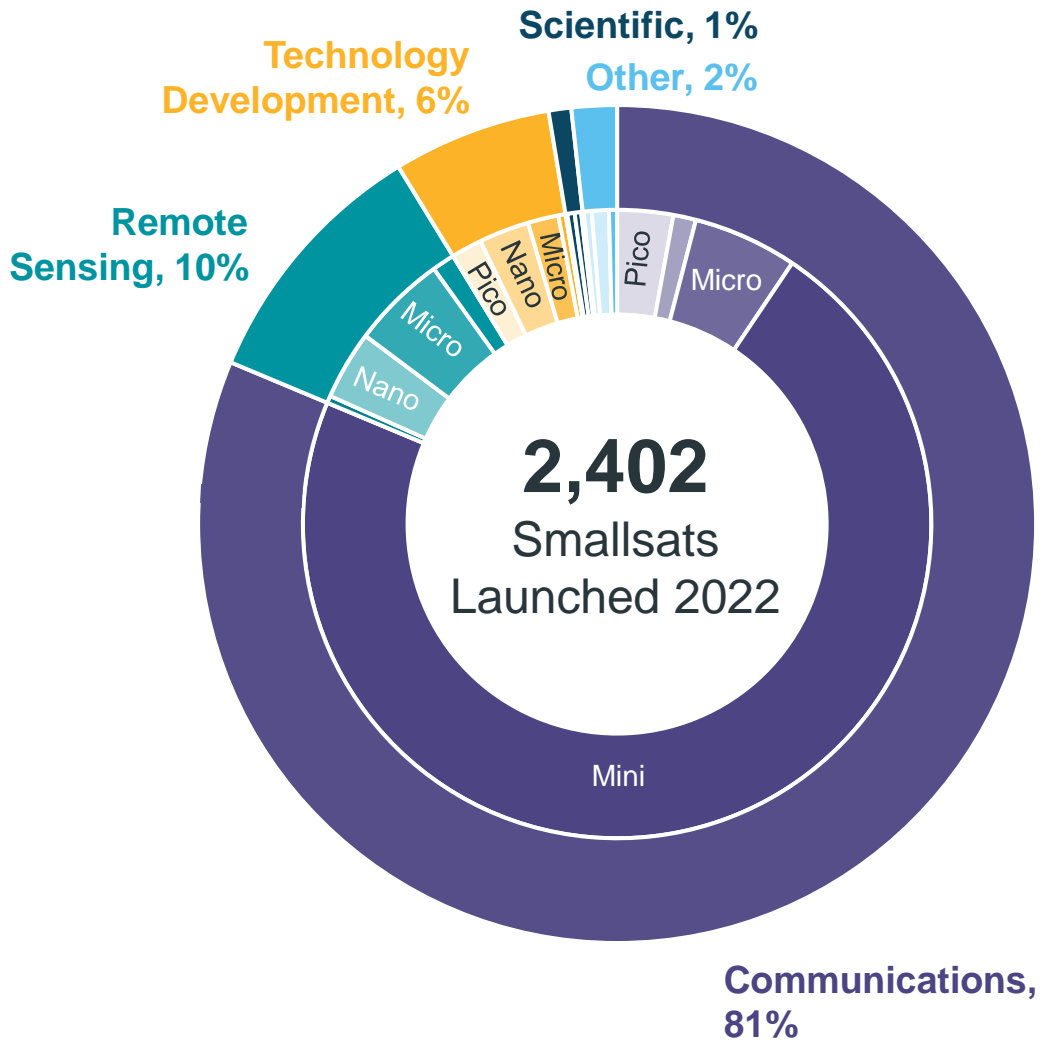


# Smallsats by the Numbers 2023



## Smallsats launched in 2022:

were **96%** of all spacecraft (2021: 94%)

accounted for **55%** of spacecraft upmass (2021: 43%)

were carried on **109** of 186 orbital launches (2021: 80)

totaled **34%** 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	<b>Femto</b>	<b>0.01 – 0.09</b>
	<b>Pico</b>	<b>0.1 – 1</b>
	<b>Nano</b>	<b>1.1 – 10</b>
	<b>Micro</b>	<b>11 – 200</b>
	<b>Mini</b>	<b>201 – 600</b>
	<b>Small</b>	<b>601 – 1,200</b>
	<b>Medium</b>	<b>1,201 – 2,500</b>
	<b>Intermediate</b>	<b>2,501 – 4,200</b>
	<b>Large</b>	<b>4,201 – 5,400</b>
	<b>Heavy</b>	<b>5,401 – 7,000</b>
	<b>Extra Heavy</b>	<b>&gt; 7,001</b>

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

## Smallsats in Context

Operator and Mission Type Trends

Smallsat Mass Trends

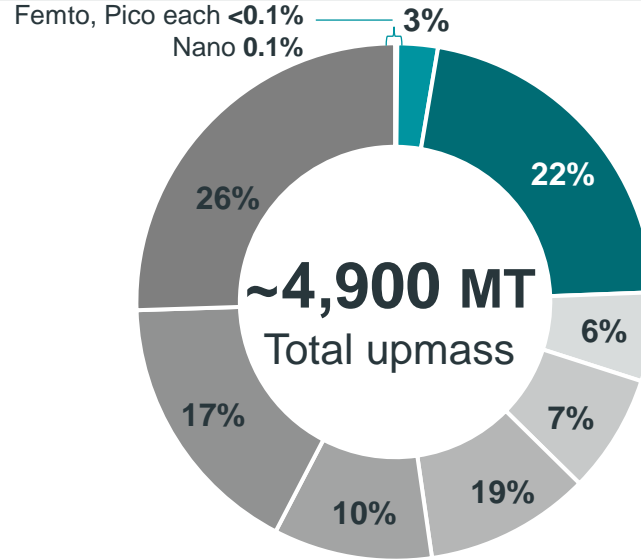
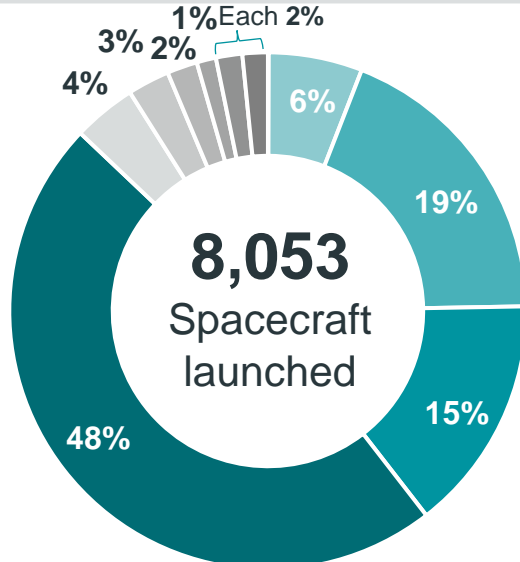
Smallsat Launch Trends

Looking Forward

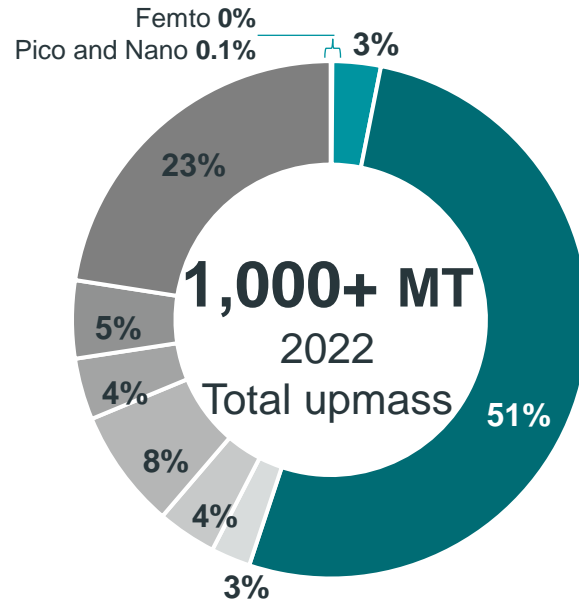
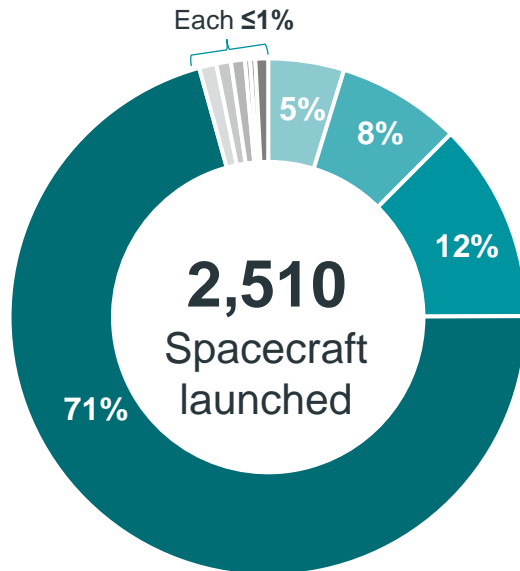
# Smallsats in Context

## Spacecraft Launched and Total Spacecraft Upmass 2013 – 2022

2013 – 2022



2022



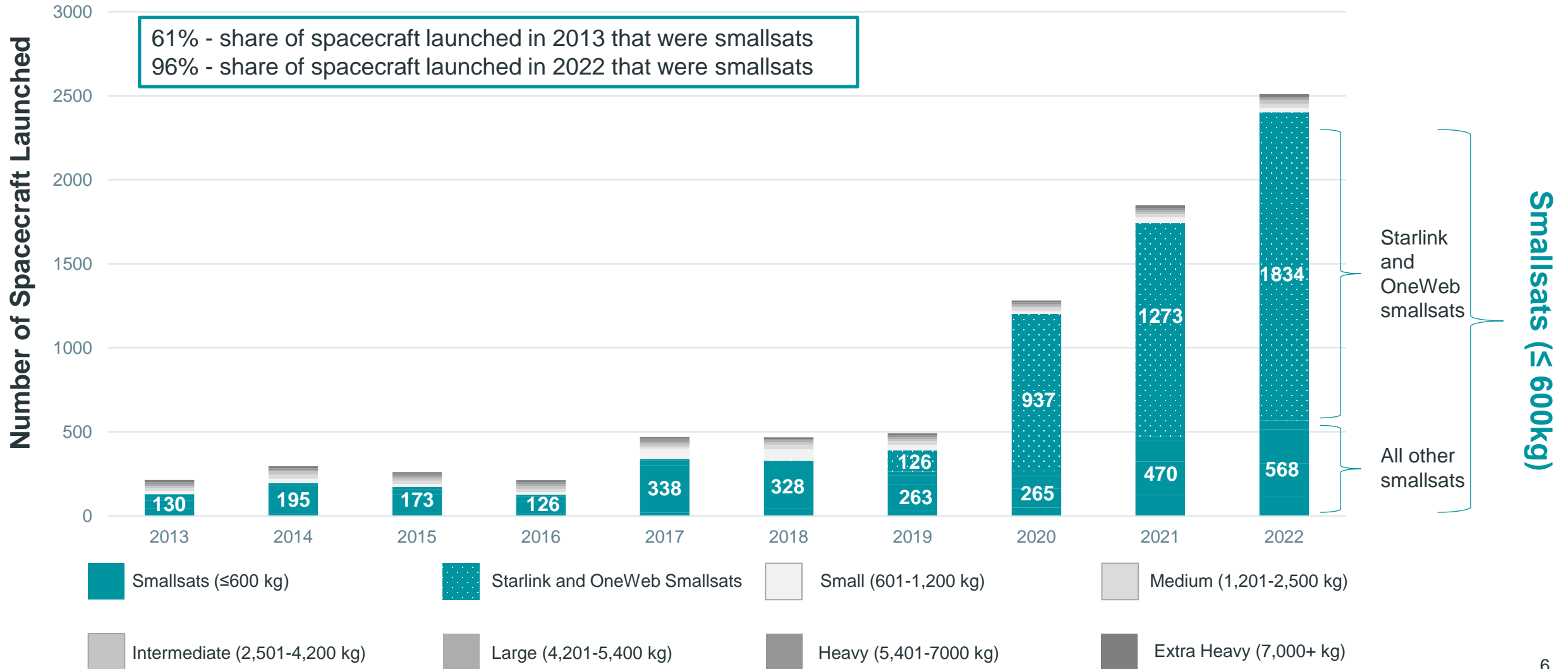
Smallsats

	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

- Smallsats represent 87% of spacecraft launched 2013 – 2022, 25% of total upmass
- Smallsats represent 96% of spacecraft launched in 2022, 55% of total upmass

# Smallsats in Context

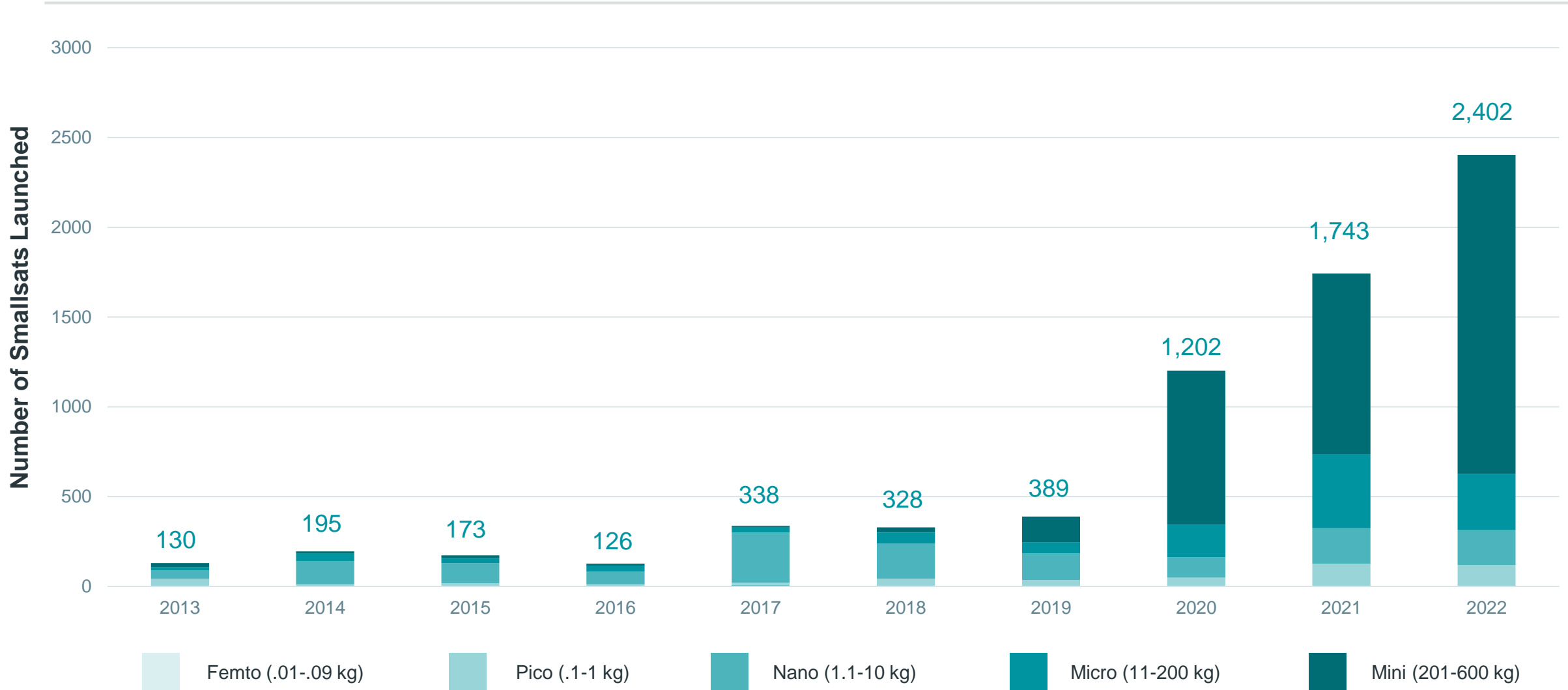
## Spacecraft Launched 2013 – 2022, by Mass Class



# Smallsats in Context



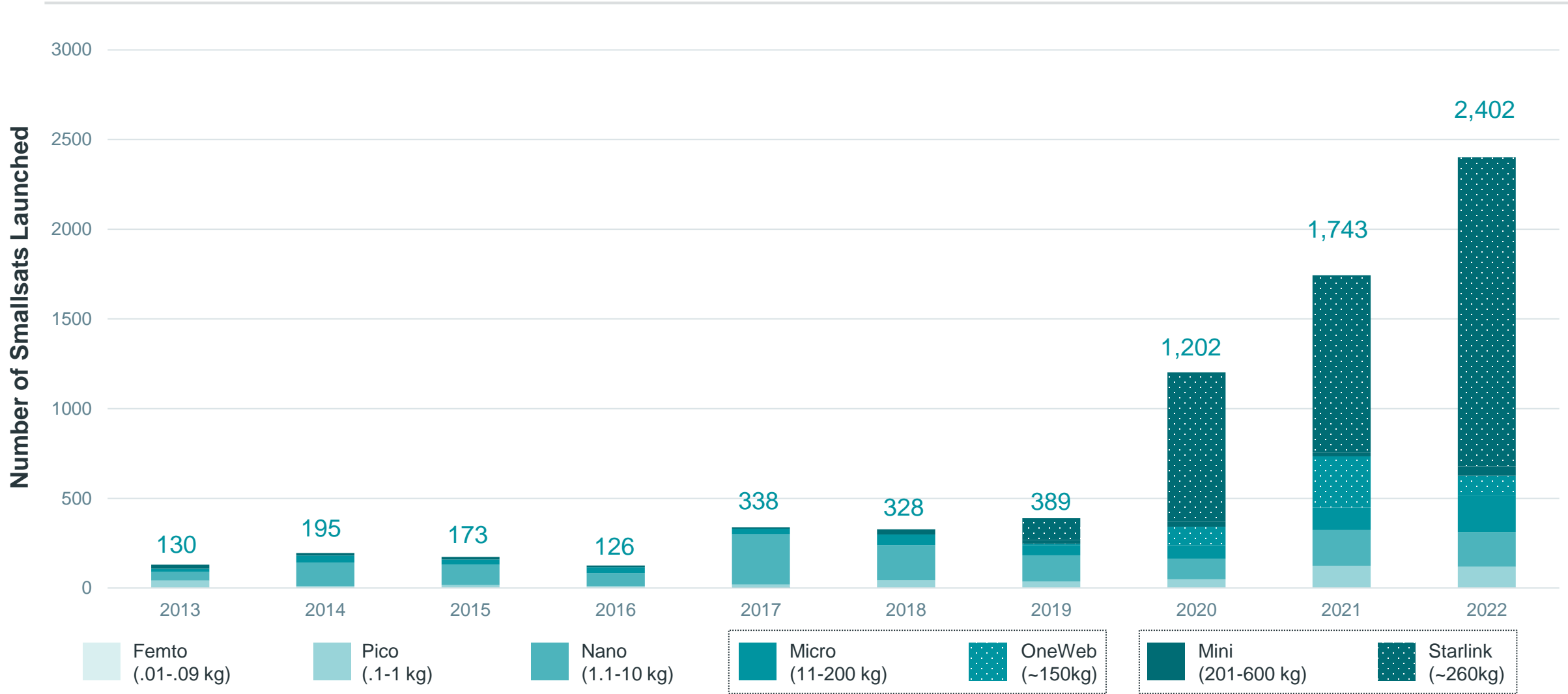
## Smallsats 2013 – 2022, by Mass Class



# Smallsats in Context



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

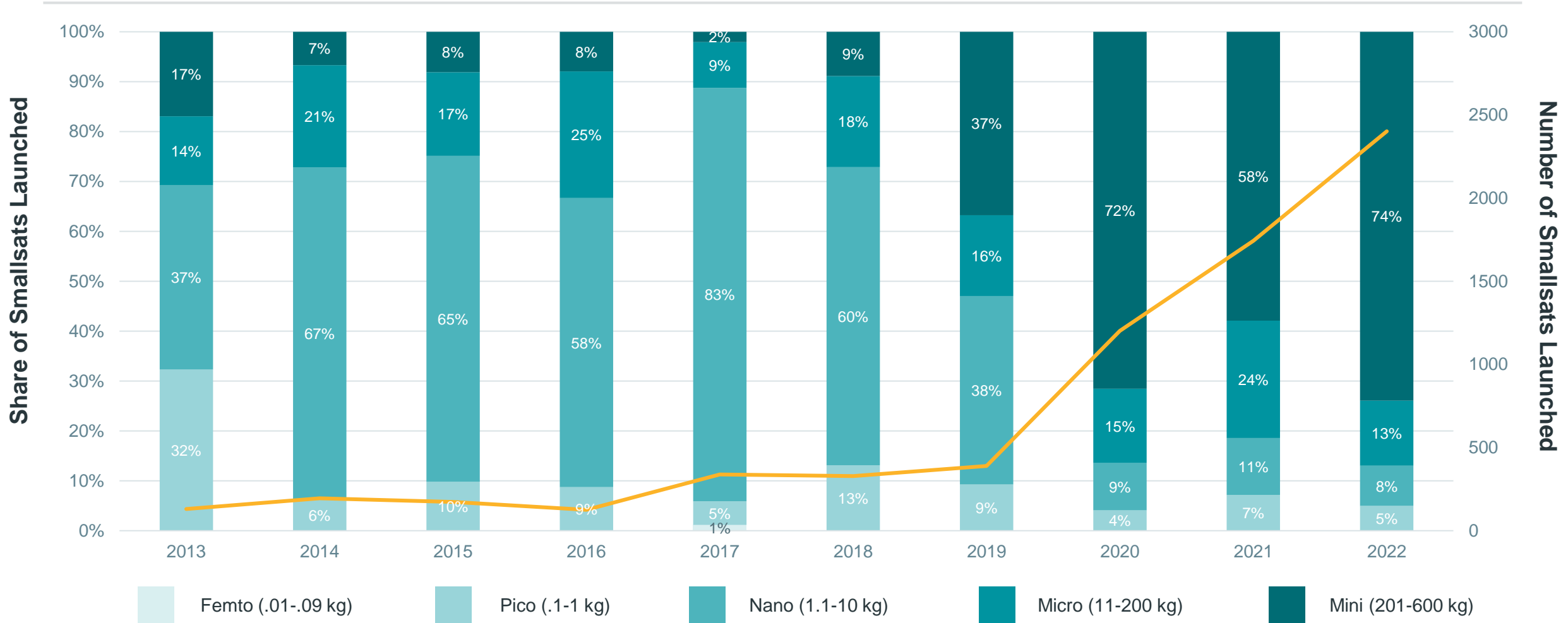




# Smallsats in Context



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

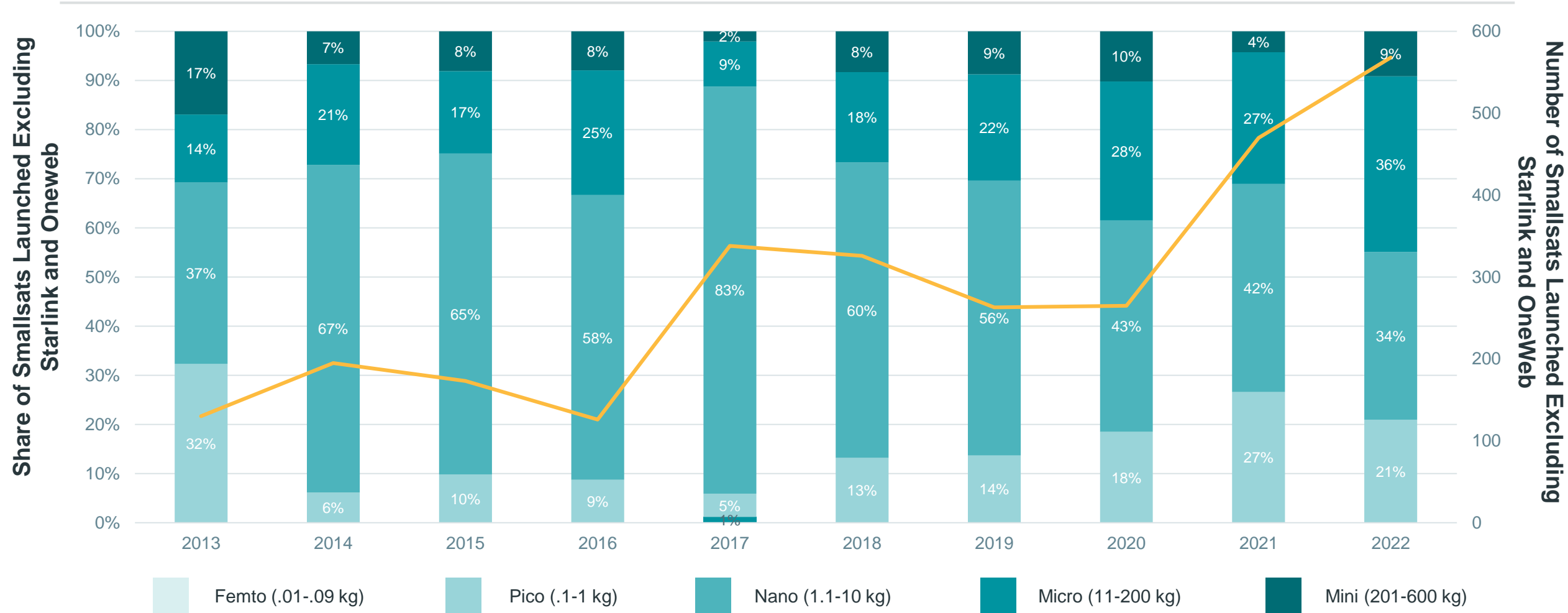


**Mini satellite mass class (which includes Starlink) constituted the largest share of smallsats in 2022 and 55% of all smallsats launched in the last decade**

# 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

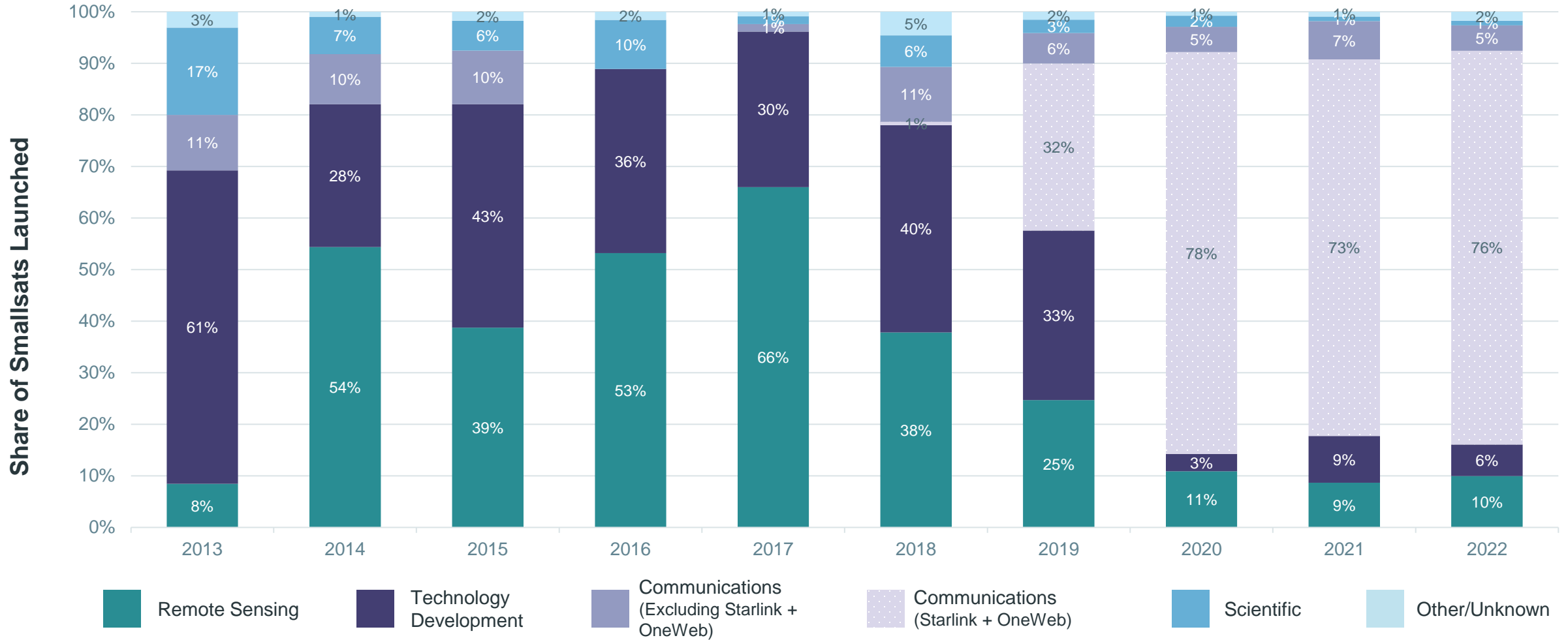
Smallsat Launch Trends

Looking Forward

# Operator and Mission Type Trends



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

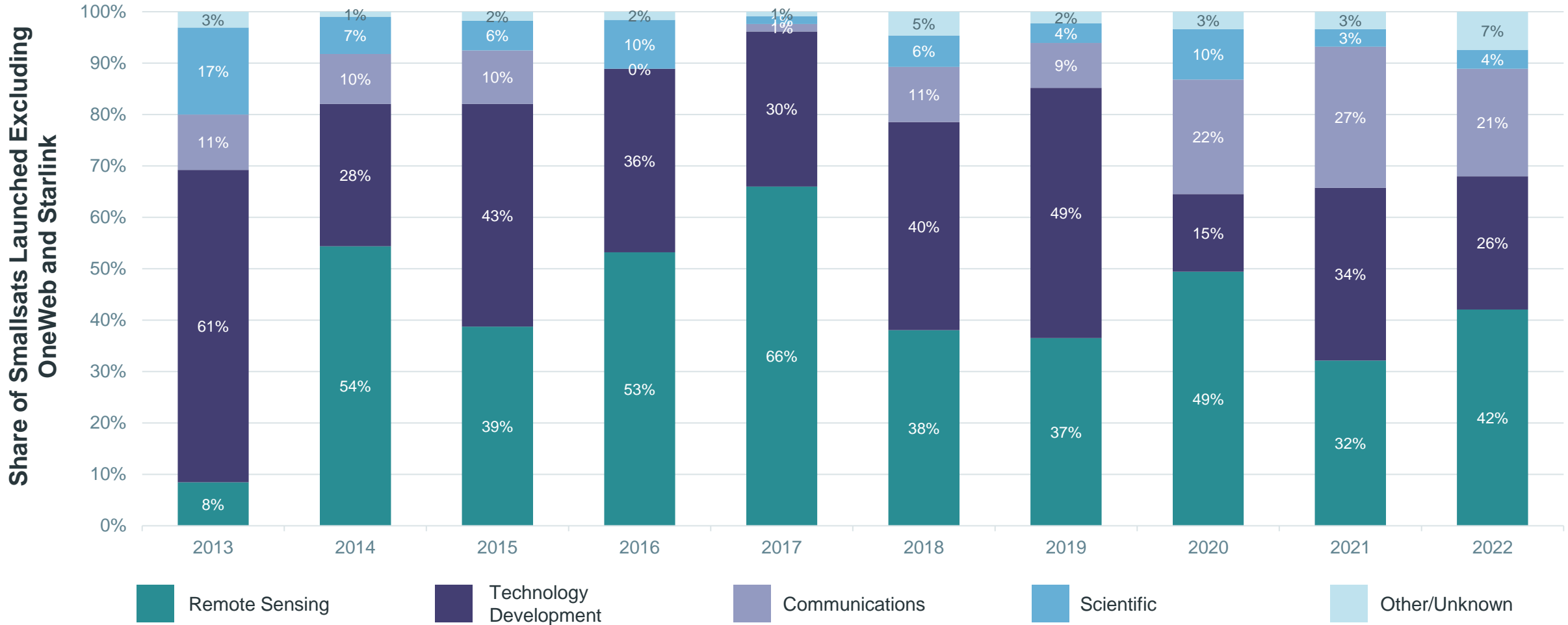


**Communications satellites constitute the largest share of smallsats in 2022. Relative share of remote sensing and technology development smallsats has decreased due to launch of LEO communication smallsats**

# Operator and Mission Type Trends



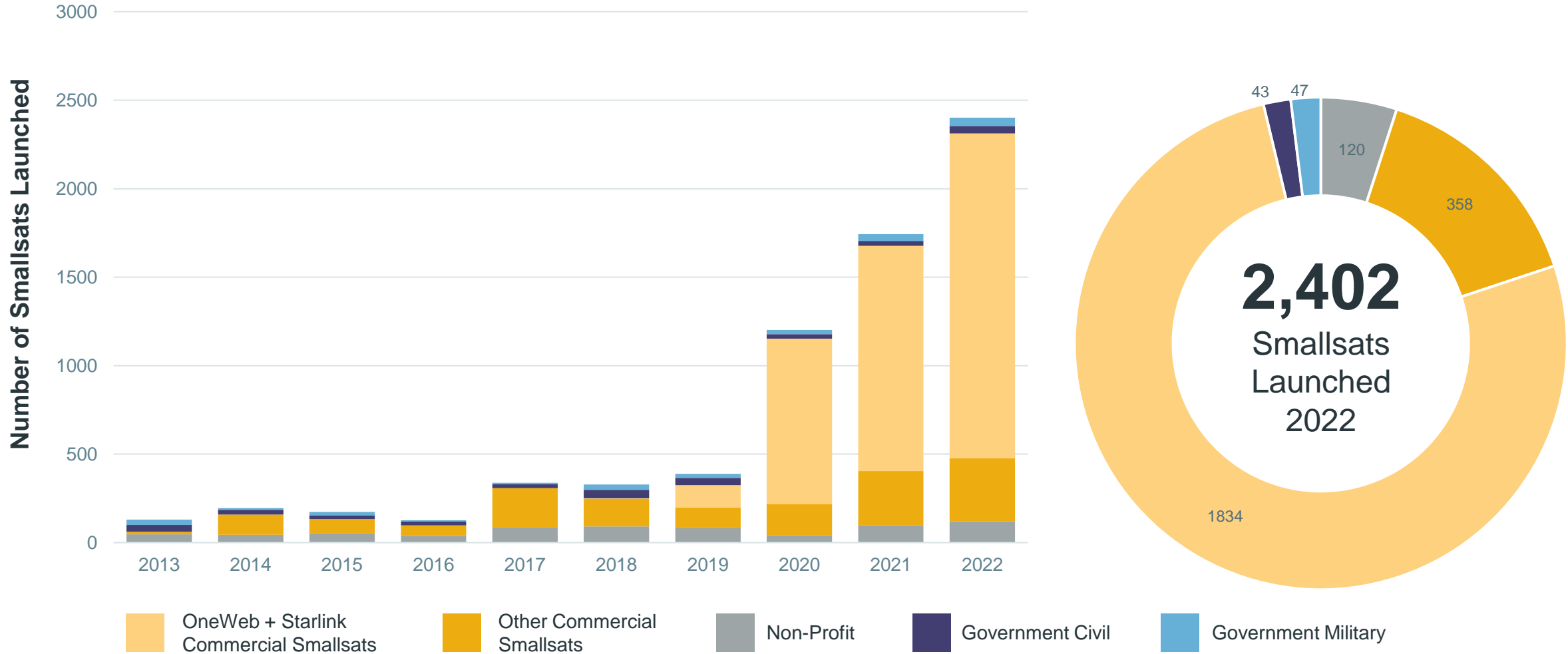
## Smallsats 2013 – 2022, by Application, Excluding OneWeb and Starlink



**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

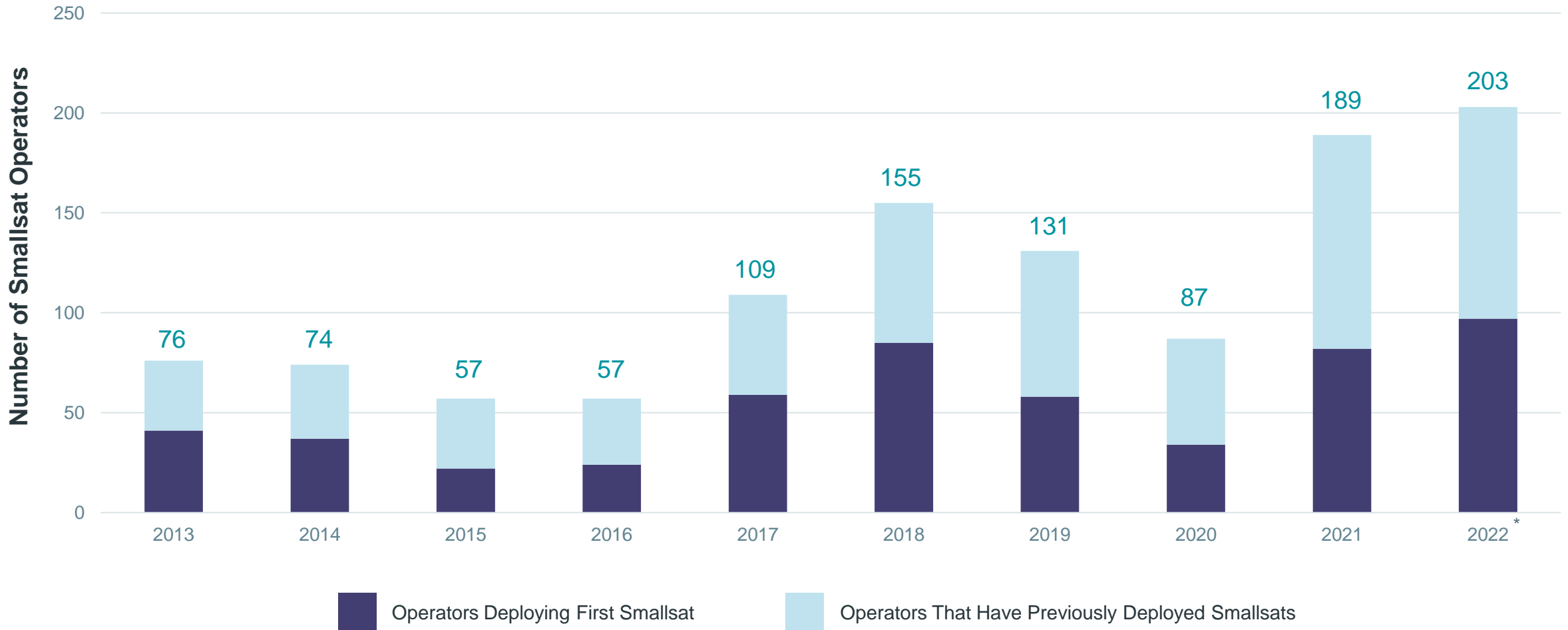
## Number of Smallsats 2013 – 2022, by Operator Type



Number of commercial smallsats launched increased from 14 smallsats in 2013 to 2,192 in 2022

# Operator and Mission Type Trends

## Operators Deploying Smallsats 2013 – 2022

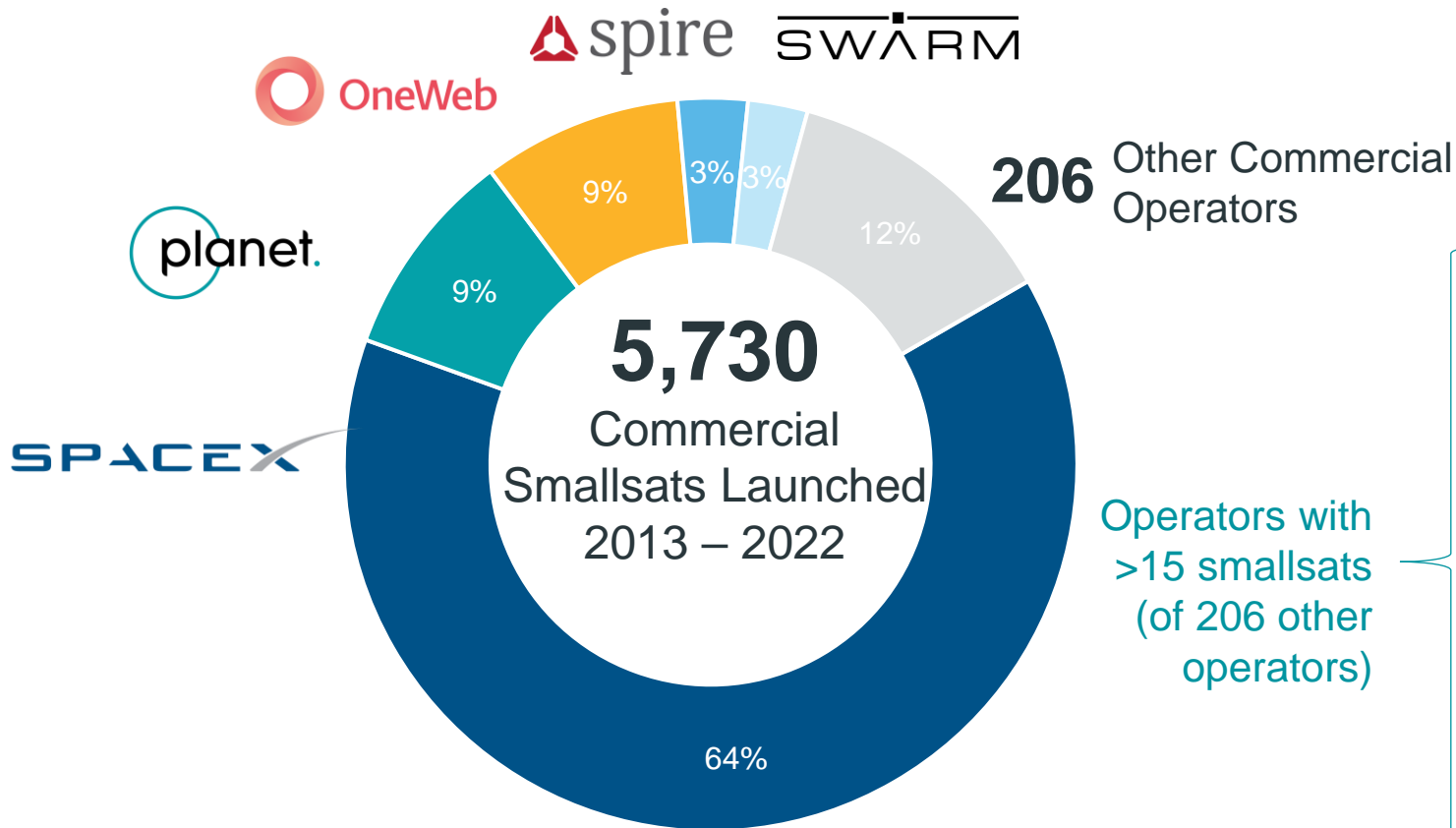


Includes government and commercial operators  
\*Some 2022 operator information not available

# 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

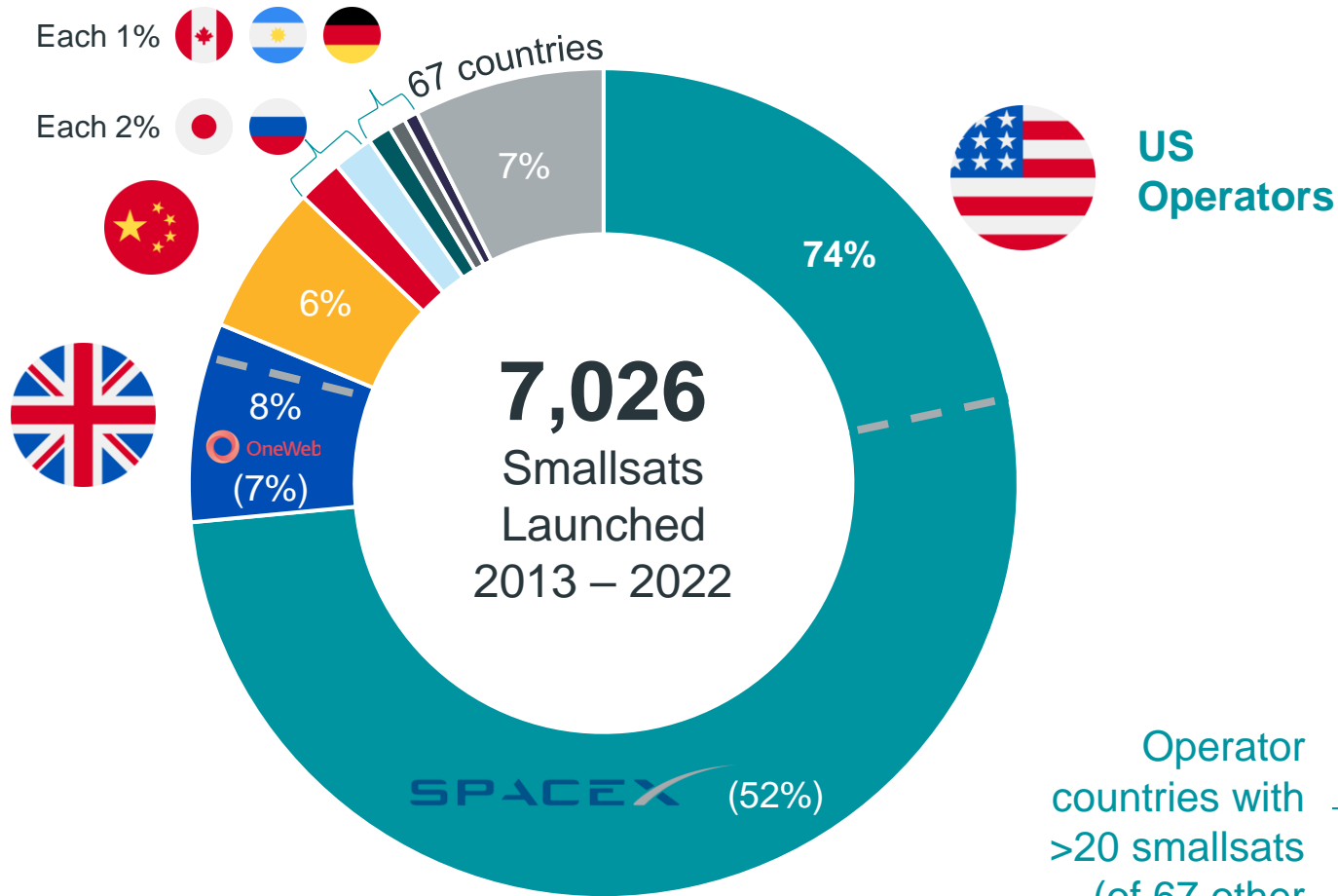
Operator	# of Smallsats
SpaceX	3659
Planet	529
OneWeb	504
Swarm Technologies	177
Spire Global	151
CGSTL	87
Satellogic	34
ICEYE	19
Kepler	19
Spacety	18
ORBCOMM	17
BlackSky	16
Astrocast	16
BlackSky Global	16
Guodian Gaoke	16

Operators with >15 smallsats (of 206 other operators)



# Operator and Mission Type Trends

## Smallsats 2013 – 2022, by Operator Country

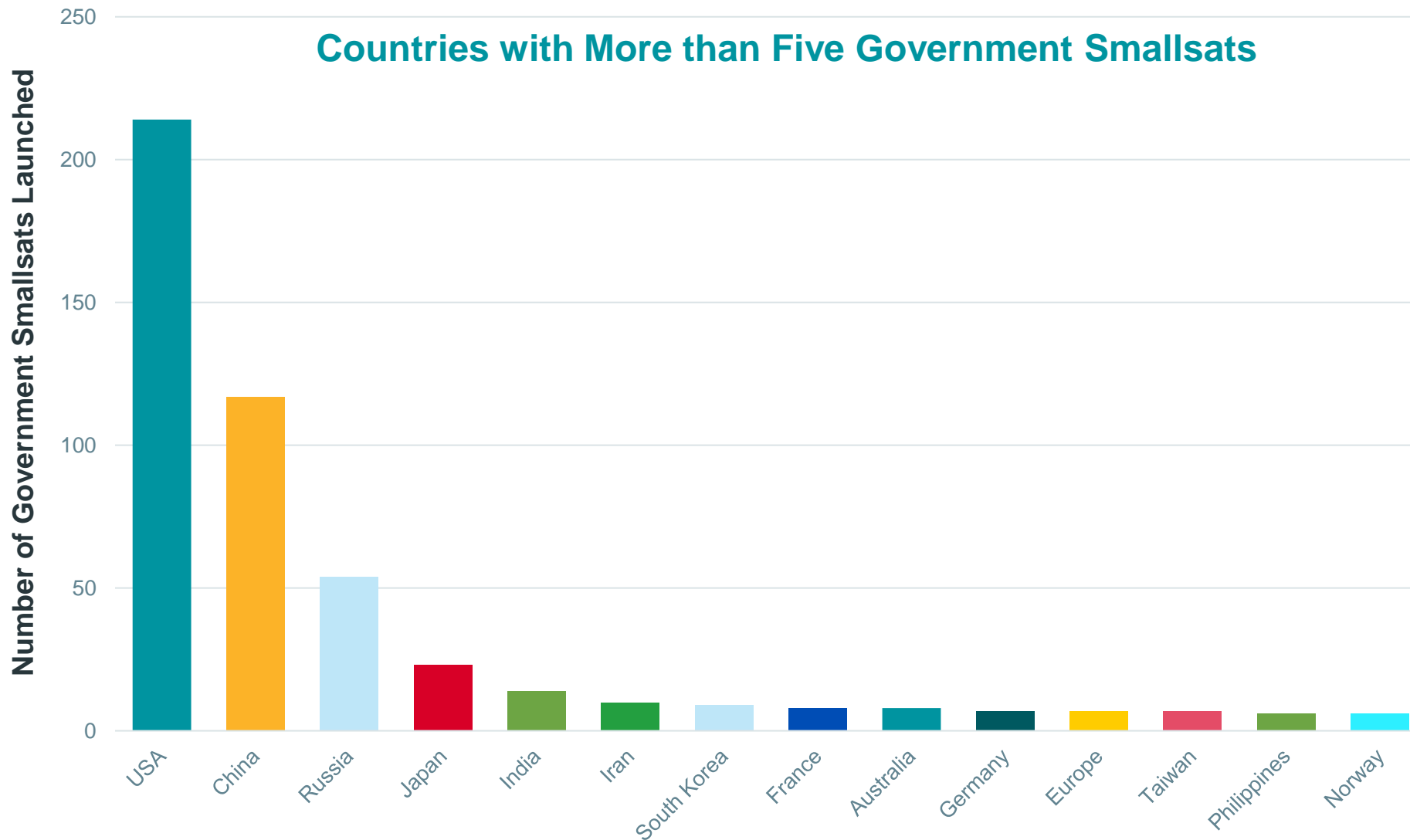


Operator countries with >20 smallsats (of 67 other countries)

Operator Country	# of Smallsats
USA	5,066 (3,668 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 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	Singapore

# Operator and Mission Type Trends



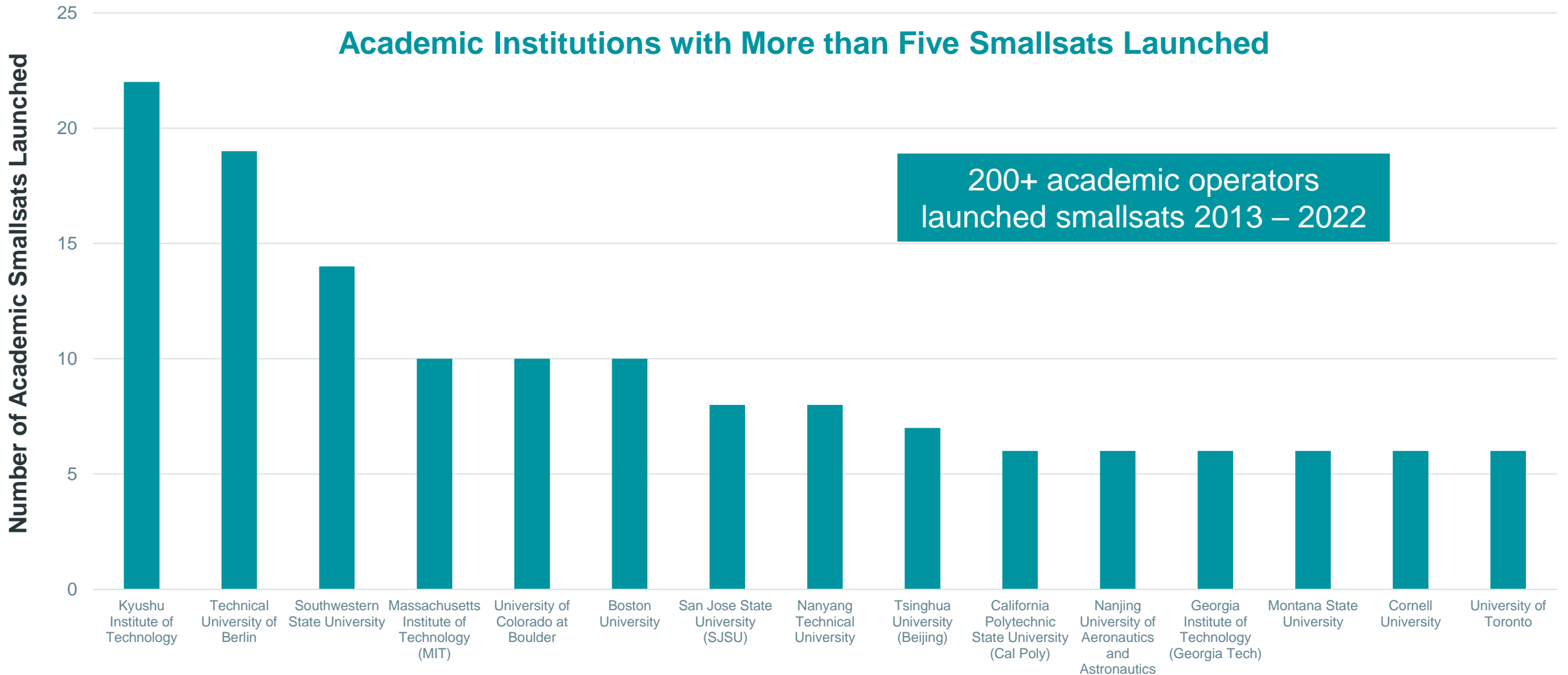
## Largest Government Smallsat Operators 2013 – 2022

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**

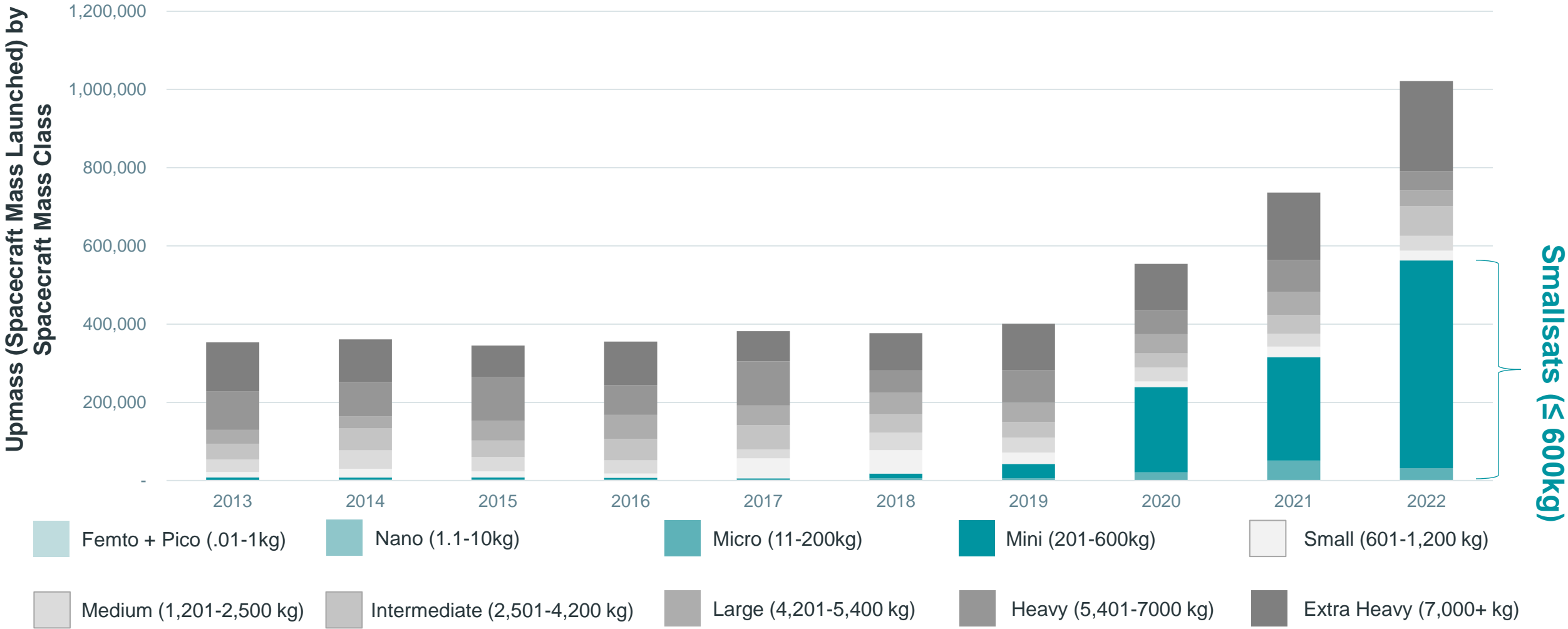
Smallsat Launch Trends

Looking Forward

# Smallsat Mass Trends



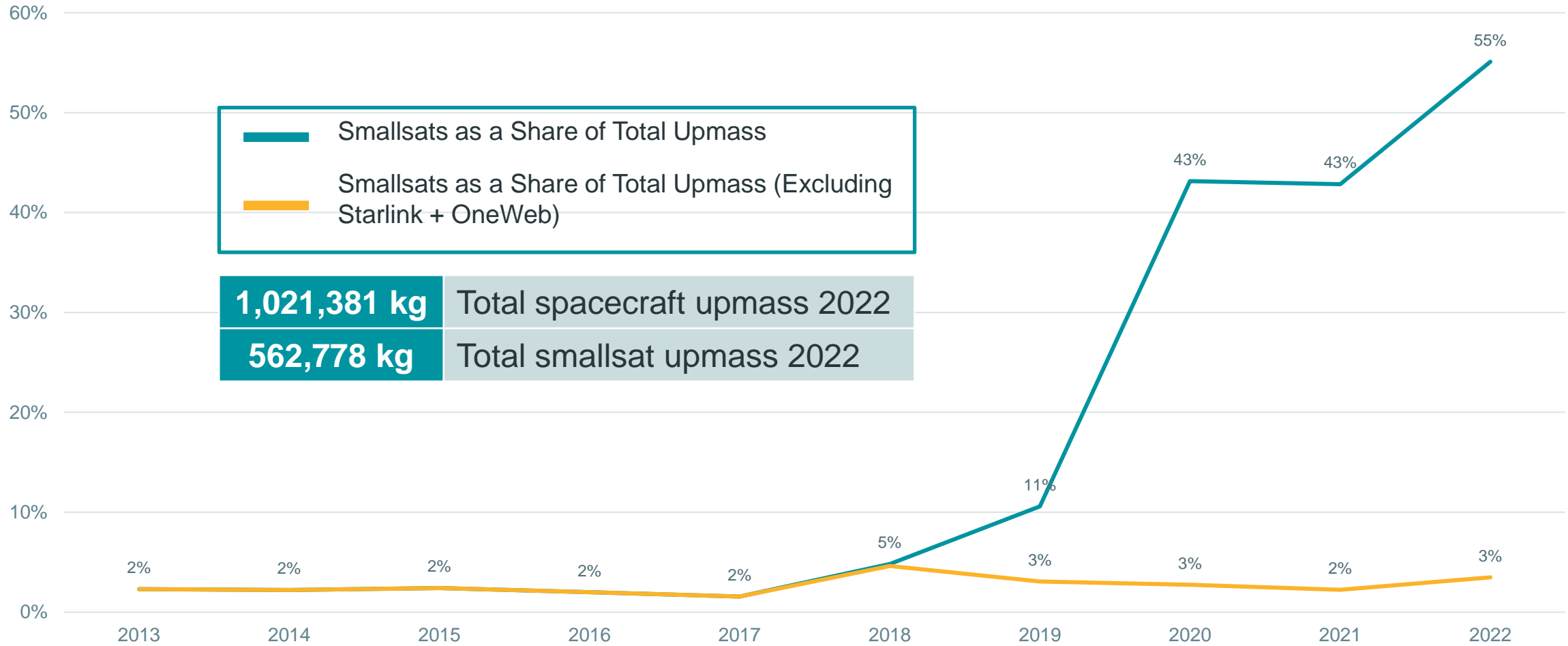
## Spacecraft Upmass 2013 – 2022, by Spacecraft Mass Class



# Smallsat Mass Trends

## Smallsats as a Share of Total Upmass 2013 – 2022

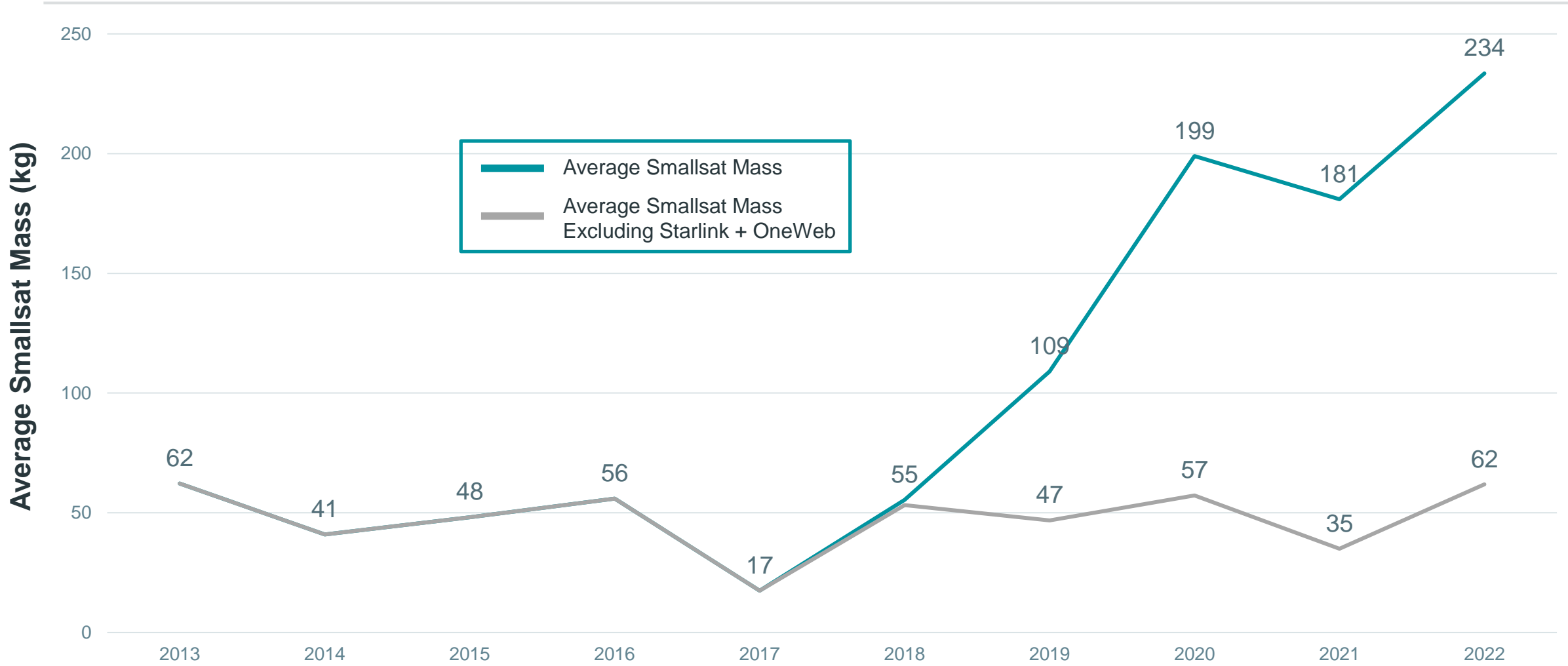
Share of Total Mass Launched



<b>1,021,381 kg</b>	Total spacecraft upmass 2022
<b>562,778 kg</b>	Total smallsat upmass 2022

# Smallsat Mass Trends

## Average Smallsat Mass 2013 – 2022

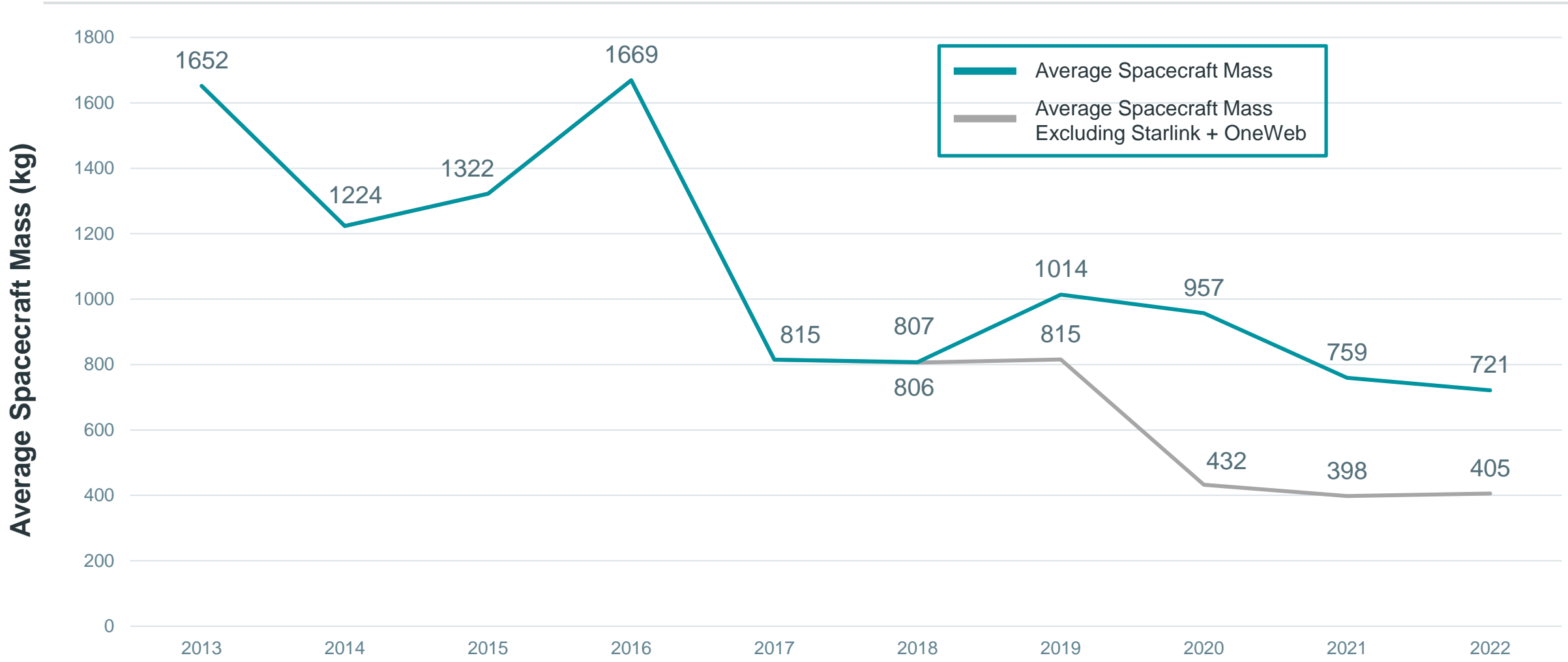




# Smallsat Mass Trends



## Average Spacecraft Mass 2013 – 2022



**Deployment of large numbers of smallsats reduces the average spacecraft mass**

Smallsats in Context

Operator and Mission Type Trends

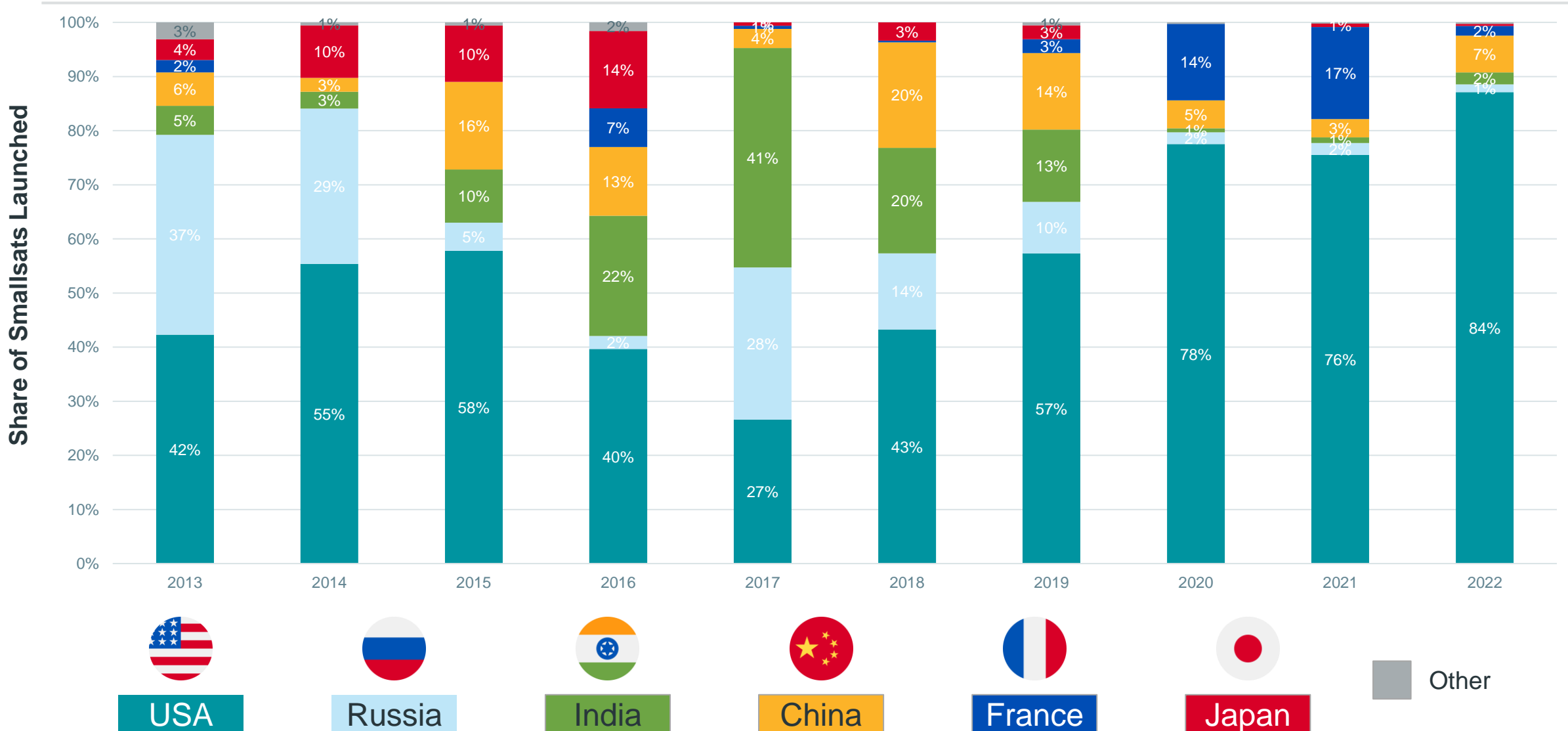
Smallsat Mass Trends

**Smallsat Launch Trends**

Looking Forward

# Smallsat Launch Trends

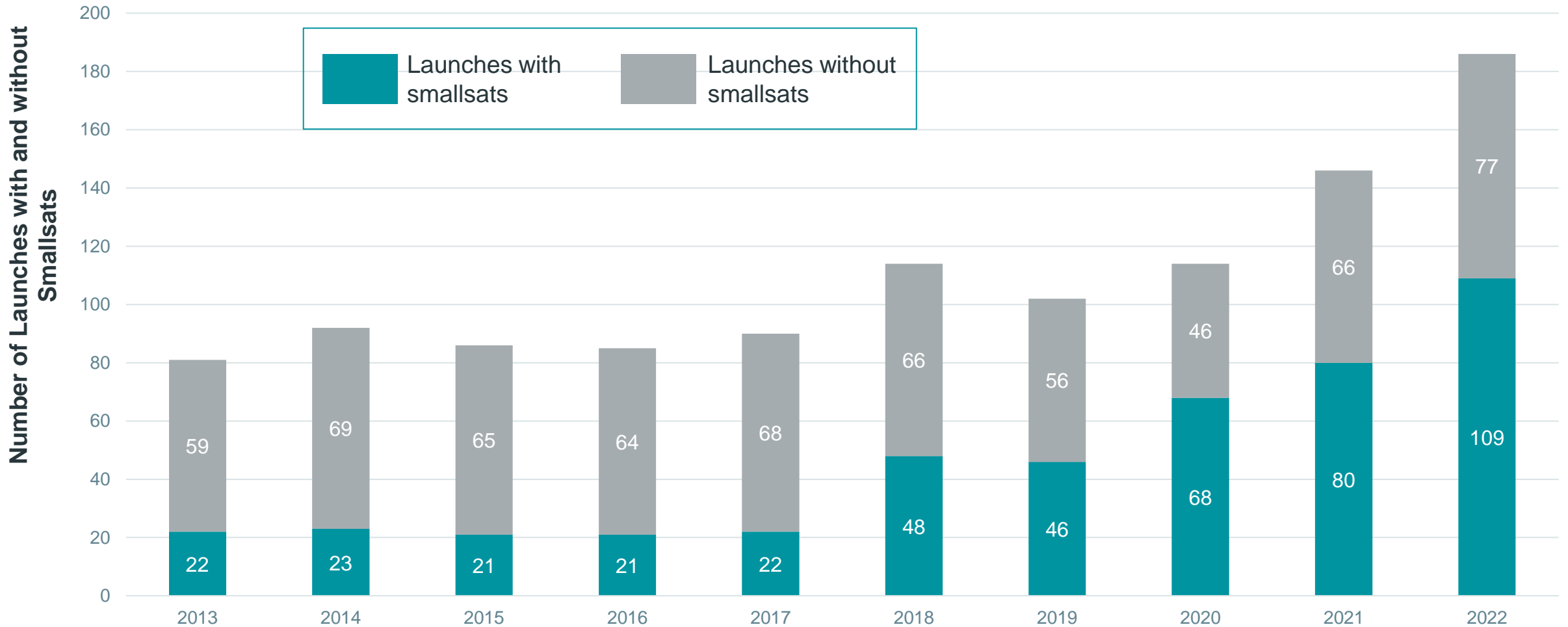
## Smallsats 2013 – 2022, by Country of Launch Provider



# Smallsat Launch Trends



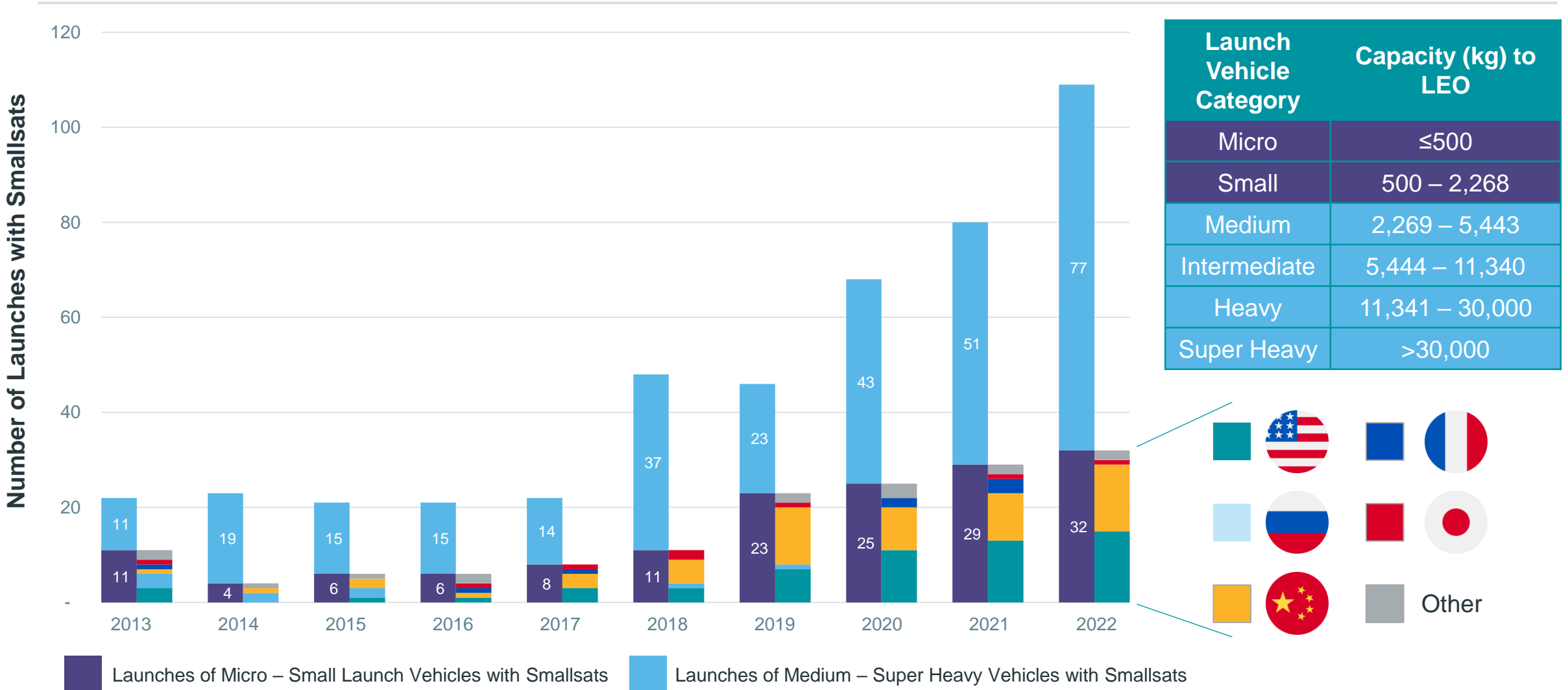
## Number of Launches with Smallsats 2013 – 2022



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

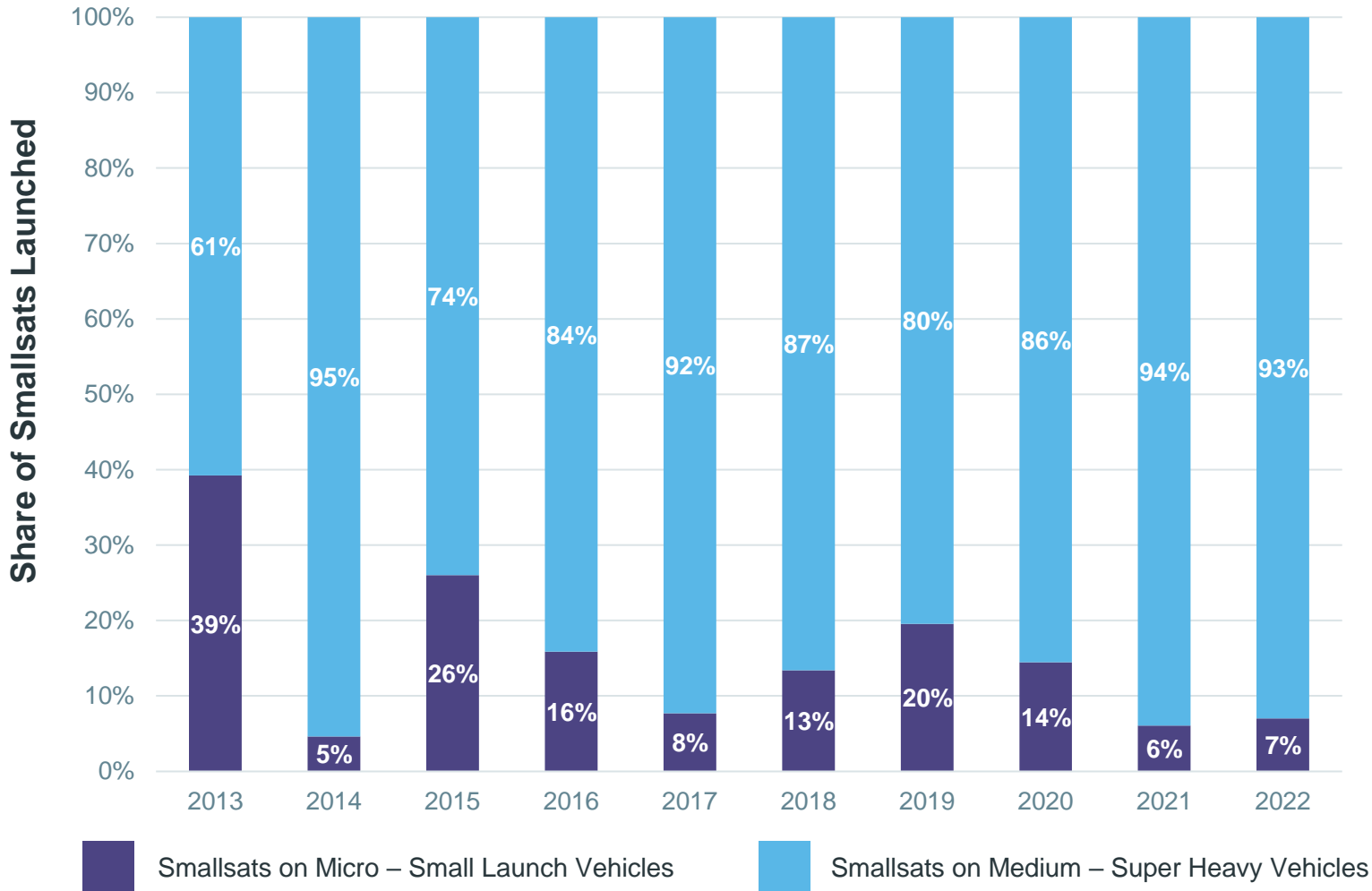
# Smallsat Launch Trends

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



# Smallsat Launch Trends

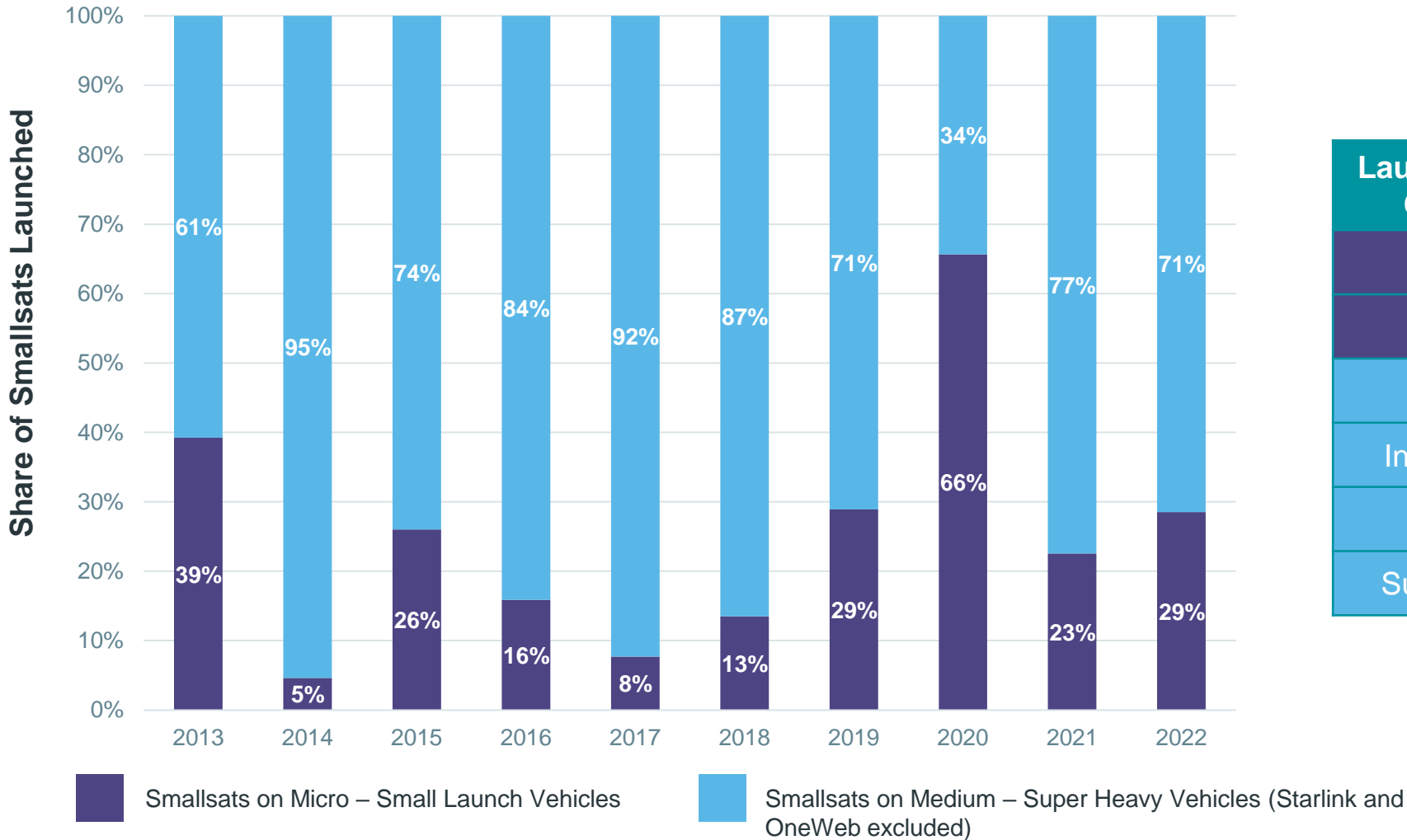
## Smallsats 2013 – 2022, by Launch Vehicle Category



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

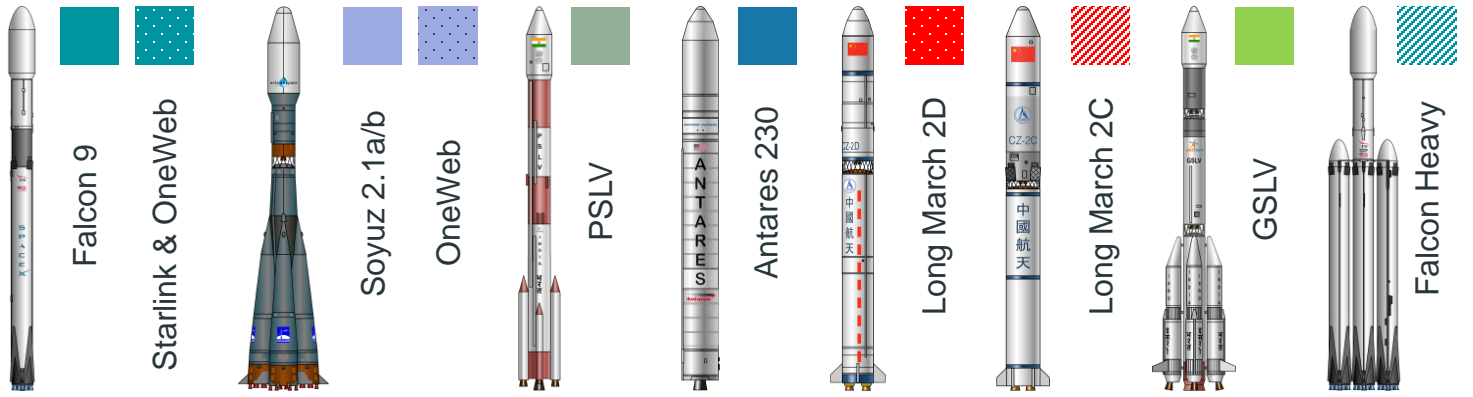
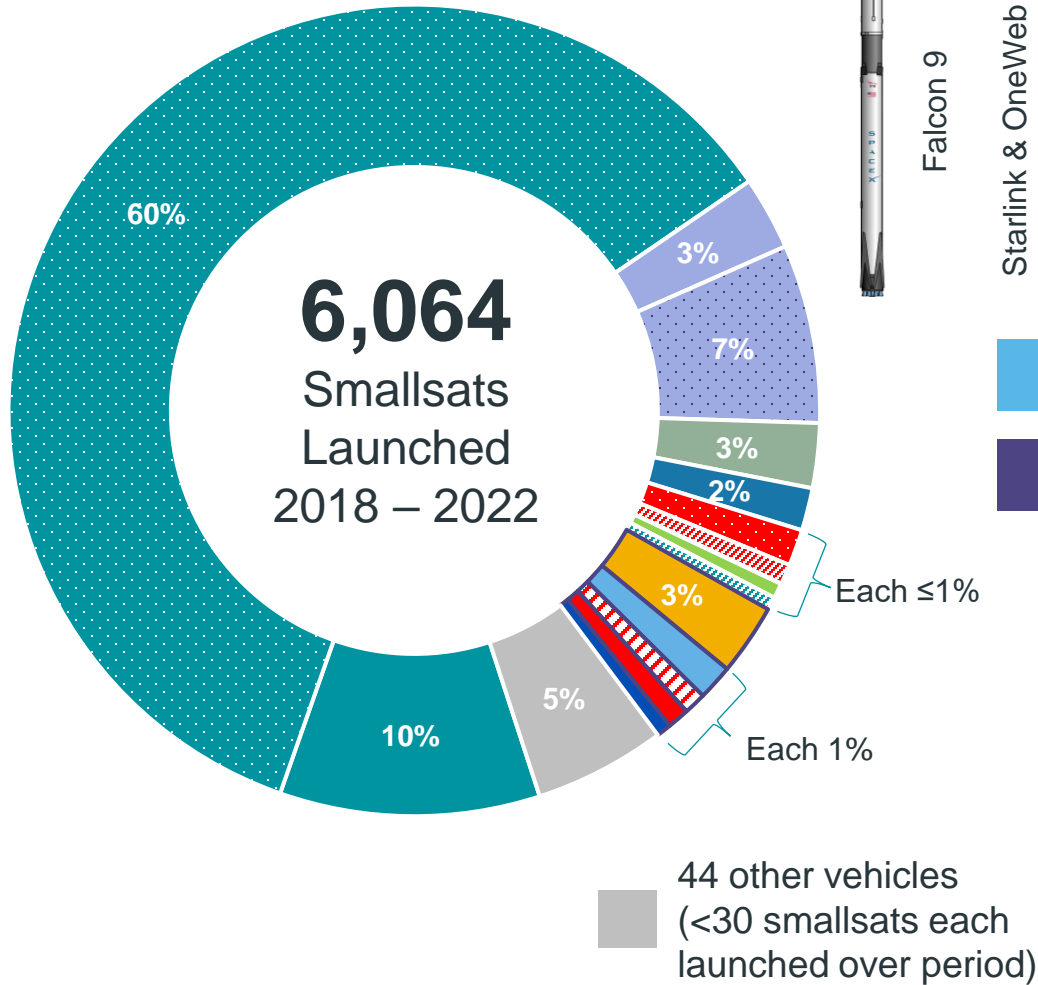
Smallsats 2013 – 2022, by Launch Vehicle Category, Excluding Starlink and OneWeb



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

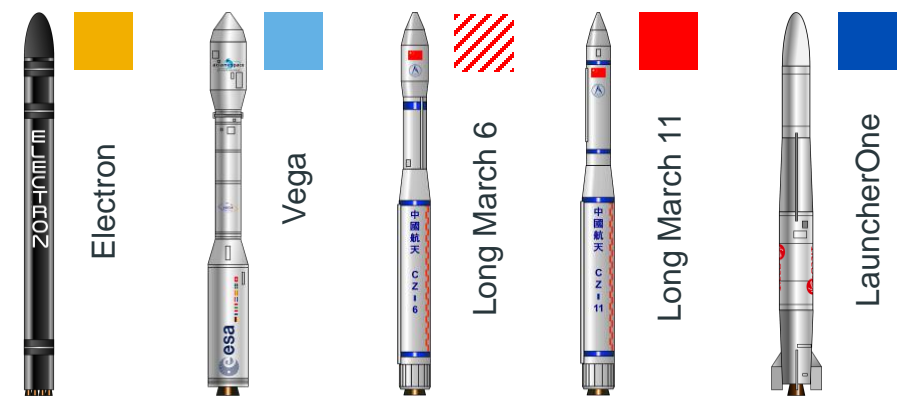
# Smallsat Launch Trends

## Smallsats 2018 – 2022, by Launch Vehicle



### Medium – Super Heavy Launch Vehicles

### Micro – Small Launch Vehicles





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

