satellites](#) at the Advanced Maui Optical and Space Surveillance Technologies Conference in Maui in Sept 2016
- Held side event on [Small Satellite Operator Best Practices for SSA and Conjunction Assessment](#) at the 2016 SmallSat Conference in Logan, Utah

Publications

- [Insight - Small Satellites for the Global South](#) – March 2017
- [Insight- Small Satellites and Space Situational Awareness](#) – Sept 2016
- [Legal and Regulatory Considerations of Small Satellite Projects](#) – April 2014



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Upcoming Events

2017 SmallSat Conference

- [Cubesat Launch and Deployment Best Practices Side Event](#) on Aug 7
 - Will provide participants with best practices from launch providers, satellite operators, and providers of space situational awareness (SSA) data to help increase the safety and sustainability of cubesat launches
- [Dialogue on Practices for Post Mission Disposal](#) on Aug 10
 - Will focus on conversation on what appropriate post mission disposal (PMD) practices are for commercial space operators, and on actions for increasing confidence in those practices

Other events

- [Trash in the Skies II: Industry Perspectives on Dealing with Space Debris](#) on July 10



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Questions?

Thanks.

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