



Promoting Cooperative Solutions for Space Sustainability

The Intersection of Commercial Space and Policy - A Survey of Current Developments

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- Secure World Foundation *is a private operating foundation* that promotes cooperative solutions for space sustainability
- **Our vision:** the secure, sustainable and peaceful use of outer space that contributes to global stability on Earth
- **Our mission:** SWF works with governments, industry, international organizations and civil society to develop and promote ideas and actions for international collaboration that achieve the secure, sustainable, and peaceful uses of outer space for the socioeconomic and environmental benefits to Earth

Key focus areas

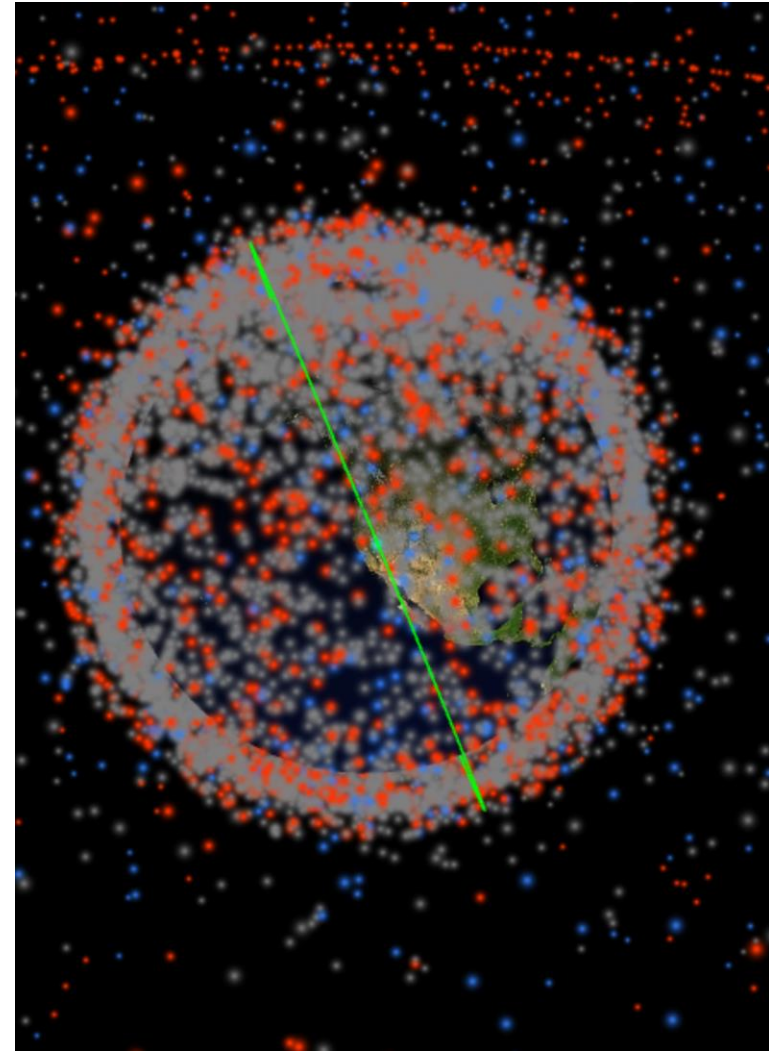
- **Space Sustainability:** mitigating environmental and human-generated threats to the long-term sustainability of space activities
- **Human and Environmental Security:** enhancing the use of space for socioeconomic benefits and security on Earth through improved governance and cooperation
- **Space Law and Policy:** supporting the development of national and international laws and policies to enhance the long-term sustainable use of space for benefits on Earth
- **Strategic Stability and Outer Space:** reducing the risk of accidents or misperceptions in space that could spark or escalate tensions

COMMERCIAL SPACE CONTEXT

Current Developments

What's In Orbit

- More than 1,300 active satellites in Earth orbit
 - 696 in LEO; 481 in GEO
 - Apx. 500 operated by commercial entities
 - Apx. 360 operated by civil government entities
 - Apx. 340 operated by military government entities
- Debris objects
 - Apx. 23,000 objects tracked by US military
 - 500,000+ objects greater than one 1cm in diameter tracked by amateur community

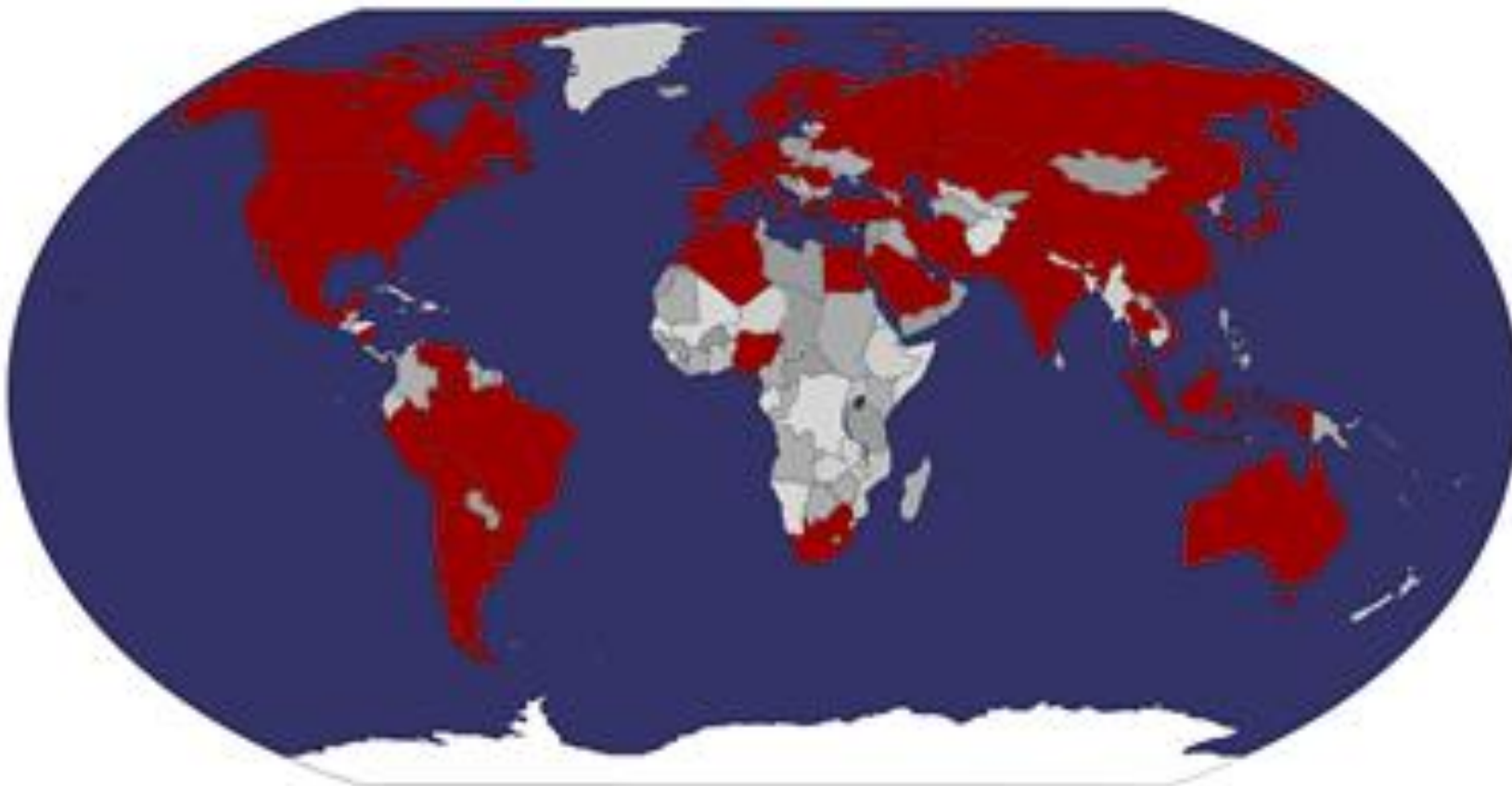


Sources: <http://stuffin.space/>, Union of Concerned Scientists

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Countries Operating In Space

States Operating Satellites as of January 2015

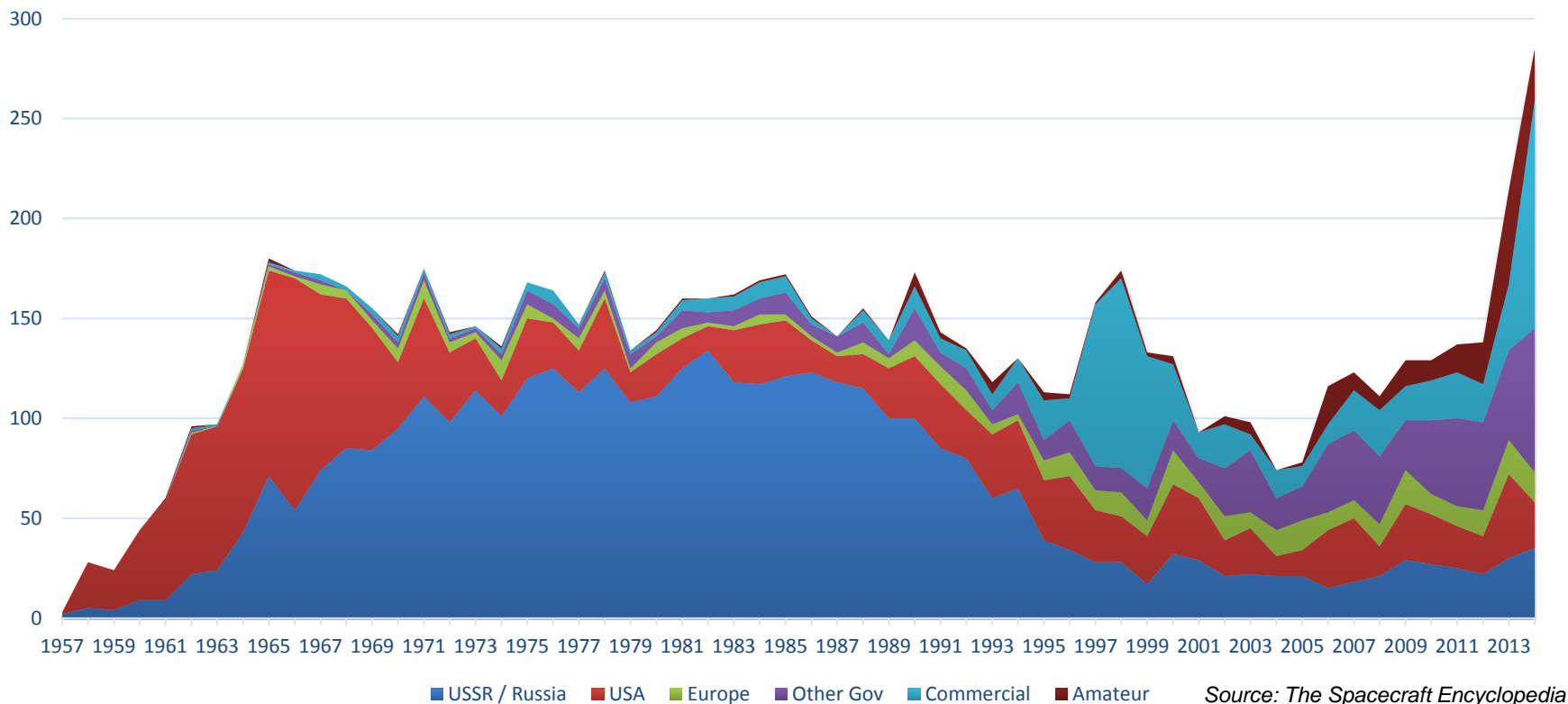


- More than 70 nations, companies, or other organizations currently operate satellites

Source: UCS Satellite Database

The Changing Make-up of Space Actors

Number of Satellites Launched Annually 1957-2014



- Currently 9 countries are capable of orbital space launch

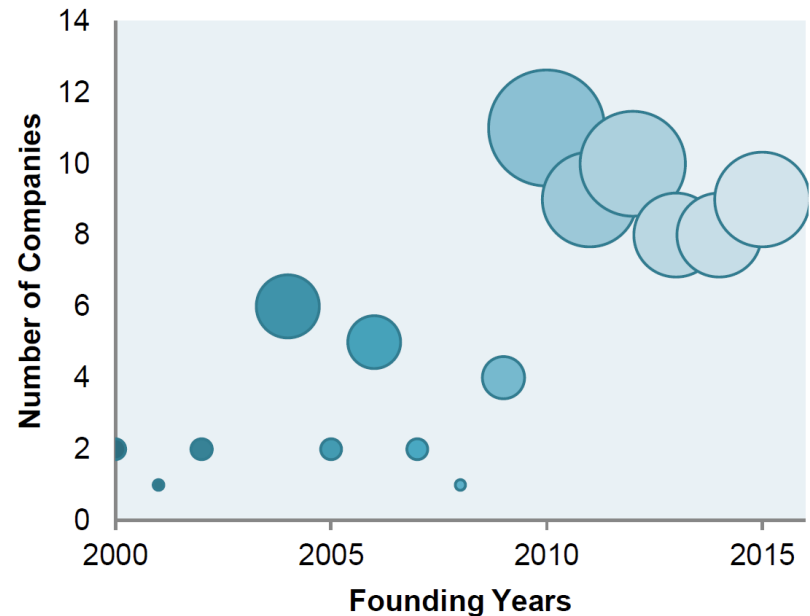
Space as a Commercial Domain

Economic Value: in 2014 the global space economy represented \$330 Billion of activity; apx. 76% of which represented private sector activity

Explosive Growth

- Massive expansion in active satellites, e.g.:
 - OneWeb: 648 smallsats
 - Planet Labs: 105 3U cubesats
 - Spire: 50+ cubesats at 600 km
- Lots more opportunities to launch
 - 25+ smallsat-class launch vehicles currently proposed or under development
- Consumer-driven remote sensing business plans

Commercial Space Companies Established Since 2000



Source: The Tauri Group, "Start-up Space: Interim Results" Paper presented the 2015 International Astronautical Congress, Jerusalem Israel, October 2015

Contested, Congested, Invested

- Contested
 - Increasing amount of commercial activity
 - Diversifying set of national actors
- Congested
 - Increasing number of active satellites & in-space applications
 - Growing space debris challenges
- Invested
 - Surge of space start-ups
 - Economic value derived from significant space investments

Presents a number of policy challenges and opportunities where multilateral, collaborative action is required.



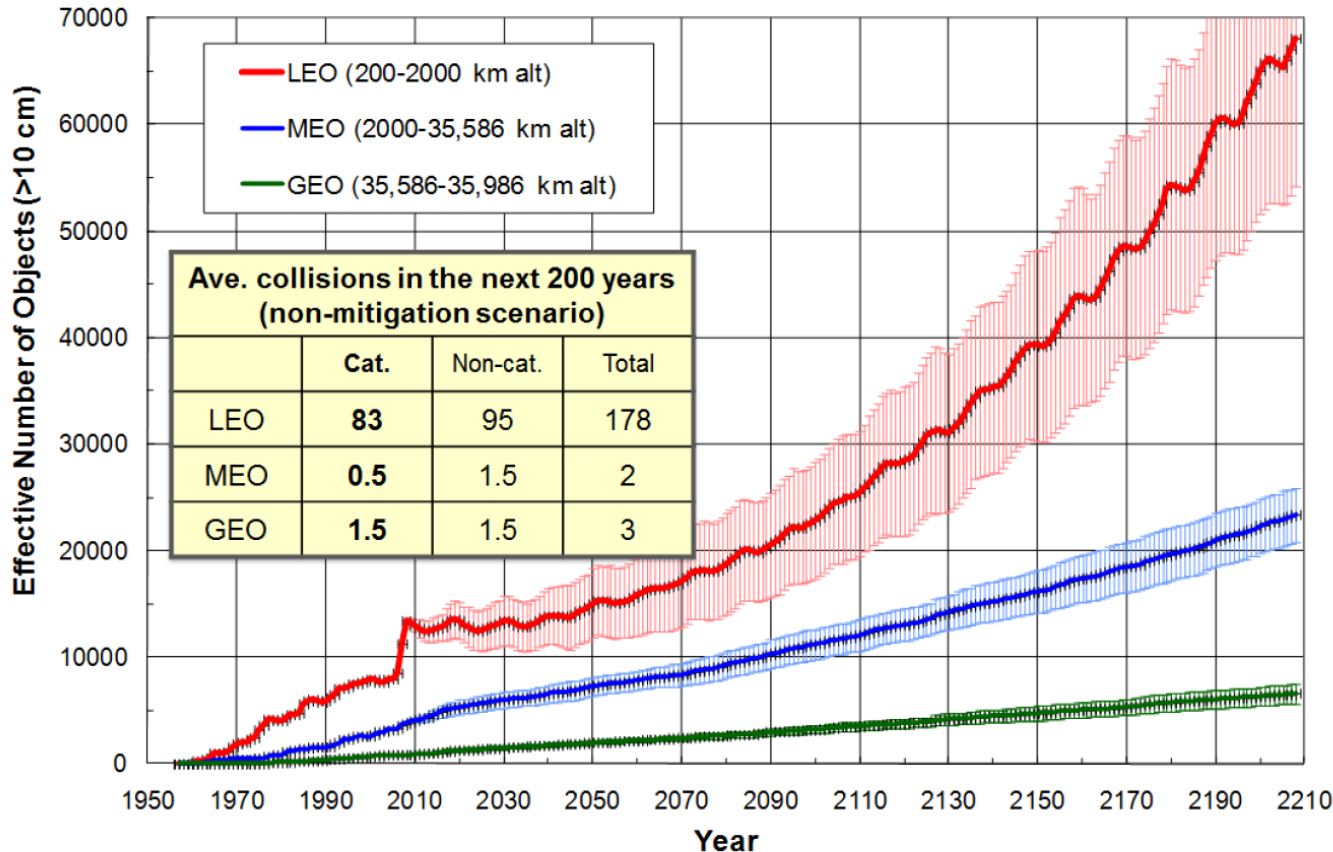
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POLICY CHALLENGES AND OPPORTUNITIES

Commercial Space and Space Sustainability

Space Debris Population and Projected Growth

Non-Mitigation Projection (averages and 1- σ from 100 MC runs)



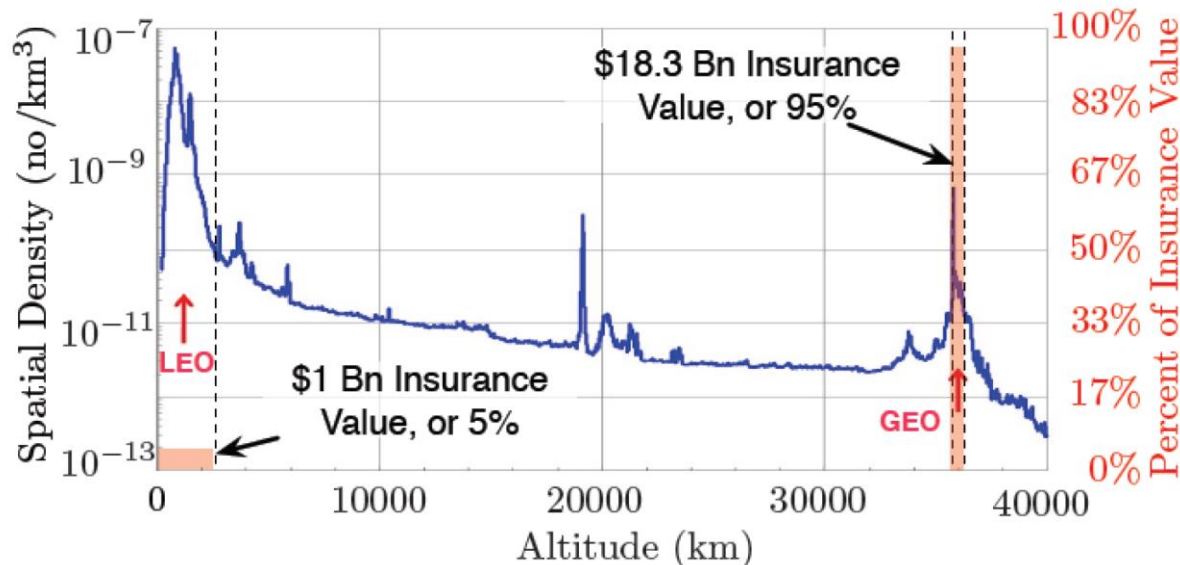
- A clear threat to a safe and sustainable space environment
- Mitigation guidelines exist
- Complex policy, legal, and economic challenges to active reduction

J-C Liou, NASA Orbital Debris Program Office, 2009

<http://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/20100017146.pdf>

Debris – The Policy and Economic Challenges

- Who tracks and notifies of possible conjunctions?
 - Commercial vs government capabilities & data-sharing
- Who owns debris objects?
 - Responsibilities/perspective of legacy vs. new actors
- Who has authority to mandate and enforce debris-reducing behavior?
- Who pays for existing debris removal?



Source: Jasper. Anderson, Schaub and McKnight (2014), <http://hanspeterschaub.info/Papers/Jasper2014c.pdf>

Radio Frequency Interference

- There are a range of natural and human-generated threats that could interfere with the ability of satellites to effectively communicate over radio frequencies
- Existing international (ITU) and national polices deal with spectrum coordination, but as new actors and applications emerging dealing with the challenges RFI is an important element of space sustainability

SWF Activities

- Radiofrequency Interference Breakfast Salon, under Chatham House Rules, at 2014 Space Symposium
- Side Event and Panel Discussion at the 2015 GEO Plenary & Ministerial: “Broadcasting GEOSS: Key Issues in Spectrum Management and Earth Observations.”

Regulatory Context For New Applications

- Treaties did not envision the level and types of commercial activity we have now
- Article VI – “continuing supervision”
 - Space resources extraction and utilization
 - Commercial space stations & hotels
 - On-orbit servicing and active debris removal
 - Etc.
- What issues should regulators consider?

SWF Activities

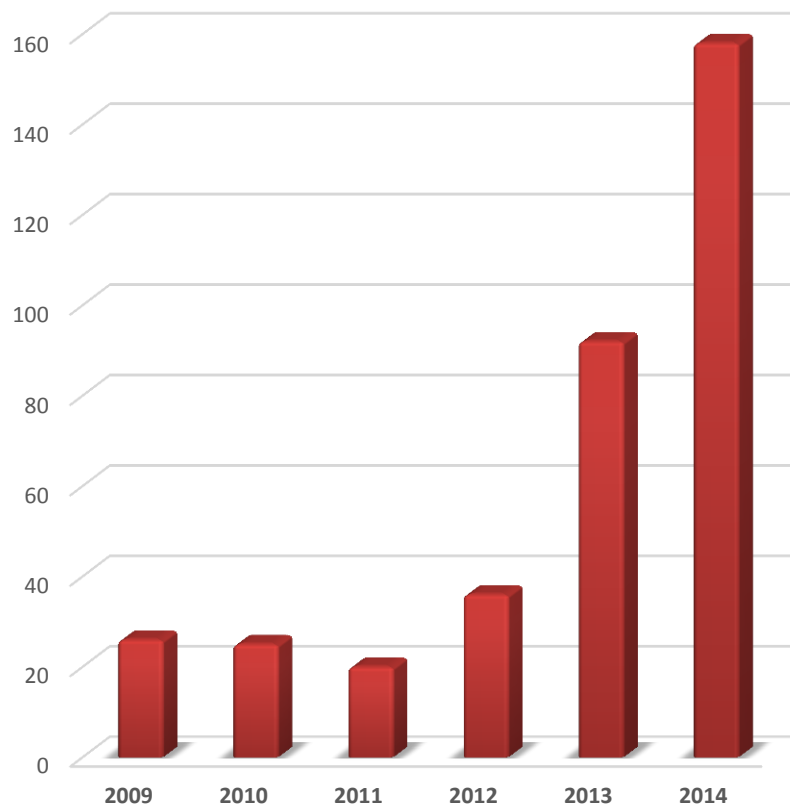
- Space Resources Working Group
 - Multilateral, multidisciplinary effort to define policy and legal “building blocks”
- Topical Panels and Workshops



The Policy Implications of Smallsats and Cubesats

- No agreed to technical definition, few standards
- Level of familiarity of operators with regulatory obligations & space operations best practices
- Interaction with the space debris challenge
- Government posture as a consumer of data vis-à-vis public good data policies
 - GEOINT
 - Commercial Weather

Number of Cubesats Launched



Source: SpaceWorks Commercial

- Will new space actors experience the same “learning curve” as the legacy actors?
 - Will they make the same mistakes, or just new ones?
- What sort of national policies and regulations should new spacefaring countries be adopting?
- How do we help maximize the benefits from new actors while minimizing potential space sustainability challenges?

SWF Activities

- SWF is currently developing the Handbook for New Actors in Space
 - Will provide an overview fundamental principles, laws, norms, and best practices for safe, predictable, and responsible activities in space
- We welcome feedback and suggestions on the Handbook



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THANK YOU!

Questions and Discussion?

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