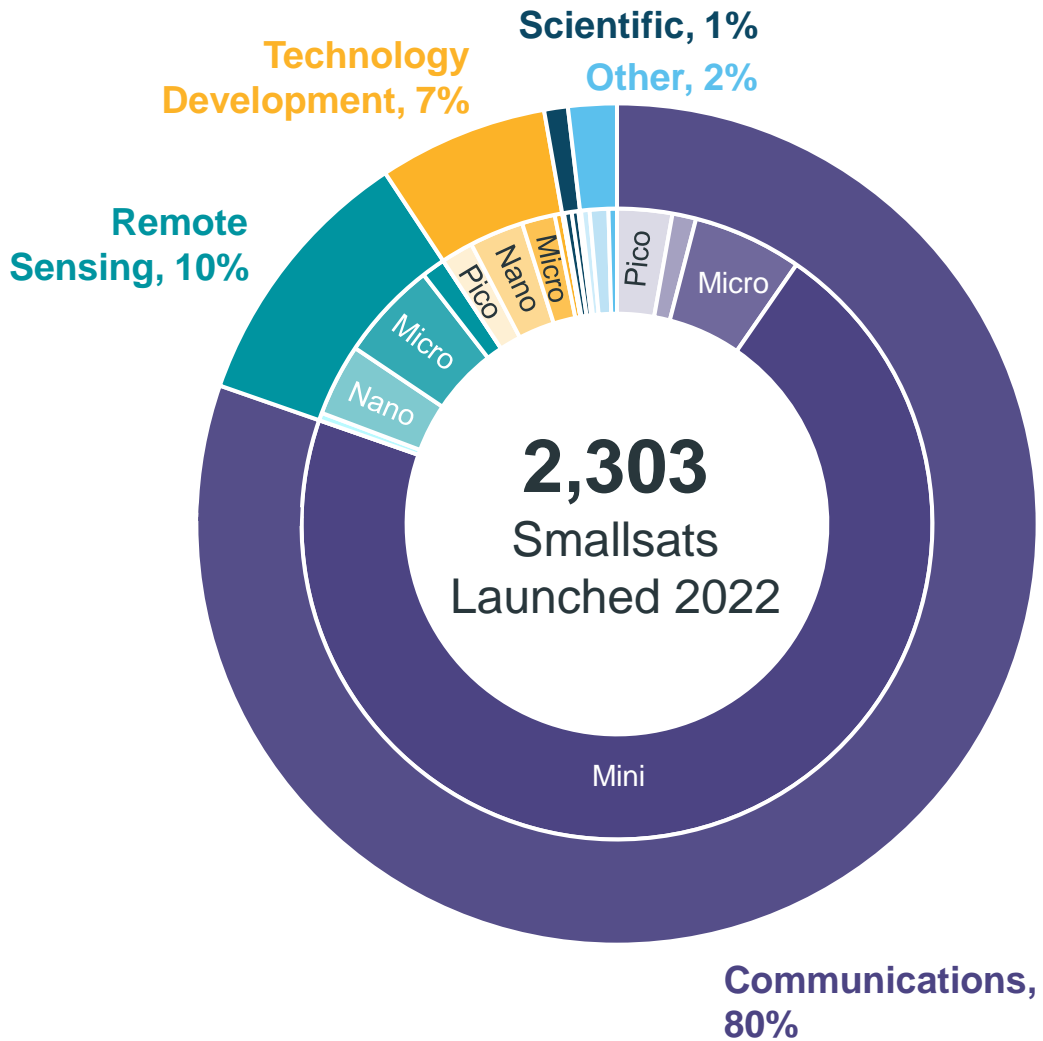


Smallsats by the Numbers 2023



Smallsats launched in 2022:

were **95%** of all spacecraft (2021: 94%)

accounted for **54%** of spacecraft upmass (2021: 43%)

were carried on **108** of 186 orbital launches (2021: 80)

totaled **33%** of all smallsats launched in the last decade (2020-2022: 76%)

included **7%** which launched on small or micro launch vehicles (2021: 6%)

- ✓ Smaller satellites have broken records and are transforming in-space architectures
- ✓ Bryce’s *Smallsats by the Numbers* presents historical information on smaller satellites launched 2013 – 2022
 - Definition used here, 600 kg and under, reflects the five smallest mass classes defined by the FAA
 - Report includes all smallsats launched regardless of operational status
 - Due to the large quantity of LEO broadband telecommunications smallsats launched in 2022, this report provides data views that both include and exclude these systems; views excluding LEO broadband telecommunications smallsat systems provide insight into trends in other types of systems

	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*

Smallsats in Context

Operator and Mission Type Trends

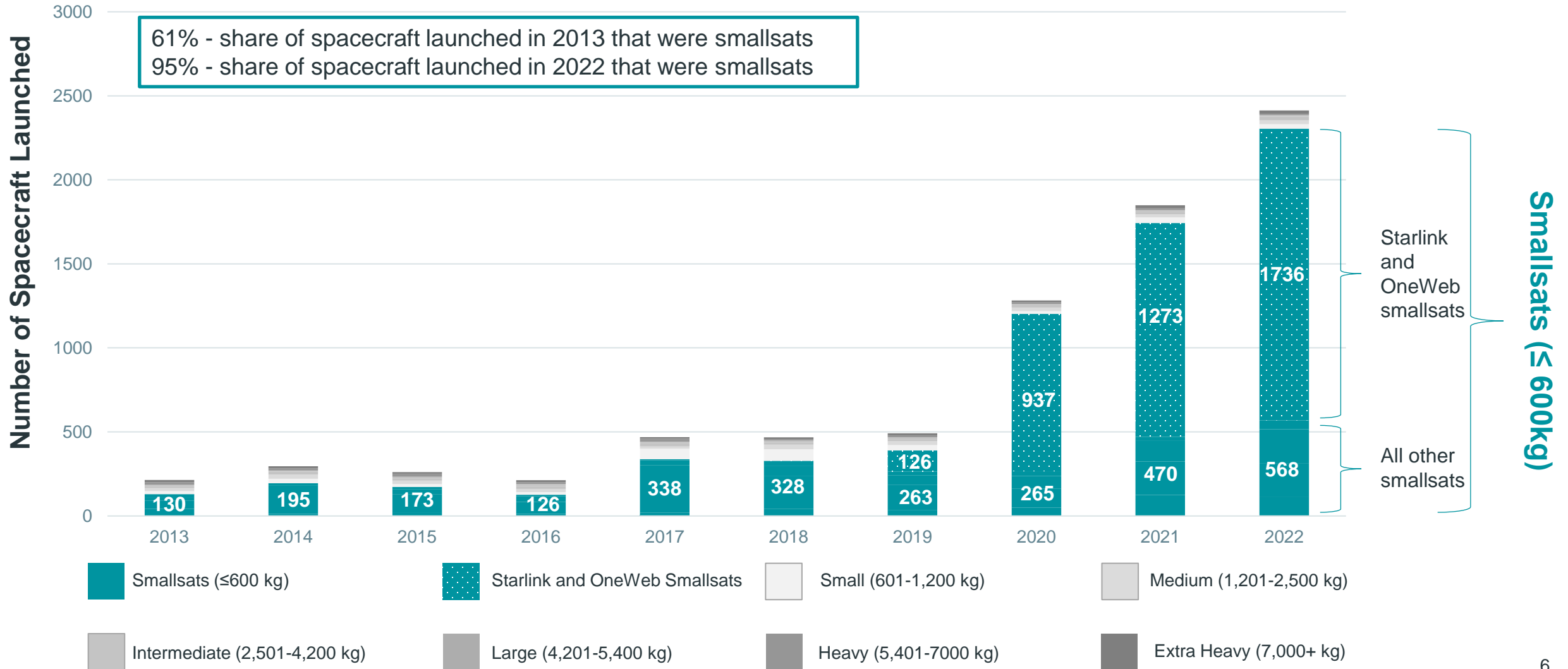
Smallsat Mass Trends

Smallsat Launch Trends

Looking Forward

Smallsats in Context

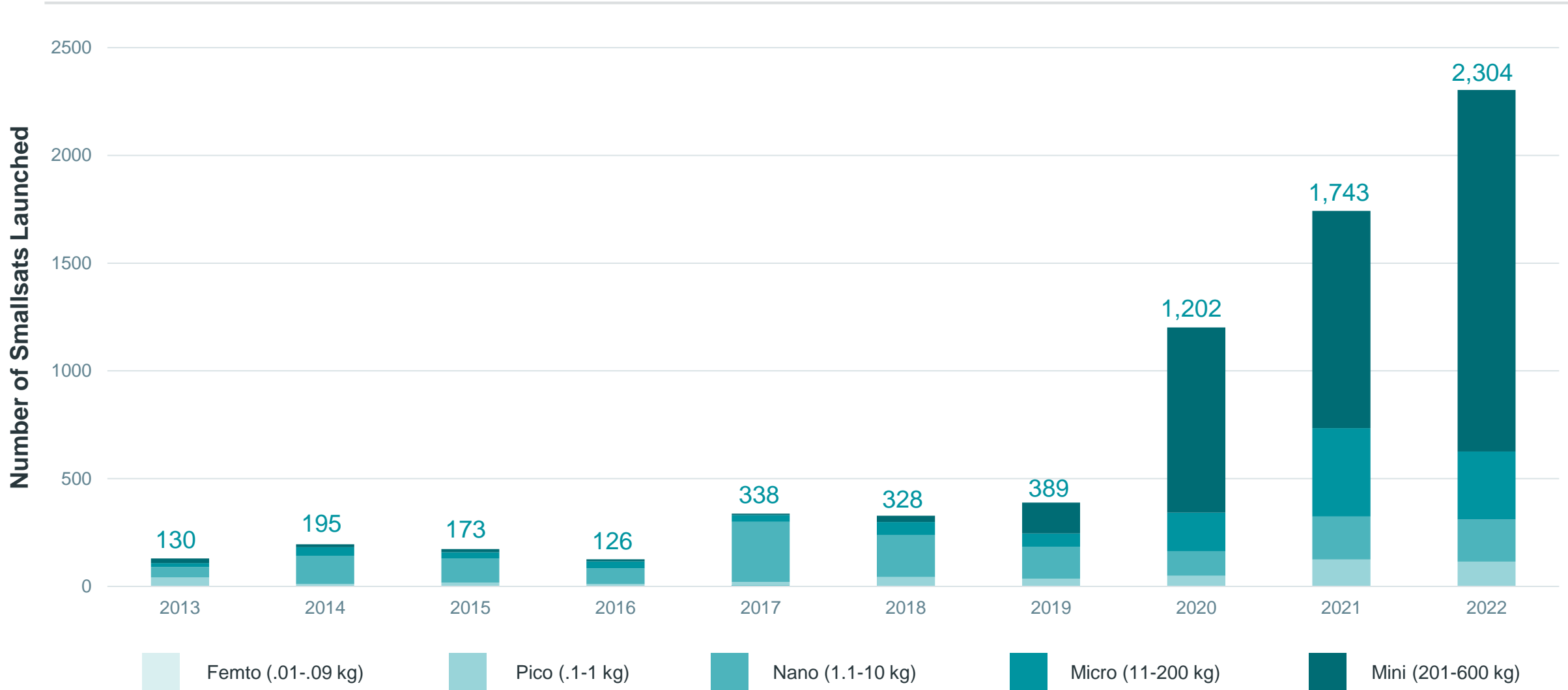
Spacecraft Launched 2013 – 2022, by Mass Class



Smallsats in Context



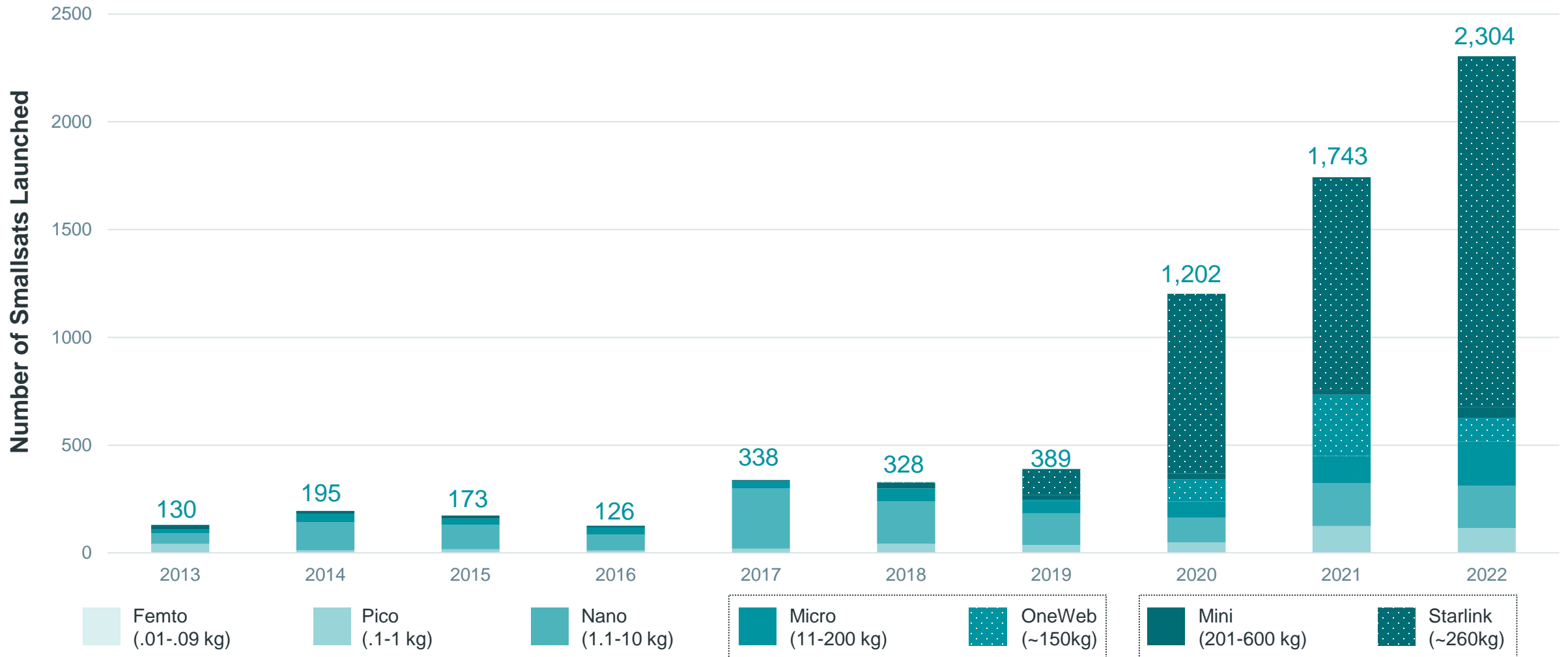
Smallsats 2013 – 2022, by Mass Class



Smallsats in Context



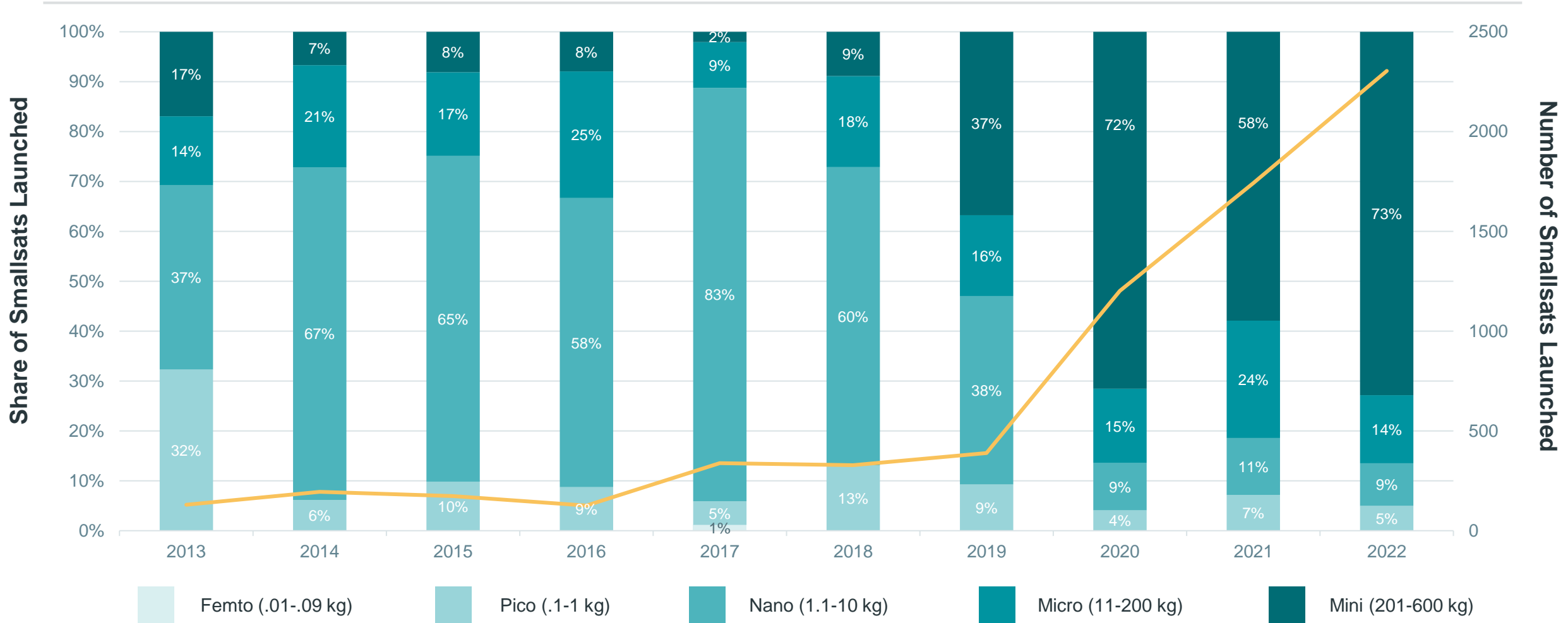
Smallsats 2013 – 2022, by Mass Class, Starlink and OneWeb Breakout



Smallsats in Context



Share of Smallsats 2013 – 2022, by Mass Class, Including Starlink and OneWeb

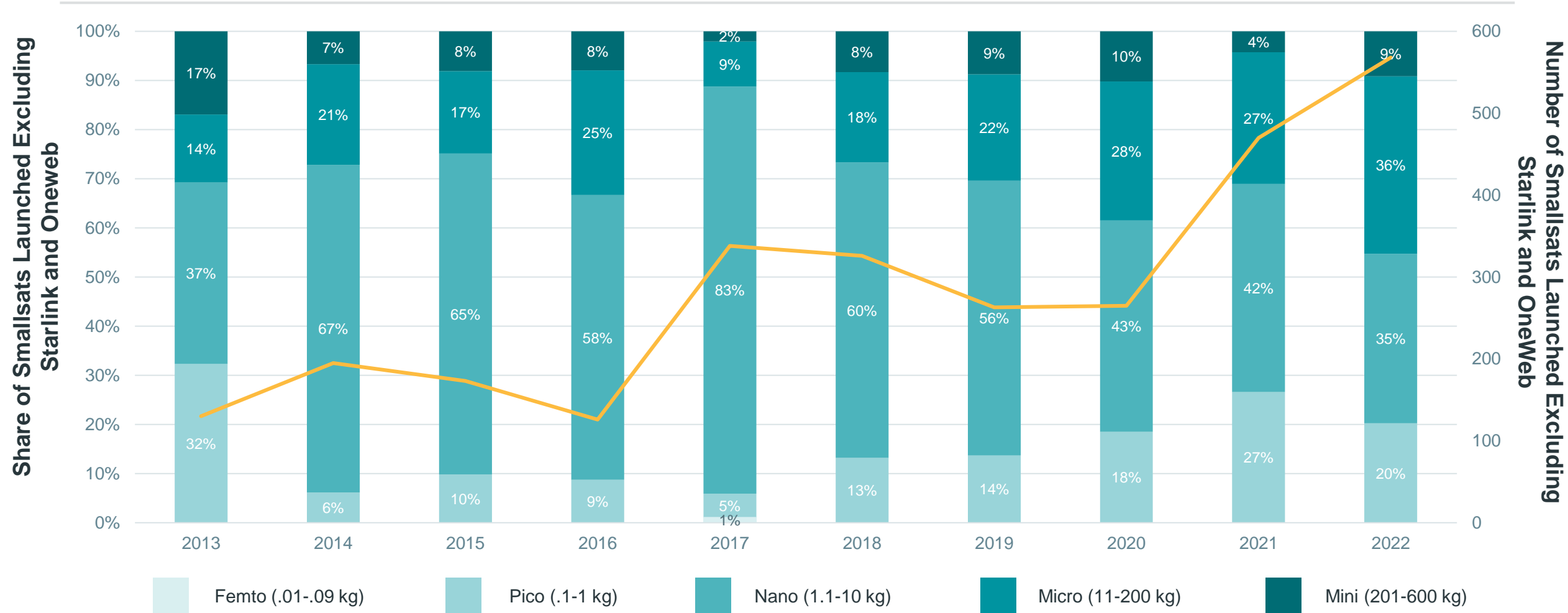


Mini satellite mass class (which includes Starlink) constituted the largest share of smallsats in 2022 and 55% of all smallsats launched in the last decade

Smallsats in Context



Share of Smallsats 2013 – 2022, by Mass Class, Excluding Starlink and OneWeb



Excluding Starlink and OneWeb, in 2022 micro satellites constituted the largest smallsat mass class, overtaking nano satellites for the first time since 2012

Smallsats in Context

Operator and Mission Type Trends

Smallsat Mass Trends

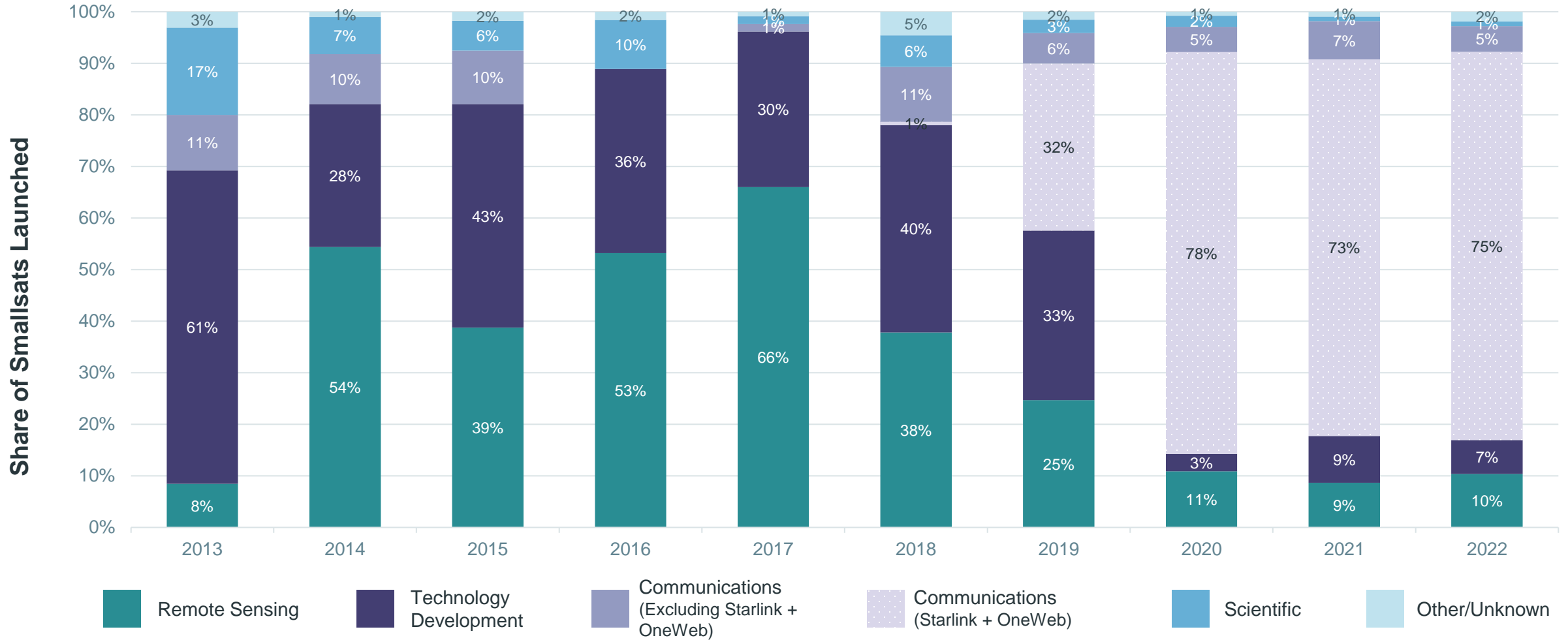
Smallsat Launch Trends

Looking Forward

Operator and Mission Type Trends



Smallsats 2013 – 2022, by Application, Including Starlink and OneWeb

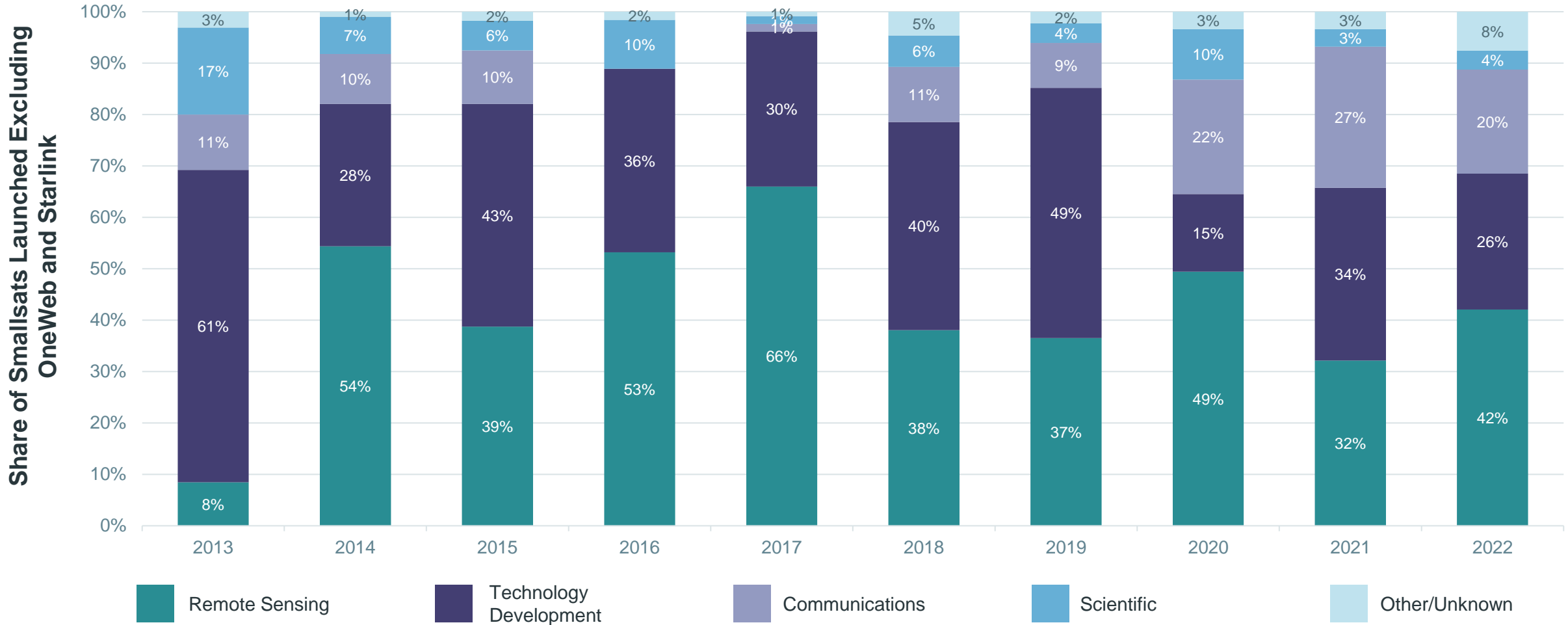


Communications satellites constitute the largest share of smallsats in 2022. Relative share of remote sensing and technology development smallsats has decreased due to launch of LEO communication smallsats

Operator and Mission Type Trends



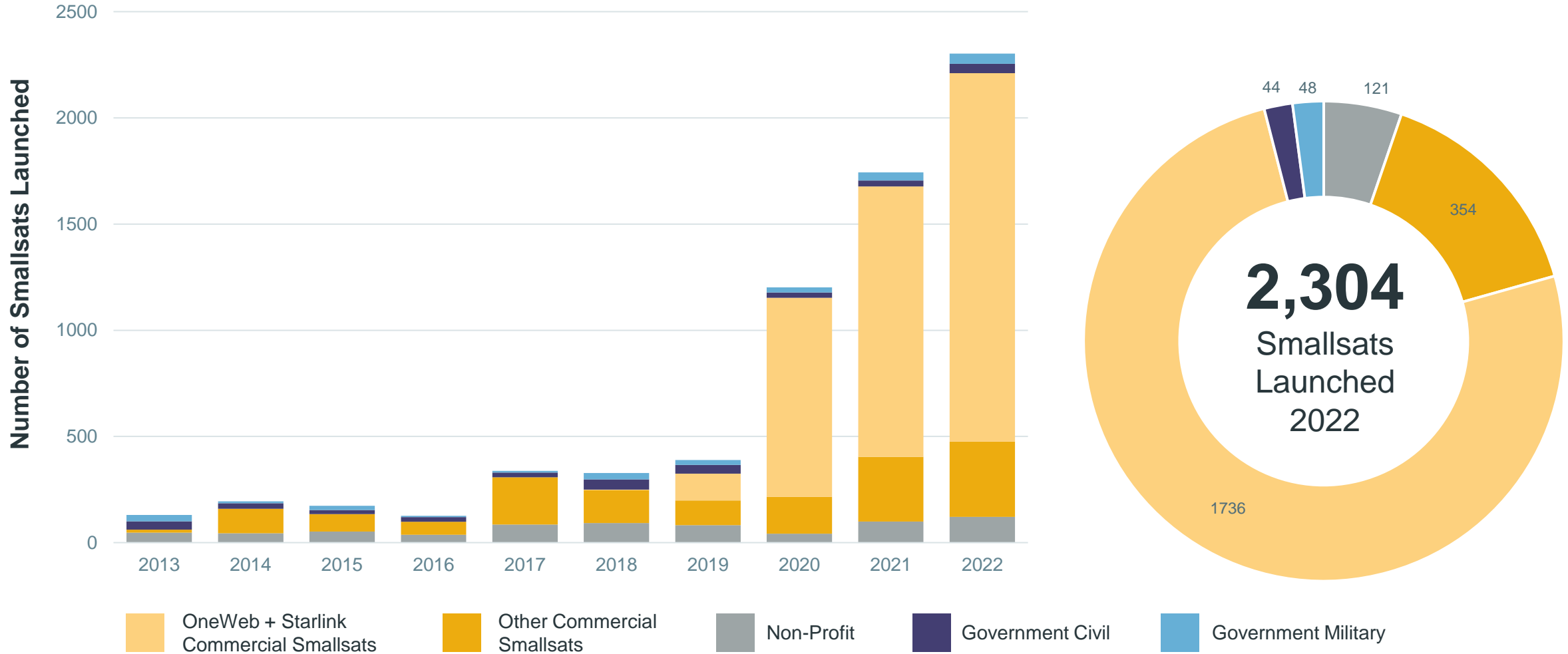
Smallsats 2013 – 2022, by Application, Excluding OneWeb and Starlink



Excluding Starlink and OneWeb, remote sensing and technology demonstration smallsats have constituted the largest share of smallsats in the last decade

Operator and Mission Type Trends

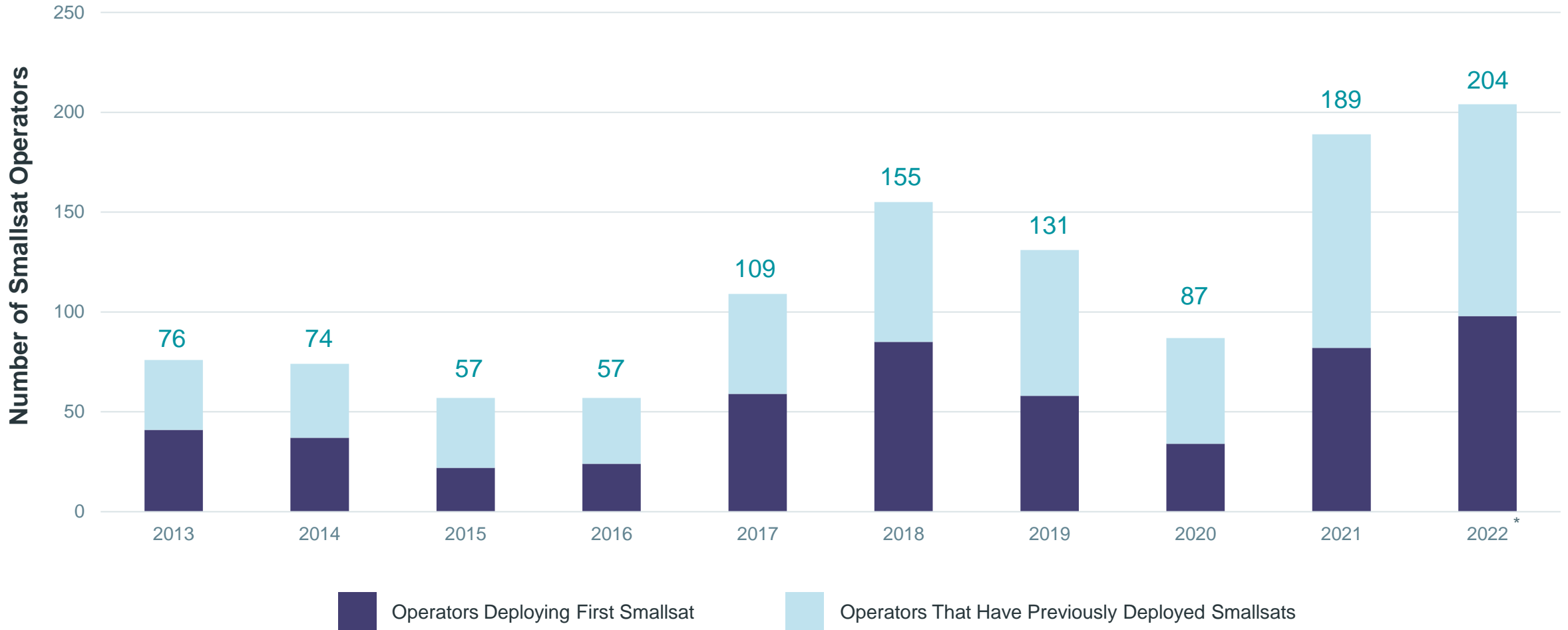
Number of Smallsats 2013 – 2022, by Operator Type



Number of commercial smallsats launched increased from 14 smallsats in 2013 to 2,090 in 2022

Operator and Mission Type Trends

Operators Deploying Smallsats 2013 – 2022

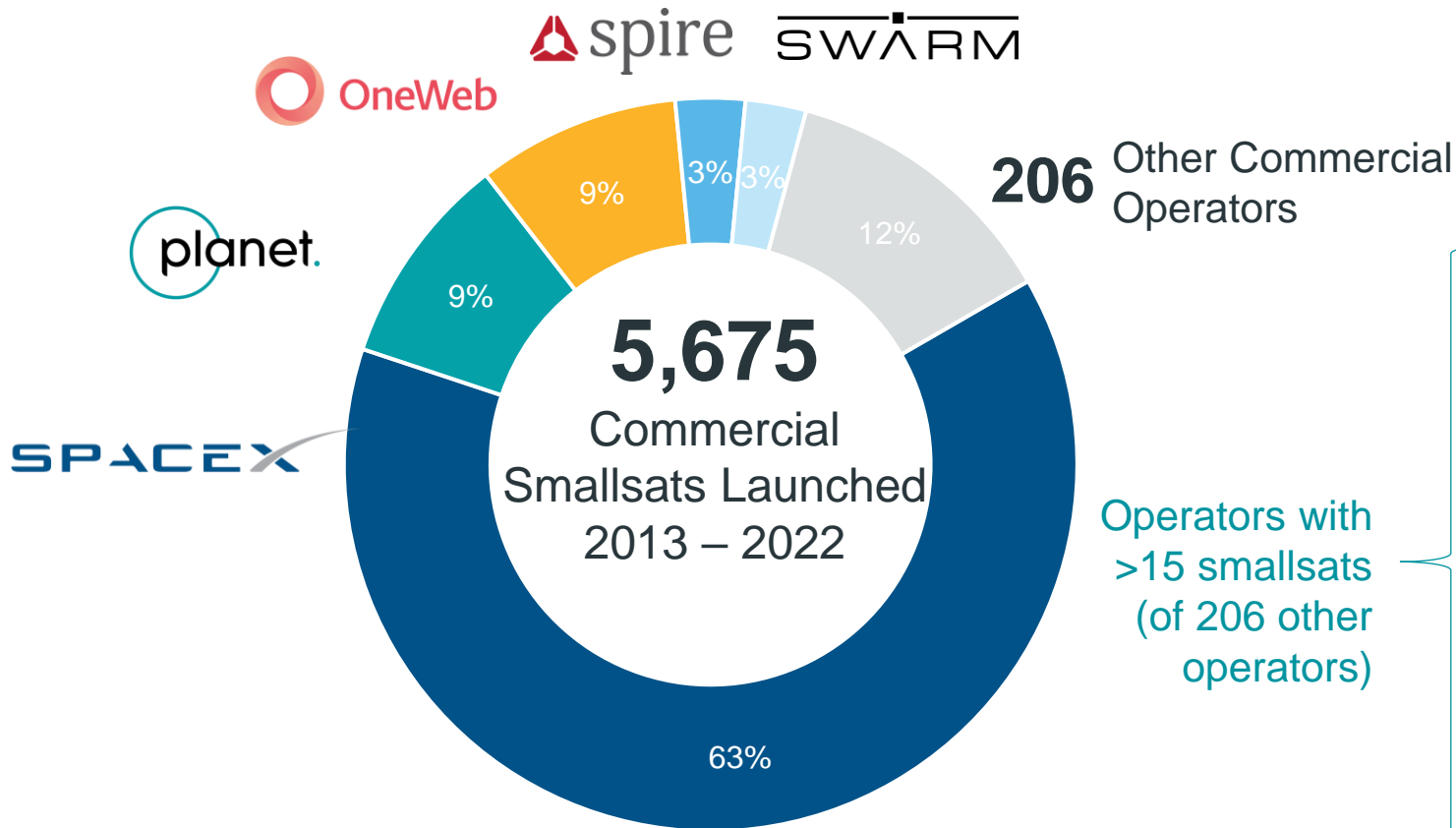


Includes government and commercial operators
*Some 2022 operator information not available

Operator and Mission Type Trends

Commercial Smallsat Operators 2013 – 2022

88% of smallsats launched 2013 – 2022 are owned by 5 operators



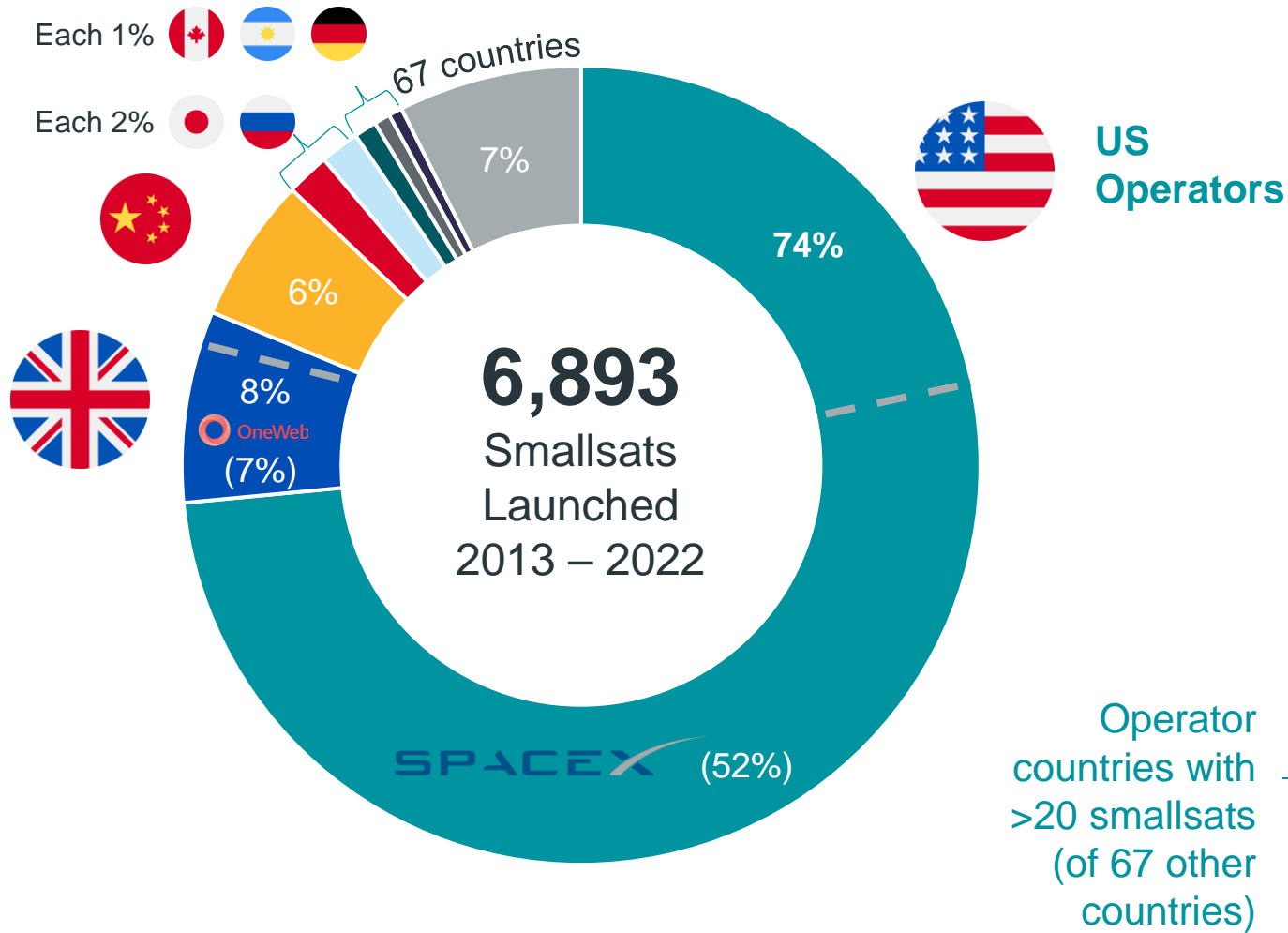
Operators with >15 smallsats

Operator	# of Smallsats
SpaceX	3570
Planet	529
OneWeb	504
Swarm Technologies	173
Spire Global	151
CGSTL	87
Satellogic	34
ICEYE	19
Kepler	19
Spacety	18
ORBCOMM	17
BlackSky	16
Astrocast	16
BlackSky Global	16
Guodian Gaoke	16

Operators with >15 smallsats (of 206 other operators)

Operator and Mission Type Trends

Smallsats 2013 – 2022, by Operator Country

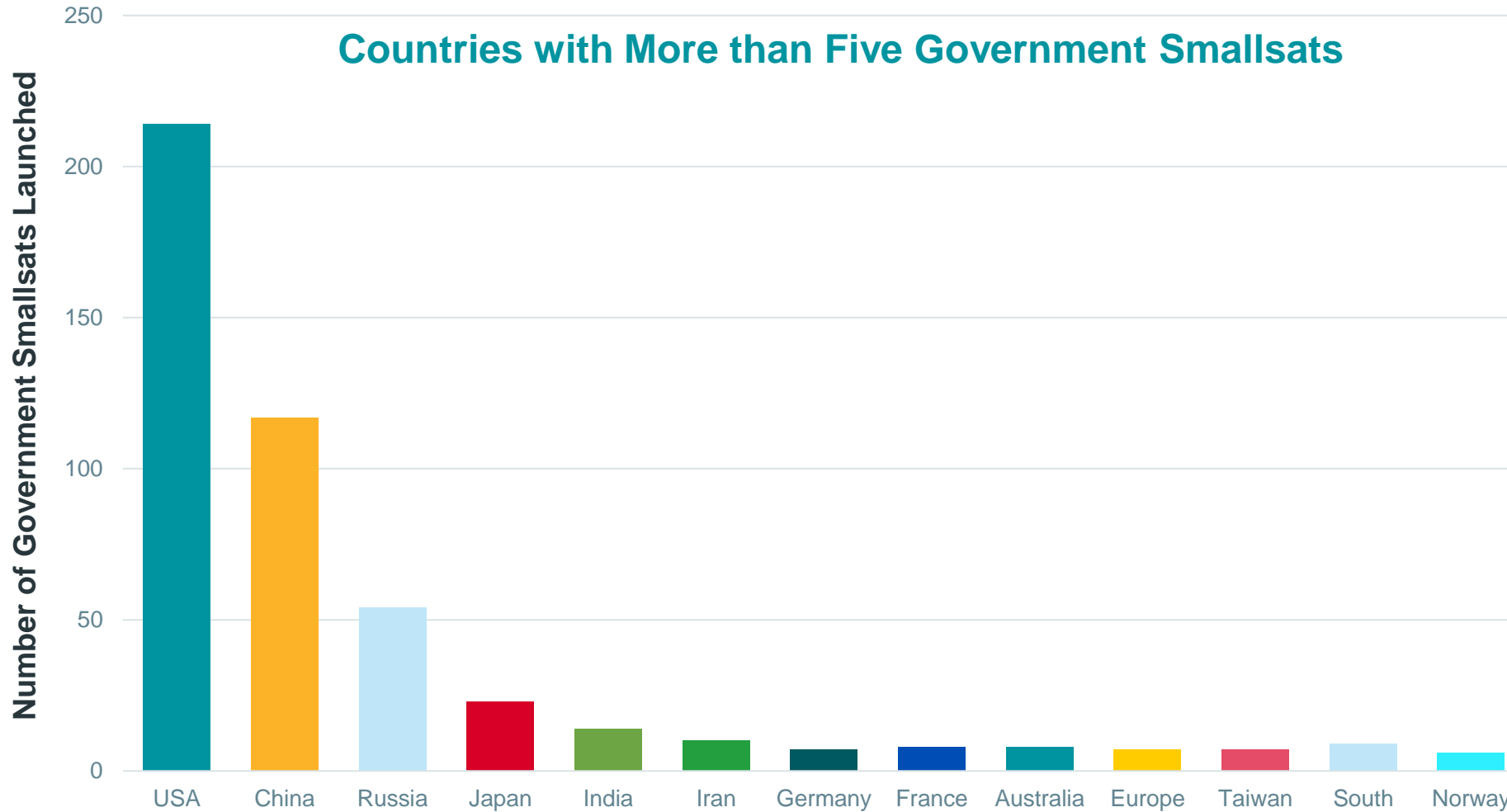


Operator Country	# of Smallsats
USA	5,066 (3,570 Starlink)
UK	535 (504 OneWeb)
China	404
Japan	121
Russia	109
Germany	63
Canada	45
Argentina	38
France	30
Australia	26
Italy	27
South Korea	27
India	29
Spain	34
Finland	27
Israel	27
Switzerland	21

Operator countries with >20 smallsats (of 67 other countries)

Operator and Mission Type Trends

Number of Government Smallsats 2013 – 2022, by Country



Five or Fewer Government Smallsats	
Argentina	Canada
Israel	United Kingdom
Saudi Arabia	Algeria
UAE	Italy
North Korea	Ecuador
Poland	Sweden
Ethiopia	Turkey
Indonesia	Rwanda
Egypt	Netherlands
Spain	Slovenia
Belarus	Colombia
Malaysia	Kazakhstan
Brazil	Thailand
Mexico	Pakistan
Peru	Belgium
Vietnam	Philippines
Singapore	

Operator and Mission Type Trends



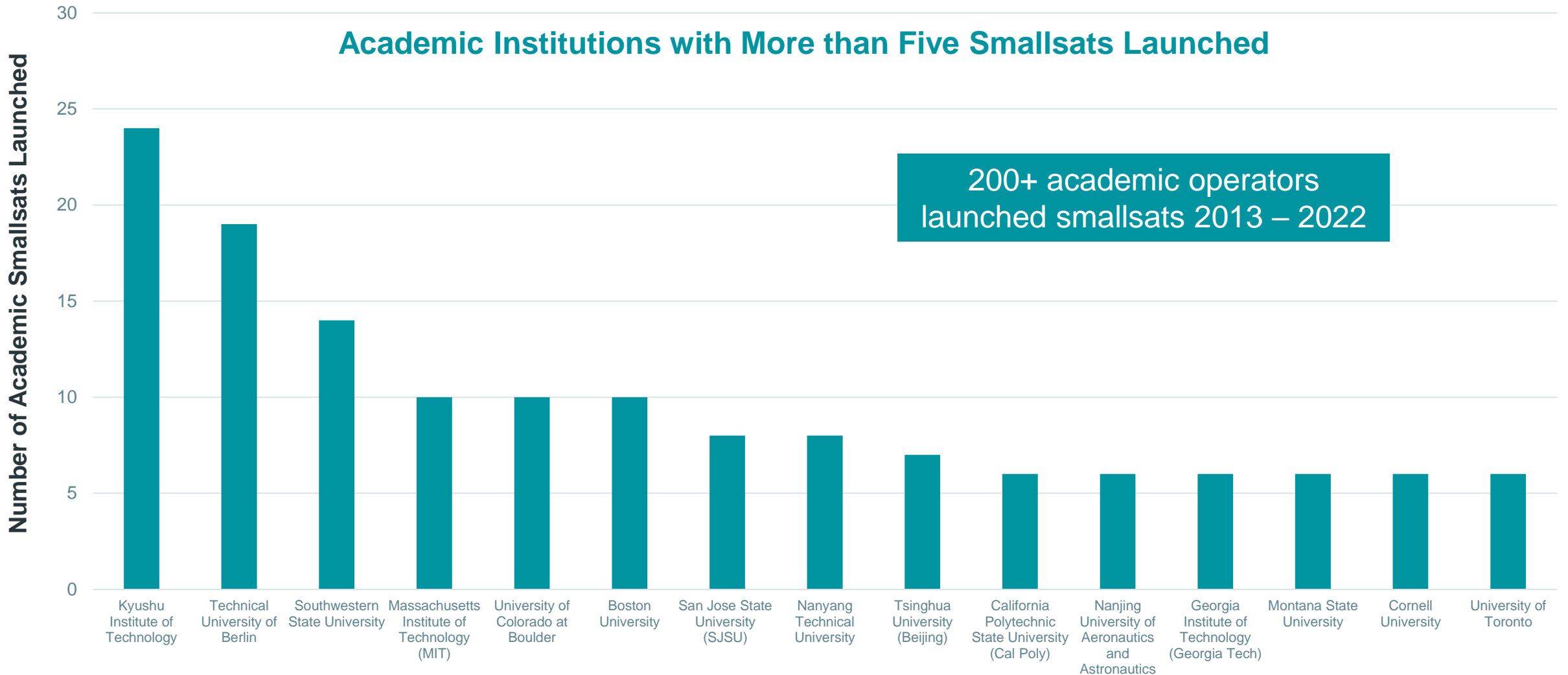
Largest Government Smallsat Operators 2013 – 2022

Type	Largest Government Operators Open-Source Data	Country	# of Smallsats Launched
Civil	National Aeronautics and Astronautics and Space Administration	USA	67
	Los Alamos National Laboratory (LANL)	USA	21
	Japan Aerospace Exploration Agency (JAXA)	Japan	15
	Gonets Satcom	Russia	12
	Indian Space Research Organisation (ISRO)	India	12
	Roscosmos	Russia	11
	China Academy of Space Technology (CAST)	China	11
	Chinese Academy of Sciences	China	9
	Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR)	Germany	7
	Iranian Space Agency	Iran	7*
	European Space Agency (ESA)	Multinational	7
	National Space Program Office (NSPO)	Taiwan	7
National Security	US Department of Defense	USA	94
	People's Liberation Army	China	40
	Russia MoD/Aerospace Forces	Russia	24
	National University of Defence Technology (NUDT)	China	13
	National Reconnaissance Office	USA	13

*No successful deployments. BryceTech includes launched smallsats regardless of operational status

Operator and Mission Type Trends

Number of Academic Smallsats 2013 – 2022, by Institution



Smallsats in Context

Operator and Mission Type Trends

Smallsat Mass Trends

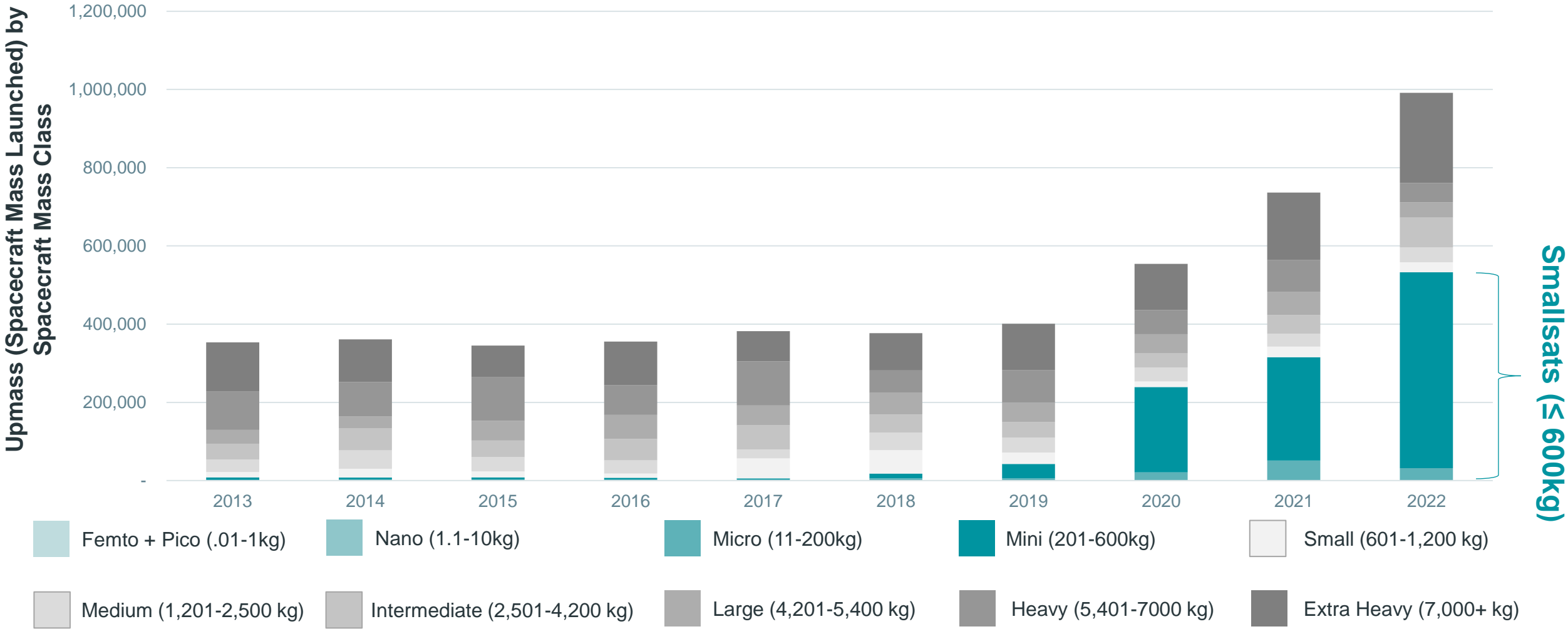
Smallsat Launch Trends

Looking Forward

Smallsat Mass Trends



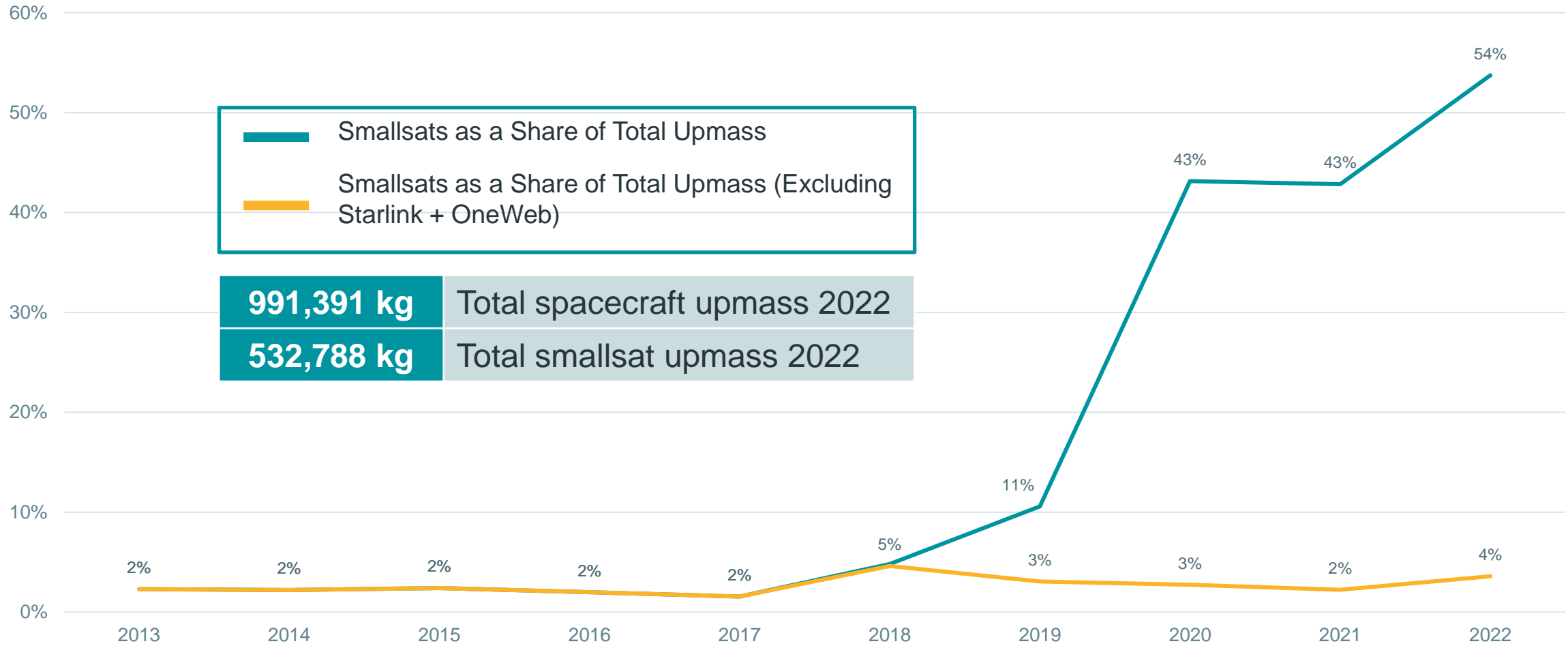
Spacecraft Upmass 2013 – 2022, by Spacecraft Mass Class



Smallsat Mass Trends

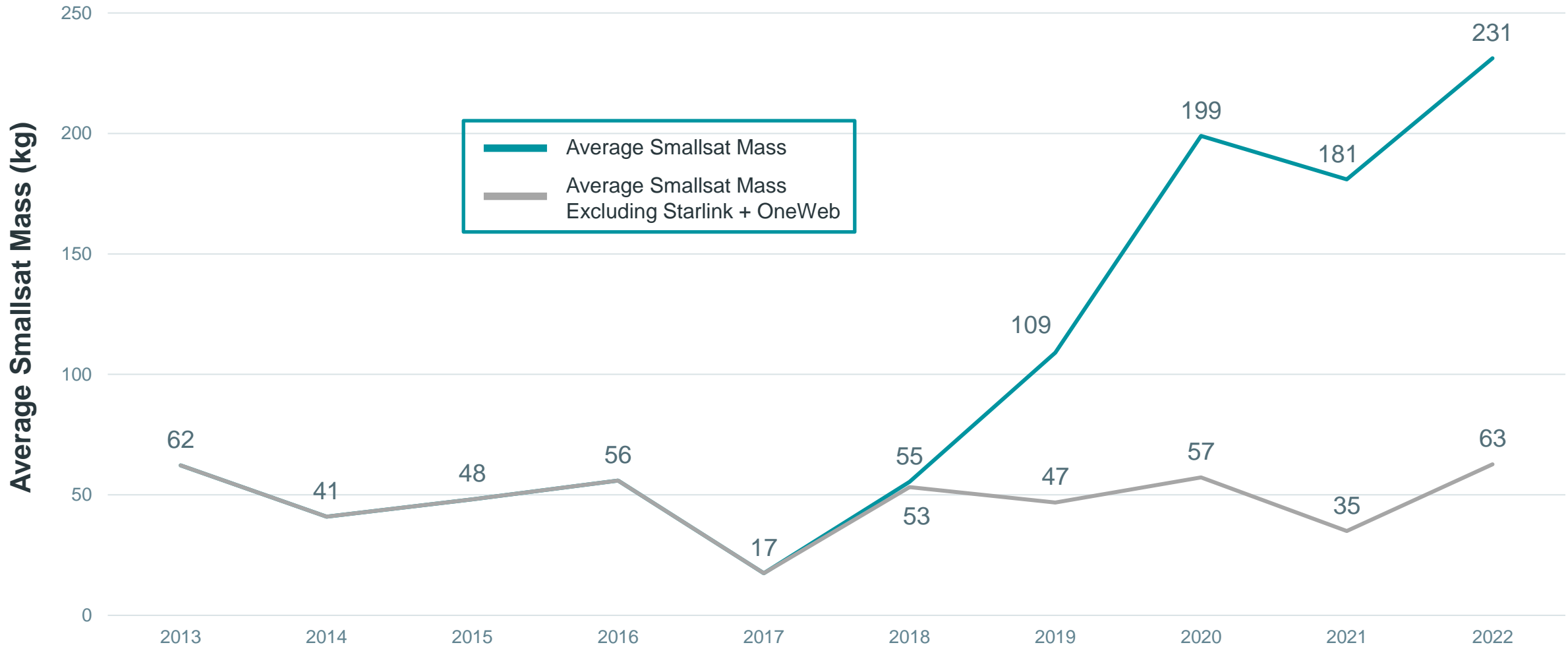
Smallsats as a Share of Total Upmass 2013 – 2022

Share of Total Mass Launched



Smallsat Mass Trends

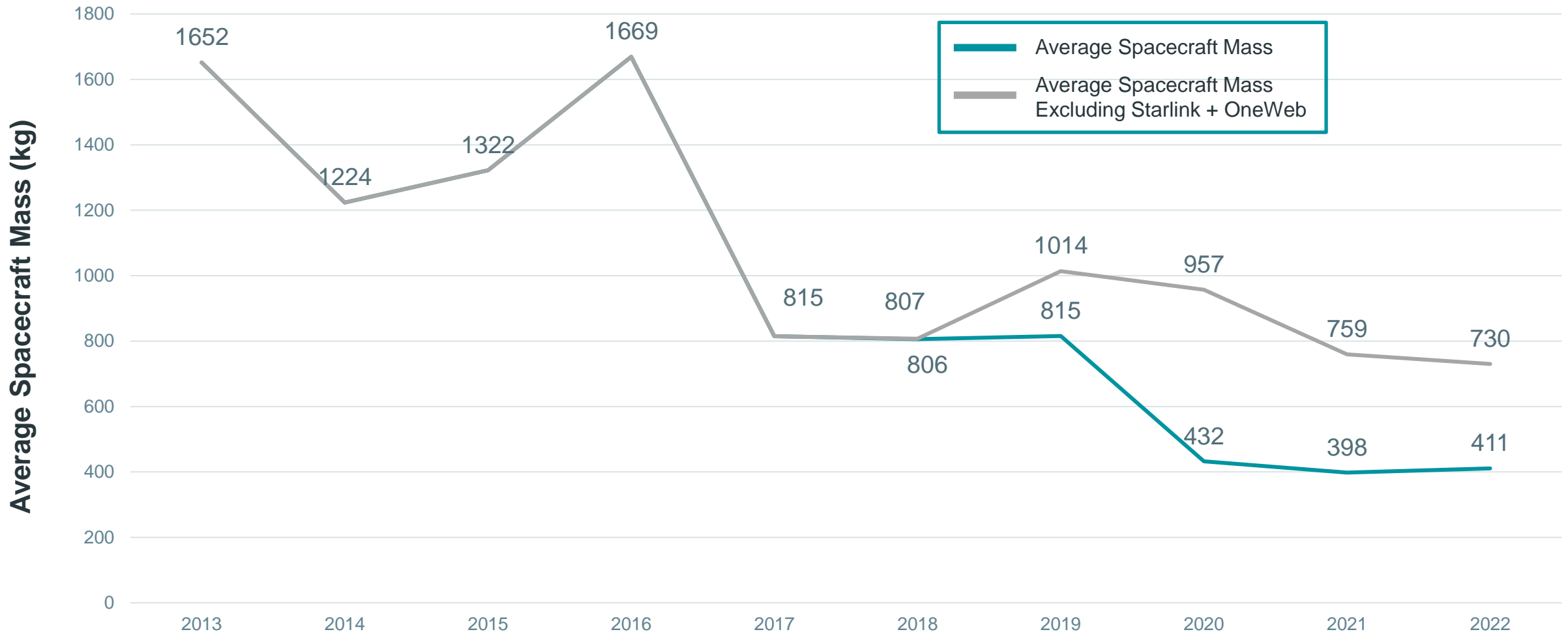
Average Smallsat Mass 2013 – 2022



Smallsat Mass Trends



Average Spacecraft Mass 2013 – 2022



Deployment of large numbers of smallsats reduces the average spacecraft mass

Smallsats in Context

Operator and Mission Type Trends

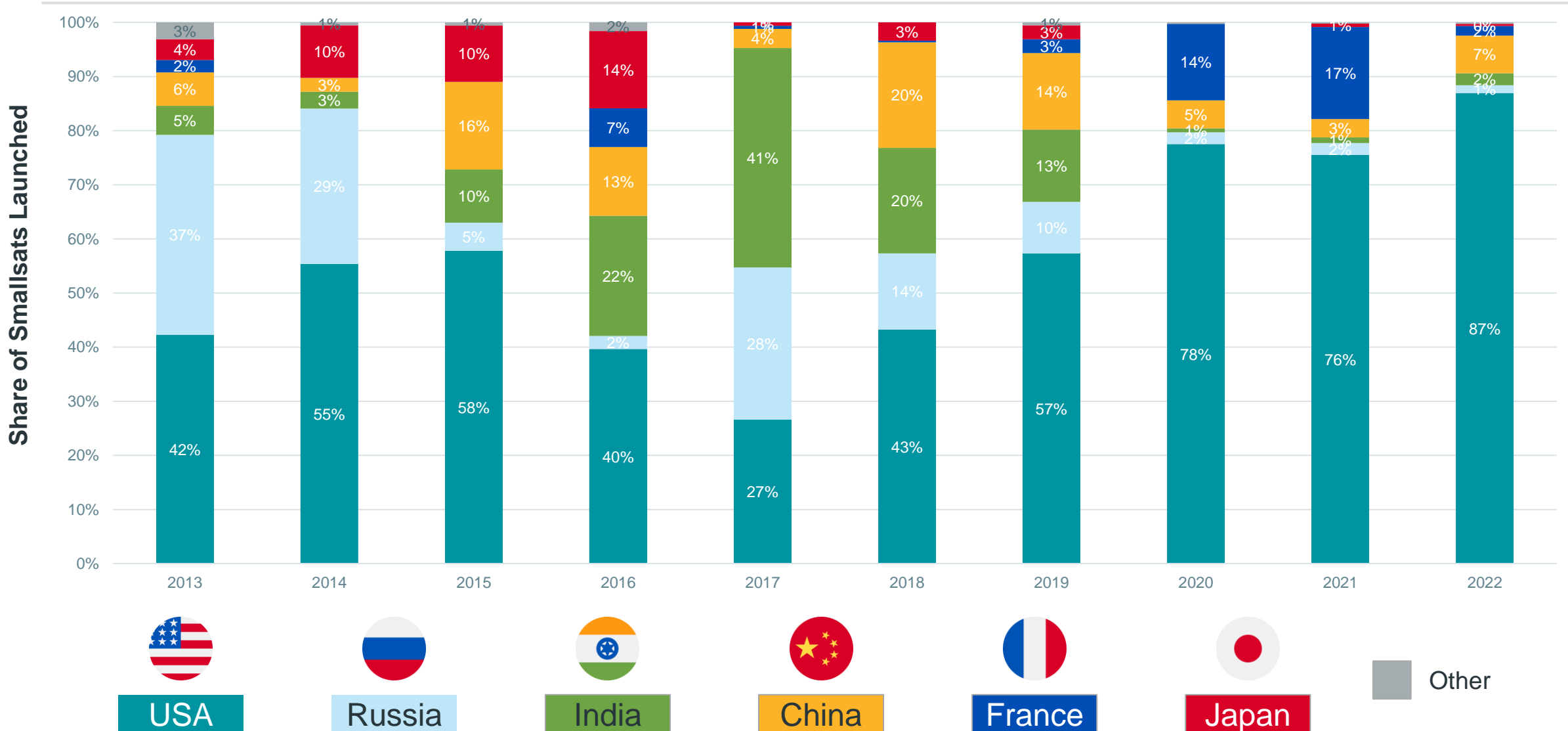
Smallsat Mass Trends

Smallsat Launch Trends

Looking Forward

Smallsat Launch Trends

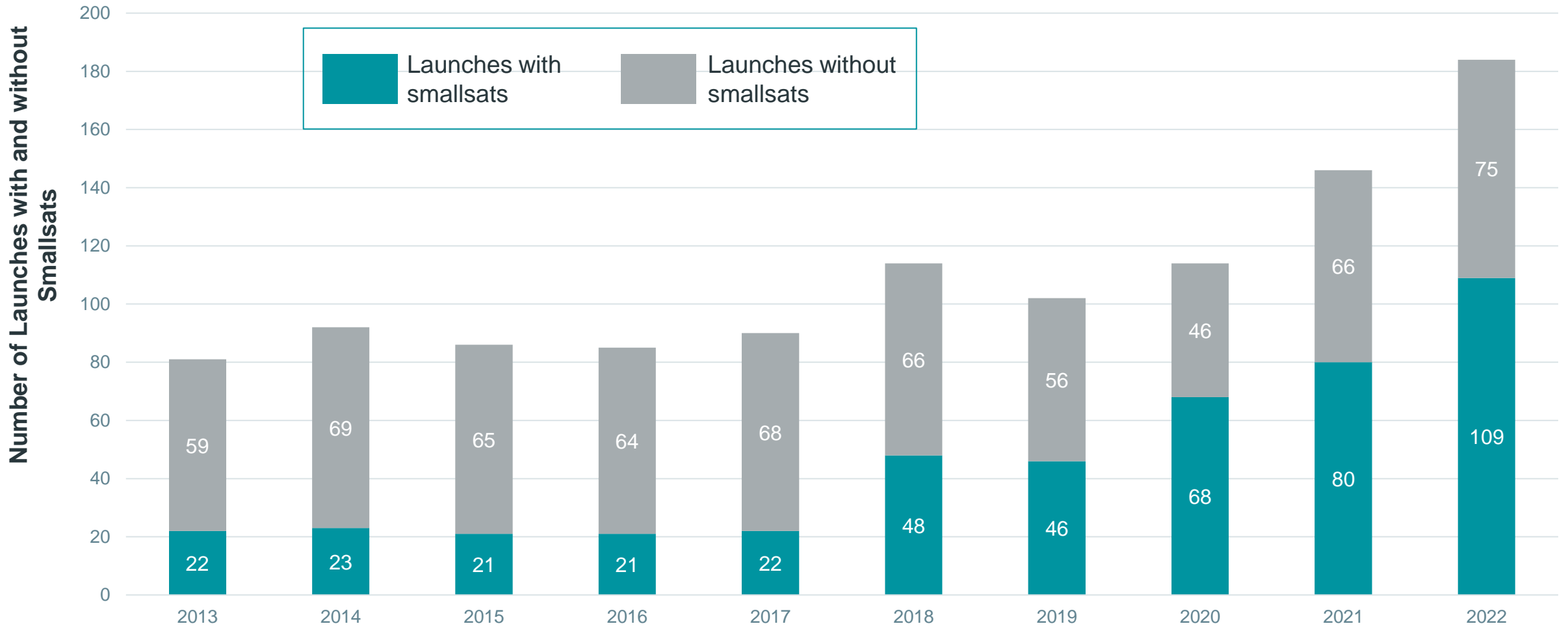
Smallsats 2013 – 2022, by Country of Launch Provider



Smallsat Launch Trends



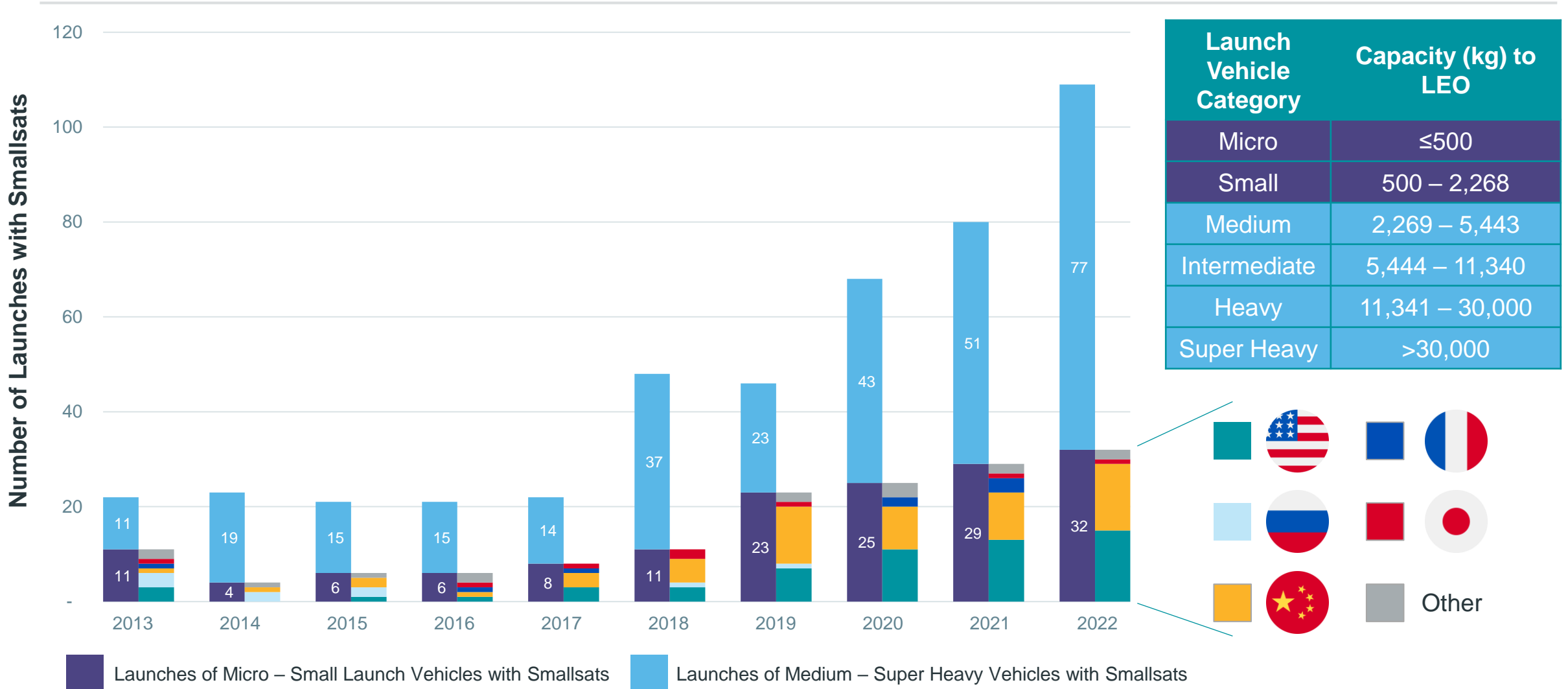
Number of Launches with Smallsats 2013 – 2022



Number of launches carrying smallsats has generally increased over time. Since 2020, more than half of orbital launches have carried smallsats

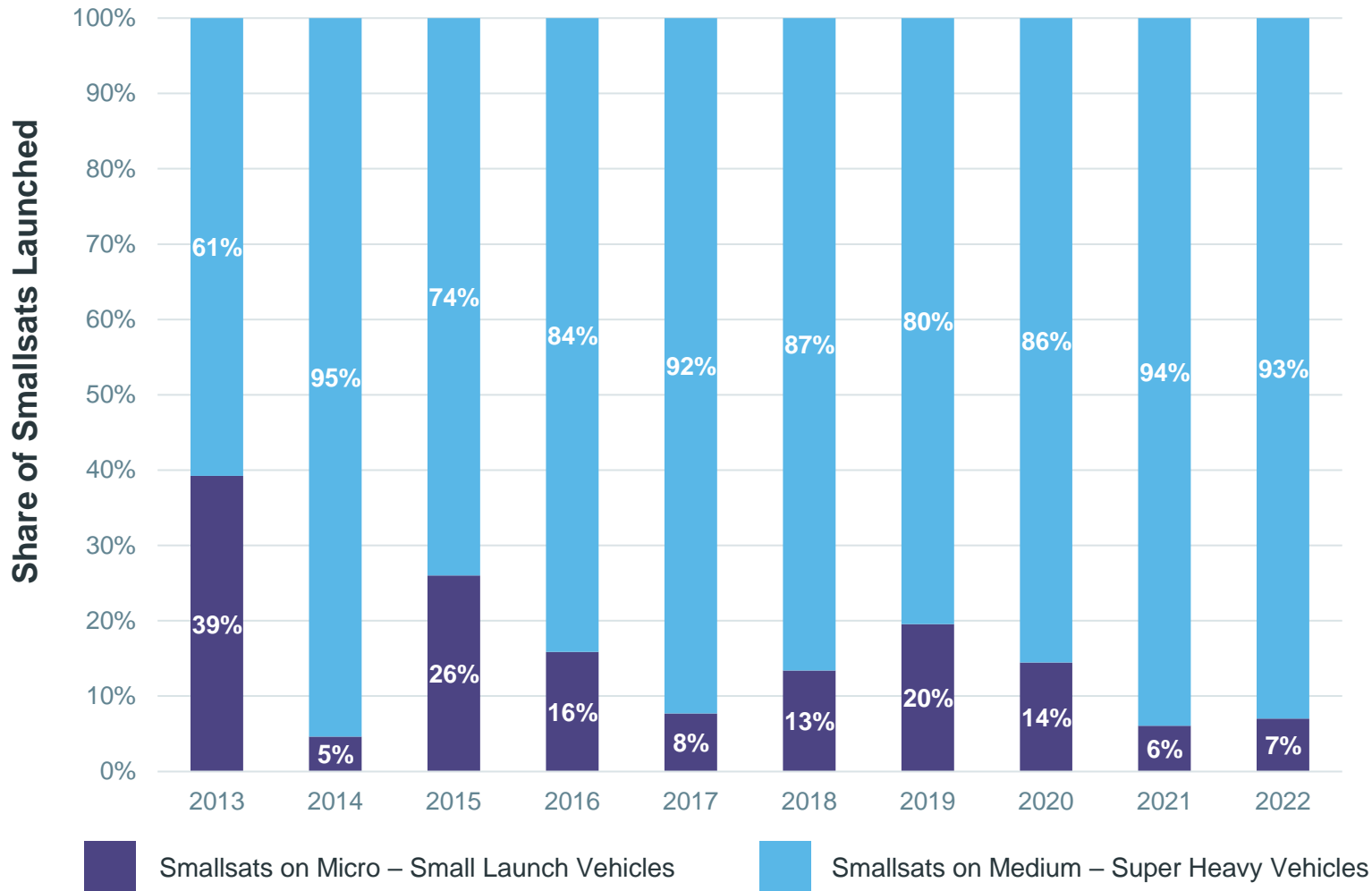
Smallsat Launch Trends

Number of Launches with Smallsats 2013 – 2022, by Launch Vehicle Category



Smallsat Launch Trends

Smallsats 2013 – 2022, by Launch Vehicle Category

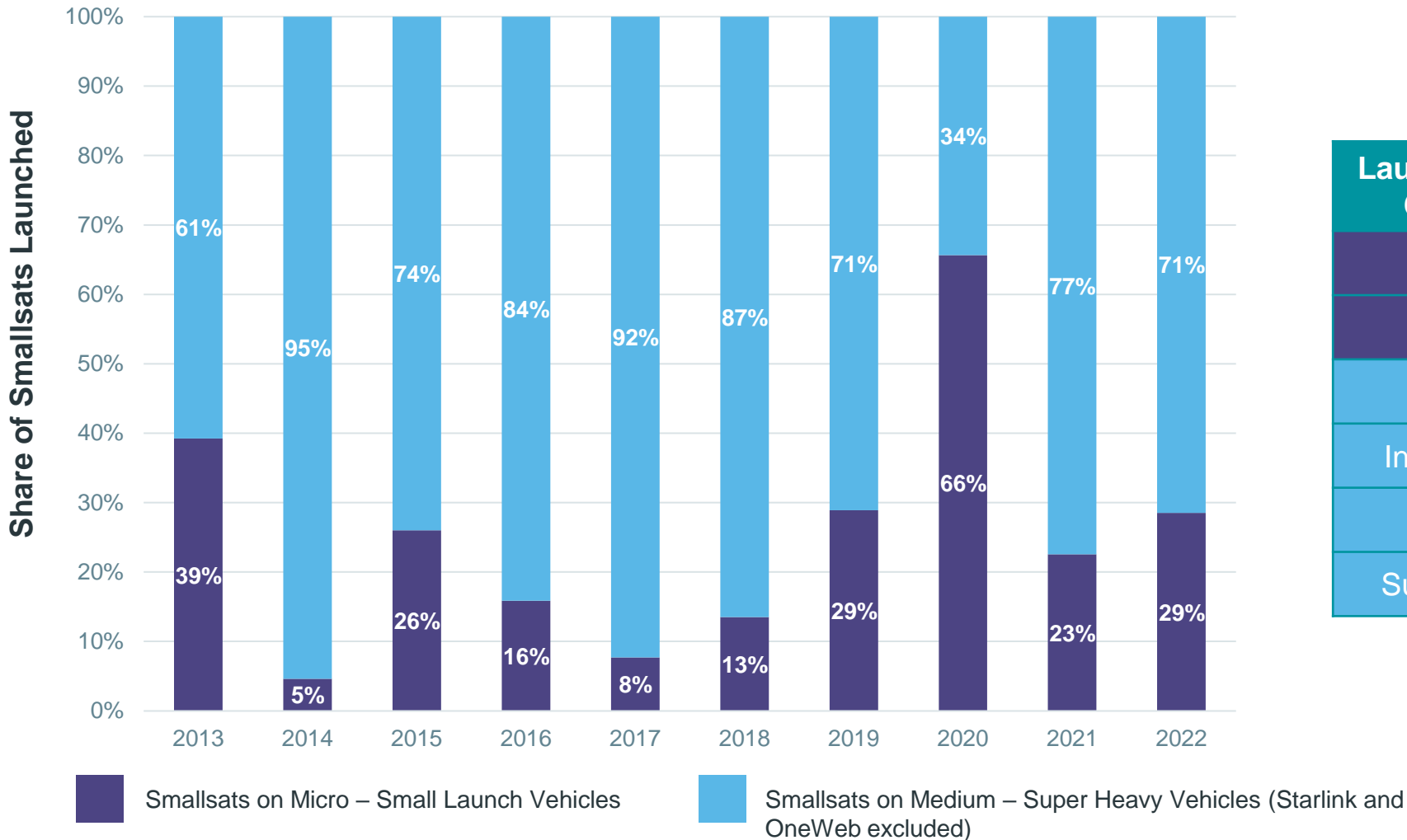


Launch Vehicle Category	Capacity (kg) to LEO
Micro	≤500
Small	500 – 2,268
Medium	2,269 – 5,443
Intermediate	5,444 – 11,340
Heavy	11,341 – 30,000
Super Heavy	>30,000

Smallsat Launch Trends



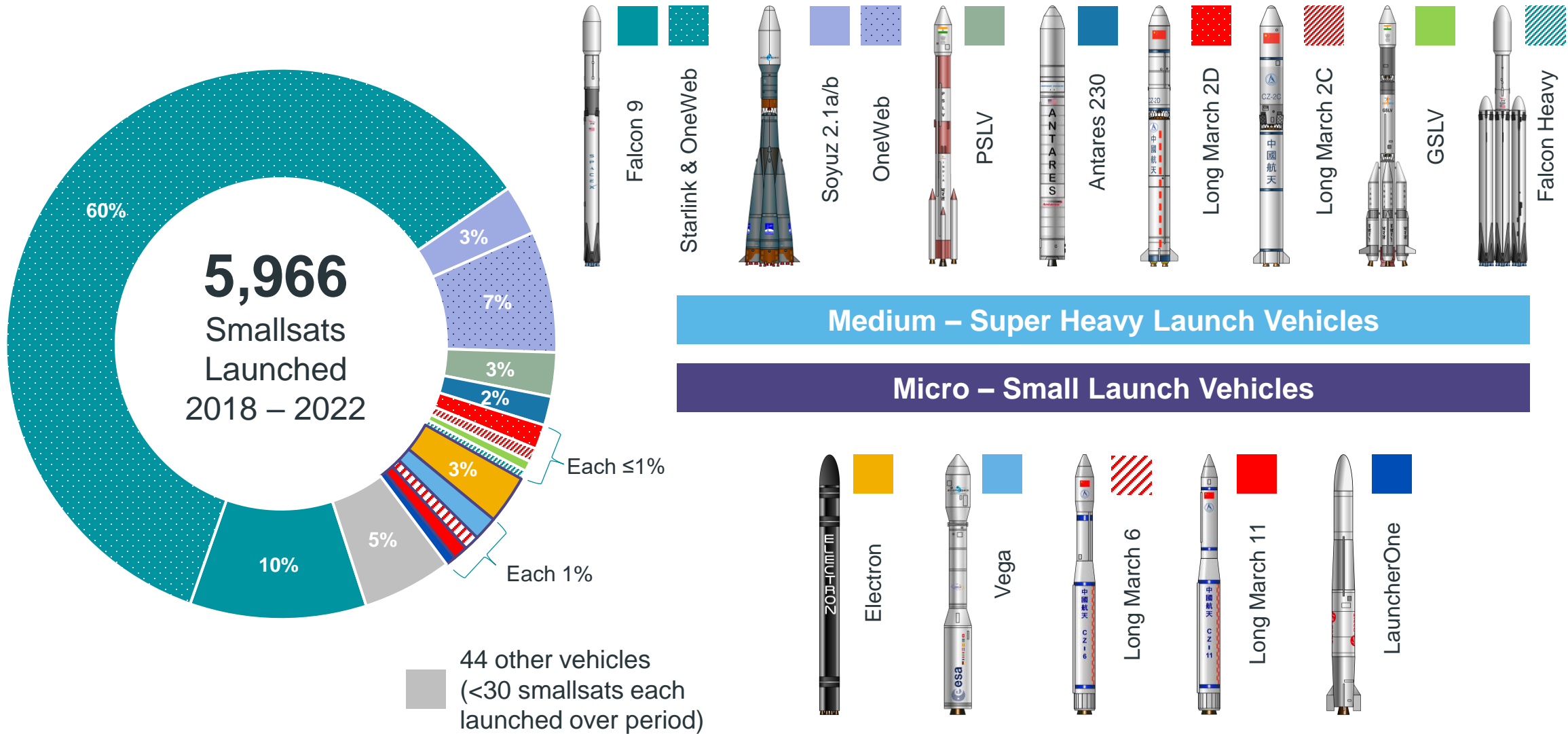
Smallsats 2013 – 2022, by Launch Vehicle Category, Excluding Starlink and OneWeb



Launch Vehicle Category	Capacity (kg) to LEO
Micro	≤500
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Super Heavy	>30,000

Smallsat Launch Trends

Smallsats 2018 – 2022, by Launch Vehicle



Smallsats in Context

Operator and Mission Type Trends

Smallsat Mass Trends

Smallsat Launch Trends

Looking Forward

Business Outcomes

Smallsat ventures continue efforts to prove their business models and generate revenue, with increasing attention on communications megaconstellations. Macroeconomic factors may have outsized impact on early-stage ventures and influence long-term smallsat market

Communications Megaconstellations

Smallsat telecommunications operators dominated smallsat activity in 2022 and are continuing deployments in 2023. Launch of these large constellations will influence smallsat activity in the next few years as initial deployments finish and expanded constellations are authorized

Smallsat Launch Options

Smallsats continue to primarily deploy on medium to heavy launch vehicles. Smallsat operators have other launch options including small launch and rideshare. In addition, dozens of companies continue to develop new small launch vehicles (many <500kg capacity)

Government Use of Smallsats

2023 will likely see first deployments of U.S. national security proliferated architectures. Governments are increasingly seeking to leverage smallsats or include them in architecture planning to augment existing capabilities

Smallsat Driven GEO/NGSO Integration

Organizations are likely to continue and expand GEO/NGSO integration, possibly through additional merger and acquisition activity, for optimal routing of traffic based on consumer speed, coverage needs, and unique remote sensing observations/data fusion

