

Remote Sensing in Context

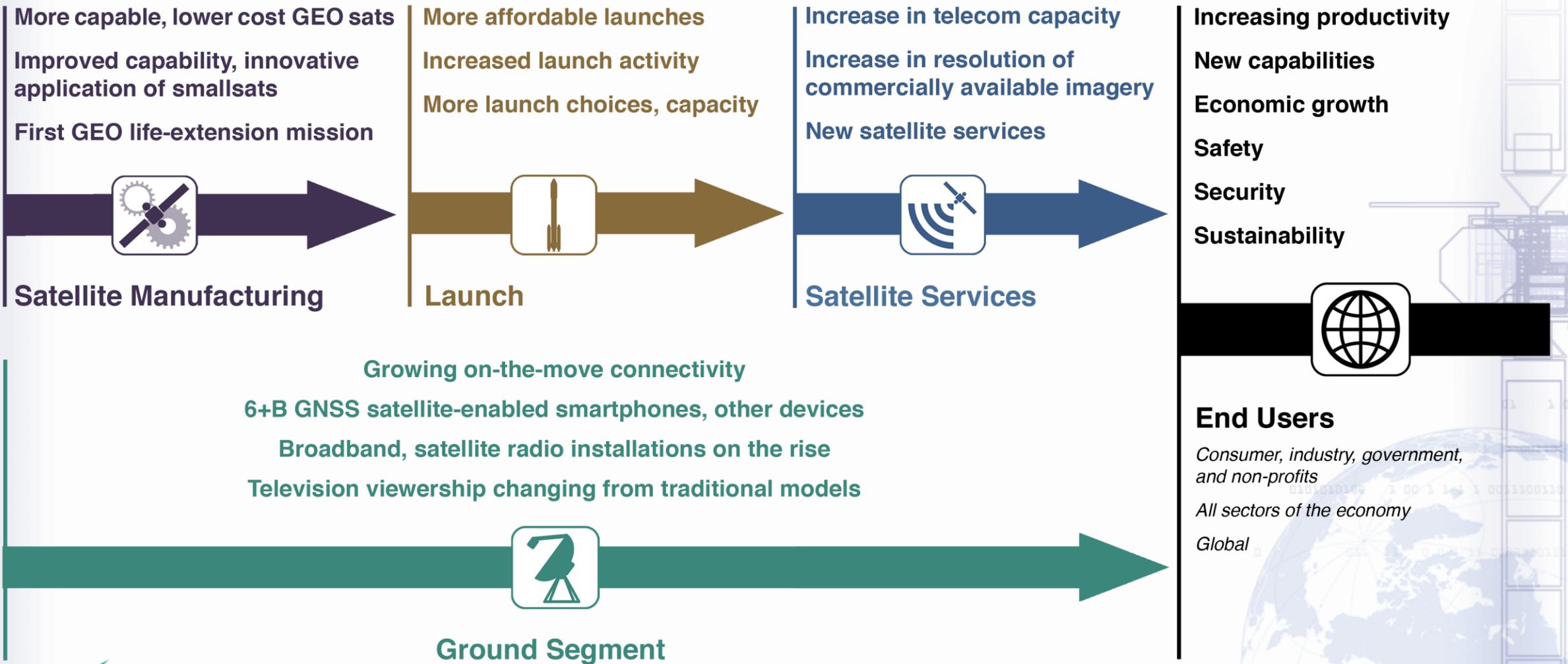
Carissa Christensen, CEO

Bryce Space and Technology

October 2020

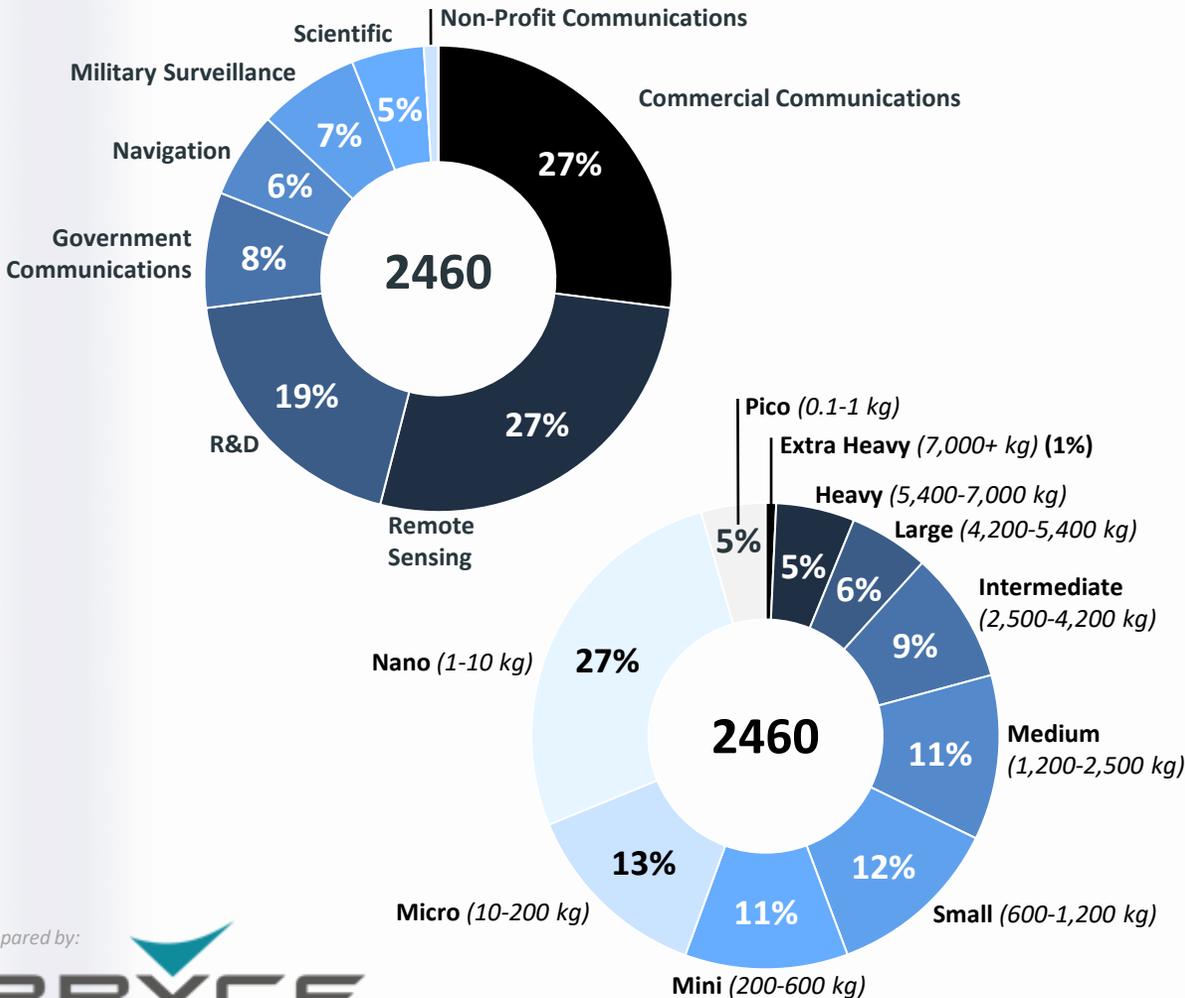
Increasing Productivity, New Capabilities

Changing Industry Dynamics



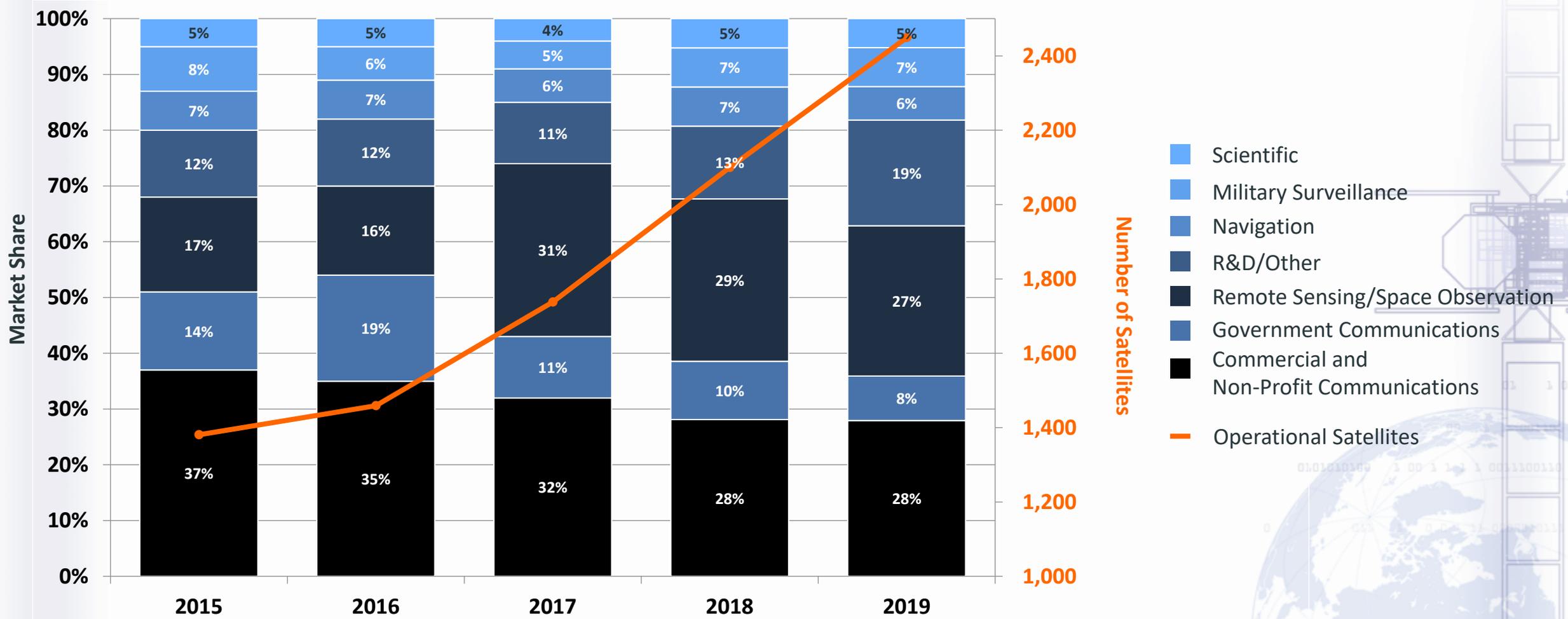
The Satellite Network in Context

**Operational Satellites
by Function and Mass Class**



- ✦ Estimated as of December 31, 2019
- ✦ Number of satellites increased 77% over 5 years (from 1,381 in 2014)
 - Satellites launched 2015—2019 increased 114% over previous 5 years
 - Average 349/year
 - Due mostly to small satellites in LEO (<1,200 kg)
 - Total satellite mass in orbit about 3,400 metric tons
 - Average operational lives of larger satellites growing; 218 active satellites launched before 2005
 - 562 active satellites in GEO (4 more than in 2018, mostly providing communications services)
- ✦ 2,460 satellites operated by entities from 75 countries (some in regional consortia). Cumulatively, 92 countries deployed at least one satellite since 1957
- ✦ U.S. entities operate 1,000+ satellites, some in partnership with other nations

Operational Satellites, by Year





Case Study: Remote Sensing Services



- ✦ Continued investment and innovation driven by interest in business intelligence products using satellite imagery and powered by advances in data analytics and artificial intelligence
- ✦ Maturing early stage firms working to build commercial customer bases, increasingly targeting government customers
- ✦ New capabilities being introduced: RF mapping, CH₄ emissions monitoring, and hyperspectral

Operational includes initial deployment through full capacity

Criteria for inclusion are satellites on orbit, announced funding, signed launch contract/agreement, or NOAA license. Other systems considered: ADASPACE, Aistech, Alba Orbital, Bluefield, Canon, ConstellIR, EOS SAR, Harris Corp., Horizon Technologies, Hypersat, Inovor, iQPS, ISIS, Karten Space, Kawa Space, KP Labs, Loft Orbital, Mino Space, OHB Italia, Orbital Sidekick, Orora Tech, Pixxel, Qian Sheng, Reaktor Space, Satbyul, Sat Revolution, Scanway, Sen, Smart Satellite, Spacefab.us, Space Systems Engineering, Spacety, Space Time, Synspectre, Trident Space, UnseenLabs, VEOWARE, XpressSAR, ZeroG Lab, Zhuhai Orbita

Acronyms: MS – multispectral, HS – hyperspectral, RO – radio occultation, RF – radio frequency, AIS – Automatic Identification System; ADS-B – automatic dependent surveillance—broadcast, SSA – space situational awareness

			High Res (<1m)	High revisit (<1 day)	Sensor Description	Number of Satellites	Typical Sat Mass (kg)	Generating Revenue (GR), Start-up no/some revenue (SU)	Added in 2019 SSIR
Large Sats	<i>Maxar</i>	USA	●	●	Optical (MS), radar	15	150-2,200	GR	
	<i>Airbus Intelligence</i>	FR	●	●	Optical (MS), radar	9	430-3,085	GR	
	<i>ImageSat</i>	IL	●		Optical (MS)	3	280-370	GR	
	<i>21AT/TripleSat</i>	UK/CN	●		Optical (MS)	3	350	GR	
	<i>SpaceWill (Gaojing)</i>	CN			Optical (MS)	24+	560	SU	
	<i>UrtheCast</i>	CAN	●	●	Optical, radar	26	300-1,400	GR	
Small Satellites (<200 kg)	<i>Astro Digital</i>	USA	●	●	Optical (MS)	30	10-20	SU	
	<i>Axelspace</i>	JP	●	●	Optical (MS)	50	95	SU	
	<i>BlackSky Global</i>	USA	●	●	Optical (MS)	60	55	SU	
	<i>Capella Space</i>	USA			Radar	40	TBD	SU	
	<i>Chang Guang (Jilin)</i>	CN		●	Optical (MS)	14	420	SU	
	<i>Earth-i</i>	UK	●	●	Optical (MS), video	15	100	SU	
	<i>GeoOptics</i>	USA		●	RO	24	~20	SU	
	<i>GHGSat</i>	CAN	●	●	Optical	10	15	SU	●
	<i>HawkEye 360</i>	USA		●	RF mapping	3+	13	SU	
	<i>Hera Systems</i>	USA		●	Optical (MS)	48	12	SU	
	<i>ICEYE</i>	FIN	●	●	Radar	18	150	SU	
	<i>Kleos</i>	LUX		●	RF mapping	20	TBD	SU	
	<i>NorthStar E&S</i>	CAN	●	●	Optical (HS), SSA	40	TBD	SU	●
	<i>Orbital Micro Systems</i>	UK		●	Optical (MS)	40	10	SU	
<i>Planet</i>	USA	●	●	Optical (MS), video	350+	4-150	GR		
<i>PlanetiQ</i>	USA		●	RO	18	20	SU		
<i>Satellopic</i>	ARG	●	●	Optical (HS)	90	37	SU		
<i>Spire Global</i>	USA		●	RO, AIS, ADS-B	115+	4.5-6	GR		
<i>SpaceVR</i>	USA	●		Optical (MS)	2	4	SU		
<i>Umbra Lab</i>	USA	●	●	Radar	12	50	SU		

Prepared by:



space and technology

Brycetech.com

✦ 703.647.8078

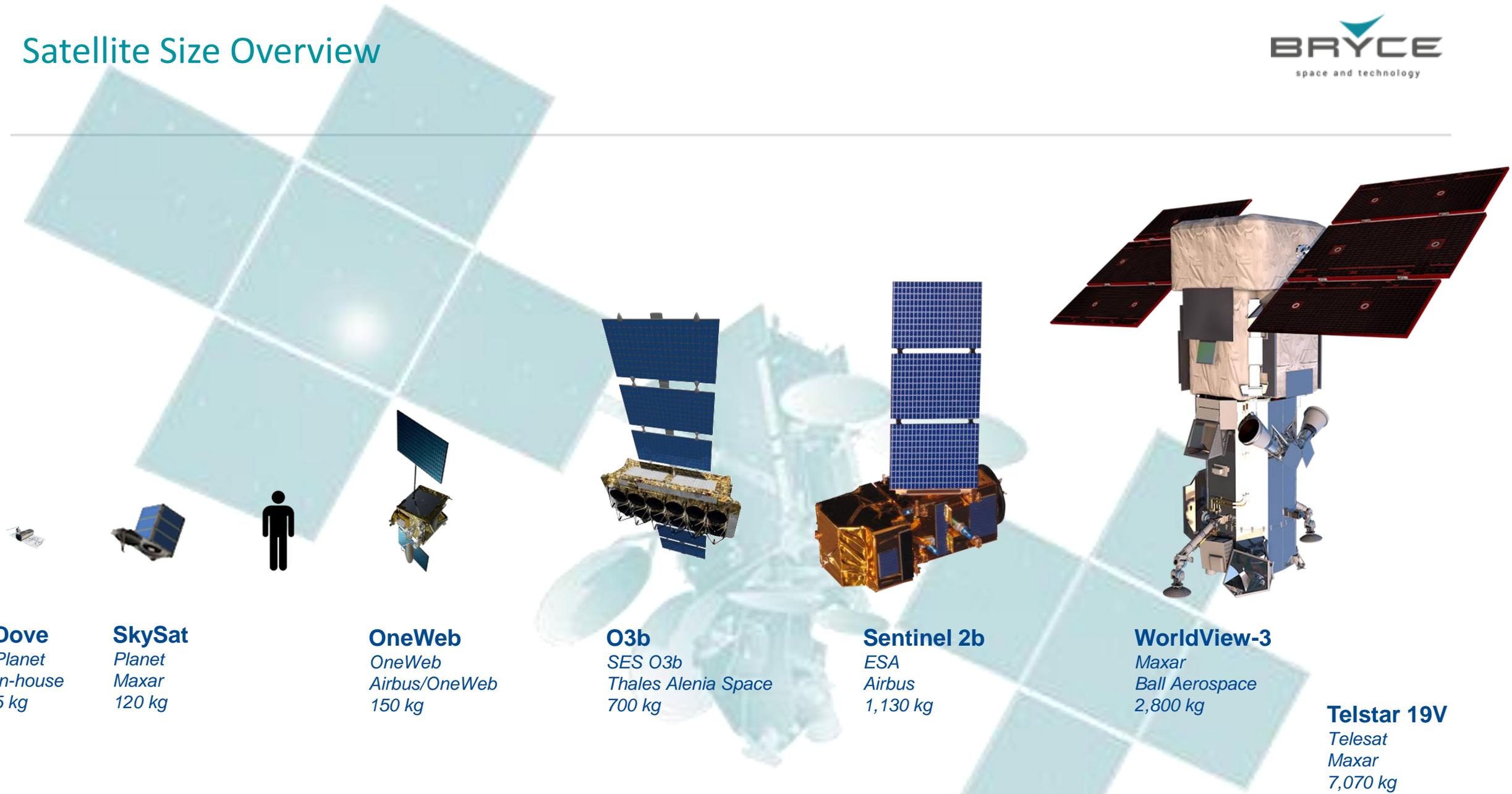
✦ @BryceSpaceTech

SIA.org

✦ 202.503.1560

✦ @SIA_satellite

Satellite Size Overview



Commercial Smallsats

Highlights



899

commercial smallsats launched, 2012 – 2019

68%

for remote sensing

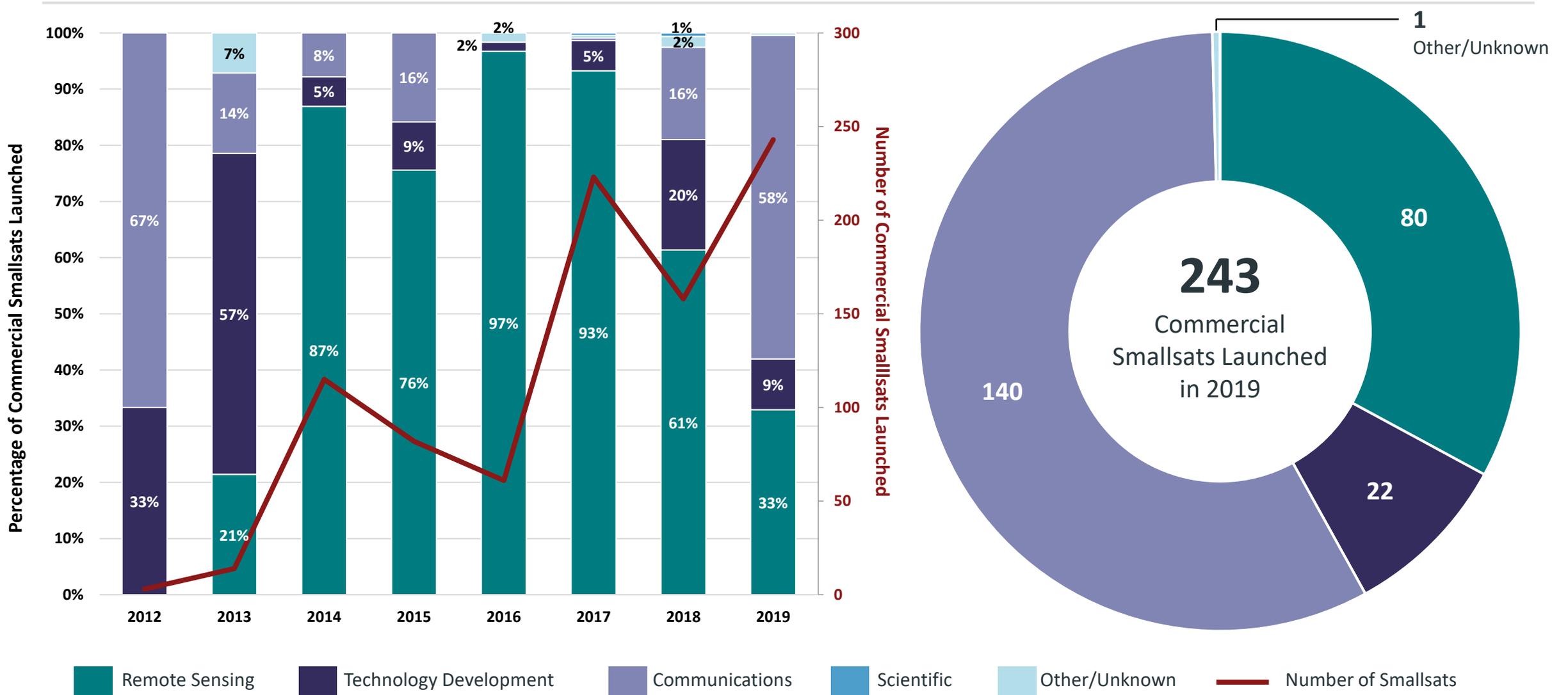
81%

manufactured by U.S. companies

70%

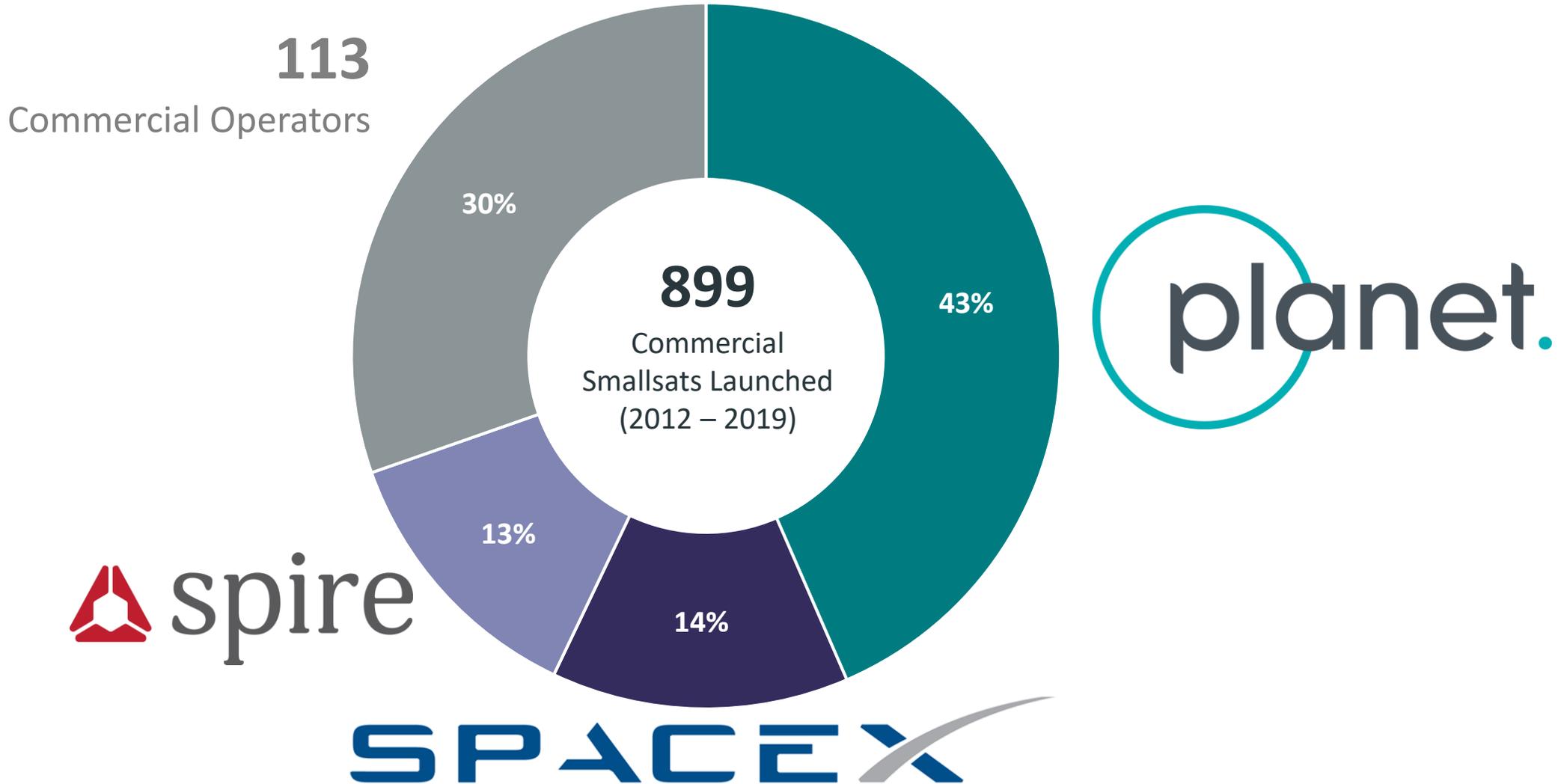
owned by Planet, SpaceX, Spire (largest smallsat operators)

Commercial Smallsats by Use

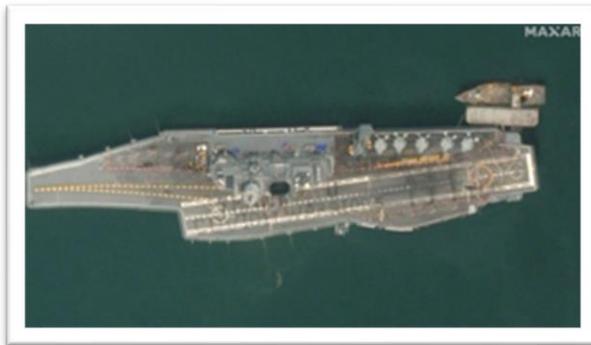


2019 Percentage by Operator

Remote Sensing Companies with Most Satellites Launched



U.S. Government



Source: Maxar

- Existing, reliable market
- Purchases imagery, increasing analytics

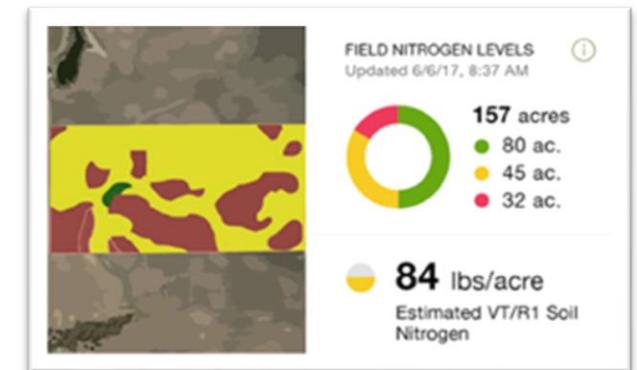
International Defense and Intelligence



Source: Airbus

- Existing, growing market
- Purchases imagery, increasing analytics

Commercial



Source: Granula

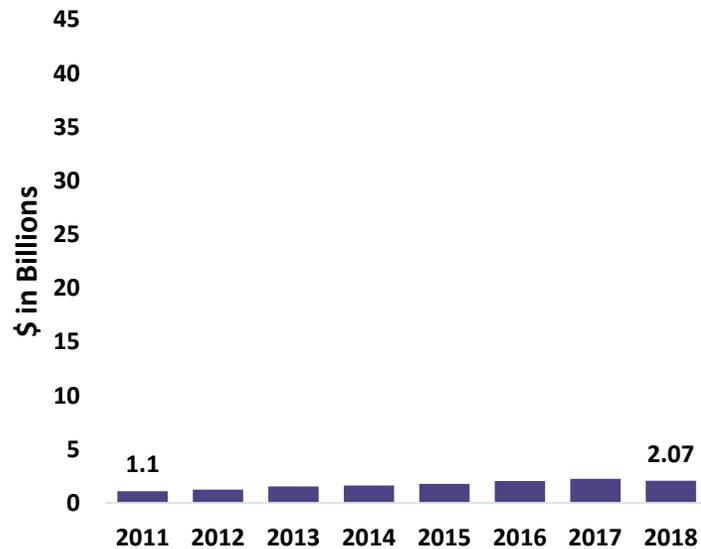
- Emerging analytics market
- Small imagery market
- Multiple industry verticals

Commercial Remote Sensing: Transition from Imagery to Analytics

Satellite companies have focused on imagery sales, which is a limited market

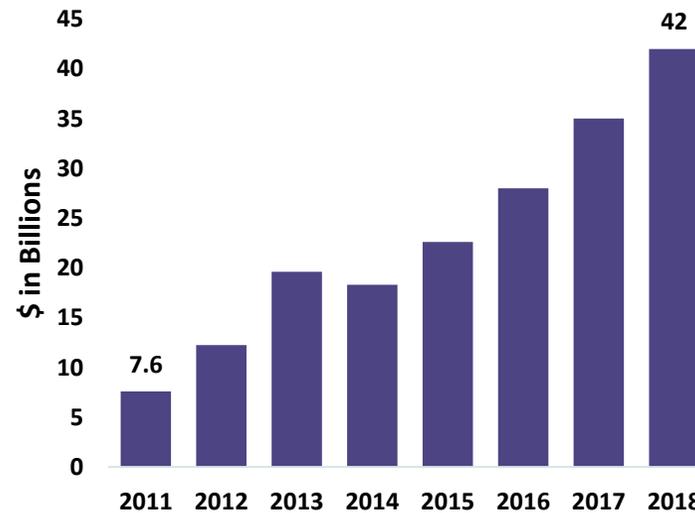
Industry now seeks to tackle broader analytics market with new data and models

Satellite Imagery Revenue



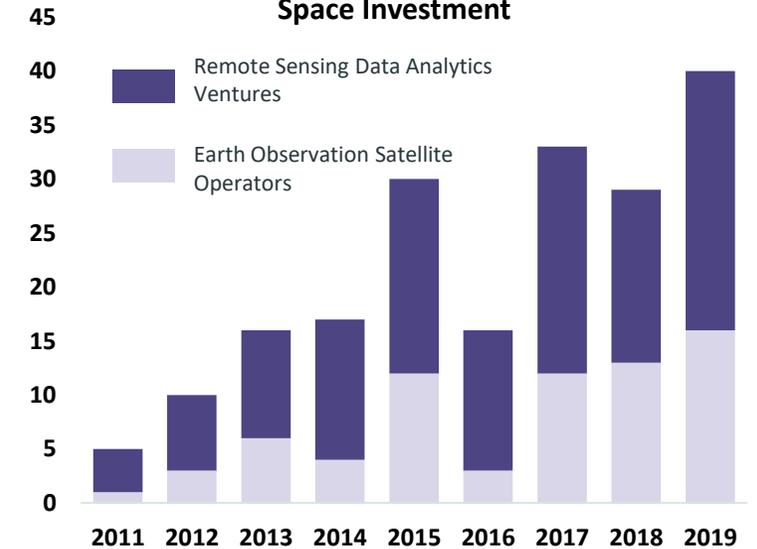
Source: State of the Satellite Industry Report, Satellite Industry Association/Bryce Analysis

All Data Analytics Revenue
(primarily non-satellite)



Source: Statista

Number of Companies Receiving Start-up
Space Investment



Source: Bryce Start Up Space Database

