



Smallsats by the Numbers 2020

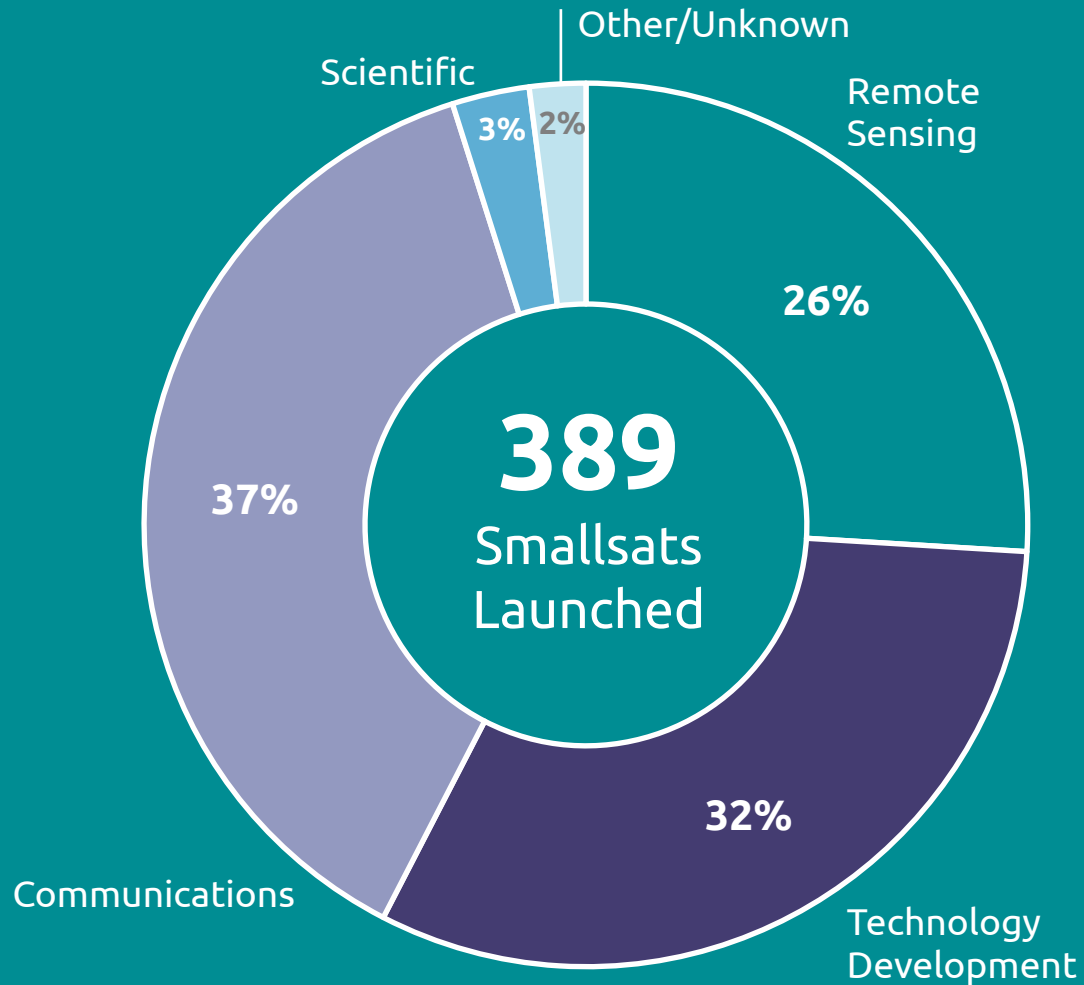
- ✓ Introduction
- ✓ 2019 Smallsat Highlights
- ✓ Smallsat Trends (2012 – 2019)
- ✓ Commercial Smallsats
- ✓ Government Smallsats
- ✓ Non-Profit and Academic Smallsats
- ✓ Looking Forward: Areas To Watch

- Smaller satellites are of increasing interest; more widely used in recent years
- Bryce's *Smallsats by the Numbers* presents historical information on smaller satellites launched 2012-2019 (regardless of operational status)
- Definition used here, 600 kg and under, reflects the five smallest mass classes defined by the FAA
- 'Smallsat' or 'very small satellite' are often used to refer to smaller satellites

	Mass Class Name	Kilograms (kg)
Smallsats	Femto	0.01 – 0.09
	Pico	0.1 – 1
	Nano	1.1 – 10
	Micro	11 – 200
	Mini	201 – 600
	Small	601 – 1,200
	Medium	1,201 – 2,500
	Intermediate	2,501 – 4,200
	Large	4,201 – 5,400
	Heavy	5,401 – 7,000
	Extra Heavy	> 7,001

From FAA *The Annual Compendium of Commercial Space Transportation: 2018*

2019 Smallsat Highlights



Smallsats by Use

109 kg

average smallsat mass, nearly 2x increase from 2018, 6x increase from 2017

45%

of launches included smallsats, nearly doubling from 24% in 2012

28

dedicated smallsat launches, almost half by China

57%

of smallsats launched by U.S. launch providers

Smallsat Trends (2012 – 2019)

Highlights



1,700+ smallsats launched

52% of smallsats provide commercial services

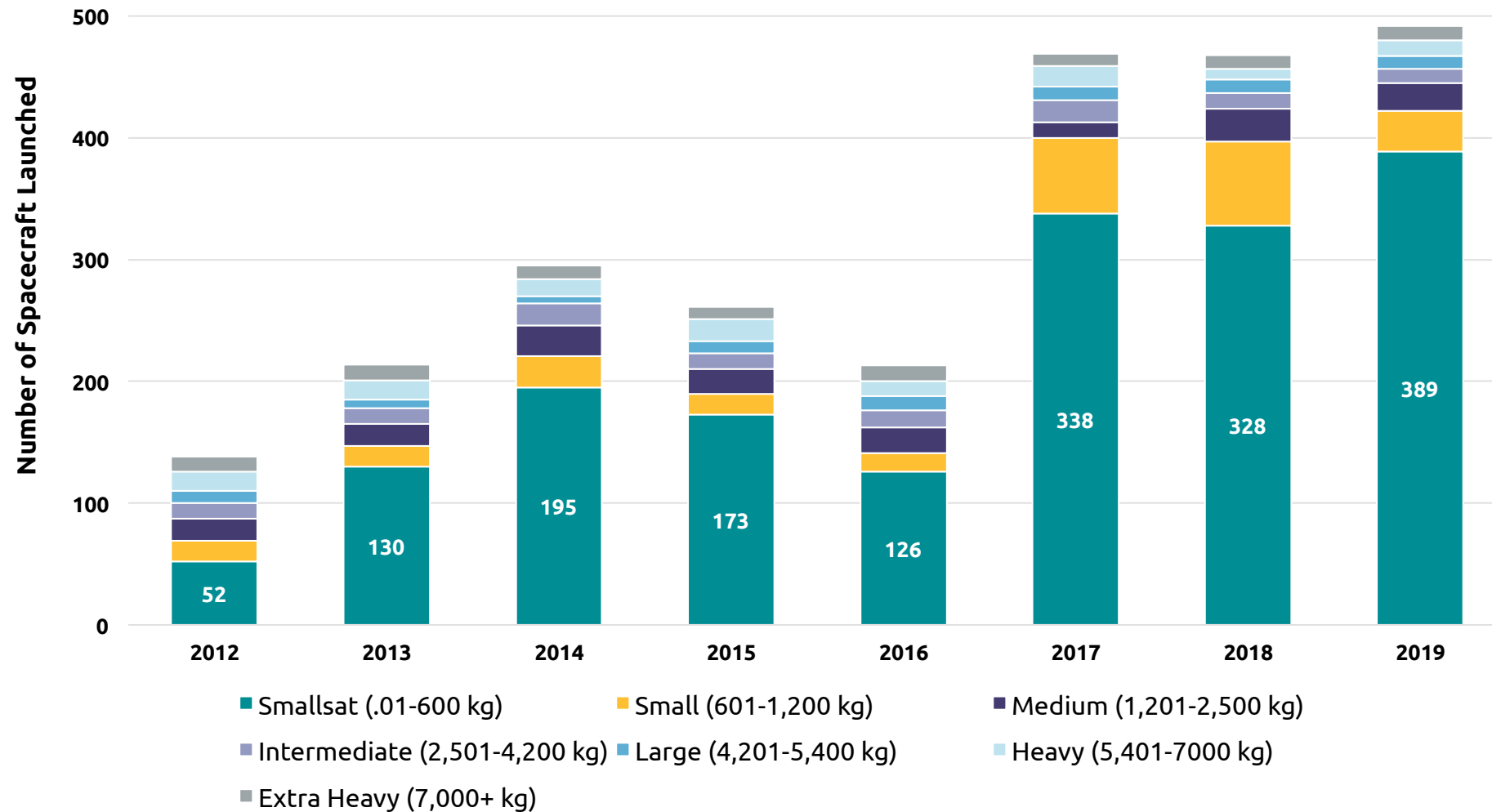
11x increase in proportion of upmass represented by smallsats over 7 years

Smallsat usage began to increase in 2012

Government and commercial sectors are increasingly using smallsats

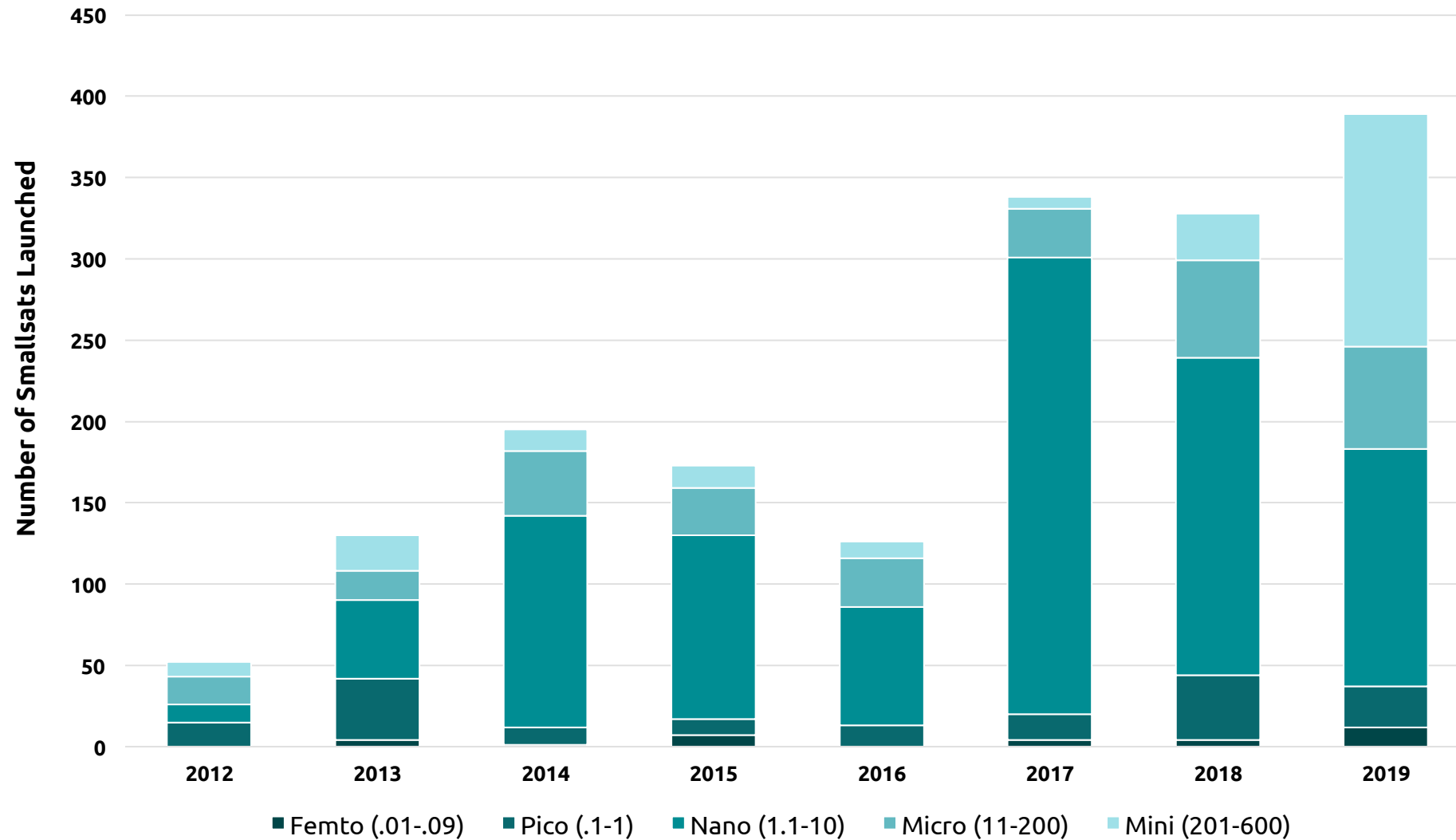
The Big Picture of Smallsats: Smallsats in Context

Smallsat Trends (2012 – 2019)



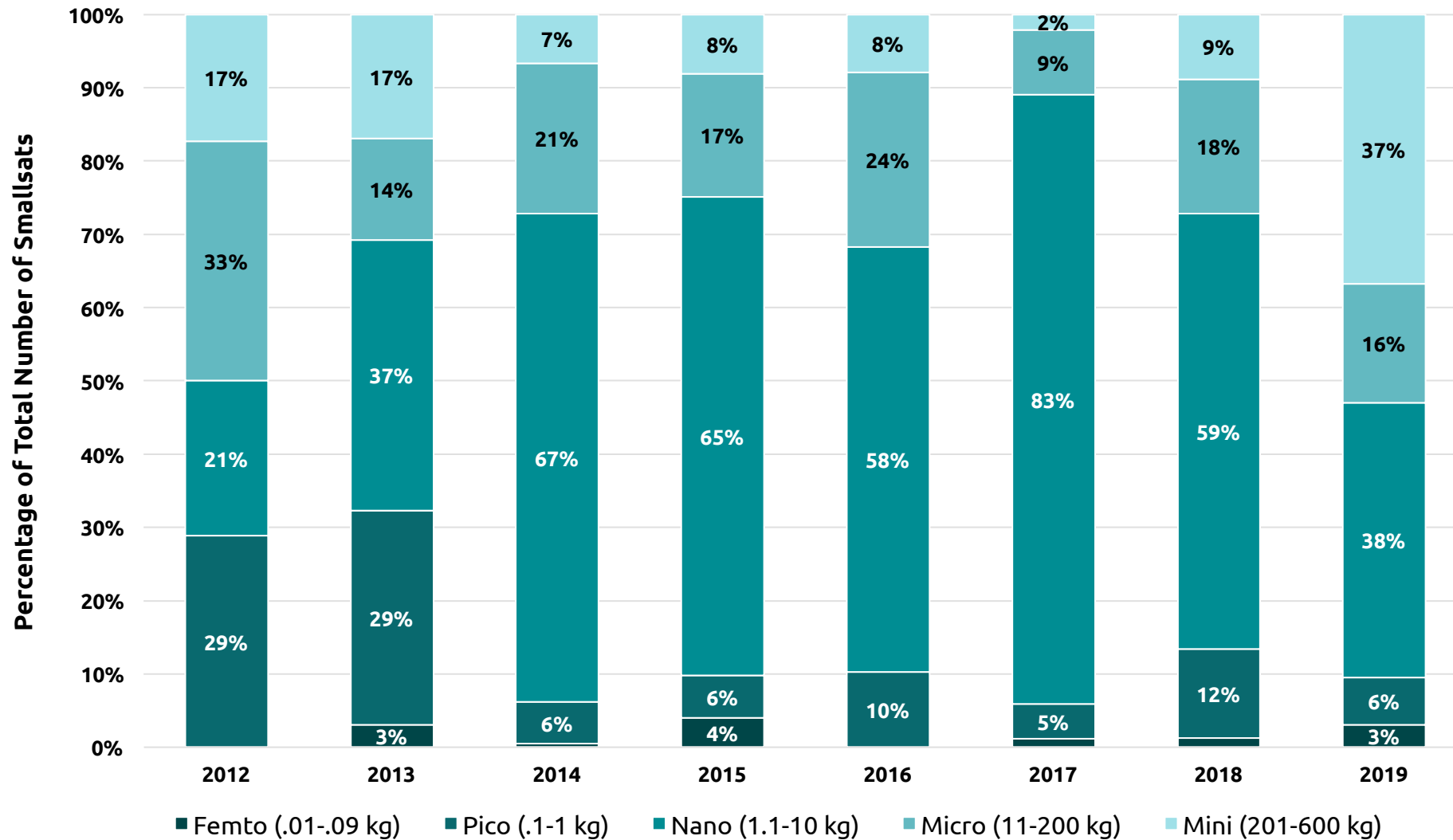
Number of Smallsats by Mass Class

Smallsat Trends (2012 – 2019)



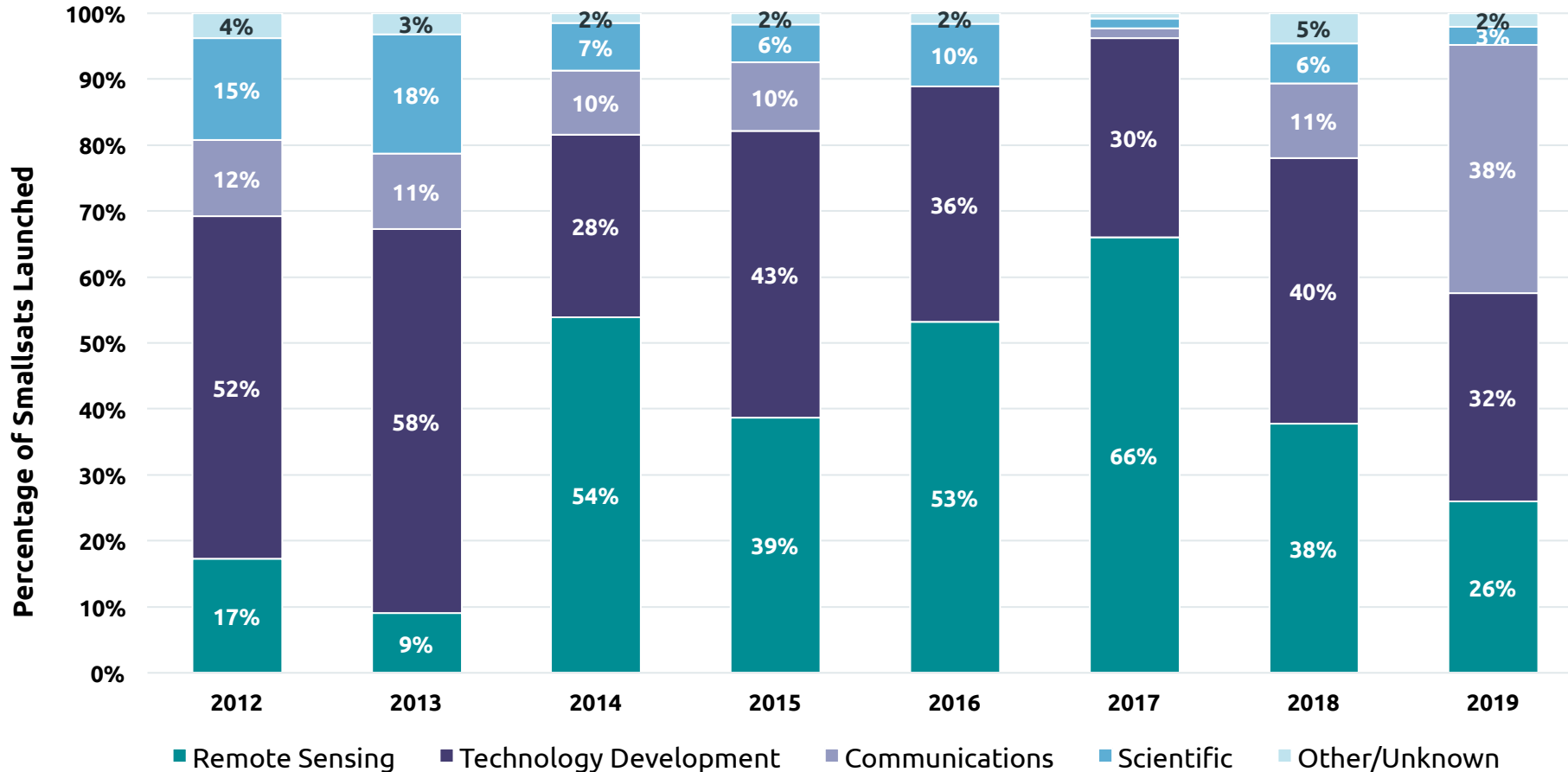
Share of Smallsats by Mass Class

Smallsat Trends (2012 – 2019)



Share of Smallsats by Use

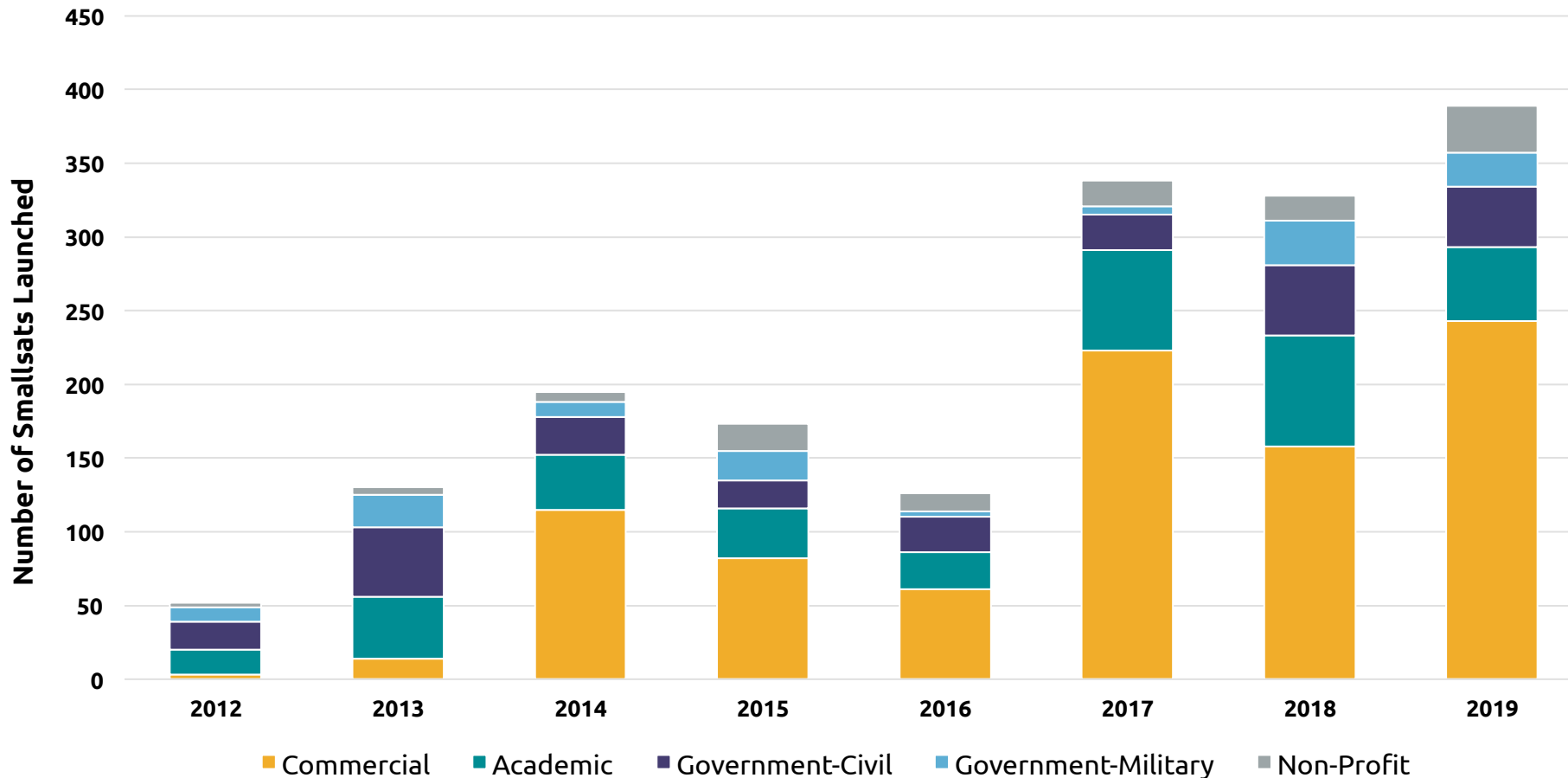
Smallsat Trends (2012 – 2019)



**Planet owned 55% of remote sensing smallsats launched;
SpaceX owned nearly 50% of communications smallsats**

Number of Smallsats by Operator Type

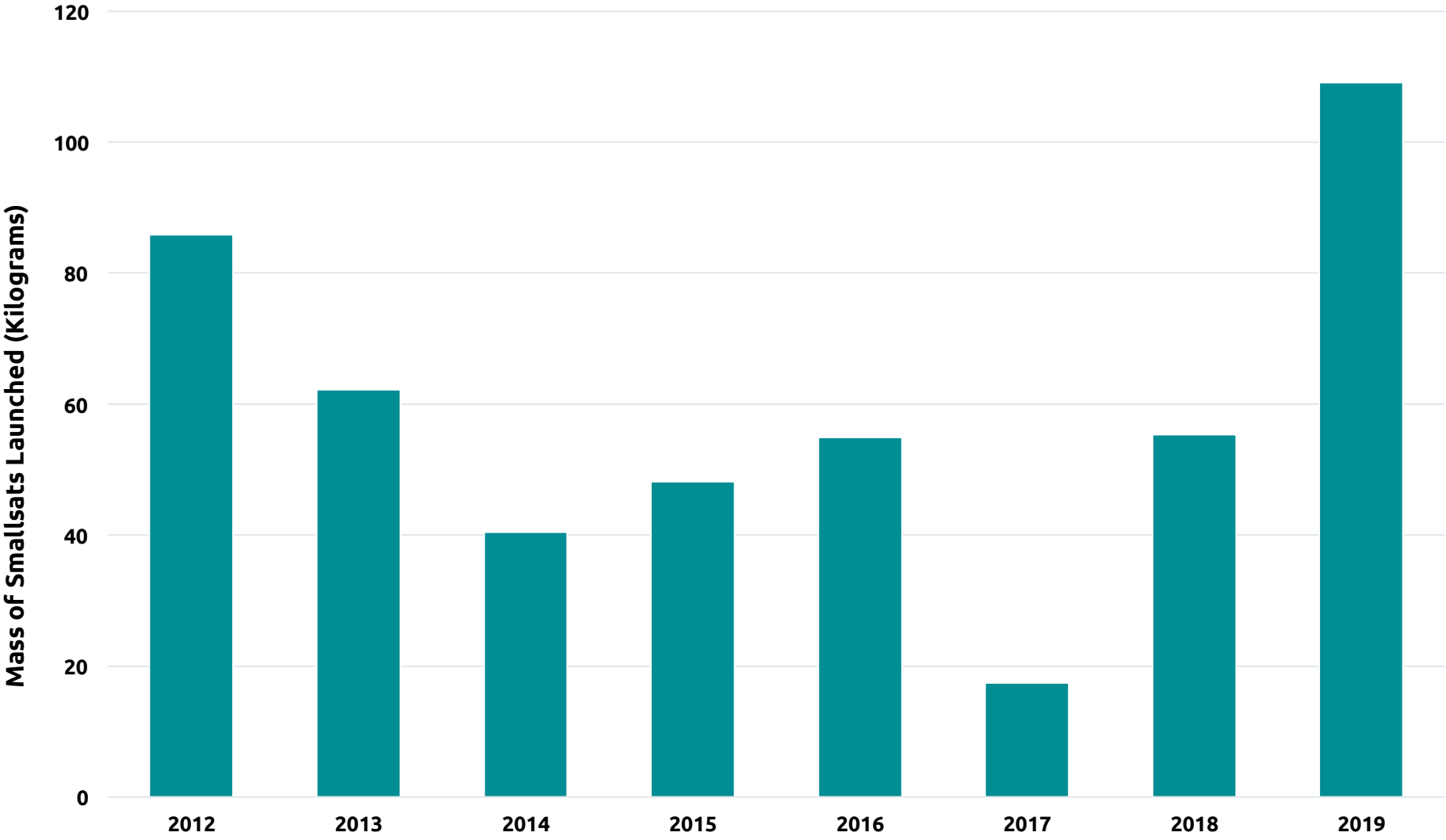
Smallsat Trends (2012 – 2019)



Share of smallsats providing commercial services grew from 6% in 2012 to 62% in 2019

Average Smallsat Mass

Smallsat Trends (2012 – 2019)



Smallsats as Percentage of Total Upmass

Smallsat Trends (2012 – 2019)

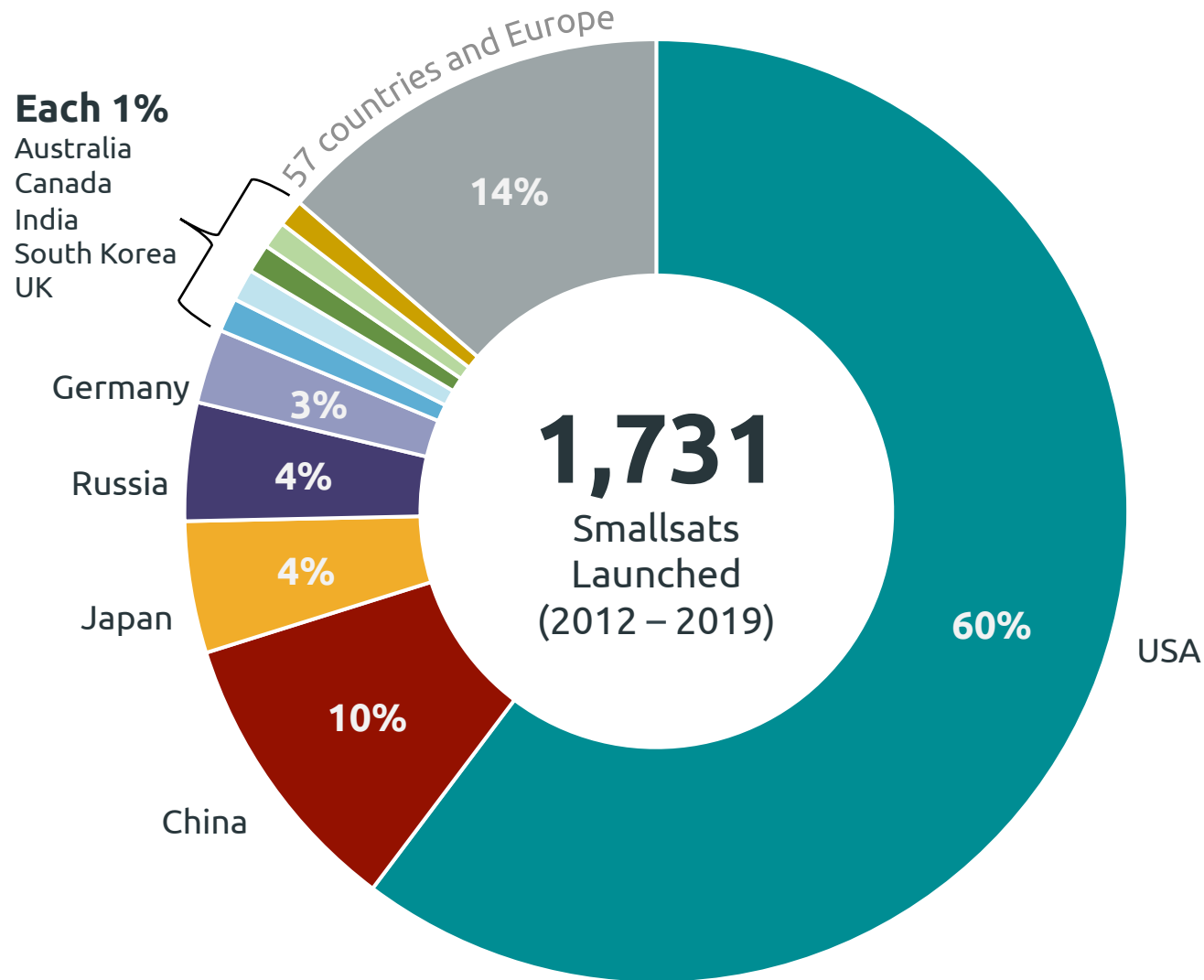


	2012	2013	2014	2015	2016	2017	2018	2019
Percentage of Total Upmass Represented by Smallsats	1%	2%	2%	2%	2%	2%	5%	11%

In 2019, smallsats made up 11% of all mass launched into orbit

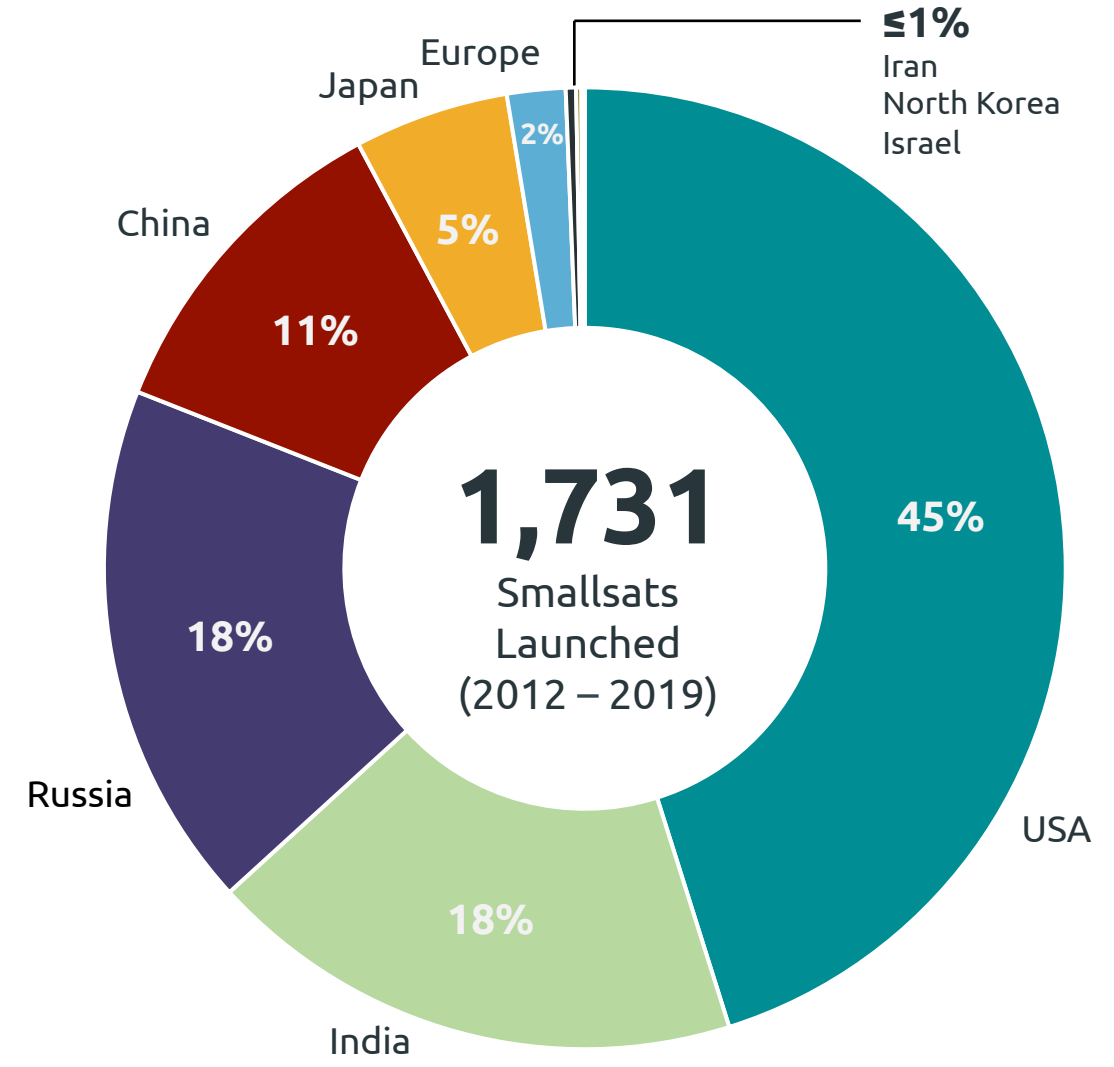
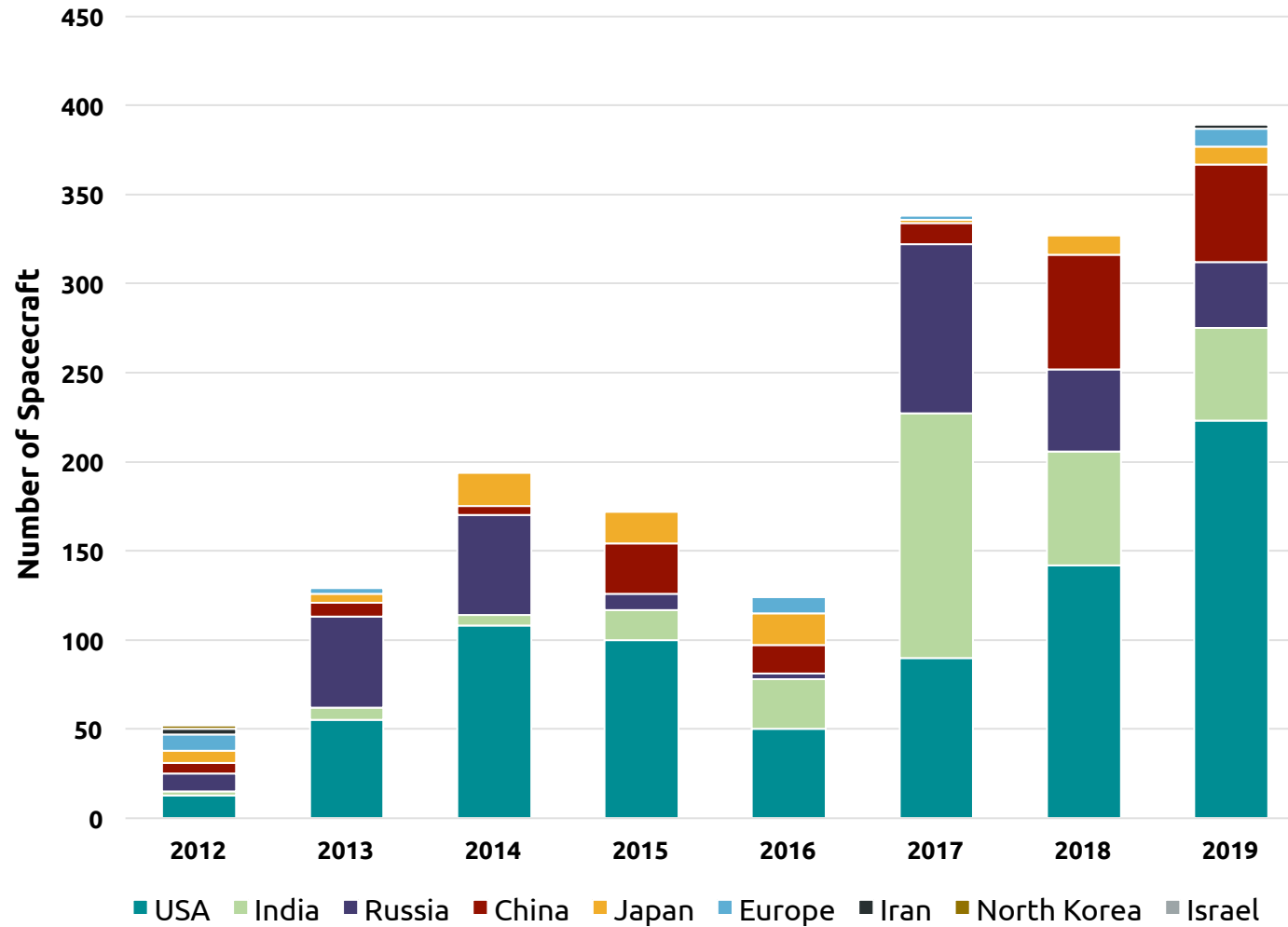
Percentage of Smallsats by Operating Country

Smallsat Trends (2012 – 2019)



Percentage and Number of Smallsats by Country of Launch Provider

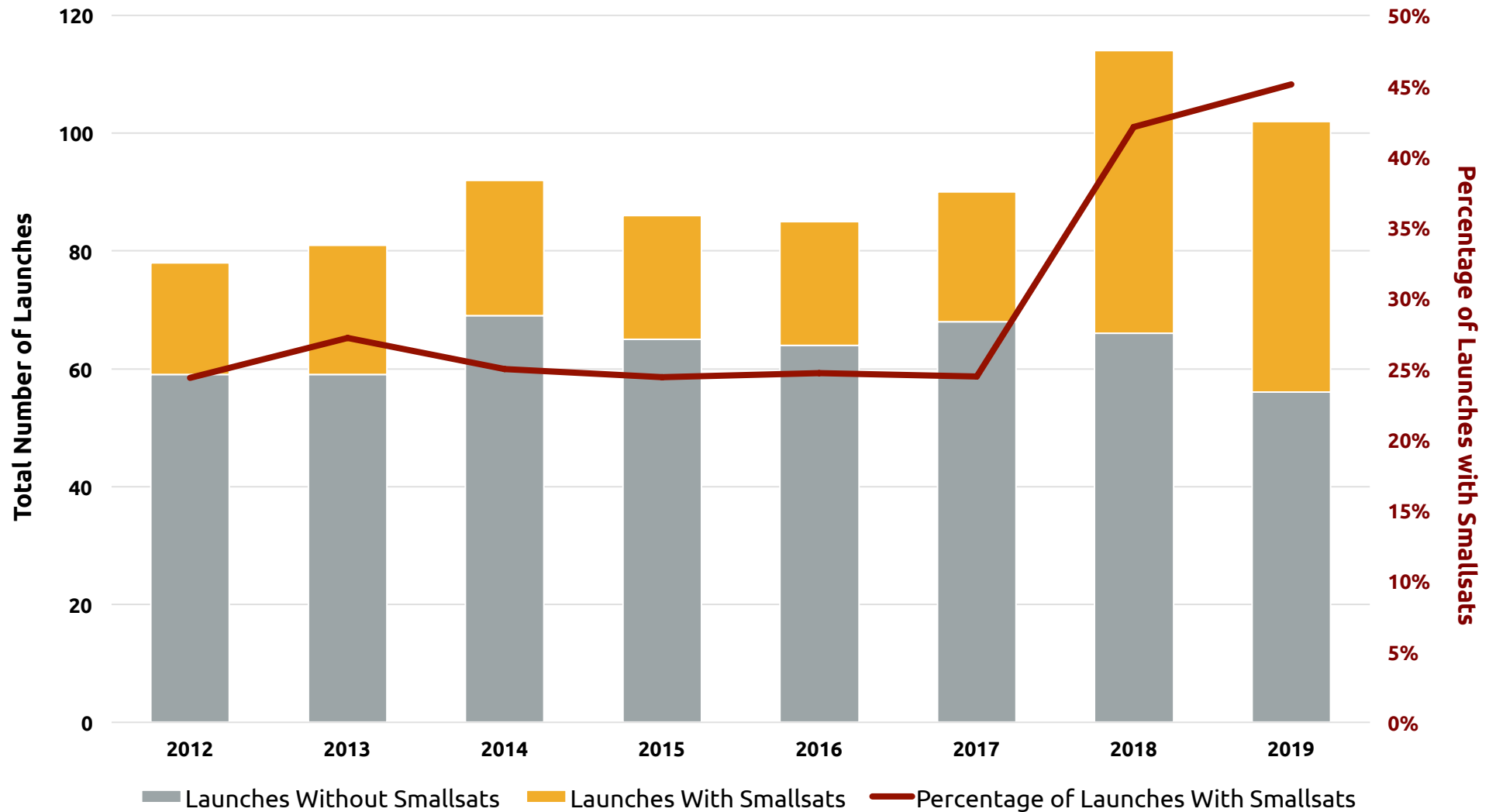
Smallsat Trends (2012 – 2019)



Rocket Lab is headquartered in the U.S. with a subsidiary in New Zealand. It is counted here as a U.S. company

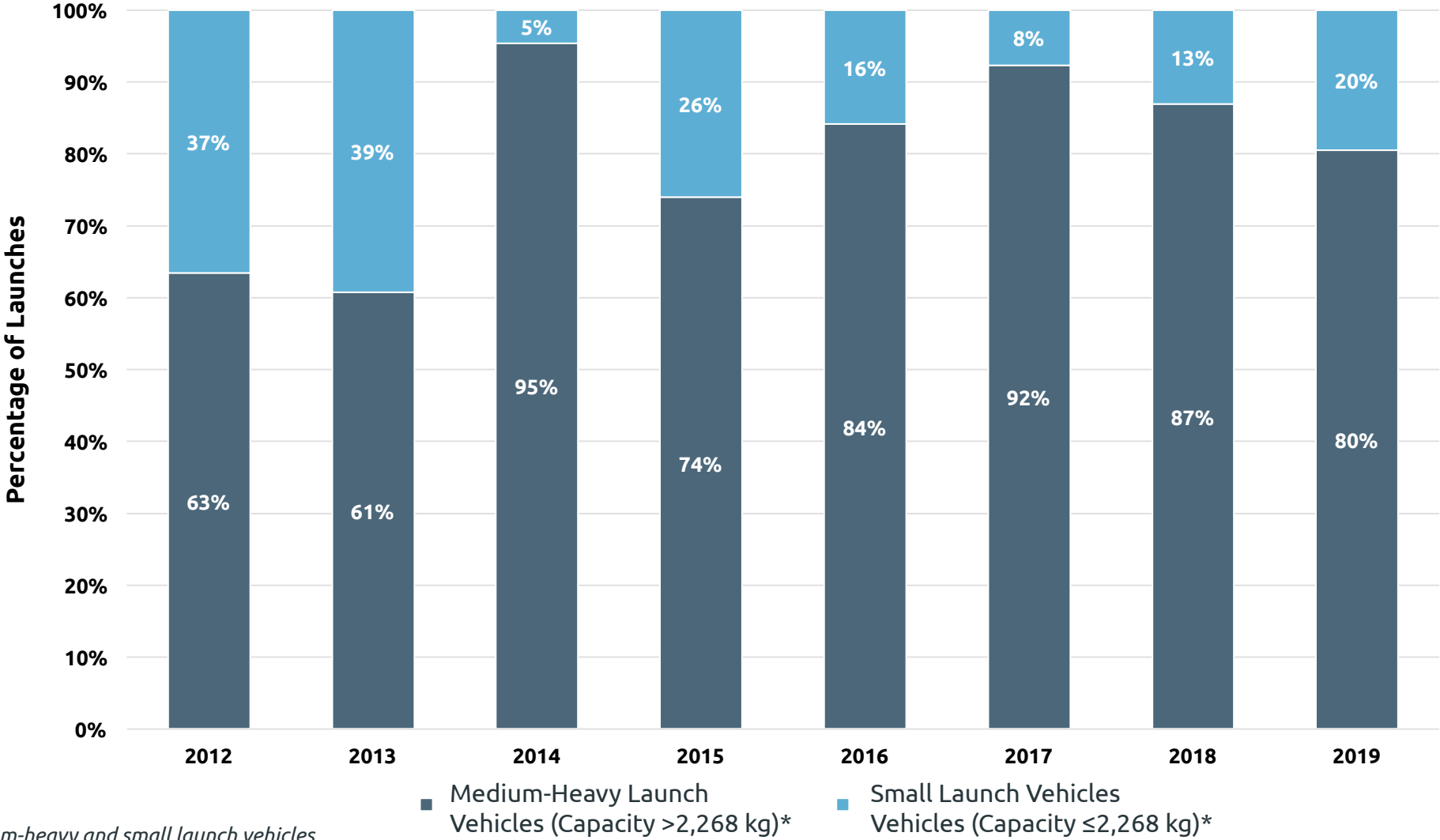
Percentage of Launches With Smallsats

Smallsat Trends (2012 – 2019)



Share of Smallsats by Launch Vehicle Category

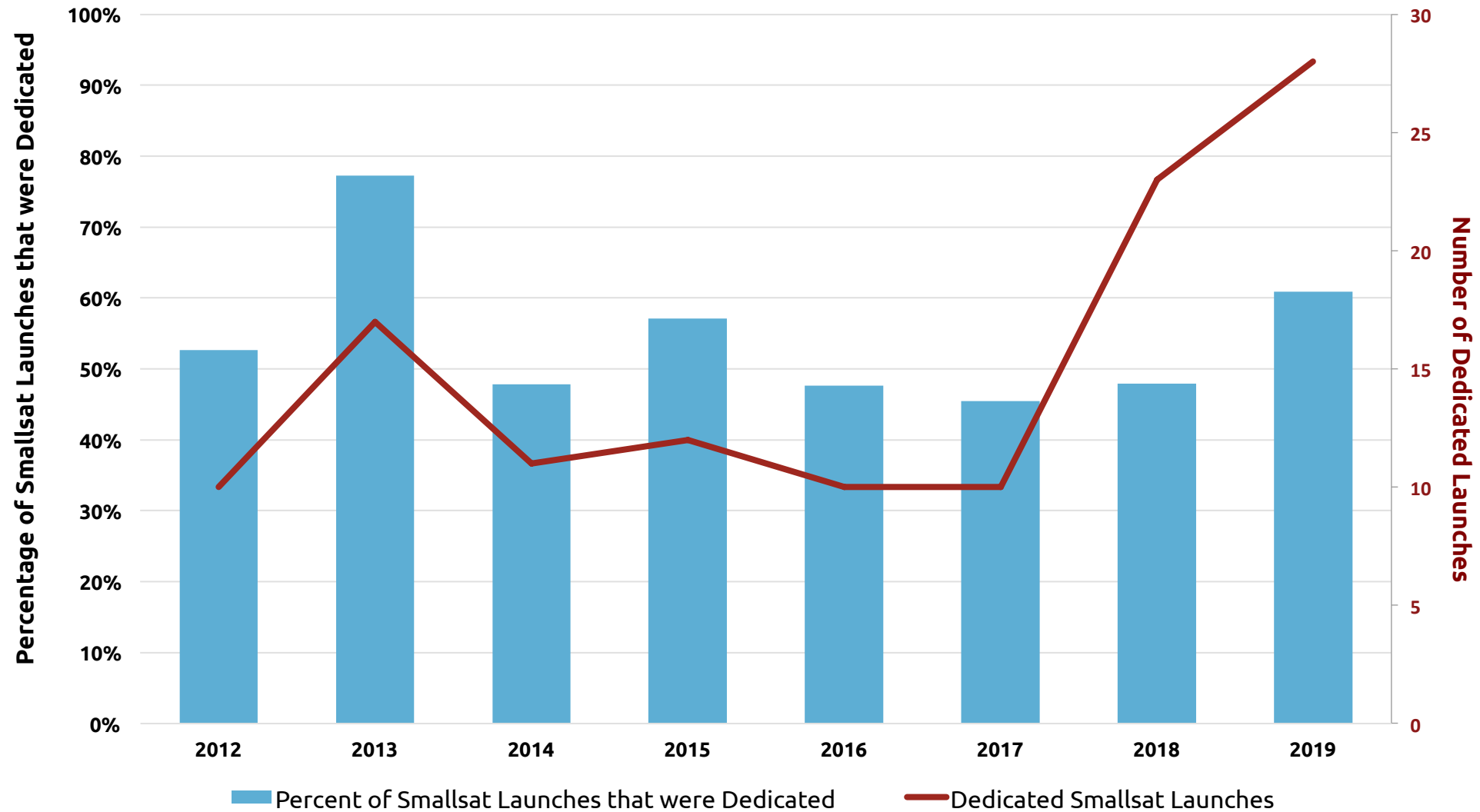
Smallsat Trends (2012 – 2019)



*FAA definitions of medium-heavy and small launch vehicles

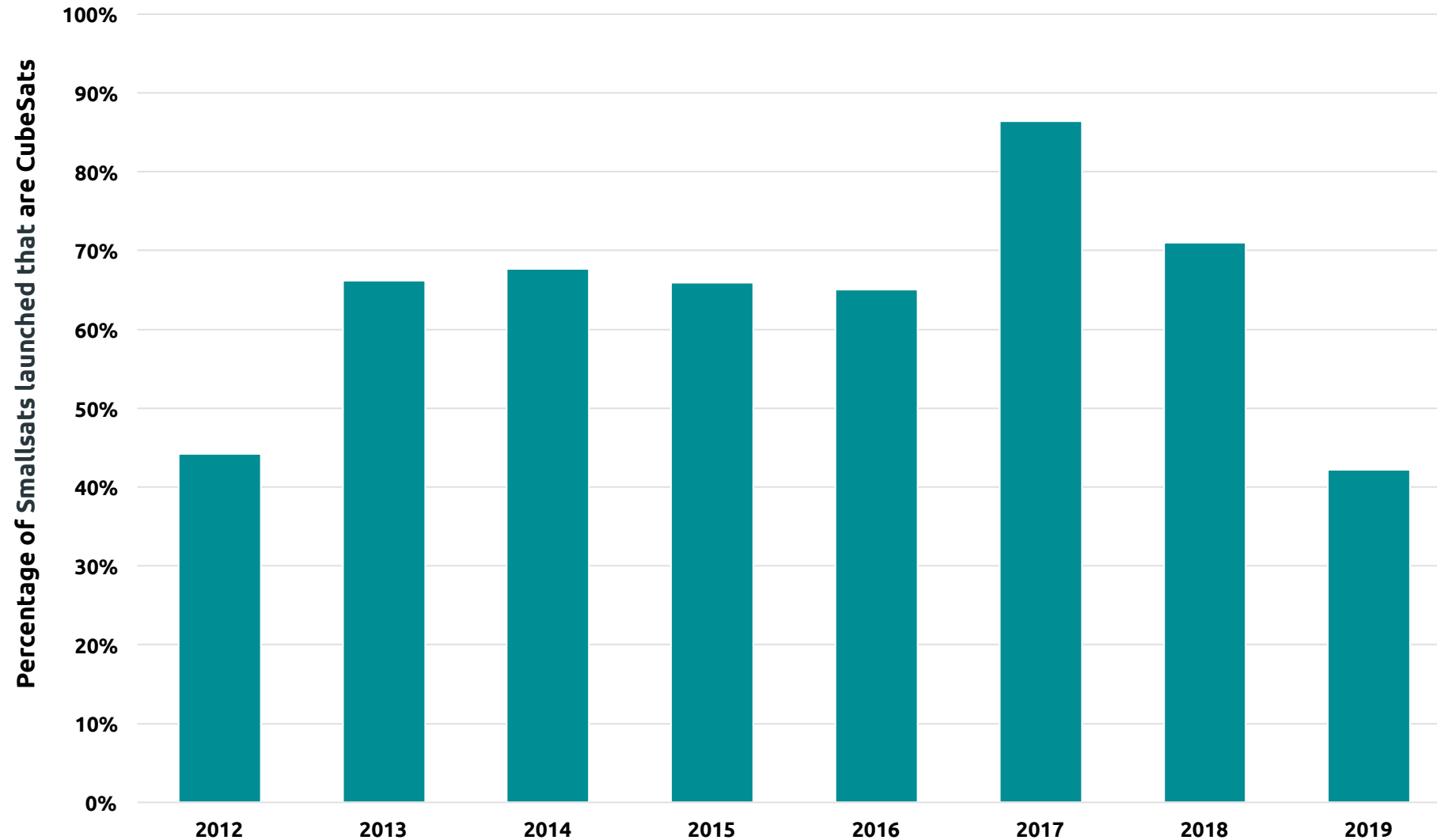
Launches Dedicated to Smallsats

Smallsat Trends (2012 – 2019)



Percentage of Smallsats Launched that are CubeSats

Smallsat Trends (2012 – 2019)

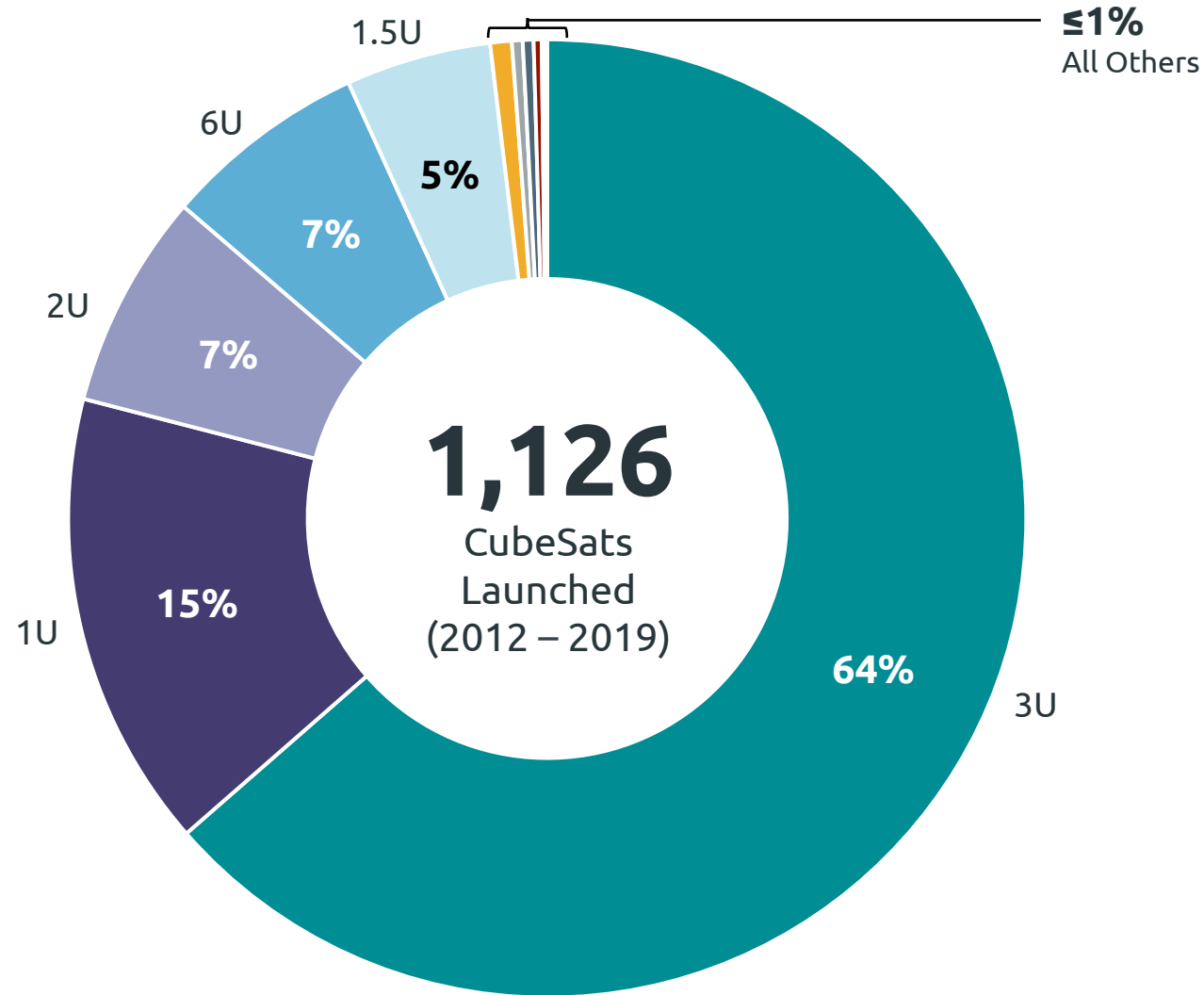


Share of CubeSats by Dimension

Smallsat Trends (2012 – 2019)

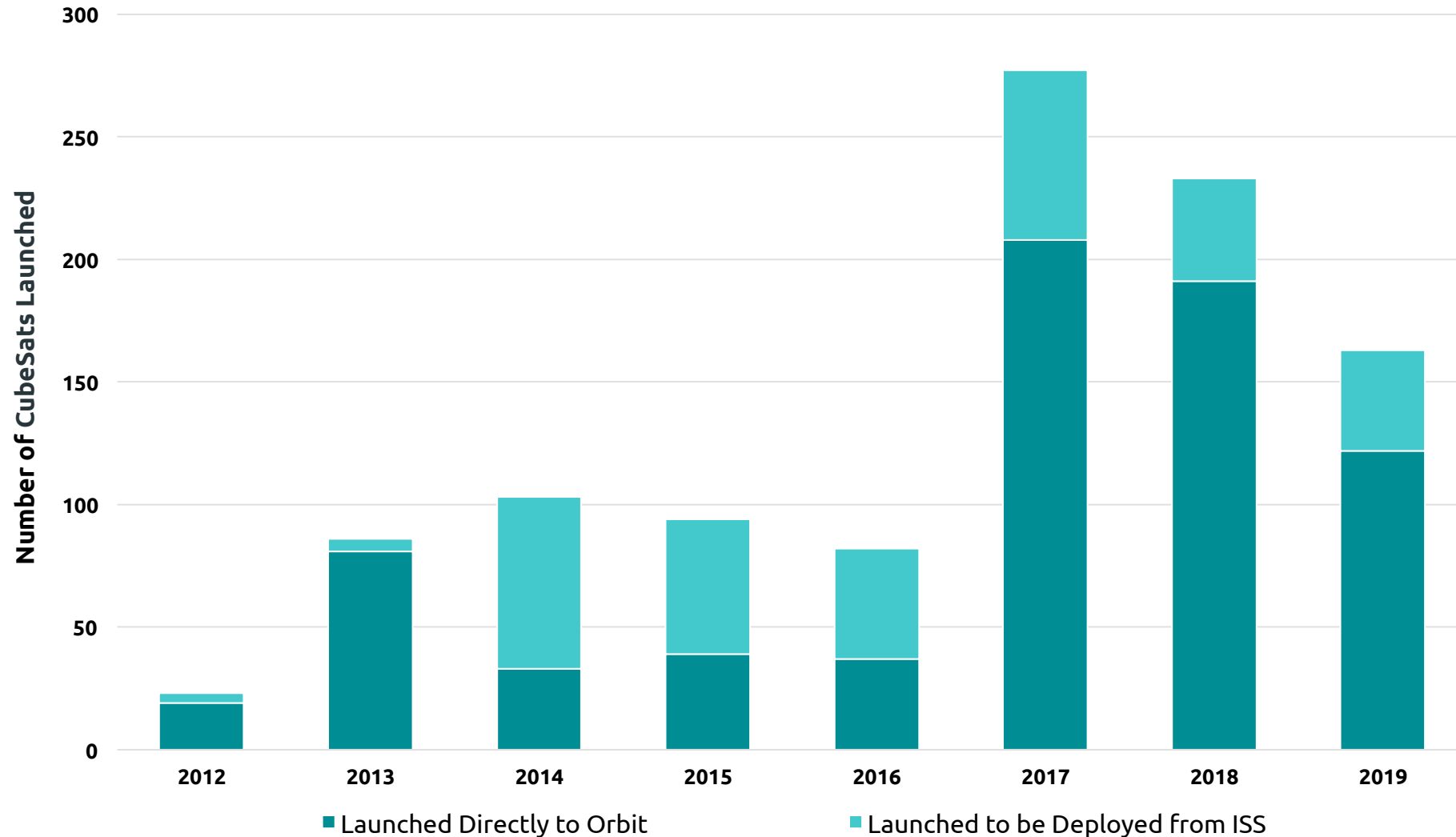
*CubeSats are a “kit” form of
smallsat with a standard form
factor*

- 1 kg, 10-centimeter cube = 1 unit = 1U
- Can combine to form larger CubeSats (e.g. 3U, 6U, more)



Number of CubeSats Launched Directly into Orbit vs Deployed From ISS

Smallsat Trends (2012 – 2019)



Commercial Smallsats Highlights



899 commercial smallsats launched, 2012 – 2019

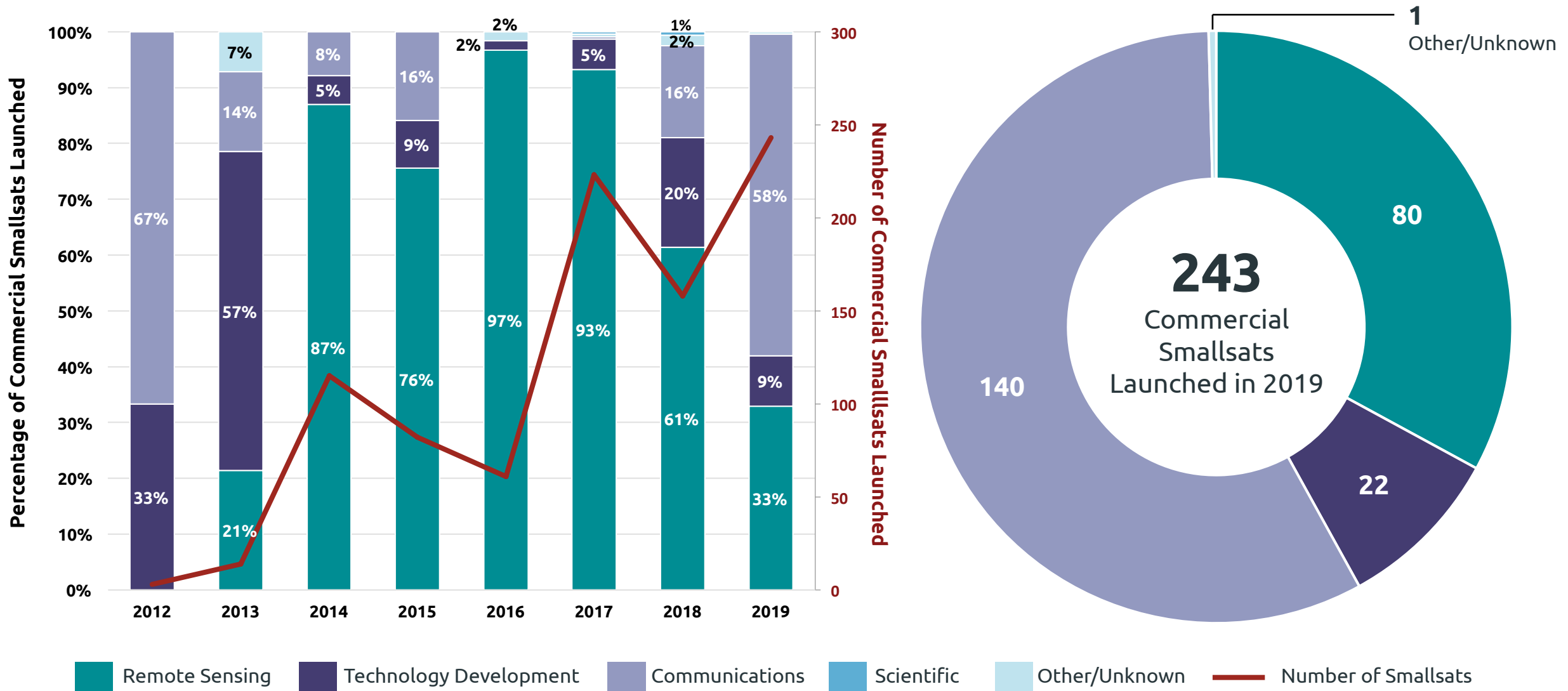
68% for remote sensing

81% manufactured by U.S. companies

70% owned by Planet, SpaceX, Spire (largest smallsat operators)

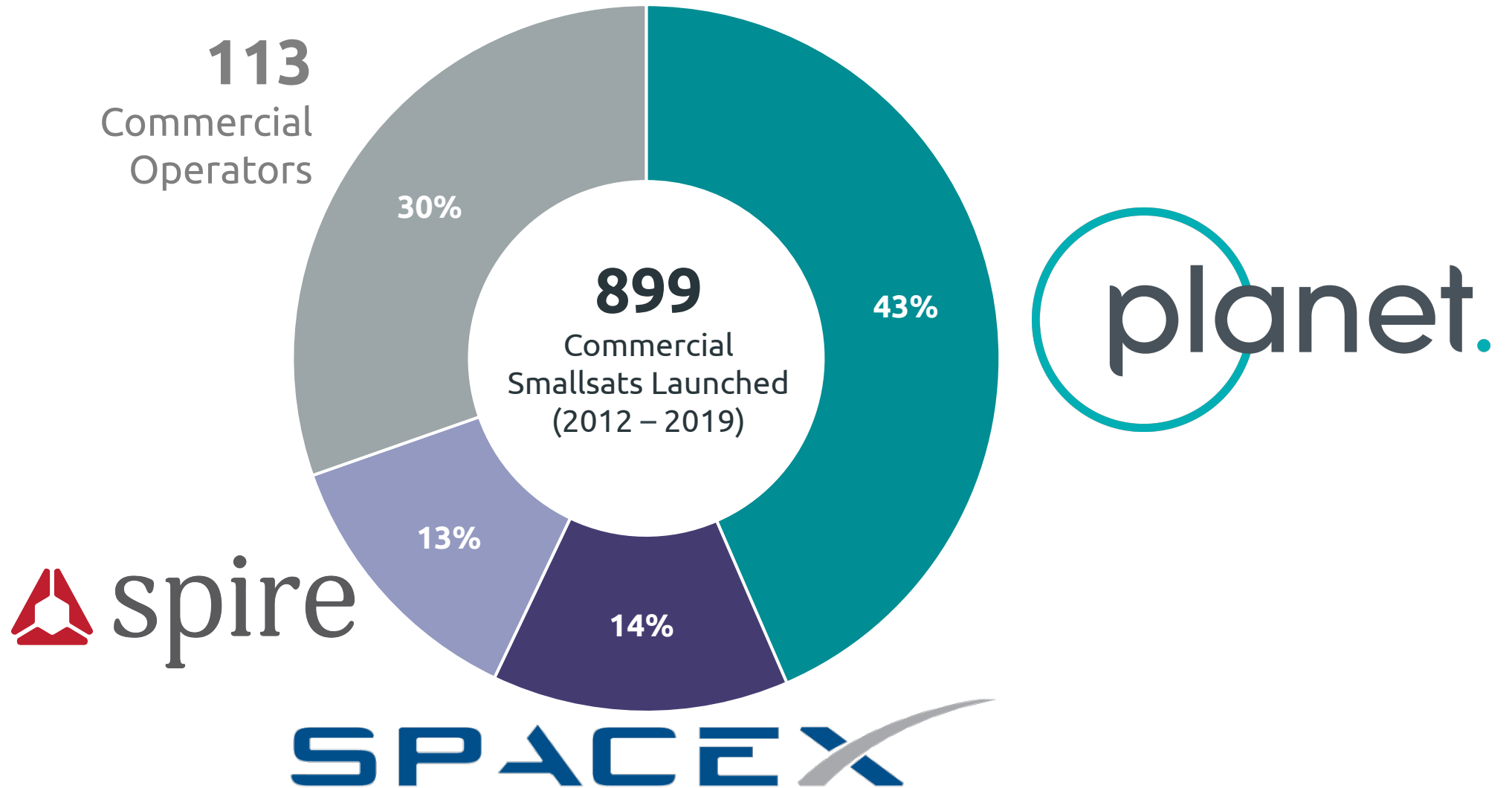
Commercial Smallsats by Use

Commercial Smallsats



Percentage by Operator

Commercial Smallsats



Government Smallsats Highlights



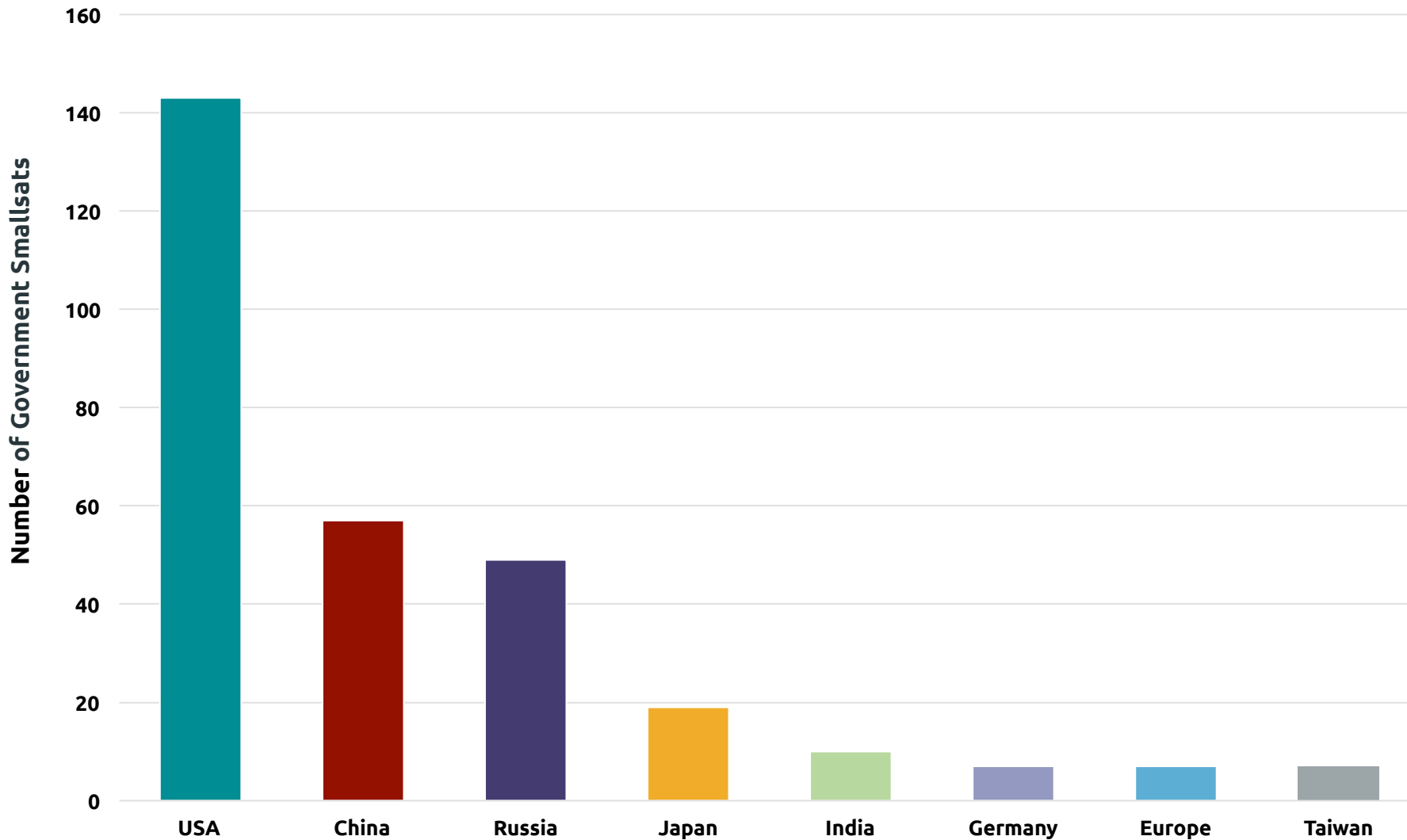
353 government smallsats launched 2012 – 2019

38% owned by U.S. government (about 1/3 NASA)

42 governments (including Europe) own smallsats

Total Number of Government Smallsats (2012 – 2019)

Government Smallsats



Six or Fewer Government Smallsats

Iran	Vietnam
Canada	Egypt
South Korea	Ecuador
Norway	Singapore
France	Belarus
Australia	Argentina
Algeria	Philippines
North Korea	Ethiopia
Israel	Colombia
United Kingdom	Malaysia
Poland	Kazakhstan
Brazil	Spain
Turkey	Mexico
Saudi Arabia	Pakistan
UAE	Peru
Indonesia	Rwanda
Italy	Sweden

Largest Government Smallsat Operators

Government Smallsats

Type	Operator	# of Satellites Launched 2012 – 2019
Civil	National Aeronautics and Space Administration (NASA)	51
	Russian Federal Space Agency (Roscosmos)	22
	Los Alamos National Laboratory (LANL), US	16
	Japan Aerospace Exploration Agency (JAXA)	12
	Indian Space Research Organisation (ISRO)	9
	Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR)	7
	European Space Agency (ESA)	7
	National Space Program Office (NSPO), Taiwan	7
Military <i>(based on public sources)</i>	US DoD	58
	Russia Ministry of Defence	21
	People's Liberation Army (PLA), China	22
	Project Biarri, Australia	3
	Korean People's Army	3

Academic and Non-Profit Smallsats Highlights



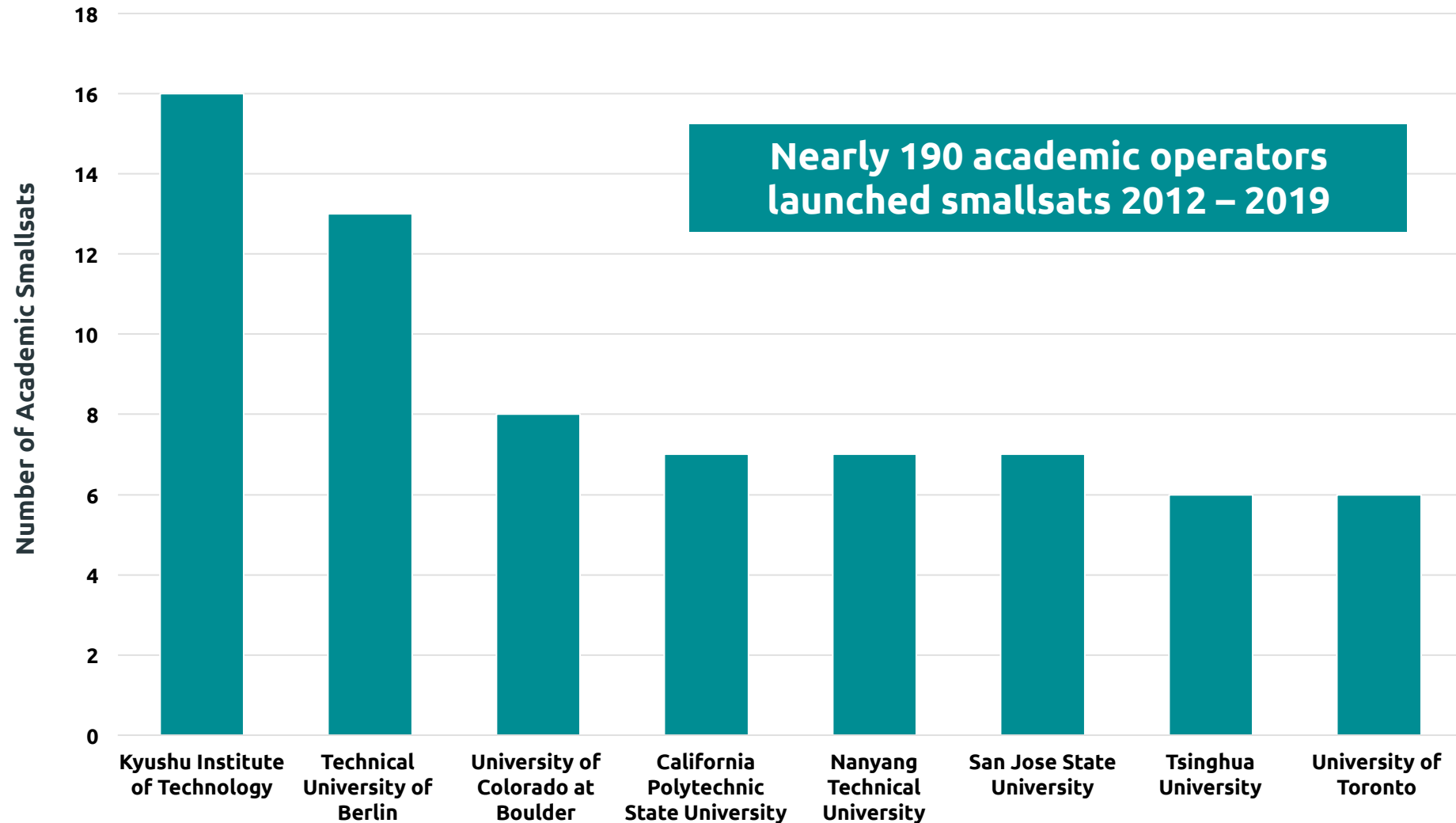
459 smallsats launched by academic (348) and non-profit (111) organizations 2012 – 2019

~80% for technology development

242 academic (189) and non-profit (53) organizations own smallsats (often only one or two)

Number of Academic Smallsats by Institution

Academic and Non-Profit Smallsats



Business Outcomes

Smallsat business ventures of all types continue efforts to prove both their business models and their ability to generate significant revenue. Financial outcomes of today's smallsat companies will impact the long-term smallsat market

Communications Constellations

Smallsat telecommunications operators have said they plan to launch tens of thousands of smallsats. Initial deployment of these large constellations will dominate smallsat activity in the next few years

Small Launch Vehicles

Dozens of new small launch vehicles (many <500kg capacity) are in development to launch smallsats. Governments are increasingly interested in small launch vehicles. Among commercial customers, competition from larger vehicles and uncertainty in smallsat business cases will shape the market

Orbital Debris

Large smallsat constellations raise concerns about orbital debris. How businesses and policy makers respond to debris risk will be a trend to watch in 2020

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