



Smallsats by the Numbers 2019

Overview



- ✓ Introduction
- ✓ Smallsat Applications
- ✓ Recent Events and Trends
- ✓ The Big Picture of Smallsats
- ✓ Commercial Smallsats
- ✓ Government Smallsats
- ✓ Non-Profit and Academic Smallsats
- ✓ CubeSats
- ✓ Outlook

Introduction

What Are Smallsats?

- Although definitions vary, 600 kg and under reflects the five smallest mass classes defined by the FAA
- ‘Smallsat’ or ‘very small satellite’ often used to refer to smaller satellites
- CubeSats are an established “kit” form of smallsat
 - Use standard 10 cm³ form factor (1U), ~ 1 kg
 - Can combine to form 3U, 6U, 12U, or more
- Smaller satellites are of increasing interest; more widely used in recent years

	Mass Class Name	Kilograms (kg)
Smallsats	Femto	0.01 - 0.09
	Pico	0.1 - 1
	Nano	1.1 - 10
	Micro	10.1 - 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

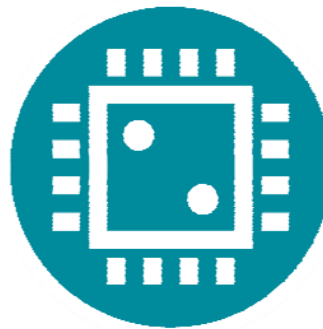
Source: FAA AST, *The Annual Compendium of Commercial Space Transportation: 2018*

Smallsat Applications

Common Uses



Remote Sensing



Technology Development



Military and Intelligence



Communications



Science

Recent Events and Trends

2012 - 2018

- ✓ In 2012, smallsats began to see significantly increased usage
- ✓ Over 1,300 smallsats launched 2012 - 2018 (includes smallsats on both successful and failed launch attempts)
- ✓ 2018 saw 6x as many smallsats launched as 2012
- ✓ Over 70% of smallsats launched 2012 - 2018 were CubeSats
- ✓ Half of smallsats launched 2012 - 2018 provide commercial services
- ✓ Government and commercial sectors are capitalizing on heightened interest in smallsats
- ✓ Launch vehicle failures have affected the rate of smallsat deployment
- ✓ CubeSats have dominated the smallsat market; 961 launched 2012 - 2018

Recent Events and Trends



2018 Activity Highlights

55 kg

Average smallsat mass
at launch

43%

Of launches involved
smallsats

71

Organizations
manufacturing smallsats for
first time

42

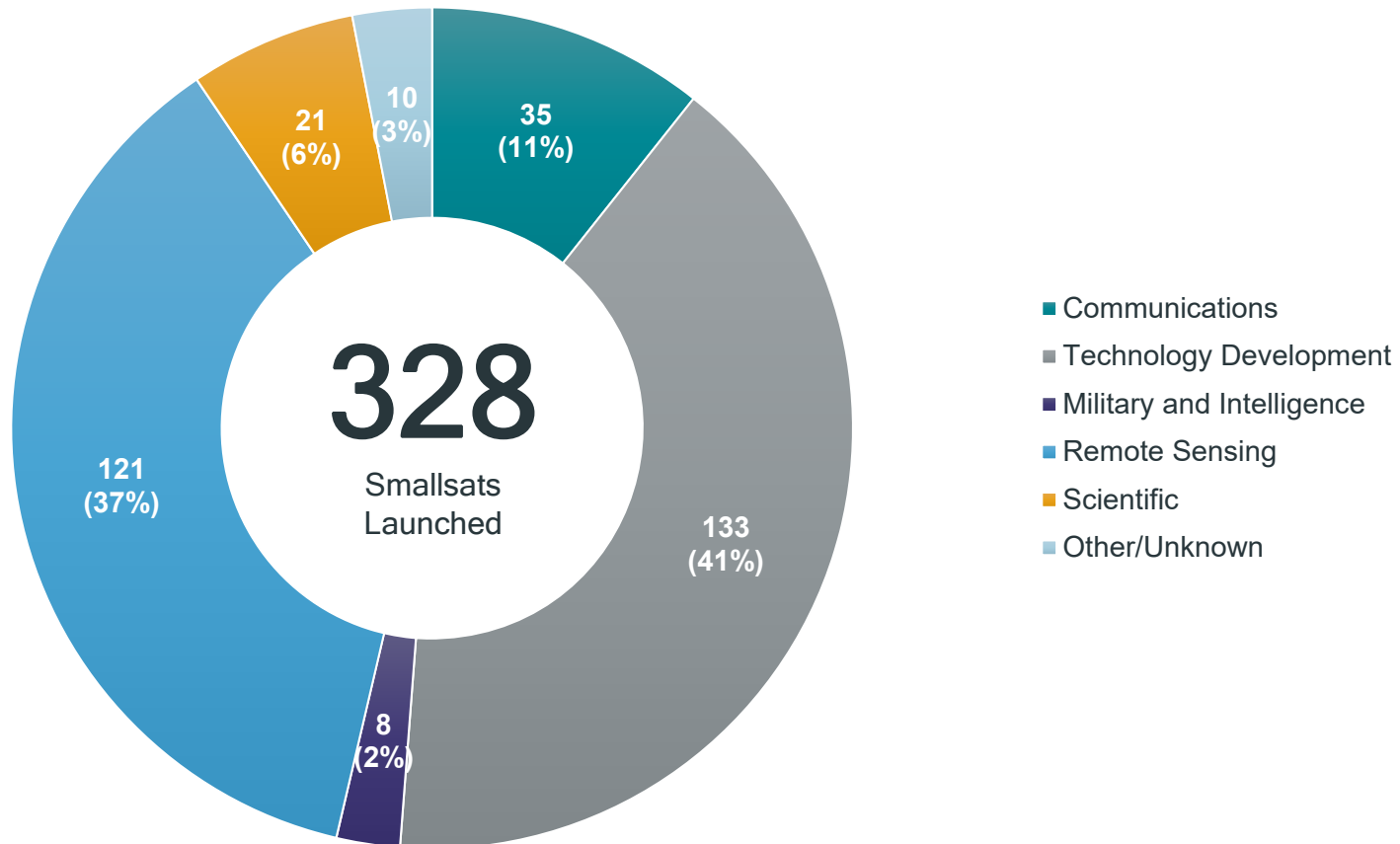
Smallsats successfully
launched to be deployed
from ISS

36%

Of smallsats
were launched from US

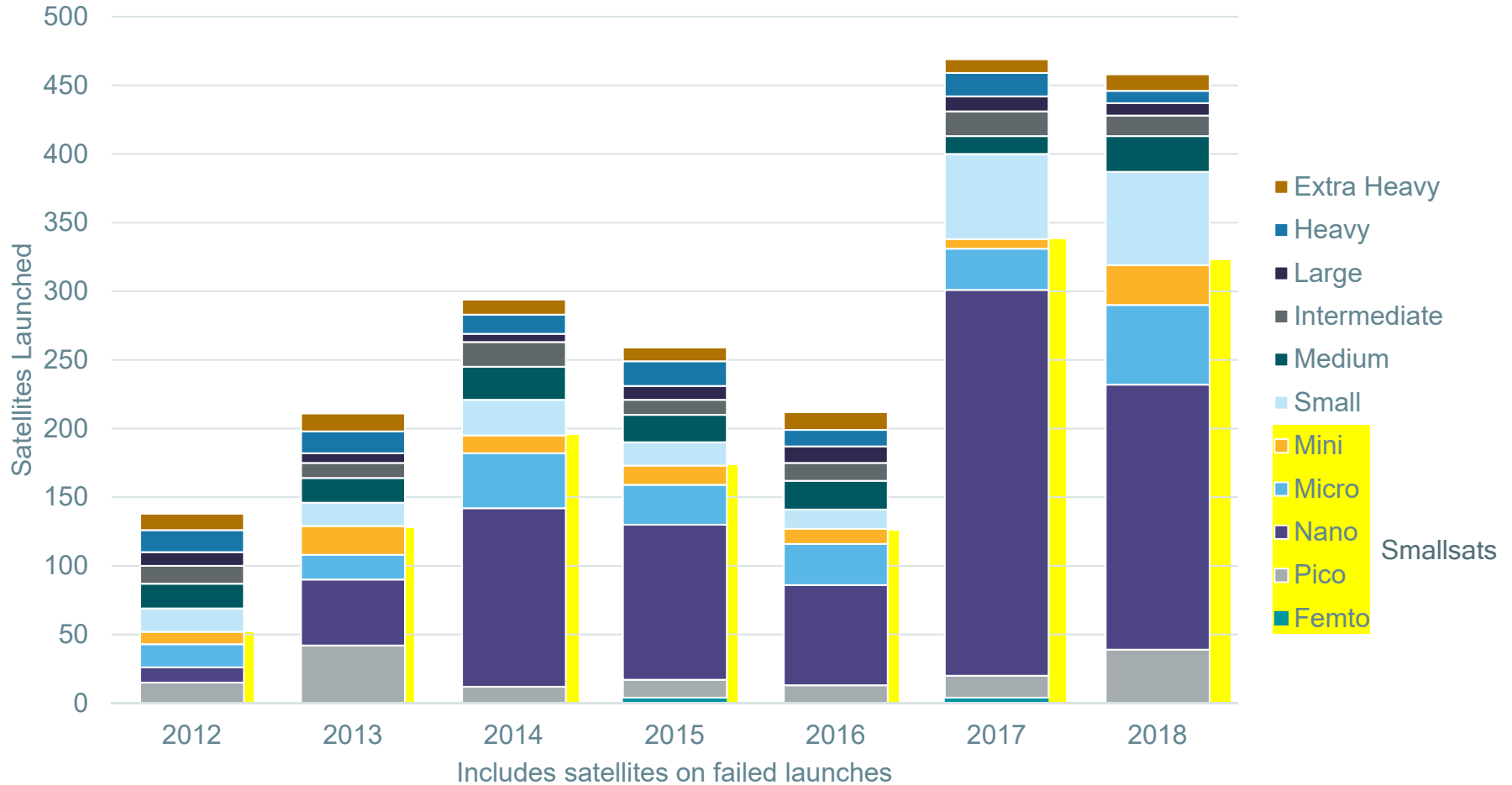
Recent Events and Trends

2018 Activity by Application



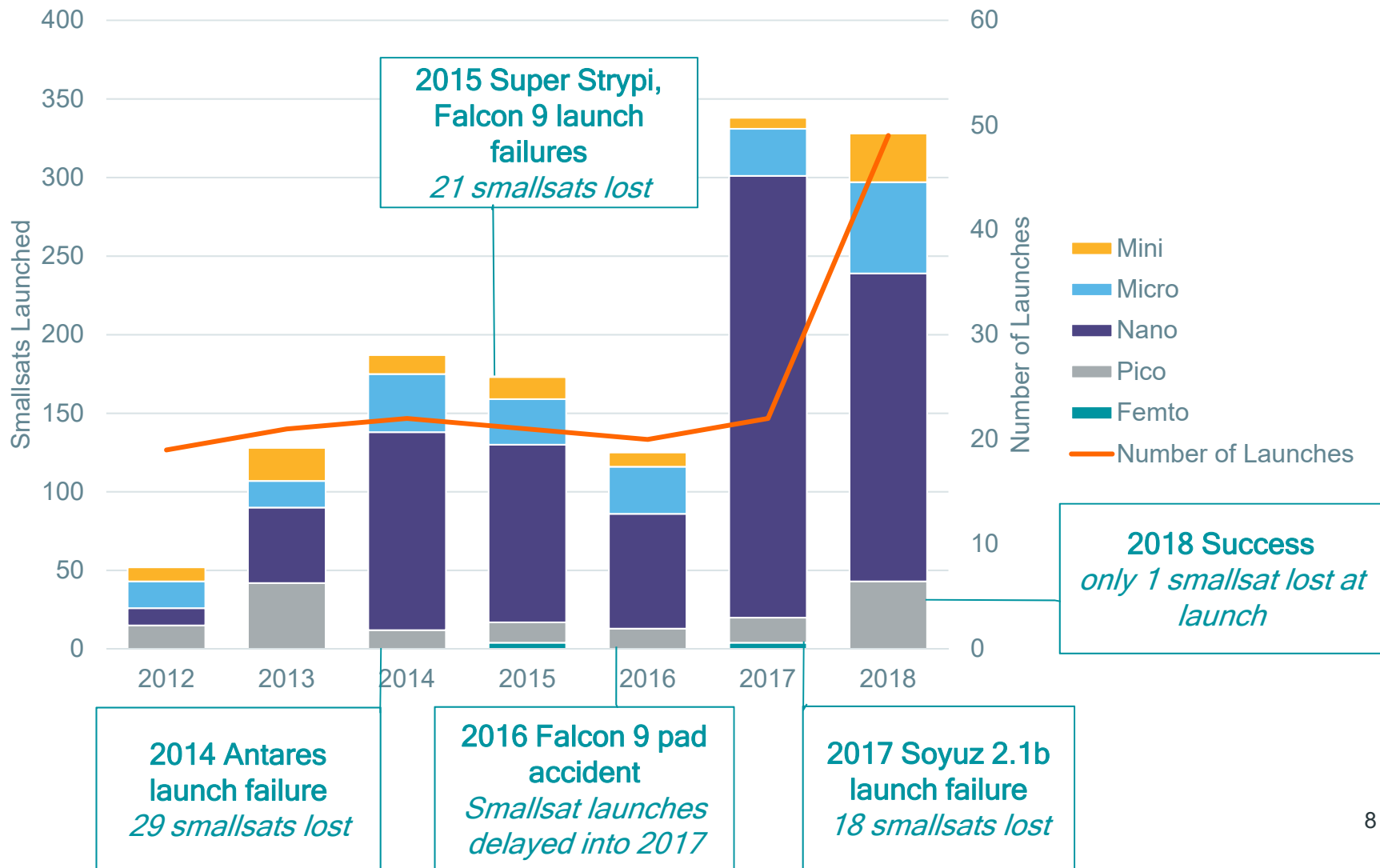
The Big Picture of Smallsats

Smallsats and All Satellites Launched, 2012 - 2018



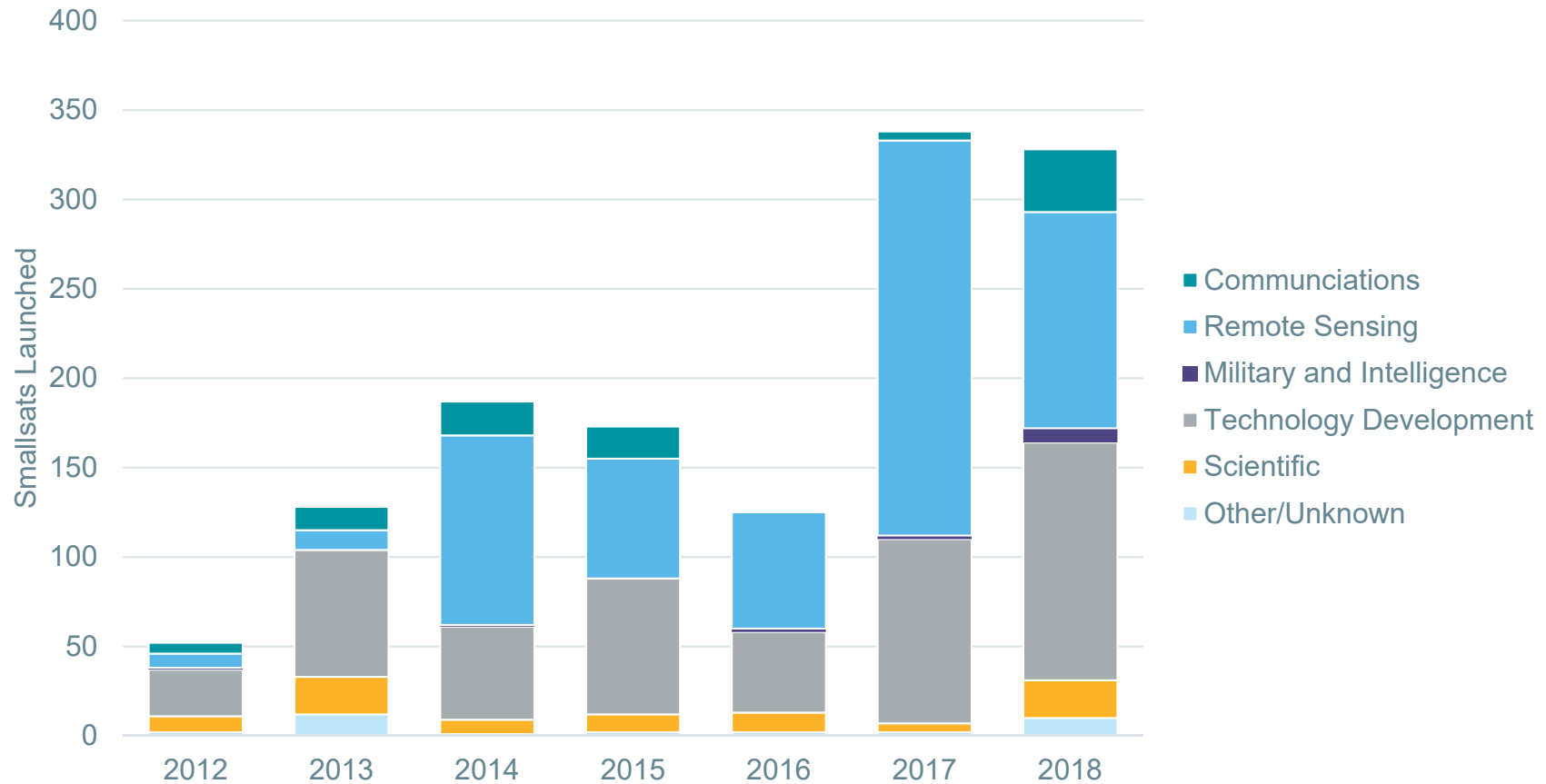
The Big Picture of Smallsats

Impact of Launch Failures, 2012 - 2018



The Big Picture of Smallsats

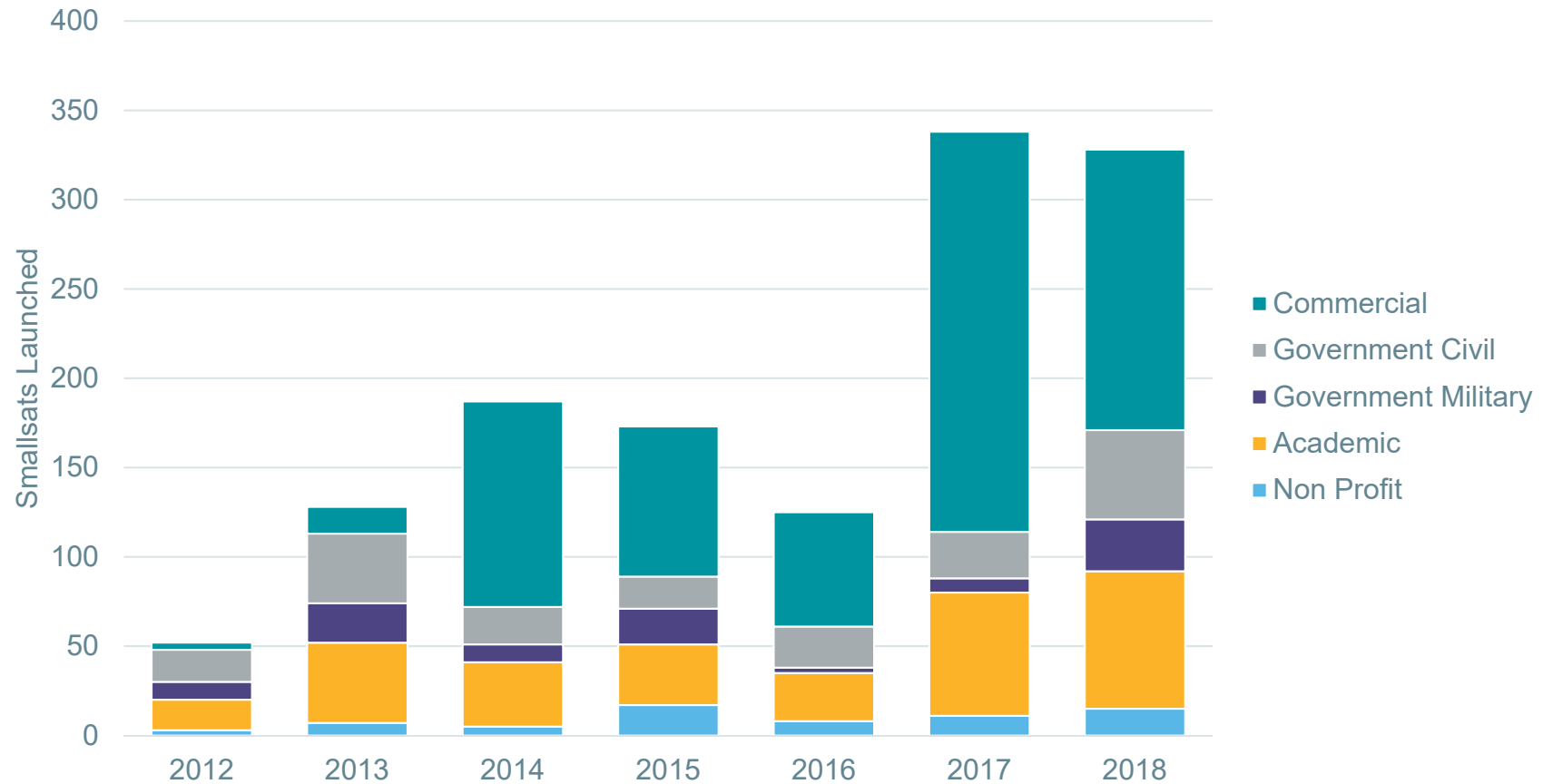
Smallsats by Application, 2012 - 2018



Planet deployed 60% of all remote sensing smallsats 2012 - 2018

The Big Picture of Smallsats

Smallsats by Operator Type, 2012 - 2018



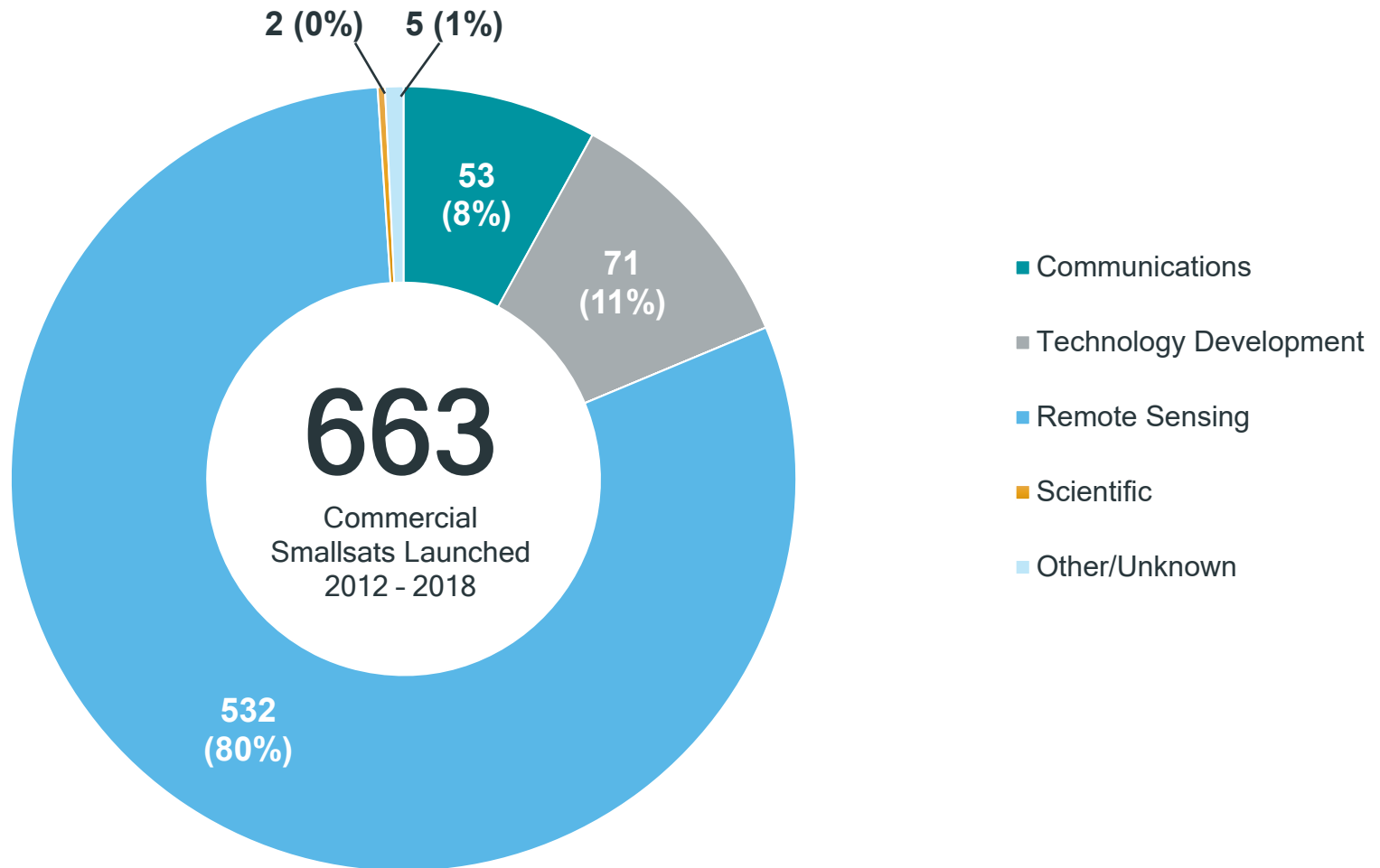
Commercial Smallsats

2012 - 2018

- ✓ In the last seven years, **663** commercial smallsats launched
- ✓ Over **80%** were for remote sensing
- ✓ Over **half** were manufactured by Planet
- ✓ Over **80%** were manufactured by US companies
- ✓ Planet and Spire account for about **two-thirds**
- ✓ From 2016 to 2018, the total number of commercial smallsats launched increased by **2.5x**

Commercial Smallsats

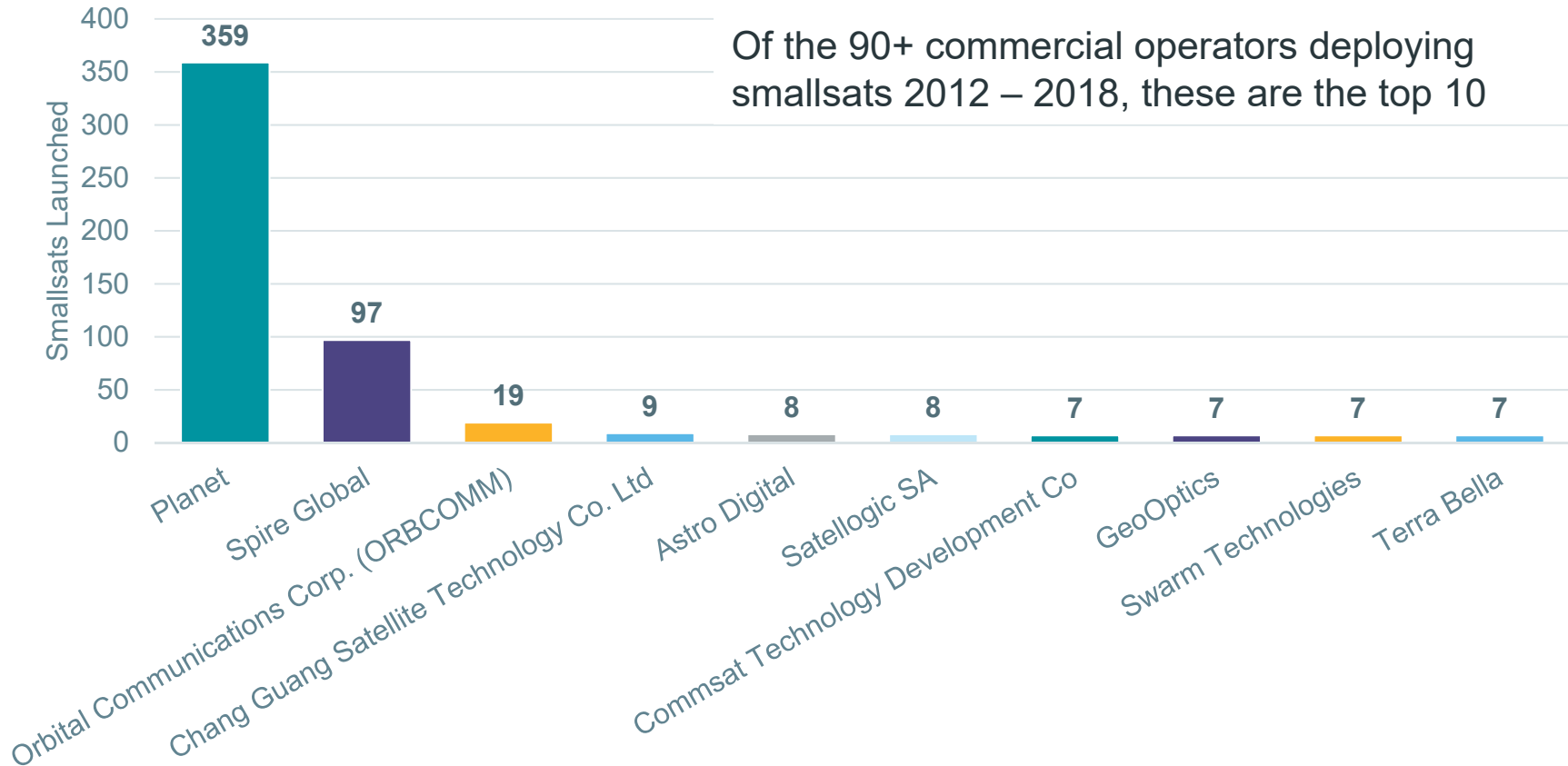
By Application



Commercial Smallsats



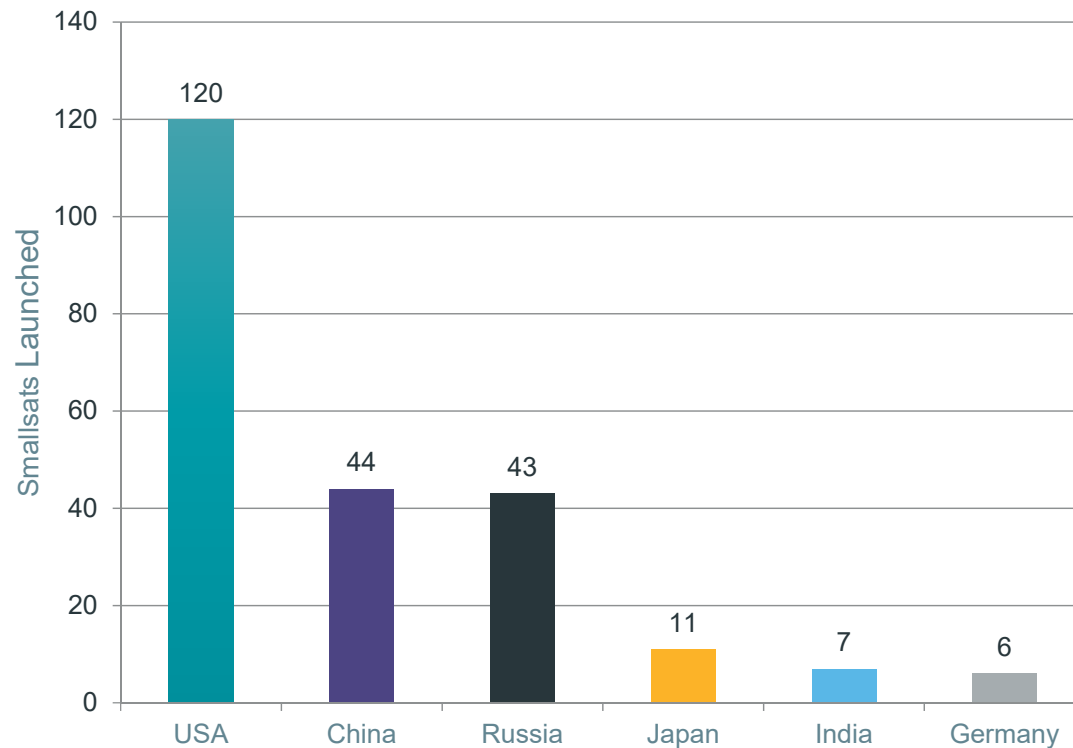
Commercial Operators Launching the Most Smallsats, 2012 - 2018



Notes: Planet has operated Terra Bella satellites since acquiring Terra Bella in 2017. Unlike the rest of the companies shown, ORBCOMM is a long-established operator, that first deployed satellites in the 1990s. In January 2018, Swarm Technologies launched 4 SpaceBee smallsats without authorization from the FCC.

Government Smallsats

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	

Government Smallsats



Largest Government Smallsat Operators, 2012 - 2018

Type	Operator	Smallsats Launched
Civil	NASA, USA	46
	Roscosmos, Russia	14
	Los Alamos National Laboratory, USA	12
	Smolsat/Gonets, Russia	8
	China Aerospace Science and Technology Corporation (CASC)	6
	China National Space Administration (CNSA)	6
Military (based on public sources)	USA DoD	39
	Russian MoD	20
	People's Liberation Army (PLA), China	17
	Project Biarri (Australia Defence)	5
	Korean People's Army	3

Academic and Non-Profit Smallsats

2012 - 2018

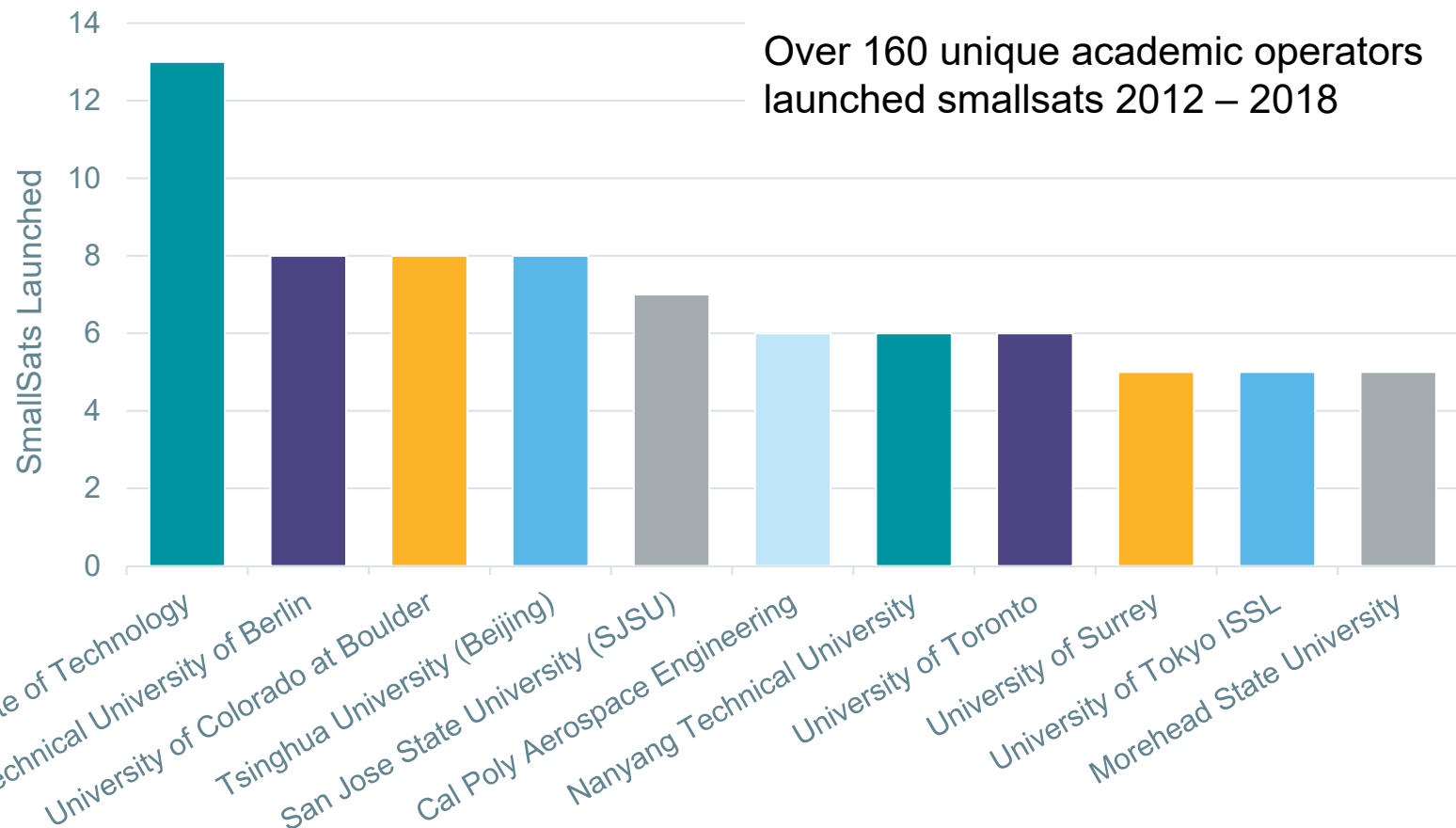
- ✓ Academic and non-profit organizations deployed **371** smallsats 2012 - 2018
 - Over **300** were for technology development
 - Over **80%** were CubeSats
- ✓ Number of academic and non-profit organizations that manufacture smallsats nearly **quadrupled** from 2012 - 2018
- ✓ Over the last six years, nearly **200** non-profit and academic organizations launched smallsats, many deploying only one or two

Academic and Non-Profit Smallsats



Top Academic Smallsat Operators, 2012 - 2018

Academic Operators with 5+ Smallsats Deployed



CubeSats

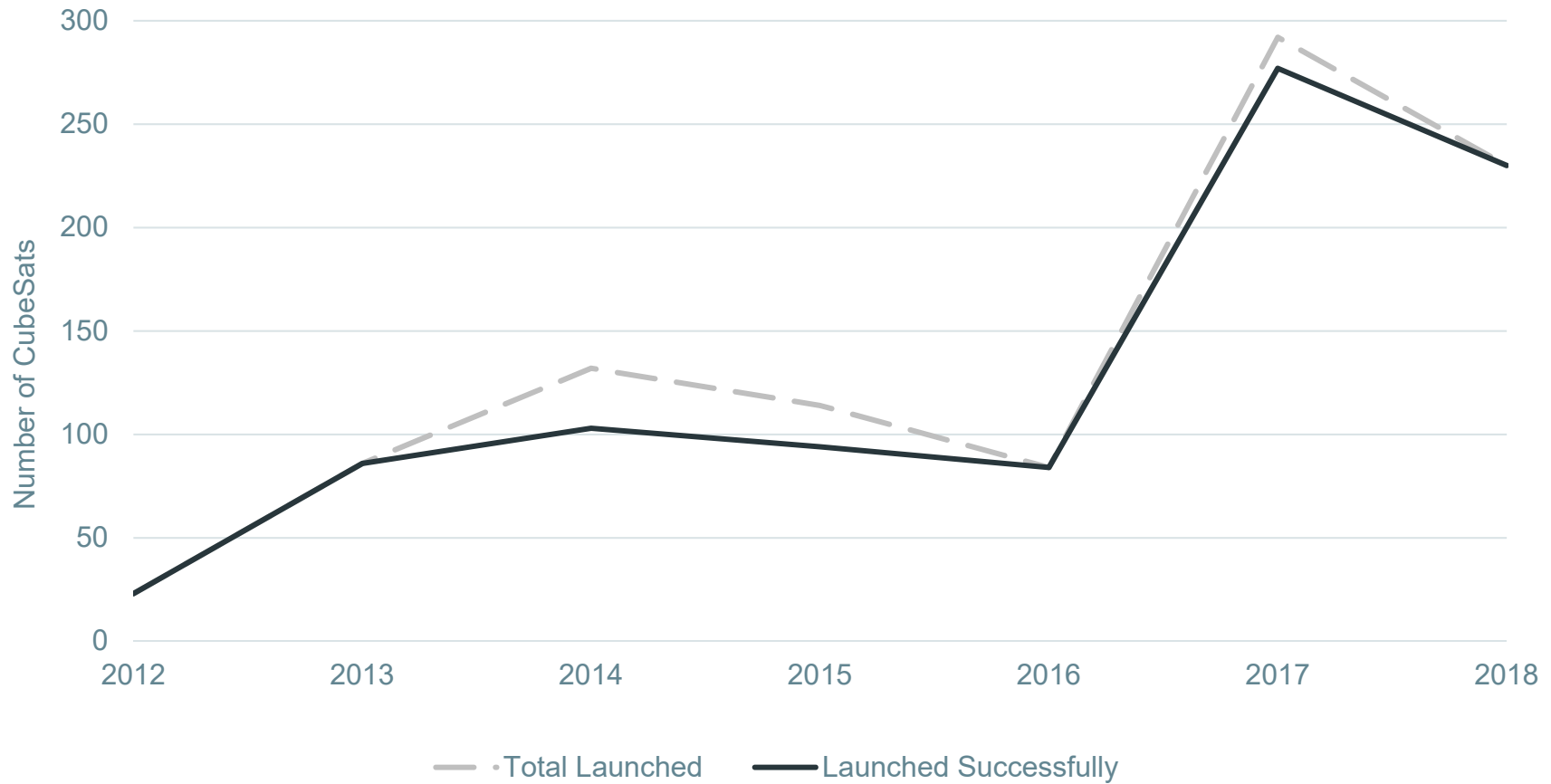


Overview, 2012 - 2018

- In total, **950+** CubeSats launched 2012 - 2018
- About **60%** have provided commercial services; about two-thirds were Planet's Dove CubeSats
- Over **10%** were government; about **two-thirds** were for civil purposes
- About **25%** were launched by academic organizations
- CubeSats launched per year grew from **23** in 2012 to **230** in 2018

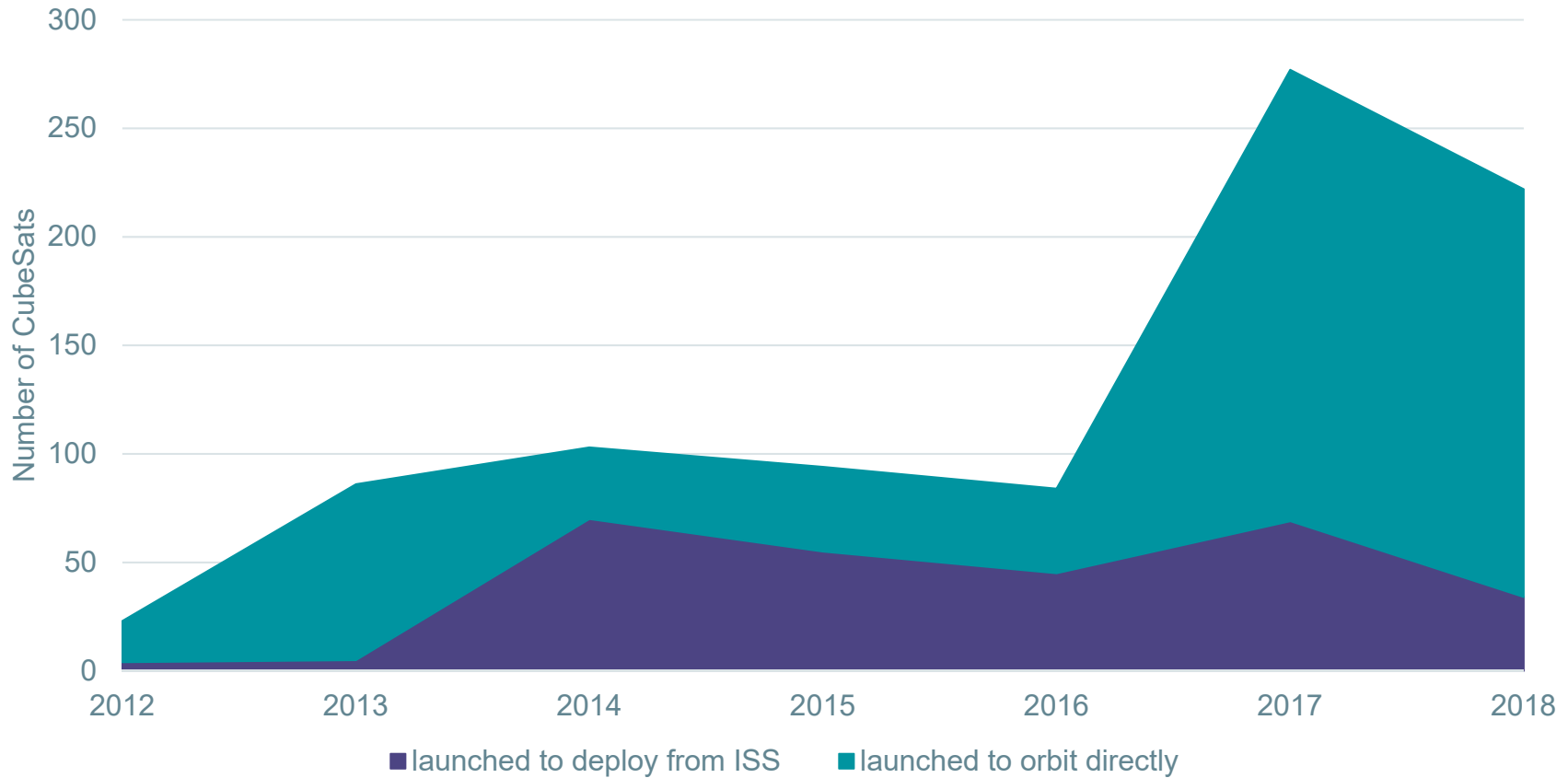
CubeSats

Launched per Year, 2012 - 2018



CubeSats

Successfully Deployed, 2012 - 2018



In addition to the successful deployments in this chart, a total of 64 CubeSats were lost in launch failures in 2014, 2015, and 2017. No launch failures affected CubeSats in other years listed.

Outlook

What Lies Ahead for Smallsats

- ✔ Smallsat business ventures seek to prove their business models and generate significant revenue in the next few years
- ✔ Deployment of future generations of smallsats will often depend on this success
- ✔ Dozens of new small launchers in development target smallsats
 - Virgin Orbit, Rocket Lab, and Vector have announced contracts
 - Rocket Lab began commercial operations in 2018; Virgin Orbit and Rocket Lab are conducting test flights with commercial operations expected in 2019
 - High business risks: uncertainty about future smallsat deployment, competition from larger vehicles
- ✔ Large smallsat constellations raise concerns about orbital debris: SpaceX, Boeing, and others are developing constellations with 600 to 1,000+ satellites



space and technology

Corporate Headquarters

1199 North Fairfax Street, Suite 501
Alexandria, VA 22314
(703) 647-8078
info@brycetek.com



[twitter.com BryceSpaceTech](https://twitter.com/BryceSpaceTech)



brycetek.com



[linkedin.com/company/bryce-space-tech](https://www.linkedin.com/company/bryce-space-tech)

Primary Authors

Tara Halt
Anna Wieger

Data Analysis

Nick Boensch
Anton Dolgopolov
Phil Smith
Amanda Hernandez

