



*Promoting Cooperative Solutions for Space Sustainability*

# Impact of Newspace and Data Revolution

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Secure World Foundation

Amsterdam, Netherlands  
April 3, 2019



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# 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



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# Activities and Partners



UNITED NATIONS  
Office for Outer Space Affairs



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**GEO** GROUP ON  
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**ORF** OBSERVER  
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SPACE GENERATION  
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## 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?**

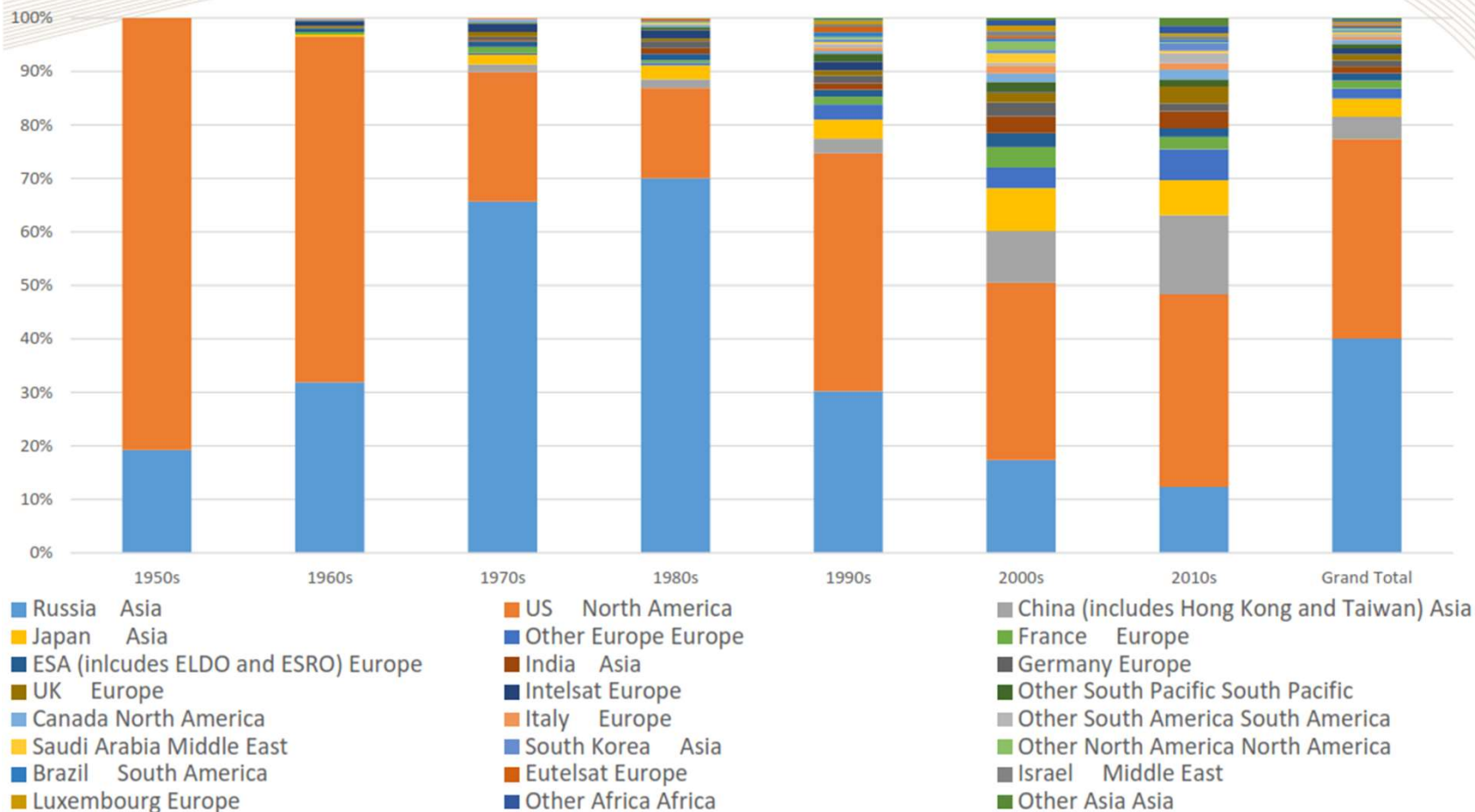
**How can SDG implementers leverage on the data revolution and newspace movement?**



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# More International

Satellites by Owner Country -1950s-today



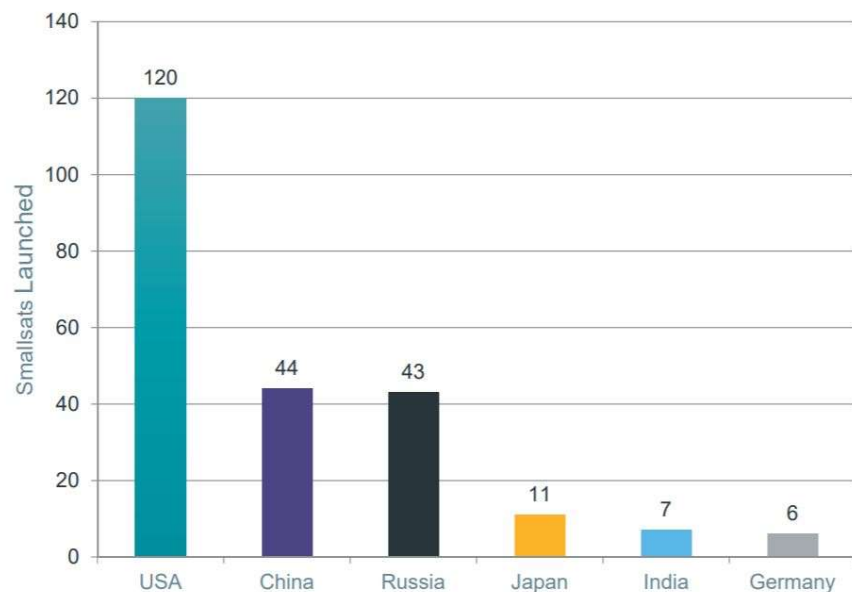
Source: Adapted from [IDA Global Trends in Civil and Commercial Space Study](#)



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# New National Entrants

## Countries Deploying the Most Government Smallsats, 2012 - 2018



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

### 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        |             |

Latest News

Telecom

May 1, 2018

Qatar Airways Begins Rollout of GX Aviation on 130 Aircraft

Telecom

May 1, 2018

RBC Signals Expands Coverage with C-Core Partnership

Telecom

May 1, 2018

DataPath Targets Unmanned Aircraft with New Satellite Solutions

Telecom

May 1, 2018

## PeruSat 1 Satellite Sees ROI in Just One Year

By Kendall Russell | December 13, 2017

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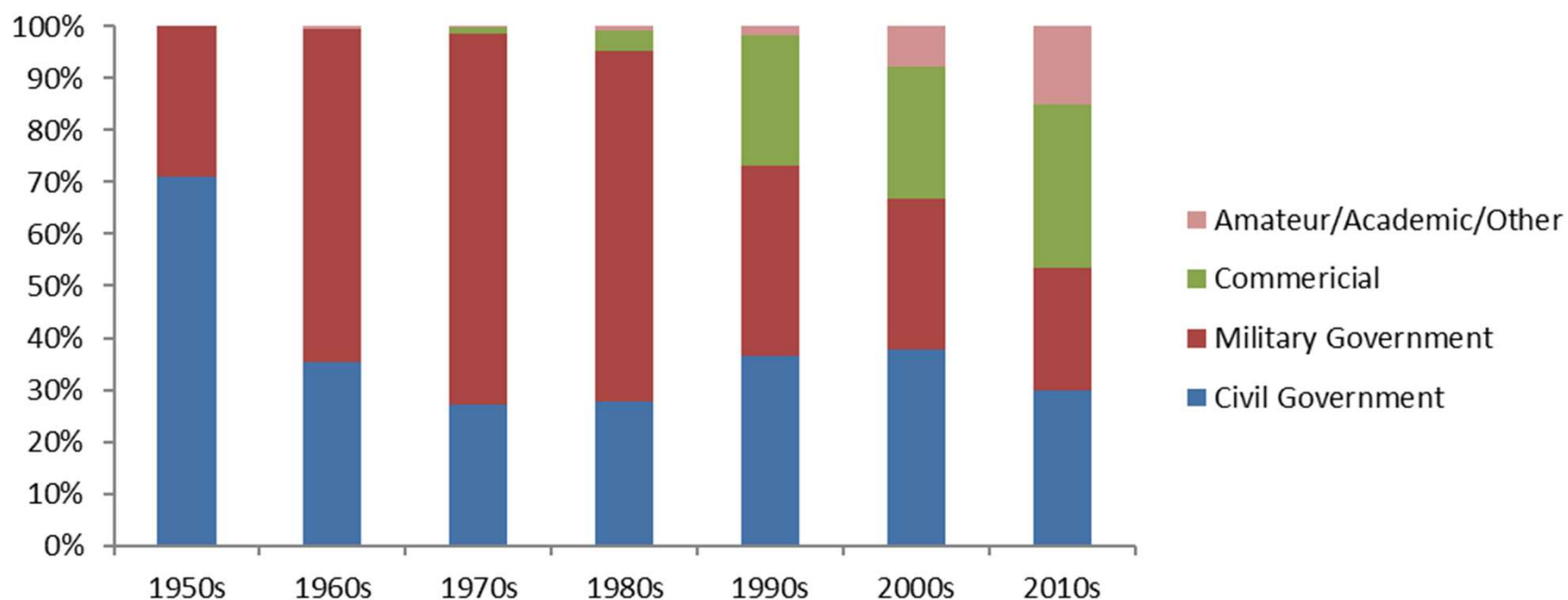
+



Rendition of PeruSat in orbit. Photo: Airbus

## More Diverse

### Share of Satellites Launched per Decade, by Operator Type



Source: McDowell, Jonathan C, 2017—Satellite Statistics [http://www.planet4589.org/space/log/stats2/own\\_catag.txt](http://www.planet4589.org/space/log/stats2/own_catag.txt)



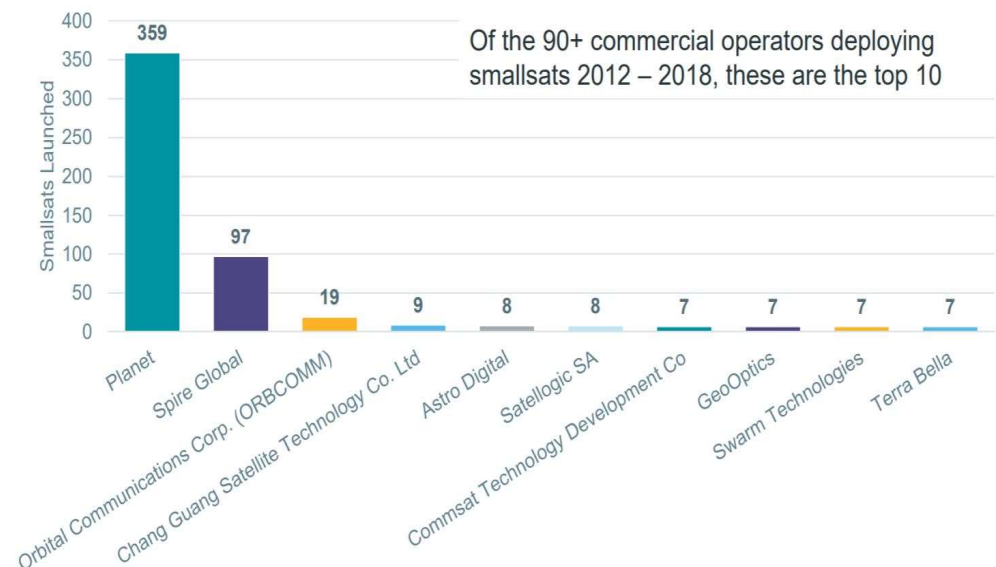


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# Commercial Satellites

|                            | Operational | Planned | High Res (<1m) | High revisit (<1dy) | 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           |
| Small Satellites (<200 kg) | ●           | ●       | ●              | ●                   | UrtheCast Optical and radar    | 24          | 1,400         |
|                            | ●           | ●       | ●              | ●                   | 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             |
|                            | ●           | ●       | ●              | ●                   | Satelloptic Optical            | 25+         | 35            |
|                            | ●           |         | ●              |                     | Spire Global Radio occultation | 50          | 3             |
|                            |             | ●       | ●              |                     | Terra Bella (Planet) Optical   | 24          | 120           |

## Commercial Operators Launching the Most Smallsats, 2012 - 2018



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

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



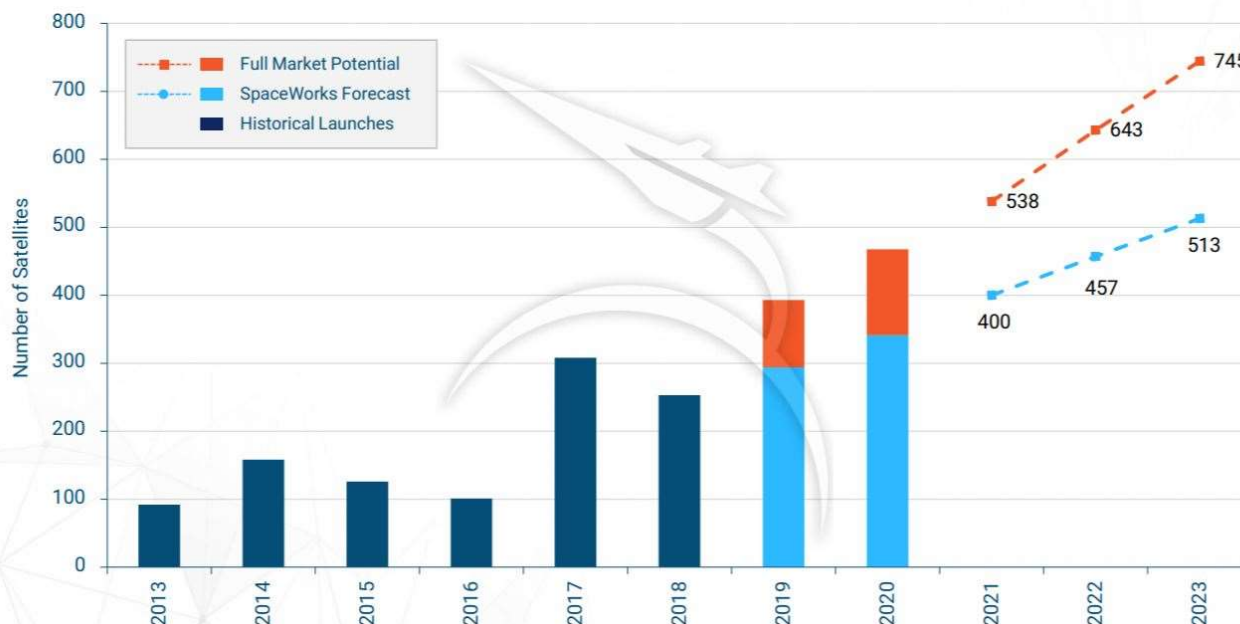


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# Launch Predictions

## SATELLITE LAUNCH HISTORY & MARKET FORECAST

Nano/Microsatellites (1 – 50 kg)



Source: Spaceworks  
Enterprises, 2019  
Nano/MicroSatellite  
Market Forecast

Launched in 2018: More than 250

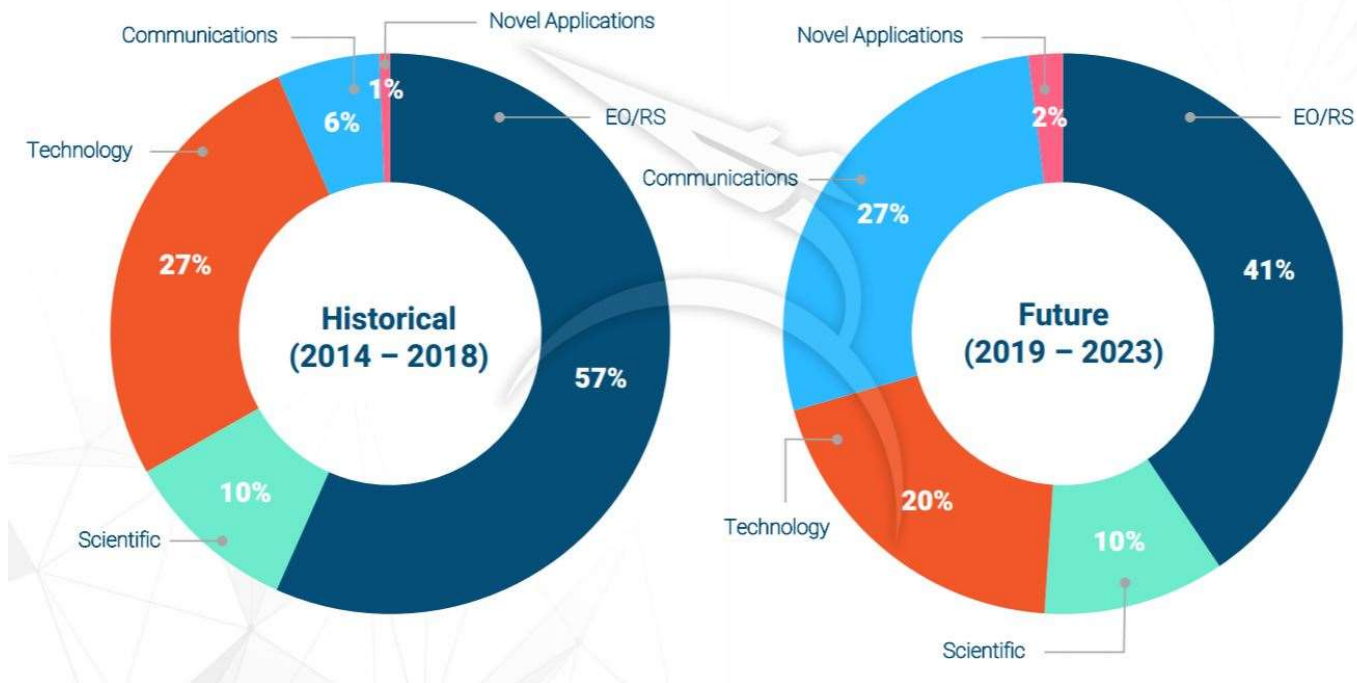
Forecast: Up to 2800 micro/nanosatellites to launch in the next 5 years

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

# Changing Landscape

## SATELLITE APPLICATION TRENDS

Nano/Microsatellites (1 – 50 kg)



Source: Spaceworks  
Enterprises, 2019  
Nano/MicroSatellite  
Market Forecast

How does this predicted shift affect efforts for supporting SDGs?



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# Societal Benefit

## SUSTAINABLE DEVELOPMENT GOALS



You are here:  
Technology News / News-Analysis

### National space agencies of Asia-Pacific countries look to develop satellites in collaboration

News-Analysis | IANS | Nov 17, 2017 23:12 PM IST

In a first-of-its-kind initiative, the national space agencies of the Asia-Pacific region are looking at collaboratively developing small and cube satellites, a senior Indian space official said on Friday.



Heads of space agencies from 10 countries in the Asia-Pacific region along with various government bodies had come together for the opening session of the Asia Pacific Regional Space Agency Forum, which was held here from 14-17 November.

At the forum, working groups with space representatives from the region are looking at collaboratively developing small and cube satellites, a senior Indian space official said on Friday.

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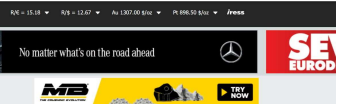
### Observing the Earth, Fueling Global Development Solutions

By Anne Hale Miglarese - April 3, 2018

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Radiant.Earth's mission is to make [Earth observation](#) (EO) imagery and data available to discover, analyze and apply for unique insights to the issues the global development community encounters daily. The science of remote sensing and the Earth observation marketplace is evolving rapidly given the innovations of cloud computing, machine learning, and big data.

CREAMER MEDIA'S  
ENGINEERING NEWS



### Space essential for meeting South Africa's economic and social development goals



## The New Times

RWANDA'S LEADING DAILY

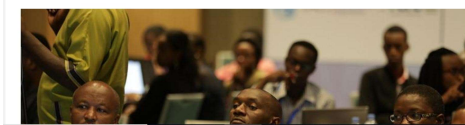
News | Opinions | Sports | Lifestyle | Events | TimesTV

NEWS

### Rwanda looks to deploy satellite tech to monitor progress on SDGs

Rwanda is currently readying itself for satellite technology as one of the key tools to monitor implementation of the Sustainable Development Goals (SDGs) in the country.

By Athan Tashobya | Published: March 13, 2018



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



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## 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



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## Challenges

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

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





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# What happens when you Google it?

## Food Security

Google search results for "remote sensing food security".

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](http://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 Onisimo - 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-availabilityremote-sensing-of-agriculture...>  
Feb 8, 2010 - Agriculture and Food Availability - **Remote Sensing** of Agriculture for Food ... The recent global food crisis brought **food security** issues to the ...
- Remote sensing: a key tool for monitoring food resources in a ...**  
[www.kaowarsom.be/documents/Conferences/DUCHEYNE.pdf](http://www.kaowarsom.be/documents/Conferences/DUCHEYNE.pdf)  
by El Ducheyne - 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 search results for "earth observation data for land degradation".

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...](http://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 ...**  
[www.earthobservations.org/activity.php?id=88](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**, ...
- What Four Decades of Earth Observation Tell Us about Land ... - ...**  
[www.mdpi.com/2072-4292/7/4/4048/pdf](https://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](https://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...](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** ...



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# Moving Forward

- More general resources which outline the “what” and the “how”
- Increased collaboration 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



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# 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





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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





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

## 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

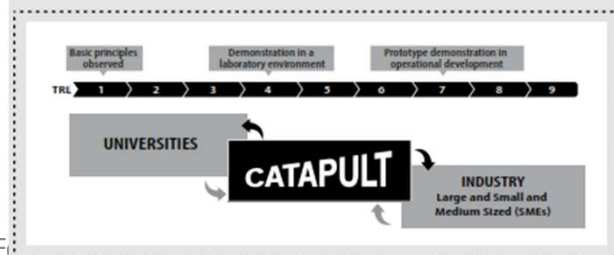
Consistent with the main elements of public policy described in the beginning of this chapter, remote sensing policies primarily seek to:

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

#### 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.





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# Questions?

## Thanks.

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