

# The Rise of SmallSats and Satellite Constellations – Growth and Drivers

Carissa Christensen  
CEO, BryceTech

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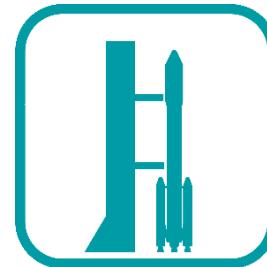
## Satellite Value Chain



Communications (tv, radio, internet)  
Remote sensing  
Satellite servicing  
SDA/STM  
Satellite manufacturing

- ✓ *Commercial*
- ✓ *Mature*
- ✓ *Under pressure, transforming*

Highly relevant to national security space



## In-Space Activities

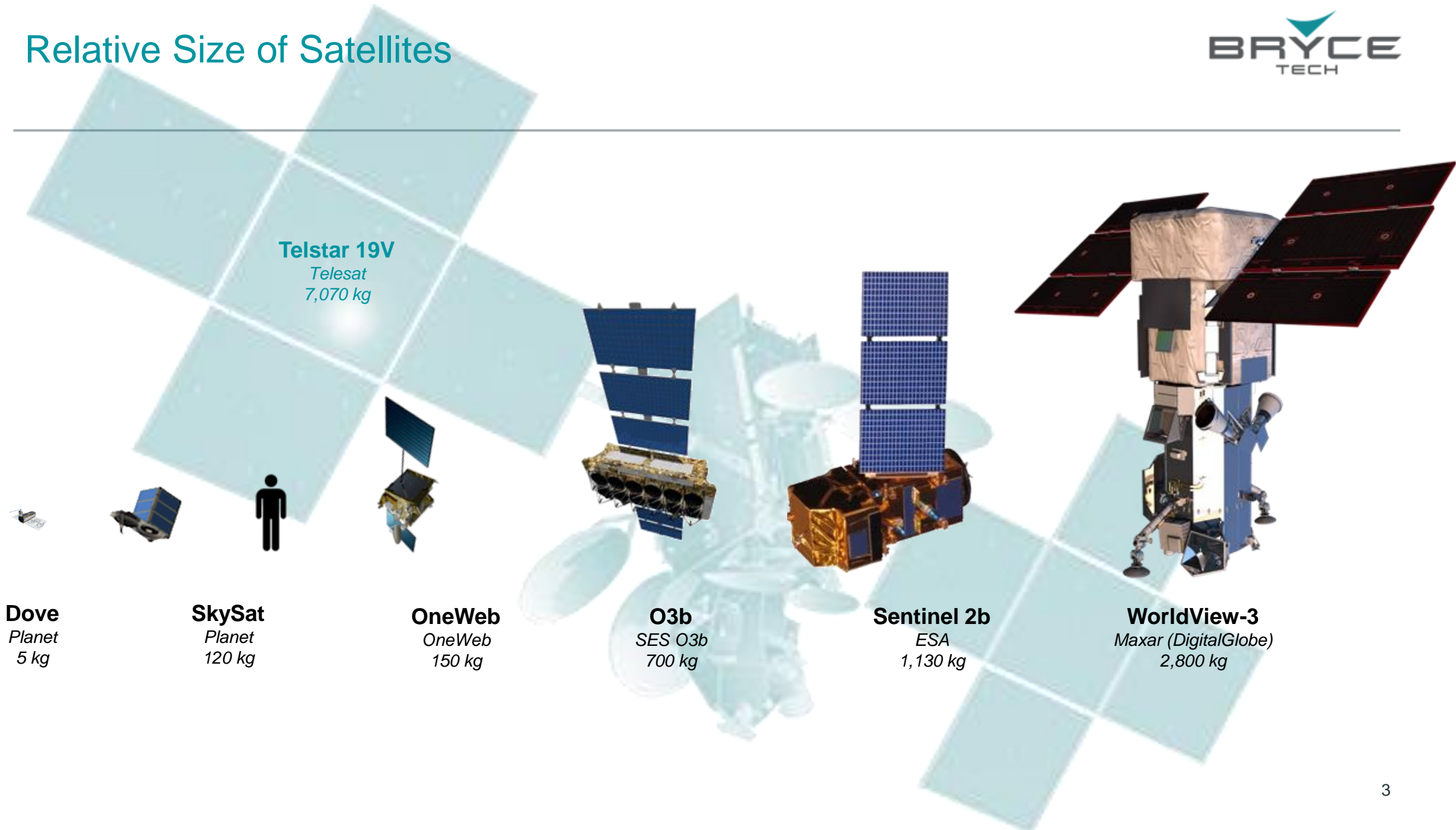


Tourism  
Platforms  
Non-satellite ISAM  
Science  
Exploration

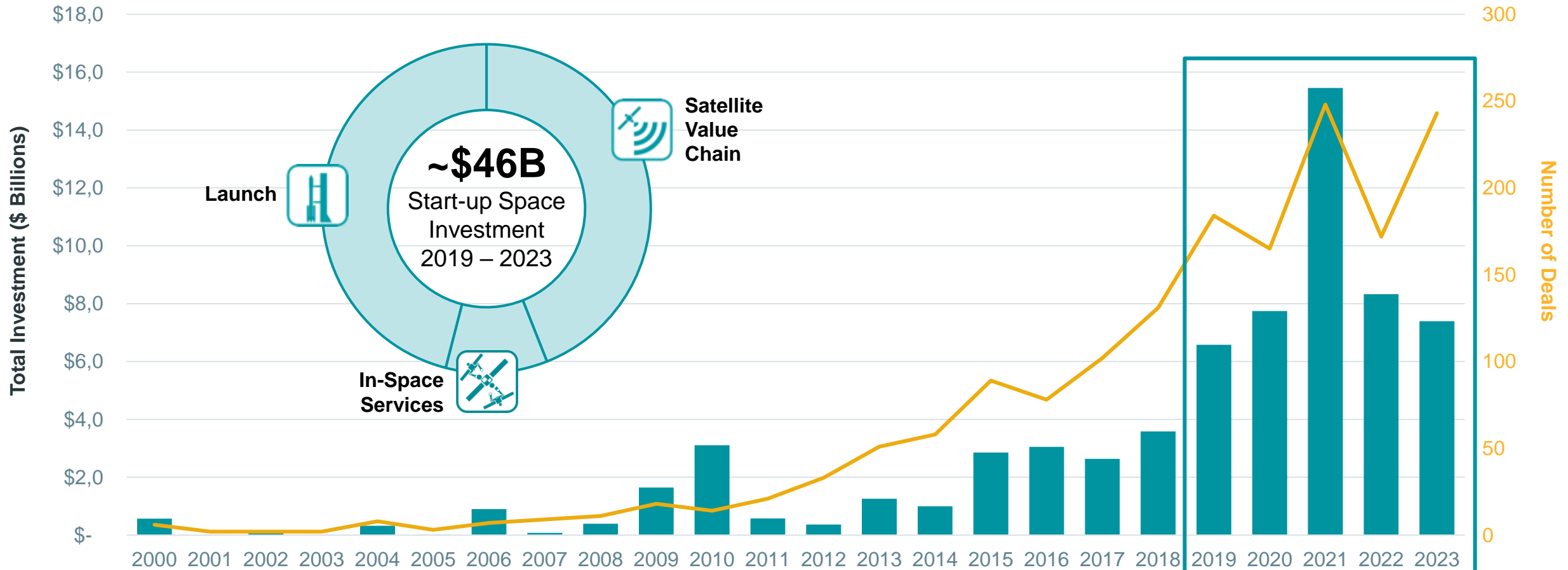
- ✓ *Government-driven*
- ✓ *Emerging*
- ✓ *Unclear path to scale*

Highly relevant to civil space

# Relative Size of Satellites

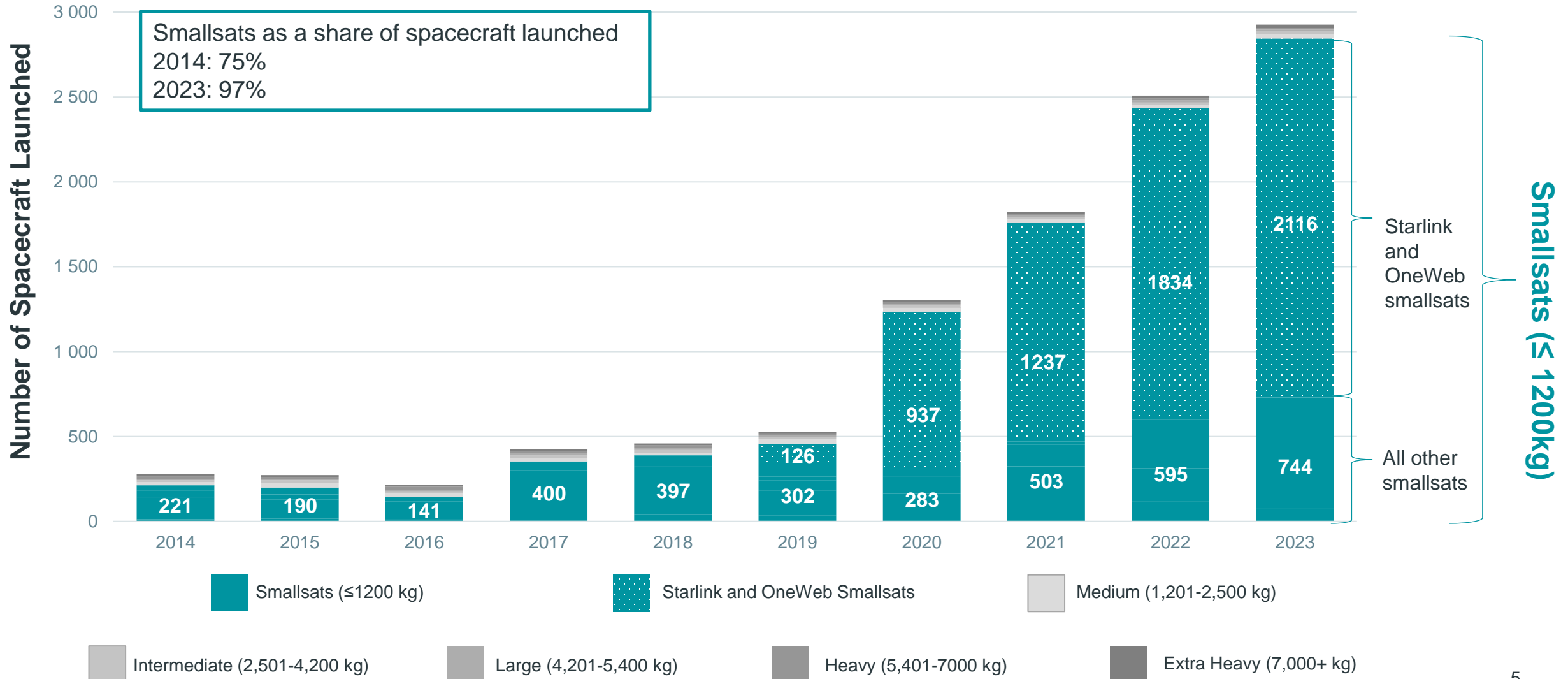


# Investment in Start-up Space Ventures

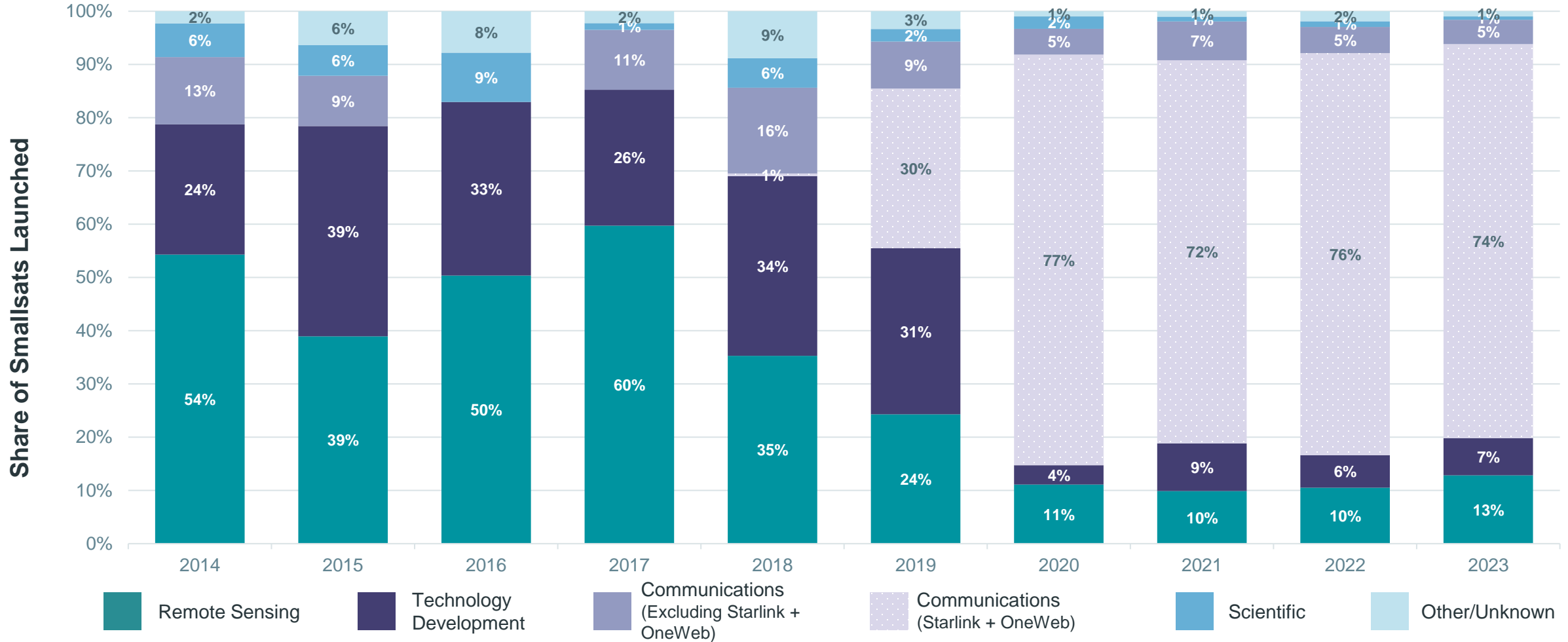


**\$7.4B of investment in 2023, ~\$46B since 2019;  
 Since 2019, ~530 space start-ups have received funding from ~1,800 unique investors**

# Spacecraft Launched 2014 – 2023, by Mass Class



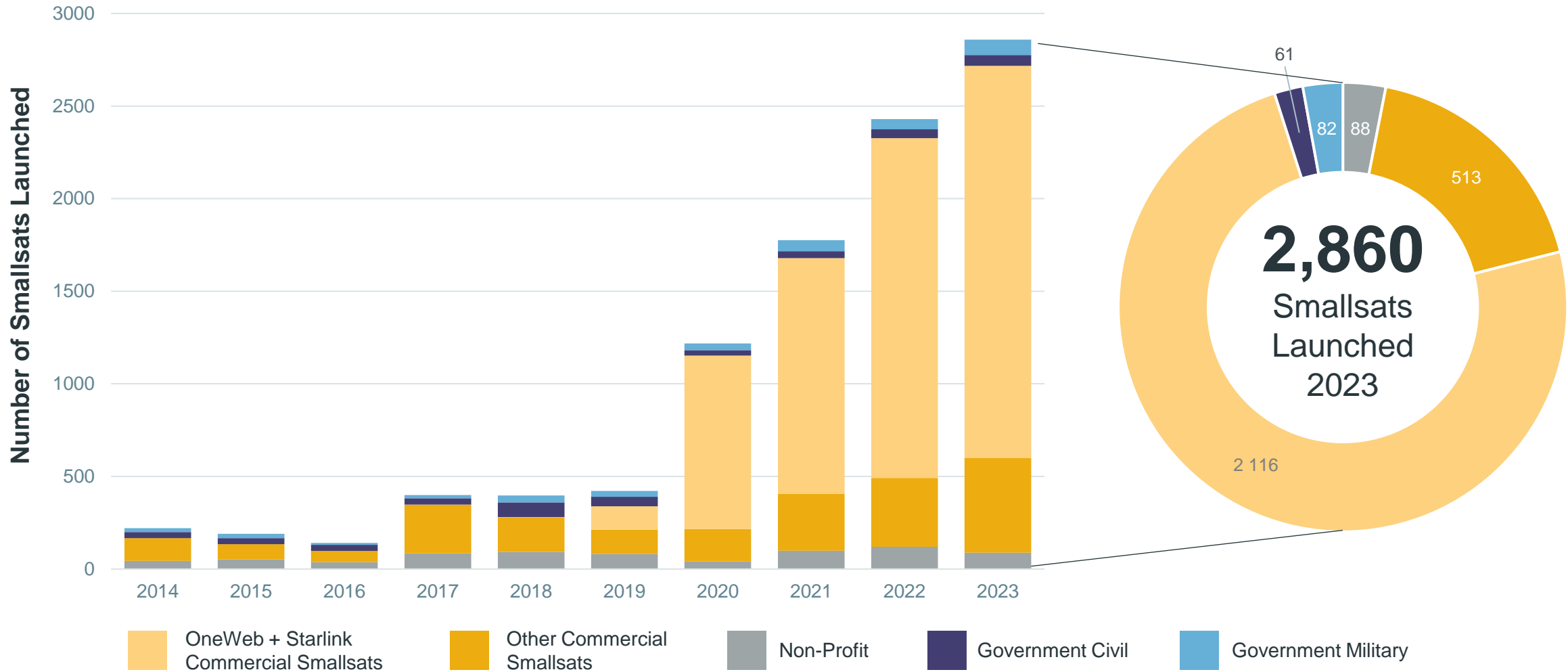
# Smallsats 2014 – 2023, by Application, Including Starlink and OneWeb



**Communications satellites constitute the largest share of smallsats in 2023. Relative share of remote sensing and technology development smallsats has decreased due to launch of LEO communication smallsats**

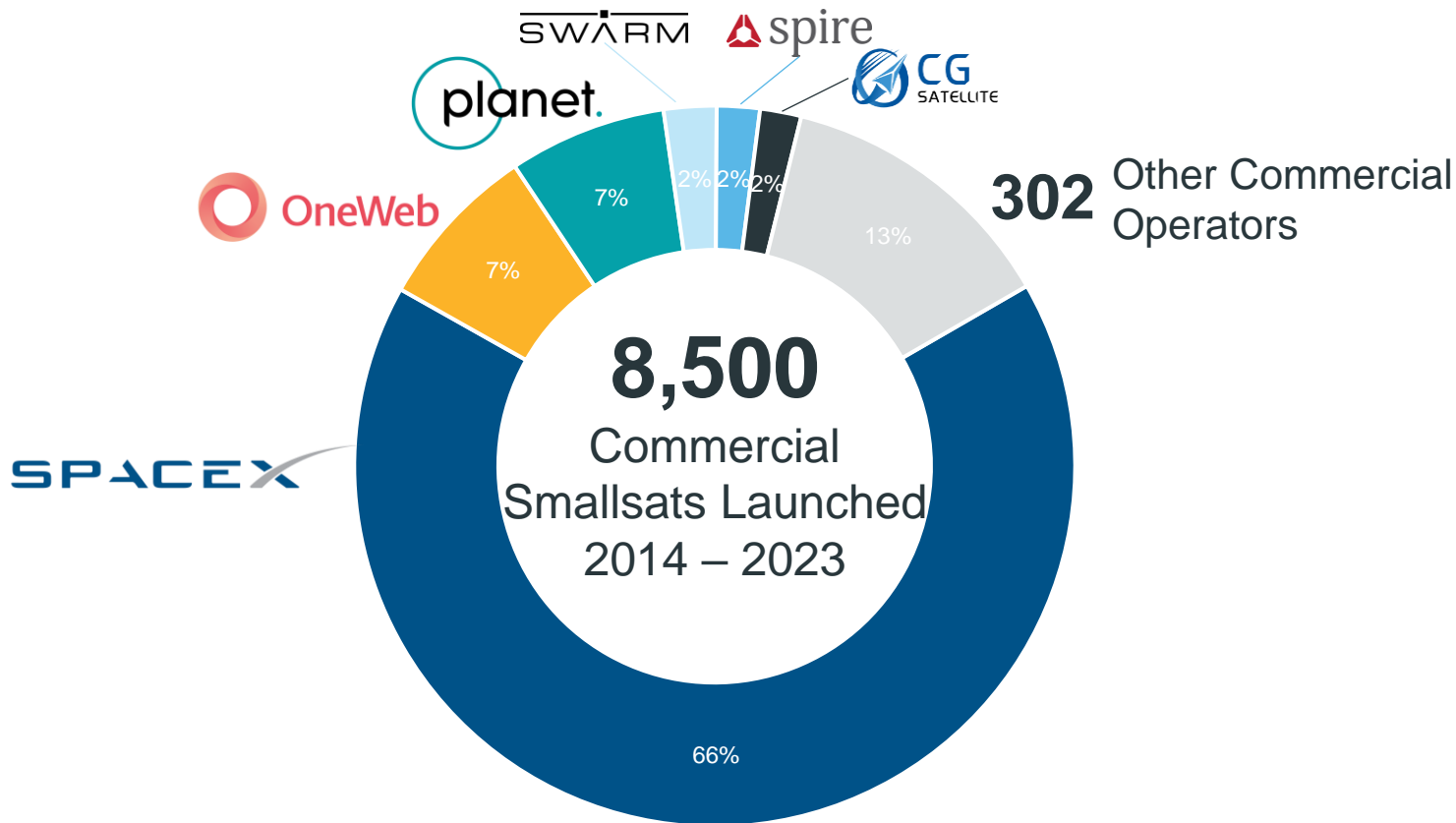
# Number of Smallsats 2014 – 2023, by Operator Type

## Number of Smallsats 2014 – 2023, by Operator Type



Number of commercial smallsats launched increased from 115 smallsats in 2014 to 2,629 in 2023

**87% of smallsats launched 2014 – 2023 are owned by 6 operators**

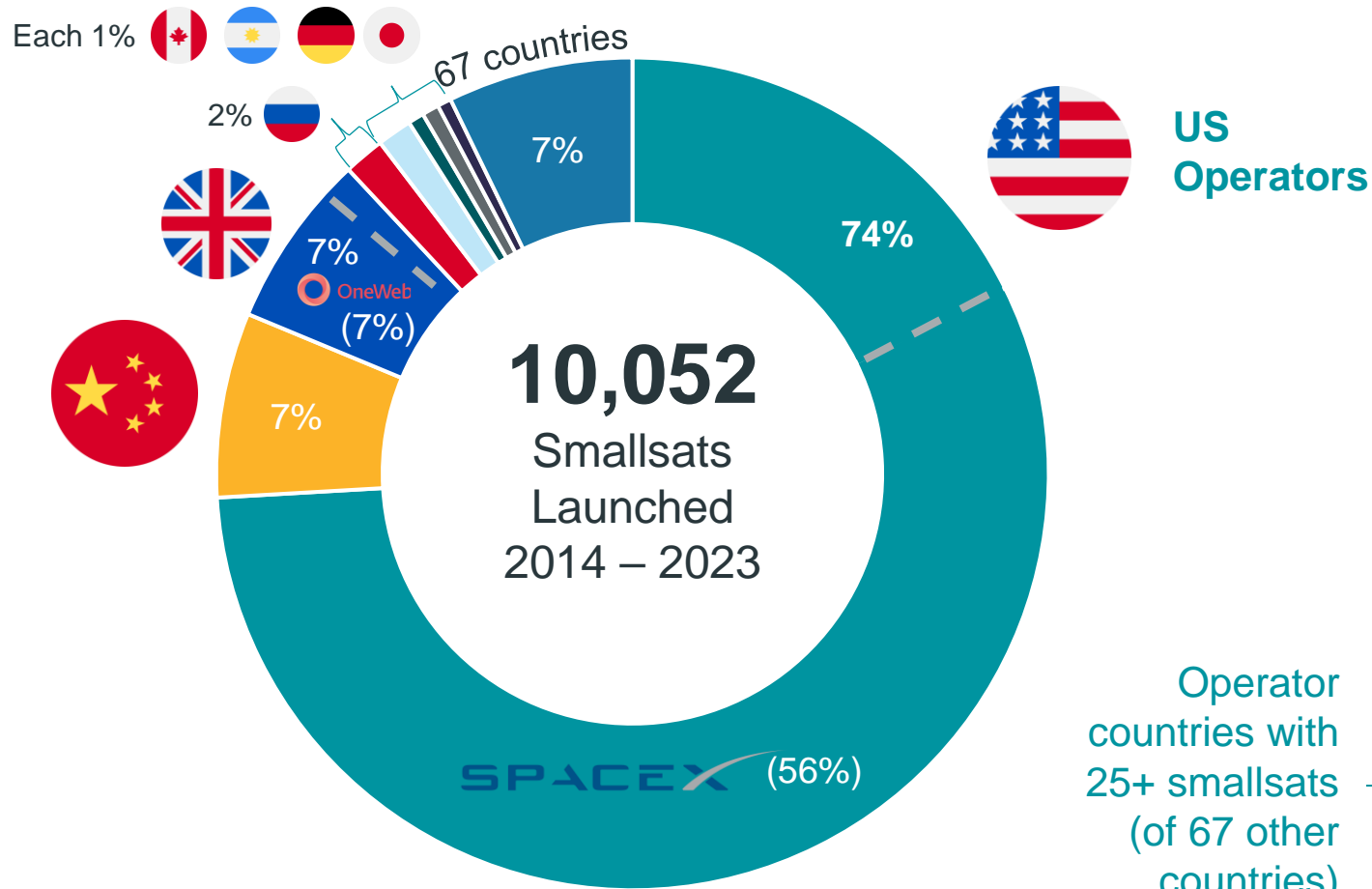


## Operators with >15 smallsats

Operator	# of Smallsats
Satelloptic	44
ICEYE	30
Kepler	23
Guodian Gaoke	21
Astrocast	20
Spacety	19
BlackSky	18
HawkEye 360	18
Xioyong Microelectronics Park	18
ORBCOMM	17
Fossa Systems	17
BlackSky Global	16
Kleos Space	16
Abla Orbital	15



# Smallsats 2014 – 2023, by Operator Country



**U.S. operators dominate smallsats, accounting for  $\frac{3}{4}$  of those launched since 2014**

Operator Country	# of Smallsats
USA	7,420 (5,652 Starlink)
China	719
UK	679 (636 OneWeb)
Russia	159
Japan	135
Canada	66
Germany	62
Argentina	54
Italy	49
France	47
Spain	47
India	45
Finland	38
South Korea	37
Israel	33
Australia	32
Netherlands	31

# Major LEO Telecommunication Constellations

As of January 2024

## OneWeb

United Kingdom  
Broadband  
648 satellites (648 on orbit)  
Estimated constellation cost: \$7B  
Initial launch: 2019  
Satellite mass: 150 kg

## Amazon Kuiper

United States  
Broadband  
3,000 satellites (none on orbit)  
Estimated constellation cost: \$10B  
Initial launch: 2024  
Satellite mass: 700 kg (est.)

## Rivada

Germany  
Broadband  
576 satellites (none on orbit)  
Contract with manufacturer for \$2.4B  
Initial launch: 2025  
Satellite mass: 500 kg

## AST SpaceMobile

United States  
Mobile telephony  
243 satellites (1 on orbit)  
Initial launch: 2022  
Satellite mass: 1,500 kg (est.)

## Iridium NEXT

United States  
Mobile telephony  
95 satellites (82 on orbit)  
Initial launch: 2017  
Satellite mass: 860 kg

## Lynk Global

United States  
Mobile telephony, broadband  
5,000 satellites (5 on orbit)  
Total raised: <\$50M  
Initial launch: 2023  
Satellite mass: TBD

## SpaceX Starlink

United States  
Broadband  
12,000 satellites approved by FCC  
40,000 satellites planned  
Estimated constellation cost: \$10B  
Initial launch: 2019  
Satellite mass:  
227-295 kg (Gen 1)  
800 (Gen 2 Mini)  
1,250 kg (Gen 2)

## Telesat Lightspeed

Canada  
Broadband  
198 satellites (none on orbit)  
Estimated constellation cost: \$4B  
Initial launch: 2026  
Satellite mass: 700 kg (est.)

## Globalstar

United States  
Telephony, data  
25 satellites (25 on orbit)  
Initial launch: 2010  
Satellite mass: 700 kg

## Kepler

Canada  
Internet of things  
150 satellites (18 on orbit)  
Total raised: \$200M+  
Initial launch: 2018  
Satellite mass: 10 kg (est.)

## E-Space

United States, France, Rwanda  
Broadband  
300,000 satellites (none on orbit)  
Total raised: \$50M+  
Awaiting FCC approval  
Initial launch: 2024 (3 demo sats in 2022)  
Satellite mass: TBD

## Guowang

China  
Broadband  
~13,000 satellites (none on orbit)  
ITU filing in 2020  
Initial launch: TBD  
Satellite mass: TBD

## G60

China  
Broadband  
~12,000 satellites (none on orbit)  
Total raised: \$50M+  
ITU filing in 2023  
Initial launch: TBD  
Satellite mass: TBD



## Fleet Space

Australia  
Internet of things  
140 satellites (7 on orbit)  
Total raised: \$70M+  
Initial launch: 2018  
Satellite mass: 10 kg (est.)

## IRIS<sup>2</sup>

European Union  
Broadband  
170+ satellites (none on orbit)  
Initial launch: 2026  
Satellite mass TBD

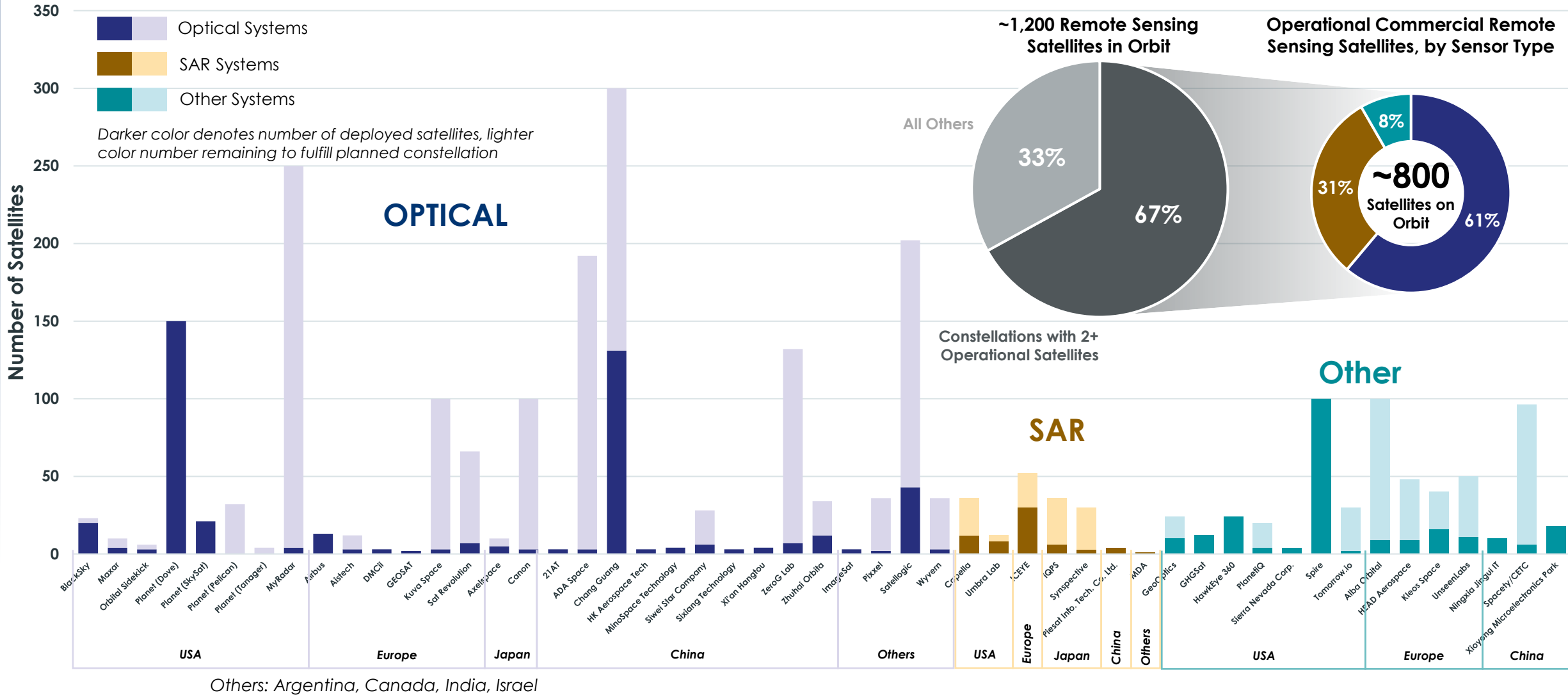
### LEGEND

-  Currently Operating Satellites
-  Constellation Size



# Case Study: Commercial Remote Sensing Services

Systems with at least two operational satellites, by relative size of constellation, percentage of satellites on orbit, and sensor type

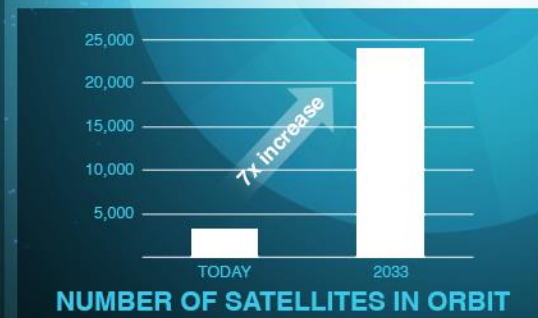


# IF PLEO BROADBAND SUCCEEDS, MOST SATELLITES WILL BE COMMERCIAL SMALLSATS IN 2033

Government satellites will typically be larger, more capable, and more expensive than commercial satellites



EMERGING SPACE SERVICES  
COMMERCIAL



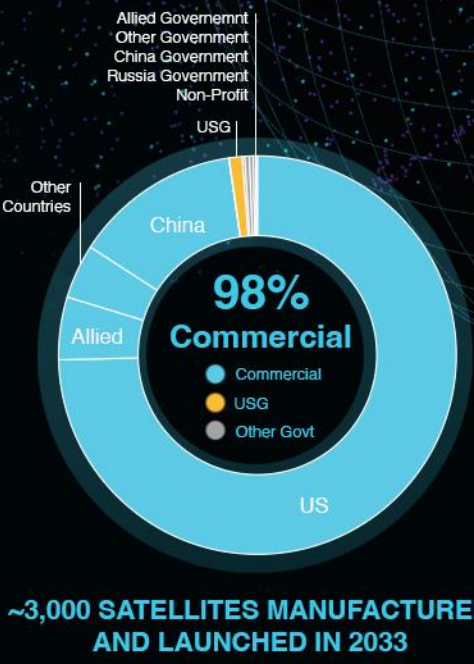
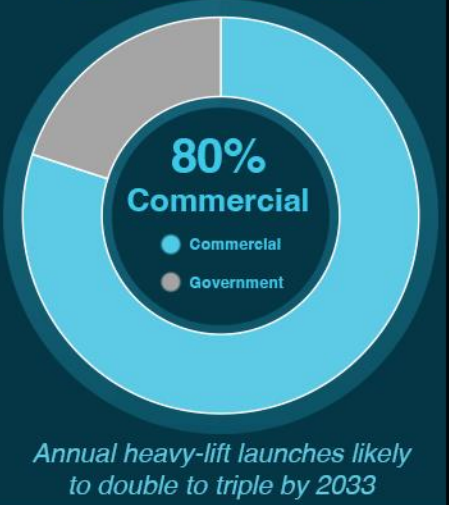
## COST COMPARISON



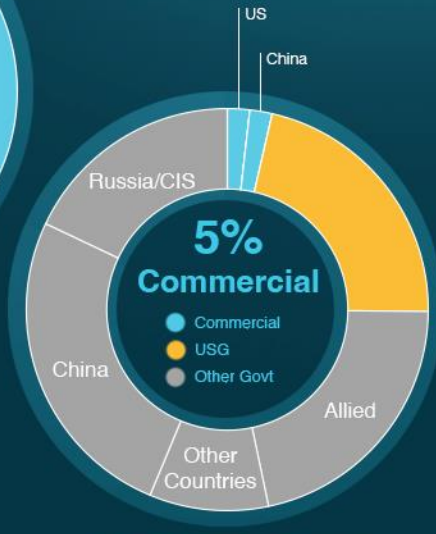
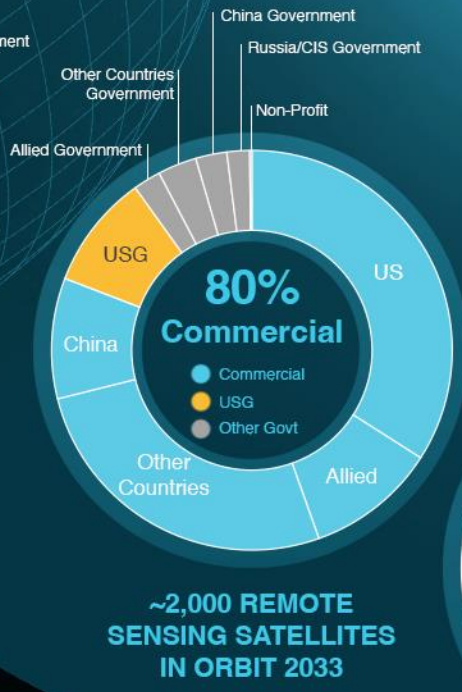
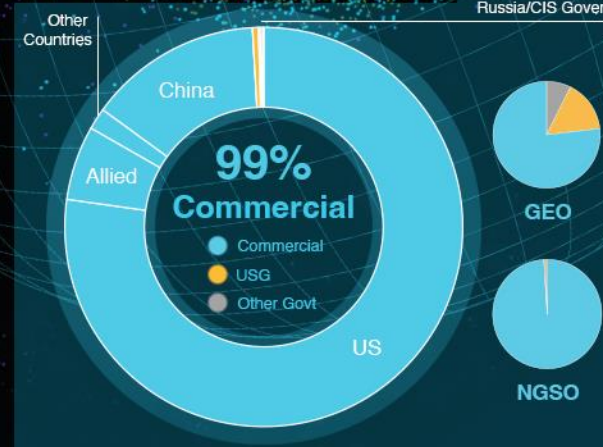
## MASS COMPARISON



## HEAVY-LIFT LAUNCHES



Allied: Australia, Canada, France, Germany, Japan, Italy, New Zealand, South Korea, and the United Kingdom



Estimates based on BryceTech data sets and models  
Debris visualization data source: <http://astria.tacc.utexas.edu/AstriaGraph/>



## BryceTech

1737 King Street, Suite 601  
Alexandria, VA 22314



@BryceSpaceTech



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



703.647.8078



[Info@brycetek.com](mailto:Info@brycetek.com)