Impact of Newspace and Data Revolution

Krystal Wilson, Director of Space Applications Programs
Secure World Foundation

Amsterdam, Netherlands
April 3, 2019

Secure World Foundation

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

- Why **space sustainability**? Increasing reliance on space assets coupled with potentially destabilizing trends

- **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

- The Foundation acts as a **research body, convener and facilitator** to examine key space policy topics

Activities and Partners

UNITED NATIONS
Office for Outer Space Affairs

INTERNATIONAL ASTRONAUTICAL FEDERATION

GEO GROUP ON EARTH OBSERVATIONS

WMO

CSSMA

NOAA

ORF OBSERVER RESEARCH FOUNDATION

CEOS

SPACE GENERATION ADVISORY COUNCIL

Trends in space

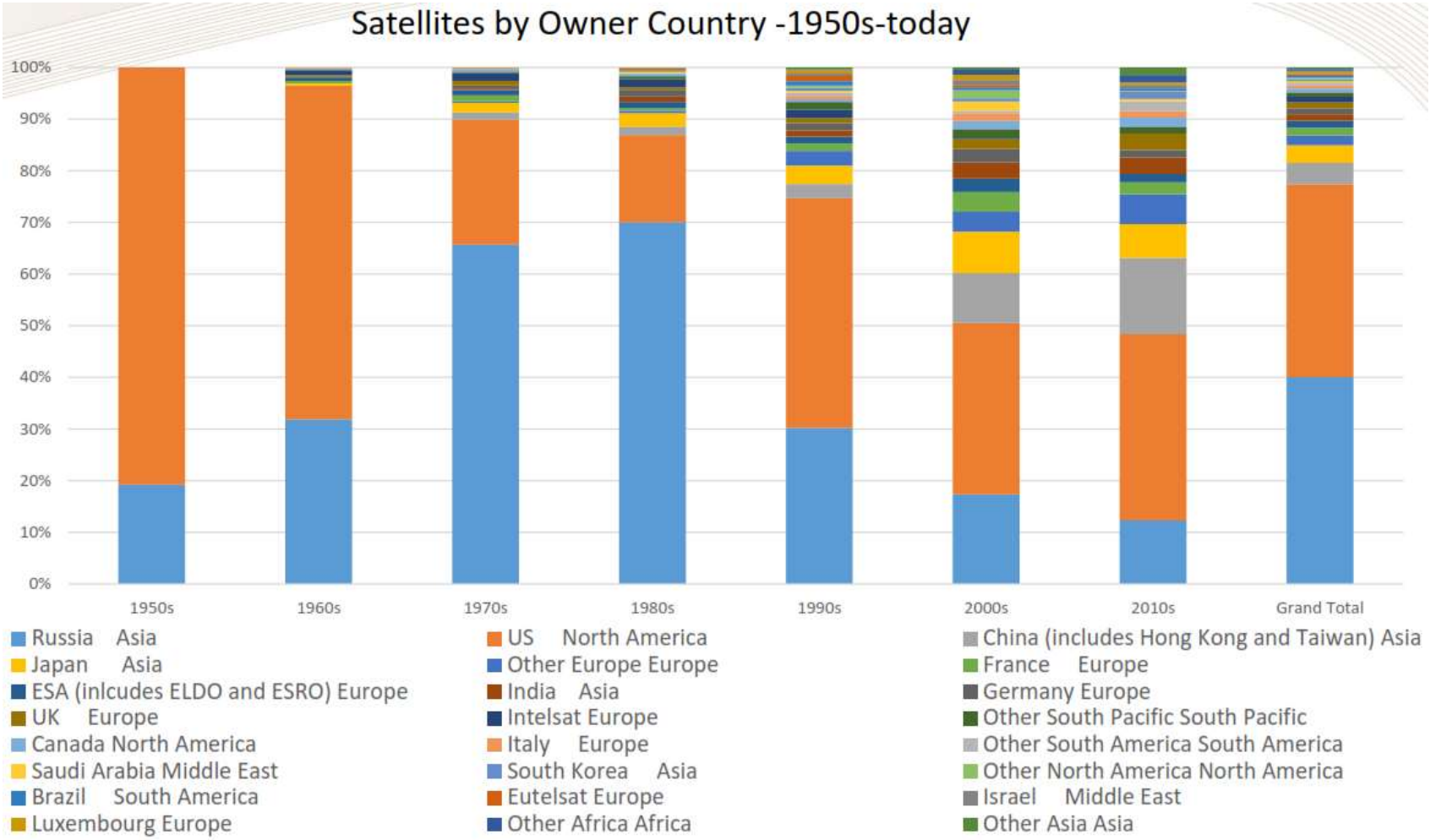
- Space is becoming more ***globalized***
  - Growing access to space technology
  - Growing interest by many countries in utilizing space for national benefits (socioeconomic development, prestige, national security)

- Space is becoming more ***diverse***
  - Space began as part of competition between governments (US and USSR)
  - Influx of technology, talent, and capital from other sectors (IT, analytics, etc)

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

How can SDG implementers leverage on the data revolution and newspace movement?

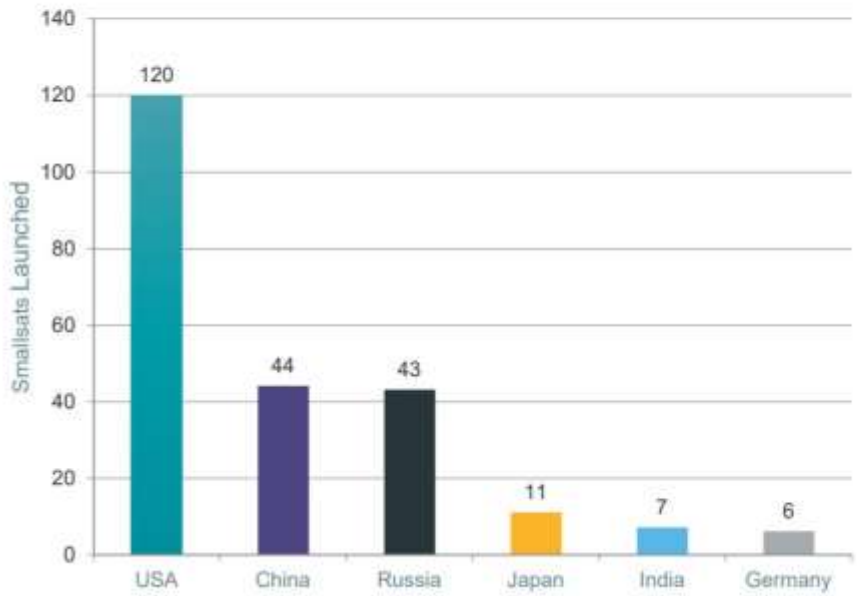
More International



Source: Adapted from [IDA Global Trends in Civil and Commercial Space Study]

New National Entrants

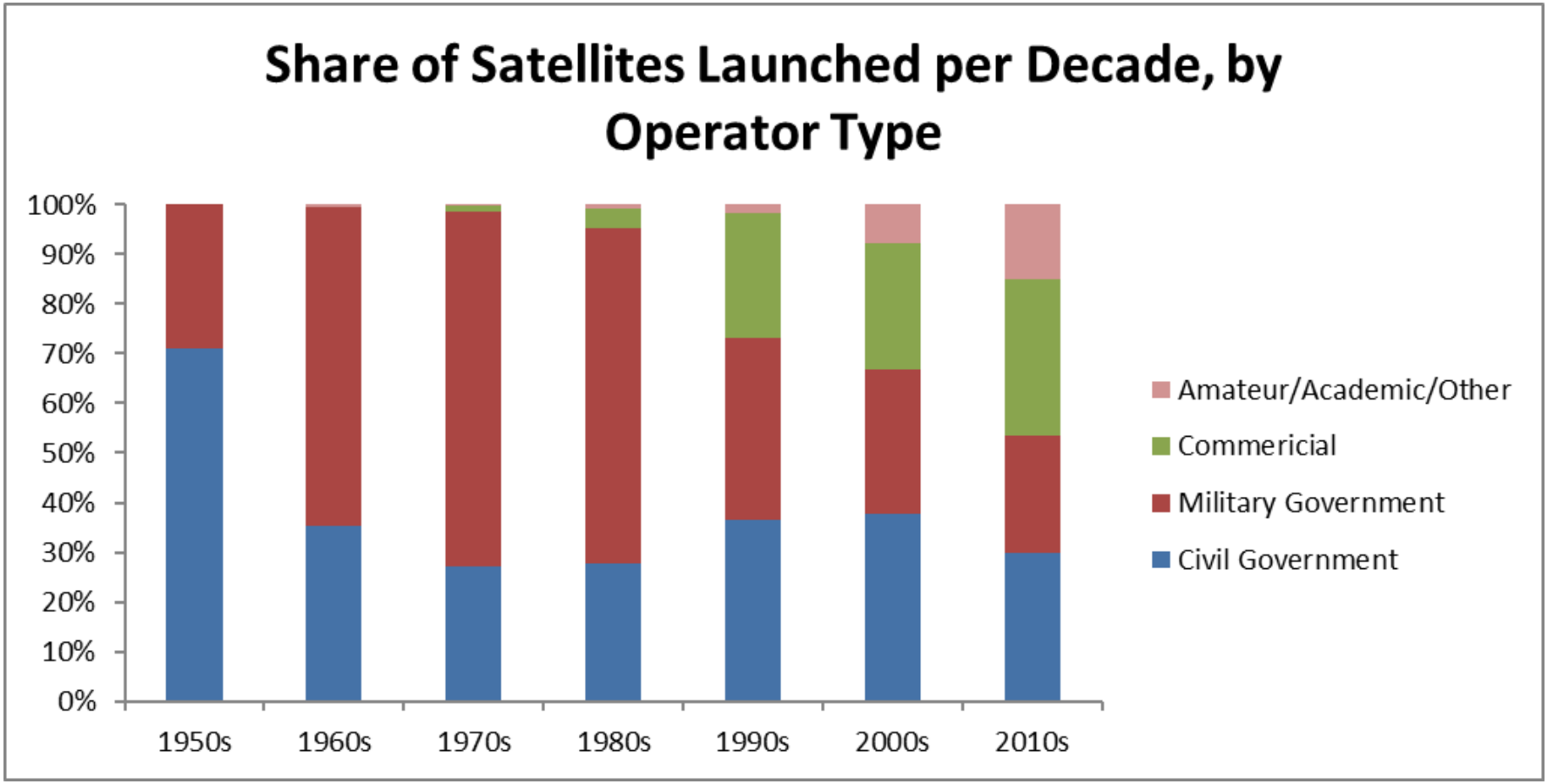
Countries Deploying the Most Government Smallsats, 2012 - 2018



5 or Fewer Government Smallsats Deployed	
South Korea	Ecuador
Australia	Indonesia
European Space Agency	Spain
Canada	Kazakhstan
Israel	Turkey
Iran	Peru
Brazil	Greece
Algeria	Taiwan
North Korea	Vietnam
Saudi Arabia	Belarus
UAE	Pakistan
Italy	Philippines
France	Colombia
Poland	Malaysia
United Kingdom	

Source: Bryce Space and Technology "Small Satellites By the Numbers 2019"

More Diverse



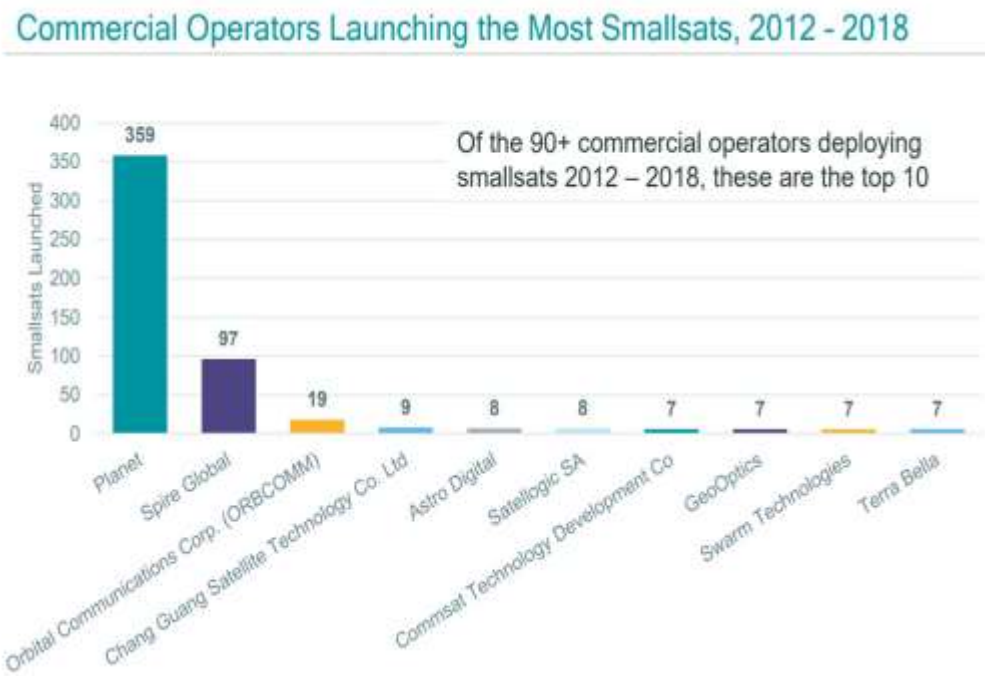
Source: McDowell, Jonathan C, 2017—Satellite Statistics http://www.planet4589.org/space/log/stats2/own_categ.txt

Commercial Satellites

Operational
Planned

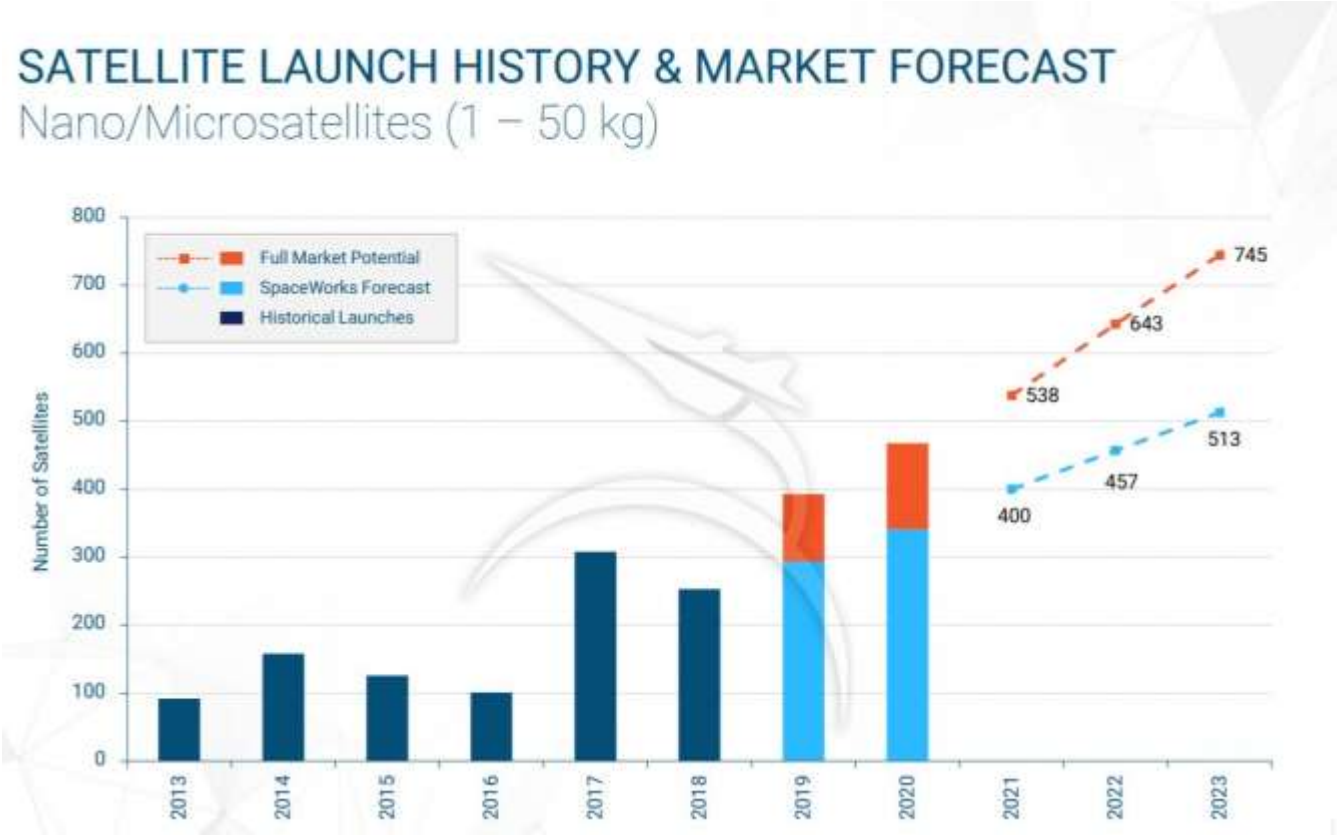
		High Res (<1m)	High revisit (<1d)	Sensor Description	System Size	Sat Mass (kg)
Large Sats	*Airbus D&S*	•		Optical and radar	4	1,000
	DigitalGlobe	•	•	Optical	5	2,800
	MDA	•	•	Radar	1	2,300
	DMCii	•		Optical	6	450
	ImageSat	•		Optical	3	350
	UrtheCast	•	•	Optical and radar	24	1,400
Small Satellites (<200 kg)	*Astro Digital*	•	•	Optical	30	20
	Axelspace	•	•	Optical	50	95
	BlackBridge (Planet)	•	•	Optical	5	150
	BlackSky Global		•	Optical	60	50
	Capella Space		•	Radar	30	TBD
	XpressSAR	•		Radar	4	TBD
	GeoOptics		•	Radio occultation	24	115
	HawkEye360		•	RF mapping	21+	TBD
	Hera Systems		•	Optical	48	24
	ICEYE	•	•	Radar	50	<100
	PlanetiQ		•	Radio occultation	12	22
	Planetary Resources	•	•	Optical	10	TBD
	Planet		•	Optical	100+	3
	Satellogic	•	•	Optical	25+	35
	Spire Global			Radio occultation	50	3
	Terra Bella (Planet)		•	Optical	24	120

Source: Satellite Industry Association "State of the Satellite Industry Report" https://www.sia.org/wp-content/uploads/2017/07/SIA-SSIR-2017.pdf



Source: Bryce Space and Technology "Small Satellites By the Numbers 2019"

Launch Predictions



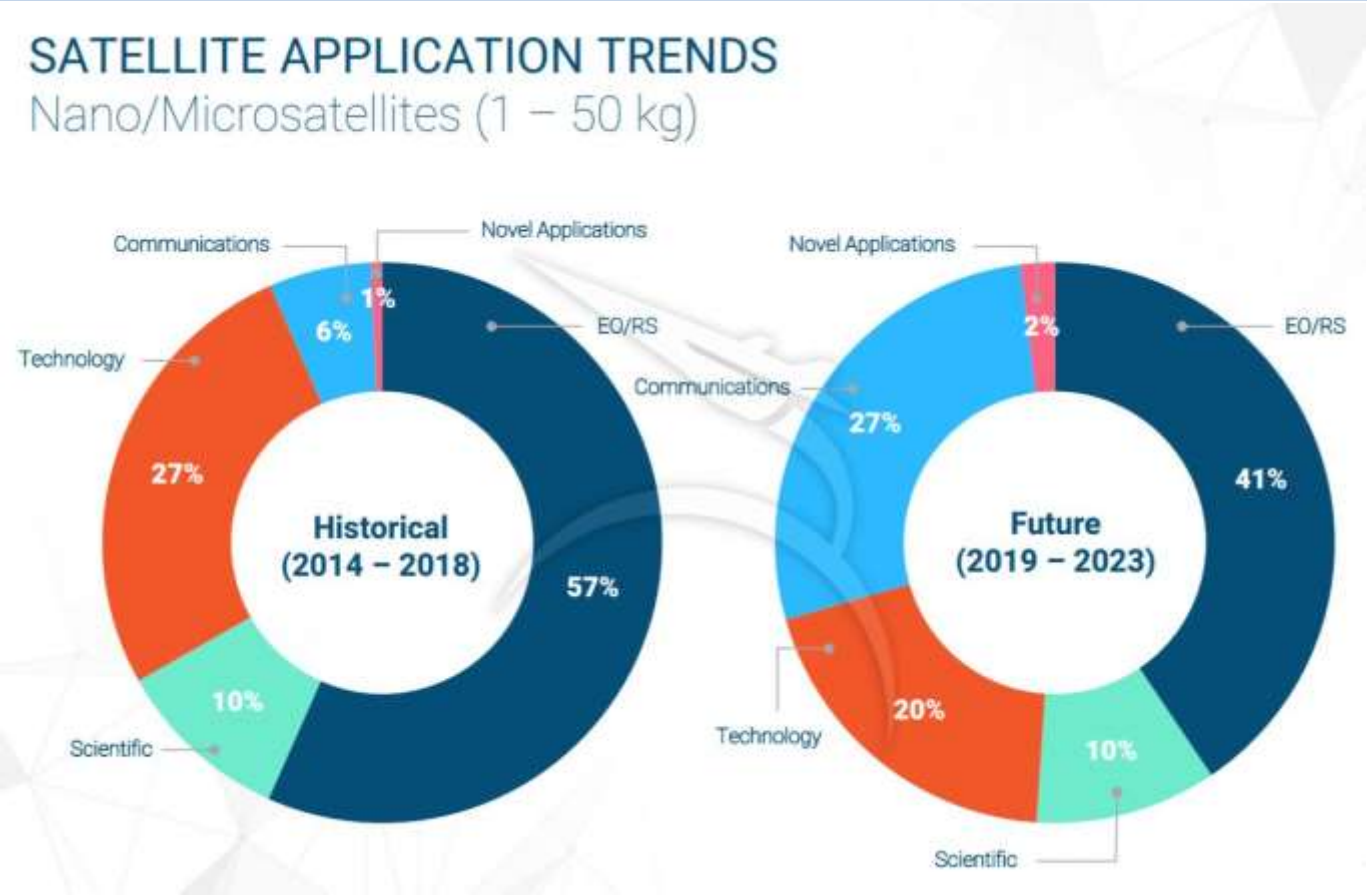
Source: Spaceworks Enterprises, 2019 Nano/MicroSatellite Market Forecast

Launched in 2018: More than 250

Forecast: Up to 2800 micro/nanosatellites to launch in the next 5 years

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

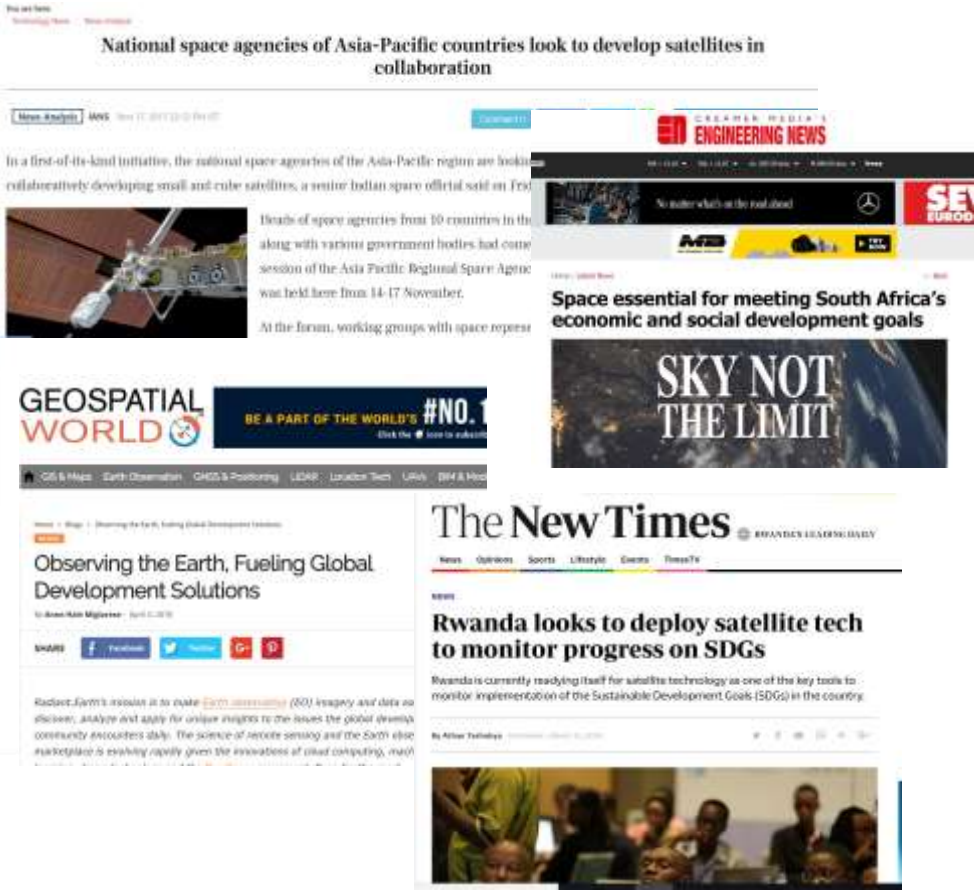
Changing Landscape



Source: Spaceworks Enterprises, 2019 Nano/MicroSatellite Market Forecast

How does this predicted shift affect efforts for supporting SDGs?

Societal Benefit



How do we take advantage of these trends for the SDGs?

Key Questions

Who are the decision makers?

- No SDG contains goals that weren't already being worked on by professionals around the world
- Need to define and think broadly from citizens to organizations to governments
- Most potential end users are unaware of the possibilities

How are we delivering it?

- What happens when a potential end user googles their specific topic?
- Who isn't represented in this room? Are these technologies and data represented in other rooms?
- Are resources being developed that can be understood and acted upon by non-geospatial professionals? What about new communication technologies?

Stakeholders

Space Infrastructure

- Space Agencies
- Manufacturers
- Satellite Operators
- Launch
- Investors

Downstream

- Analytics Companies
- Nat'l Statistics Agencies
- Nat'l EO Agencies
- Ground Segment
- Academia
- Hardware vendors

End Users

- Gov't Service Agencies
- NGOs
- Donors
- INGOS
- Local civil society
- Contractors

Challenges

Awareness and use of Earth observation and other space-dervived technology is increasing but wide-spread adoption is still slow. Why?

- Lack of technical knowledge or training
- Focus on traditional areas of application
- “Intertia”
- Donor skepticism
- Time and money
- Data set integration concerns including privacy
- Open data “vs.” Commercial data
- Too much data, not the right data
- Licensing

What happens when you Google it?

Food Security

Google

remote sensing food security

All | Images | News | Videos | Maps | More | Settings | Tools

Any time · All results

Scholarly articles for **remote sensing food security**
Precision agriculture and **food security** - Gebbers - Cited by 326
... resources and **food security**: how can **remote sensing** ... - Thenkabail - Cited by 42
... advanced **remote sensing** and non **remote sensing** ... - Thenkabail - Cited by 58

How Remote Sensing Can Help Address Food Security Around the ...
https://www.nasa.gov/.../how-remote-sensing-can-help-address-food-security-around-t... ▾
May 28, 2014 - When floods, droughts, and other natural disasters hit isolated and poor regions of the world, it can have devastating impacts on the local price of **food**. Research scientist Molly Brown, of NASA's Goddard Space Flight Center in Greenbelt, Maryland, is using satellite data to ...

Remote Sensing in Food Production and Food Security - MDPI
www.mdpi.com/journal/remotesensing/special_issues/rs_food_production_security ▾
Dear Colleagues, **Food security** is one of the most essential factors for our physical wellbeing; it is a fundamental prerequisite for a healthy and happy life. Food ...

Satellite Remote Sensing in Agriculture and Food Security Assessment
https://www.sciencedirect.com/science/article/pii/S1878029615005551
by ME Brown - 2015 - Cited by 2 - Related articles
NASA provides daily satellite **remote sensing** observations on a wide variety of environmental parameters at the global scale, including rainfall, temperature ...

Remote sensing of crop health for food security in Africa: Potentials ...
https://www.sciencedirect.com/science/article/pii/S2352938517301465
by M Onsimo - 2017 - Related articles
Accurate and timeous detection, mapping and monitoring of crop diseases and pests is critical for **food security**, particularly in sub-Saharan Africa where hunger ...

GIS Remote Sensing in Food Security | ReliefWeb
https://reliefweb.int/training/2462044/gis-remote-sensing-food-security ▾
Feb 14, 2018 - GIS AND **REMOTE SENSING** IN **FOOD SECURITY** PROGRAMME. The main purpose of the course is to enhance the capabilities of technical ...
Jun 18 - Jun 29 · on-site

Remote Sensing of Agriculture for Food Security Monitoring in the ...
https://earthzine.org/.../agriculture-and-food-availability-remote-sensing-of-agriculture... ▾
Feb 8, 2010 - Agriculture and Food Availability – **Remote Sensing** of Agriculture for Food ... The recent global food crises brought **food security** issues to the ...

[PDF] Remote sensing: a key tool for monitoring food resources in a ...
www.kaowarsom.be/documents/Conferences/DUCHEYNE.pdf ▾
by El Duchesne - Related articles
Keywords: **Remote Sensing**, food production, crop and livestock production ... livestock is an important resource that contributes to **food security**, improves the ...

Land Degradation

Google

earth observation data for land degradation

All | Images | News | Videos | Maps | More | Settings | Tools

About 10,300,000 results (0.45 seconds)

What do four decades of earth observation tell us about land ...
blog.worldagroforestry.org/.../what-do-four-decades-of-earth-observation-tell-us-abo... ▾
Jul 10, 2015 - The team used a method known as **Earth Observation**, to collect **data** using **remote sensing** techniques, to assess the **land degradation** ...

Use of earth observation satellite data for land degradation ... - NCBI
https://www.ncbi.nlm.nih.gov/pubmed/24197846 ▾
by J Hill - 1995 - Cited by 22 - Related articles
Environ Monit Assess. 1995 Jan;37(1-3):143-58. doi: 10.1007/BF00546886. Use of **earth observation** satellite **data for land degradation** mapping and monitoring ...

Use of earth observation satellite data for land degradation mapping ...
https://link.springer.com/article/10.1007/BF00546886 ▾
by J Hill - 1995 - Cited by 22 - Related articles
The degradation of the permanent seminatural vegetation and the resulting acceleration of **soil degradation** and erosion processes constitute major elements of ...

Earth Observations for Geohazards, Land Degradation and ...
https://www.earthobservations.org/activity.php?id=88 ▾
Current and emerging **Earth Observation** (EO) technologies have the potential ... such as: landslide and subsidence dynamics, **soil degradation** and contamination due ... and **data** sets and plans for integration of new generation satellite **data** ...

[PDF] What Four Decades of Earth Observation Tell Us about Land ... - ...
www.mdpi.com/2072-4292/7/4/4048/pdf ▾
by C Mbow - 2015 - Cited by 38 - Related articles
Apr 2, 2015 - (4) fill **data** gaps, (5) agree on scales and assumptions, (6) set up a ... Keywords: Sahel; **land degradation**; desertification; **remote sensing**; ...

What Four Decades of Earth Observation Tell Us about Land ... - MDPI
www.mdpi.com/2072-4292/7/4/4048 ▾
by C Mbow - 2015 - Cited by 38 - Related articles
Apr 2, 2015 - The assessment of **land degradation** and the quantification of its effects on land ... After four decades of **Earth Observation** (EO) applications, little ... **data**-access, (4) fill **data** gaps, (5) agree on scales and assumptions, (6) set ...

The role of Remote Sensing in land degradation assessments ...
https://www.tandfonline.com/doi/full/10.1080/22797254.2017.1378926
by O Dubovyk - 2017 - Related articles
Sep 18, 2017 - **Land degradation** (LD) is one of the biggest global challenges for the people's ... Currently, **Remote Sensing data** are featured by satellite ...

Use of Earth Observation Satellite Data for Land Degradation...
https://www.researchgate.net/.../258336842_Use_of_Earth_Observation_Satellite_Data_...
Dec 20, 2017 - Download citation | Use of **Earth** Observa... | The **degradation** of the permanent seminatural vegetation and the resulting acceleration of **soil** ...

Moving Forward

- More general resources which outline the “what” and the “how”
- Increased colloboration among a wider range of stakeholders
- More support for sector cross-training, both academically and professionally
- Better engagement with media
- Don’t let “perfect” or “most efficient” be the enemy of “good” and “effective”
- Leveraging corporate social responsibility principles
- Take advantage of existing skills sets and synergies

Connecting with Secure World Foundation

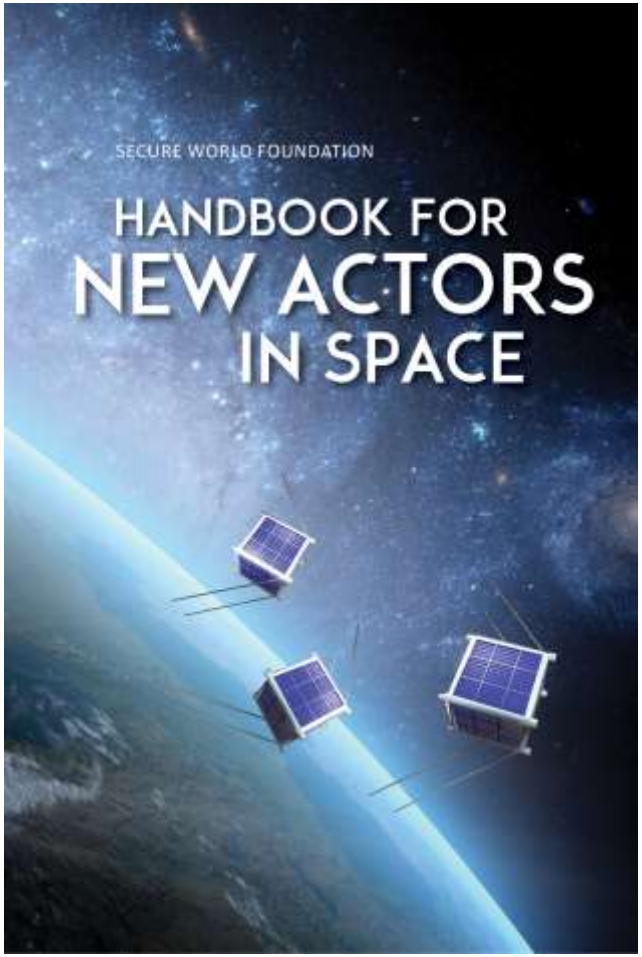
The Summit for Space Sustainability will be a high-level multi-day event focused on developing solutions for space sustainability. It will encompass a cross-section of space sustainability issue areas, including:

- Space debris
- Space situational awareness
- Space law and policy
- Space governance
- National and international space security
- Use of space for human and environmental security on Earth

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

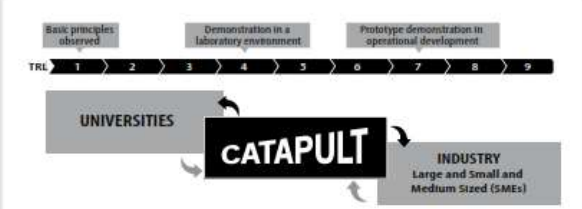
- **Two specific audiences:**
  - Countries developing space programs and/or having to oversee and regulate their first satellites
  - Universities and start-up companies that are developing/operating satellites



Contents

- **Chapter 1** – International framework
- **Chapter 2** – National policy and administration
- **Chapter 3** – Responsible space operations

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.



NATIONAL SPACE PO

IN-DEPTH ANALYSIS: REMOTE SENSING POLICY AND ADMINISTRATION

Remote sensing satellites have continually sensed Earth for more than four decades, yielding a valuable repository of data about the planet which has applications in areas as far-reaching as health, climatology, and urban planning. Given its strong linkages to socioeconomic development, space-based remote sensing is a key area of activity for new and established space actors alike. In light of this, remote sensing is a useful case study highlighting the interaction between public policy and public administration and illustrates some of the approaches different countries have taken to managing this kind of activity. Additionally, new trends in remote sensing activities, especially by non-governmental actors, illustrate larger policy transformations that are useful for new space actors to consider.

Remote Sensing Policy

Consistent with the main elements of public policy described in the beginning of this chapter, remote sensing policies primarily seek to:

- identify objectives and priorities guiding the acquisition of data about the planet;

| 83

Questions?

Thanks.

kwilson@swfound.org