



20th Edition

2017

State of the Satellite Industry Report

Prepared by:



space and technology

Formerly Tauri Group Space and Technology

October 2017

Satellite Industry Association: 21 Years as the Voice of the U.S. Satellite Industry



SIA MEMBER COMPANIES



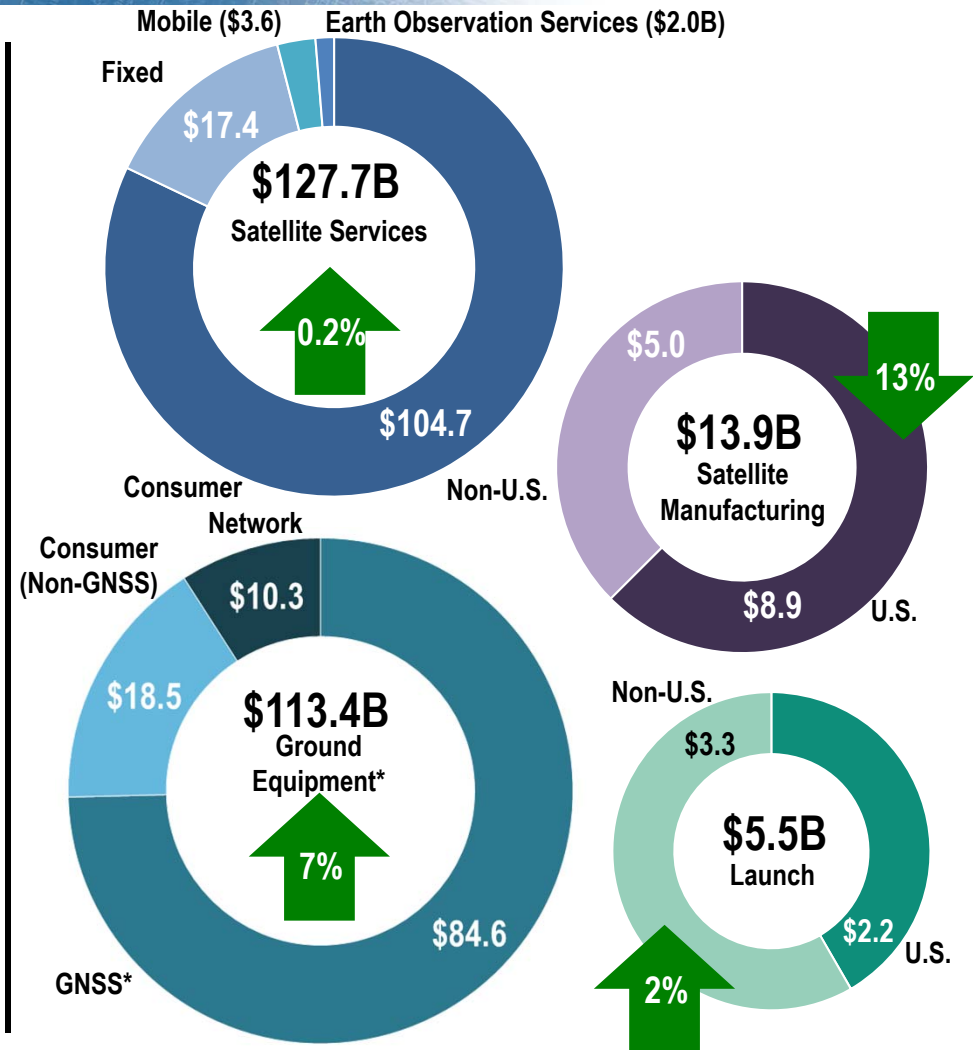
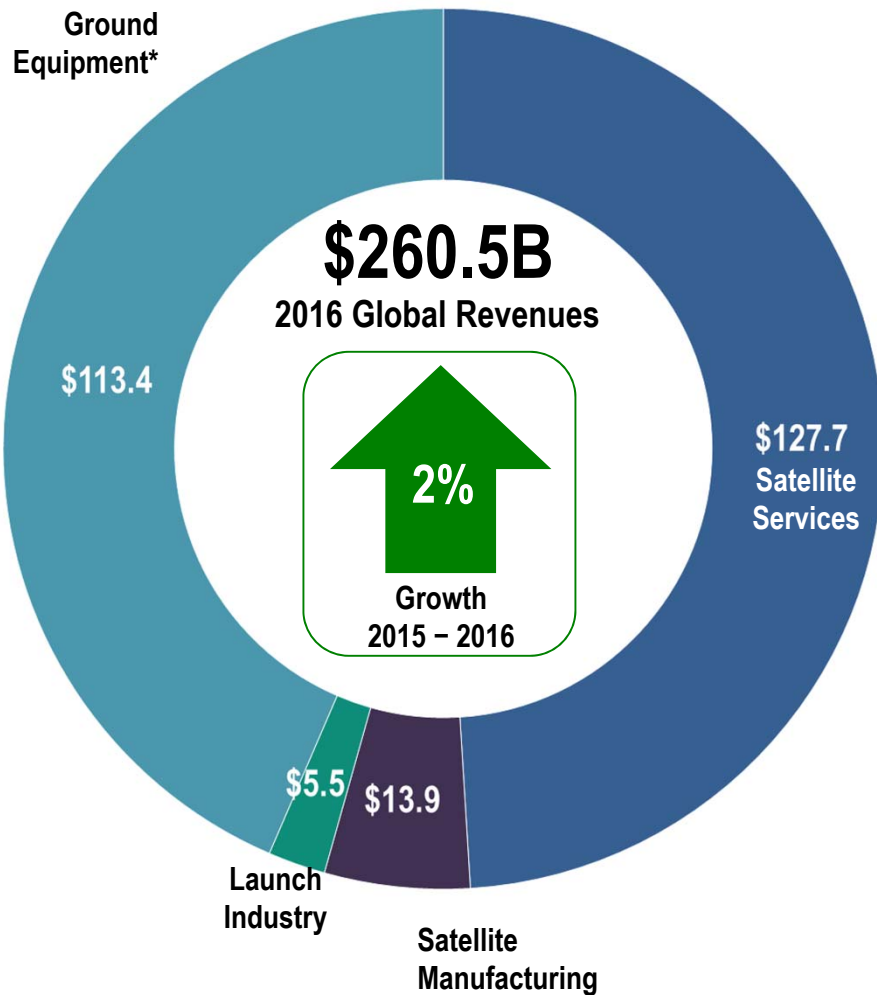
Study Overview



- SIA's 20th annual study of satellite industry data
- Performed by Bryce Space and Technology
- Reports on 2016 activity derived from unique data sets, including proprietary surveys, in-depth public information, and independent analysis
- All data are global, unless otherwise noted
- Prior year revenues are not adjusted for inflation

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2016 Satellite Industry Indicators Summary



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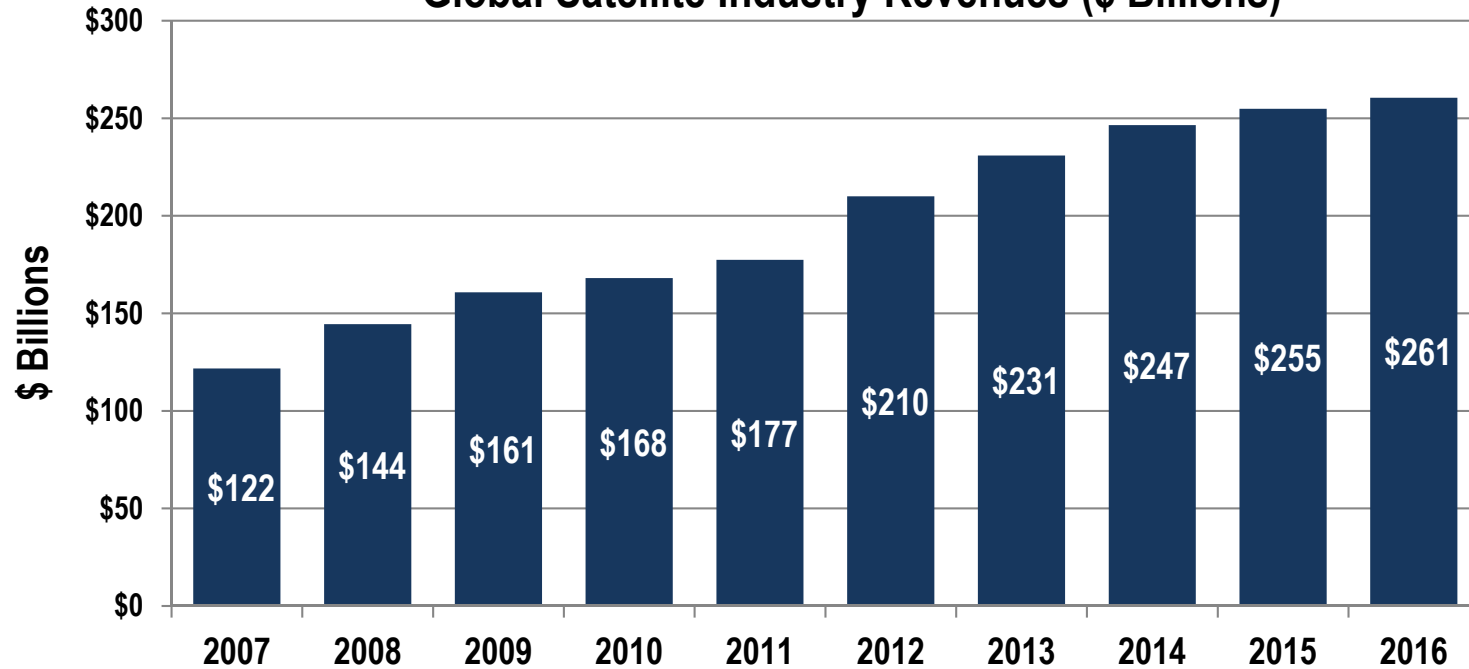


*Ground equipment revenues include the entire GNSS segment: stand-alone navigation devices and GNSS chipsets supporting location-based services in mobile devices; traffic information systems; aircraft avionics, maritime, surveying, and rail . 4

Global Satellite Industry Revenues



Global Satellite Industry Revenues (\$ Billions)



2X
Ten-Year
Global Industry
Growth

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Growth Rate	15%	19%	11%	5%	6%	18%*	10%	7%	3%	2%

Global satellite industry grew 2% in 2016, below worldwide economic growth (3.1%) and slightly above the U.S. growth (1.6%)

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*Beginning with 2012, ground equipment revenues include the entire GNSS segment: stand-alone navigation devices and GNSS chipsets supporting location-based services in mobile devices; traffic information systems; aircraft avionics, maritime, surveying, and rail.

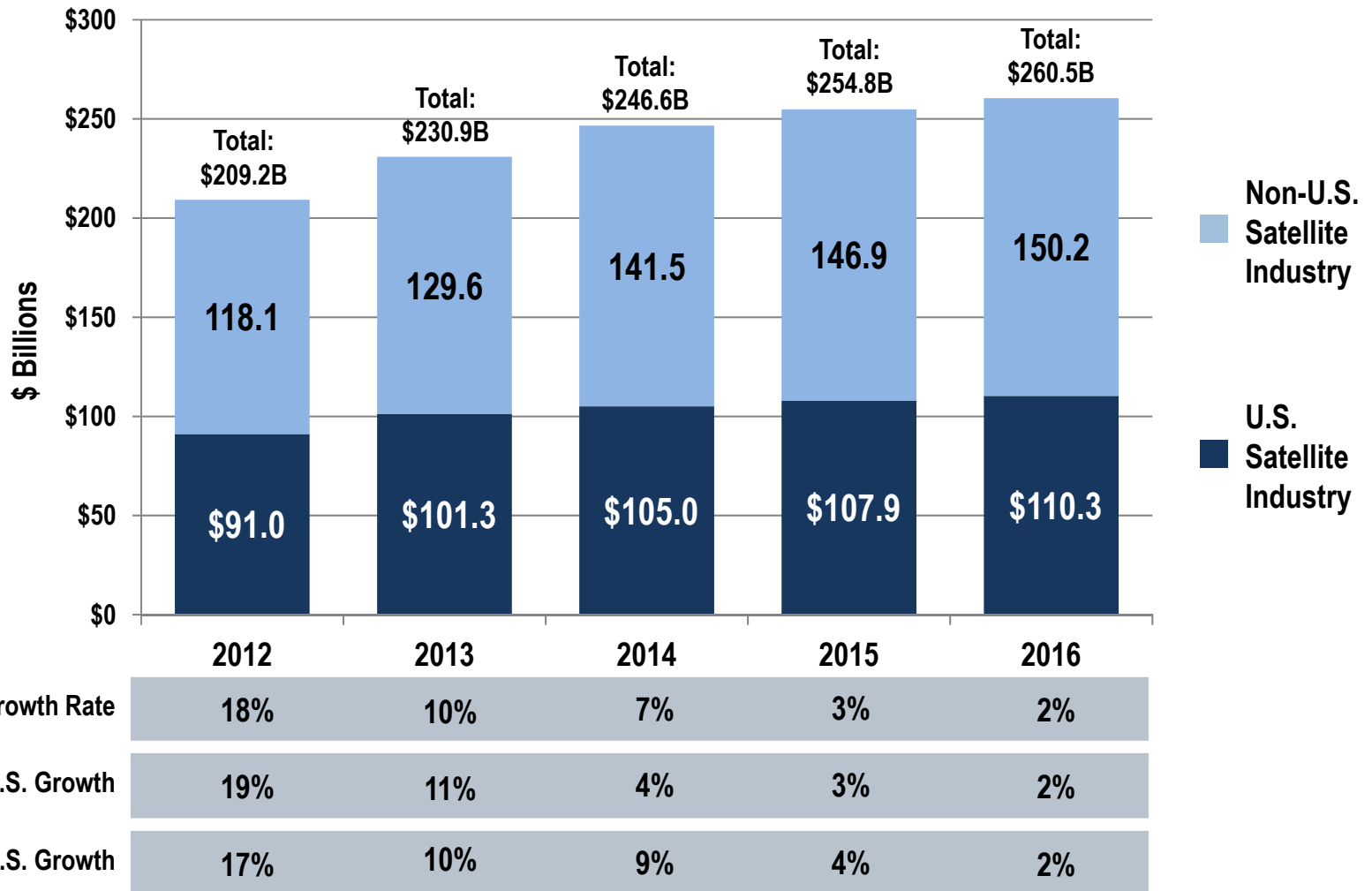
U.S. Portion of Global Satellite Industry Revenues



Average yearly U.S. market share

44%

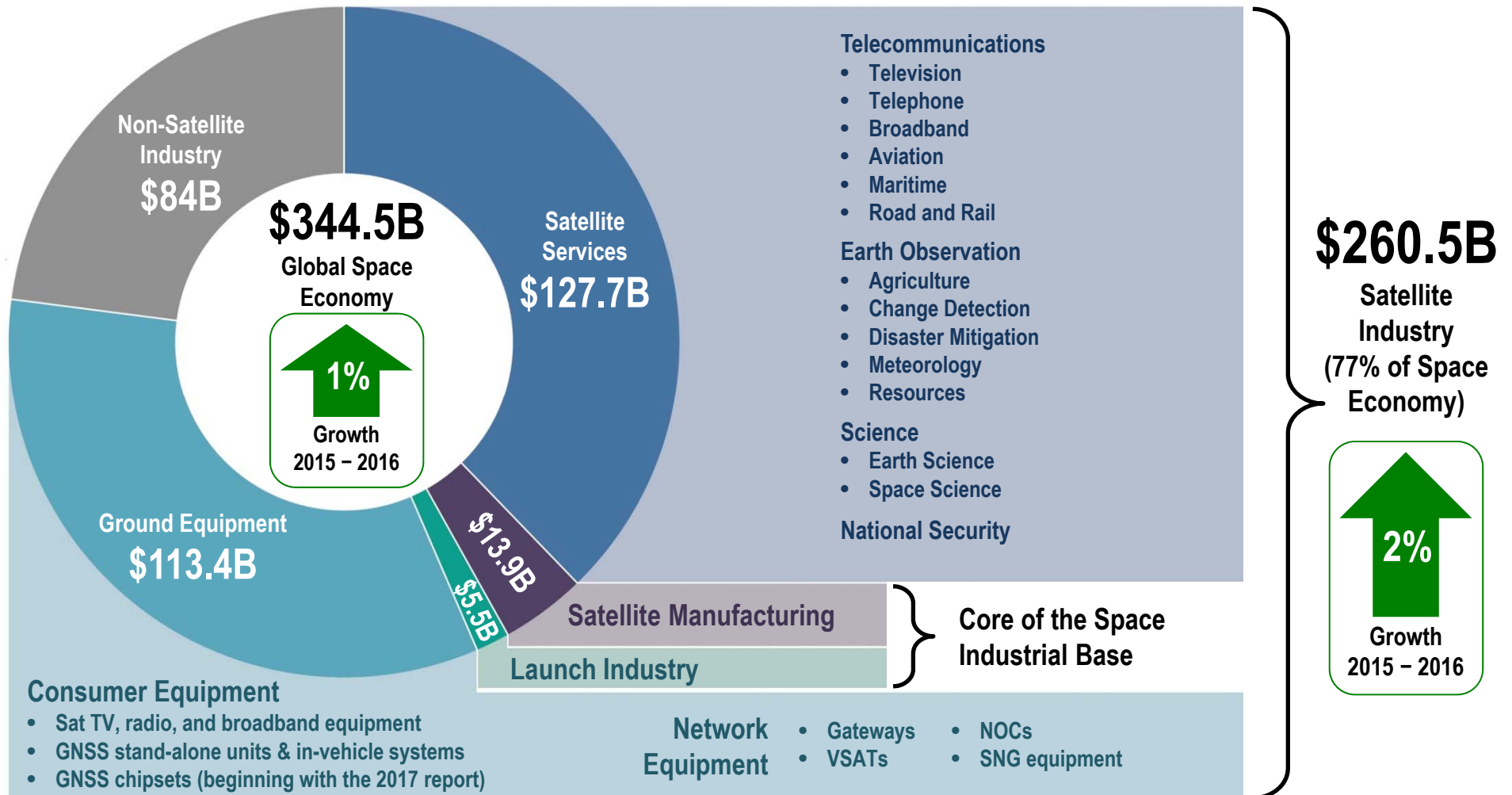
of global industry



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The Satellite Industry in Context



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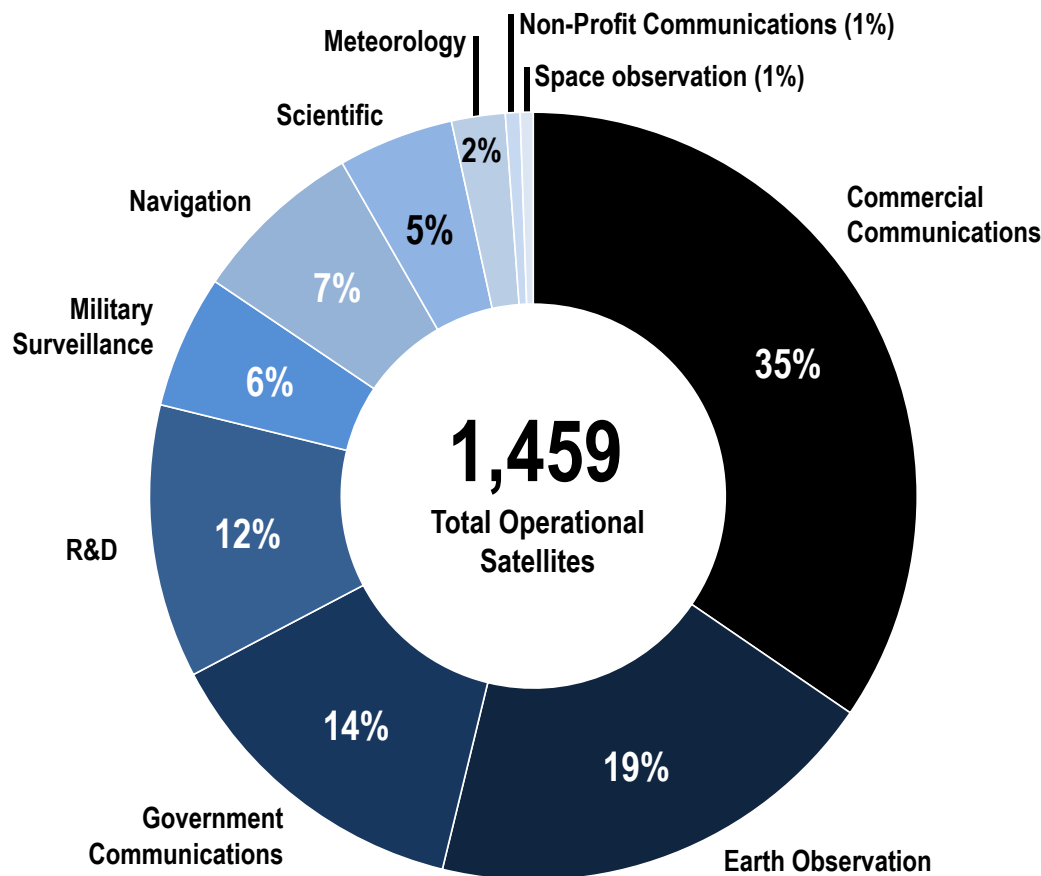
Notes: Network operations centers (NOCs), satellite news gathering (SNG), very small aperture terminal (VSAT) equipment, global navigation satellite systems (GNSS)

The Satellite Network in Context



Operational Satellites by Function

(as of December 31, 2016)



- Number of satellites increased 47% over 5 years (from 994 in 2012)
 - » Satellites launched 2012 — 2016 increased 53% over previous 5 years
 - » Average 144/year
 - » Due mostly to small/very small satellites in LEO (<1200 kg)
 - » Average operational lives of larger (mostly communications) satellites becoming longer, exceeding 15 years; 247 active sats launched before 2002
 - » 520 satellites in GEO (mostly communications)
- 59 countries with operators of at least one satellite (some in regional consortia)
- U.S. entities operate 594 satellites

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Top-Level Global Satellite Industry Findings



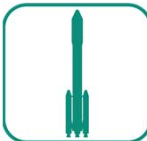
- Satellite industry revenue was \$260.5 billion in 2016
- Overall industry growth of 2% worldwide
- Two of four satellite industry segments posted meaningful growth



Satellite services: the largest segment; revenues remained flat
Consumer services continue to be a key driver for the overall satellite industry



Satellite manufacturing revenues decreased by 13%
Fewer satellites launched in 2016, reflecting replacement cycles approaching an end and a bottleneck in immediate availability of launch services



Launch industry revenues grew by 2%
Several launches deploying government-manufactured payloads contributed to moderate growth



Ground equipment revenues grew by 7%
Growth in GNSS and network equipment, consumer equipment remaining flat

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Satellite Industry Segments



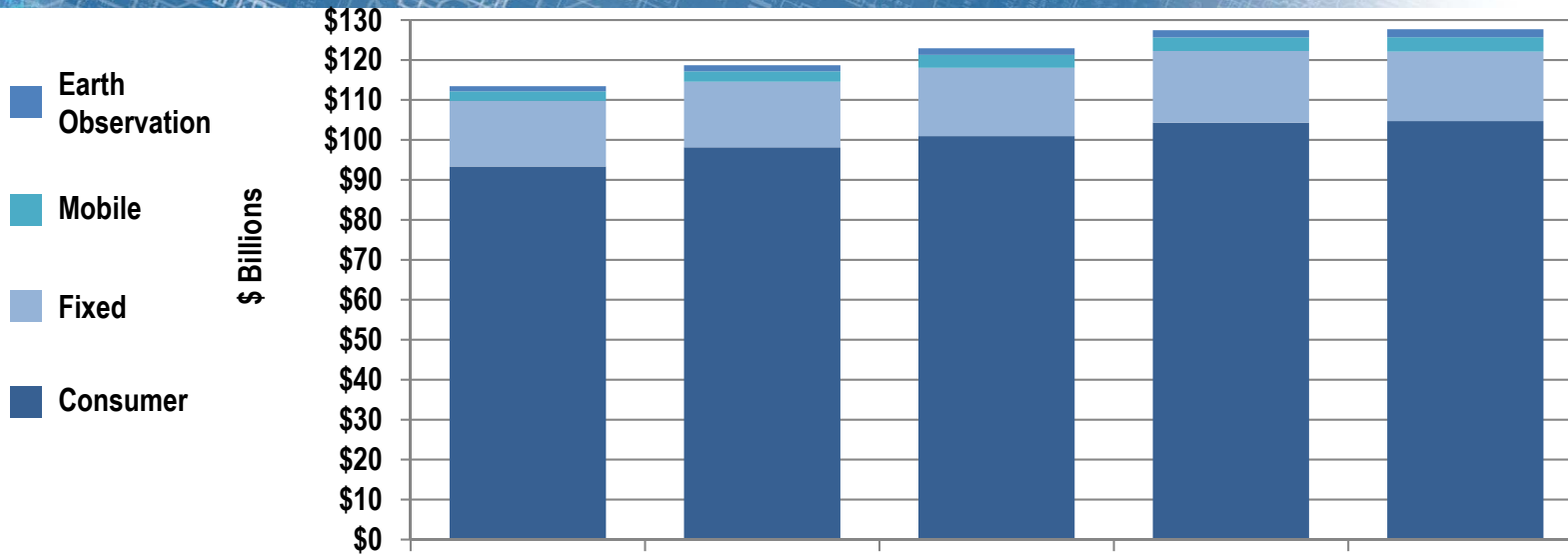
Satellite Services

- Consumer Services
 - » Satellite Television
 - » Satellite Radio
 - » Satellite Broadband
- Fixed Satellite Services
 - » Transponder Agreements
 - » Managed Network Services (including in-flight services)
- Mobile Satellite Services
- Earth Observation Services

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Global Satellite Services Revenue



0.2%
2015 – 2016
Global
Growth

	2012	2013	2014	2015	2016
Growth Rate	5%	5%	4%	4%	0.2%
Total	\$113.5	\$118.6	\$122.9	\$127.4	\$127.7
Consumer	\$93.3	\$98.1	\$100.9	\$104.3	\$104.7
Satellite TV (DBS/DTH)	\$88.4	\$92.6	\$95.0	\$97.8	\$97.7
Satellite Radio (DARS)	\$3.4	\$3.8	\$4.2	\$4.6	\$5.0
Satellite Broadband	\$1.5	\$1.7	\$1.8	\$1.9	\$2.0
Fixed	\$16.4	\$16.4	\$17.1	\$17.9	\$17.4
Transponder Agreements (1)	\$11.8	\$11.8	\$12.3	\$12.4	\$11.2
Managed Services (2)	\$4.6	\$4.6	\$4.8	\$5.5	\$6.2
Mobile	\$2.4	\$2.6	\$3.3	\$3.4	\$3.6
Earth Observation	\$1.3	\$1.5	\$1.6	\$1.8	\$2.0

The U.S. share of
satellite services
revenue in 2016
was
40%

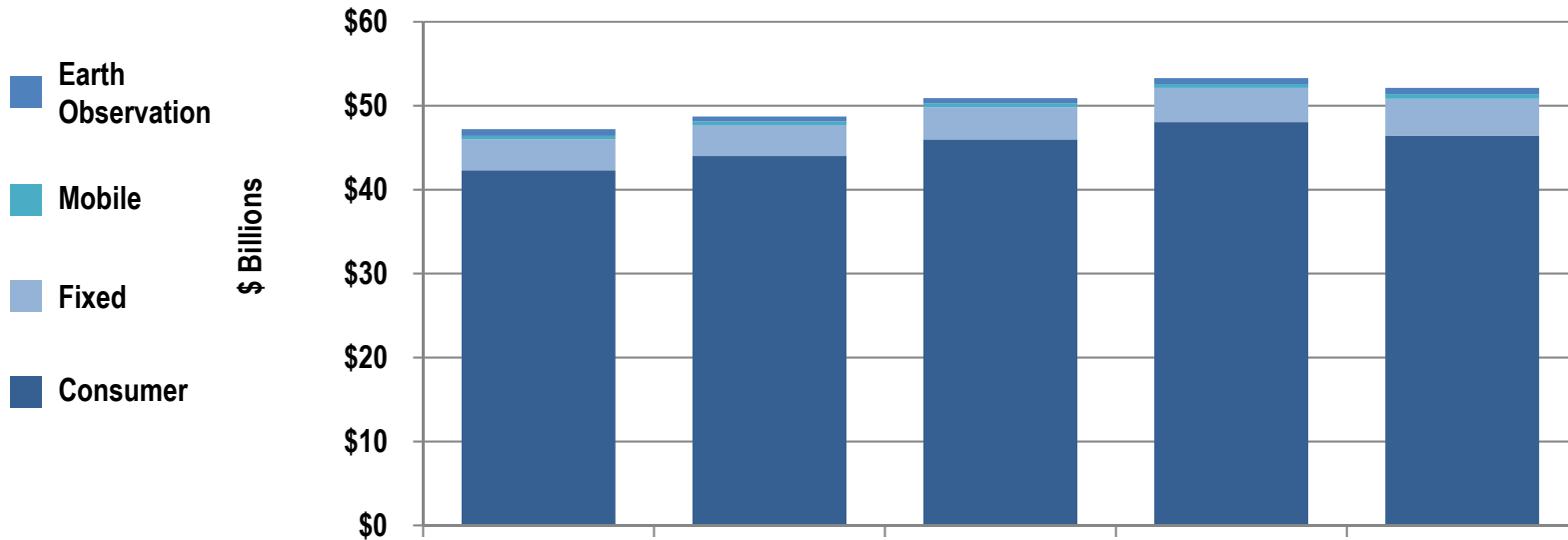
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Notes: Numbers may not sum exactly due to rounding. (1) Includes capacity for DTH satellite TV and some mobility service platforms. (2) Includes VSAT, mobility, and in-flight connectivity.



U.S. Satellite Services Revenue




2%
 2015 – 2016
 U.S.
 Growth

	2012	2013	2014	2015	2016
Growth Rate	6%	3%	4%	5%	-2%
Total	\$47.2	\$48.7	\$50.9	\$53.3	\$52.1
Consumer	\$42.3	\$44.0	\$46.0	\$48.0	\$46.4
Satellite TV (DBS/DTH)	\$37.5	\$38.6	\$40.1	\$41.7	\$39.7
Satellite Radio (DARS)	\$3.4	\$3.8	\$4.2	\$4.6	\$5.0
Satellite Broadband	\$1.4	\$1.6	\$1.7	\$1.7	\$1.7
Fixed	\$3.7	\$3.7	\$3.8	\$4.1	\$4.4
Transponder Agreements (1)	\$0.3	\$0.3	\$0.3	\$0.3	\$0.3
Managed Services (2)	\$3.4	\$3.4	\$3.5	\$3.8	\$4.1
Mobile	\$0.4	\$0.4	\$0.4	\$0.5	\$0.5
Earth Observation	\$0.8	\$0.6	\$0.7	\$0.7	\$0.8

The U.S. share of
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Notes: Numbers may not sum exactly due to rounding. (1) Includes capacity for DTH satellite TV and some mobility service platforms. (2) Includes VSAT, mobility, and in-flight connectivity.



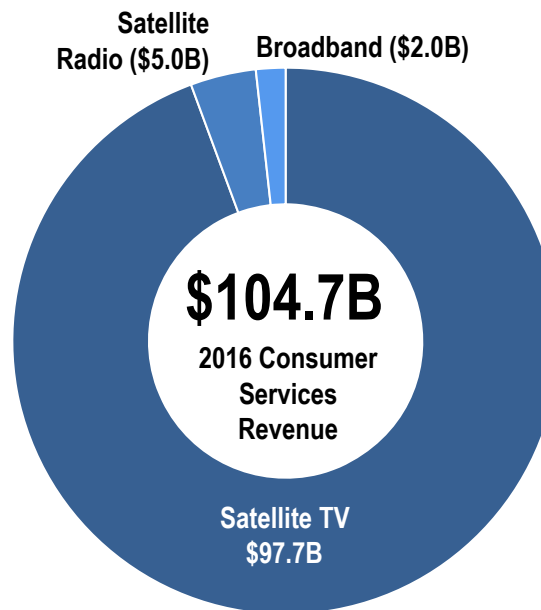
Satellite Services Findings: Consumer Services Highlights



Satellite radio and consumer satellite broadband posted 10% and 3% growth respectively in the consumer services segment, while more mature satellite TV stayed flat

Satellite TV Services

- Satellite TV services (DBS/DTH) stayed flat and accounted for 77% of all satellite services revenues; 93% of consumer revenues
- Up to 220 million satellite pay-TV subscribers worldwide (plus at least half as many free-to-air satellite TV households), driven by demand in emerging markets
- 41% of global revenues attributed to U.S.
- U.S. growth driven by premium service revenues
- Production of UHD content drives increasing (but still relatively low) # of channels
- Potential slowdown of demand growth for satellite capacity: compression technologies continue to improve, more consumers opt for IP-based video services



Satellite Radio

- Satellite radio (DARS) revenues grew by 10% in 2016
- Satellite radio subscribers grew 6% in 2016, to 31.3 million
- Primarily U.S. customer base

Satellite Broadband

- Revenue grew 3%
- About 3% more subscribers, approaching 1.9 million
- Faster growth anticipated with more capacity available on newly launched satellites over the U.S.
- Most subscribers in the U.S. Non-U.S. subscriber growth rate high, though accelerating from lower base

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Satellite Services Findings



- **Mobile satellite services grew 5%**
 - » Includes some revenue from Ku and Ka-band FSS capacity provided by MSS operators to provide maritime, airborne, and some other mobility services
- **Fixed satellite services decreased by 3%**
 - » Transponder agreement revenues down 10%, compared to 1% growth in 2015
 - » Revenues for managed services grew 12%, in line with 15% in 2015; driven primarily by HTS capacity on the supply and in-flight services on the demand side
 - » Substantial share of in-flight and other managed services is provided by the same satellite operators that provide consumer satellite broadband services, their HTS capacity divided between the two types of service
- **Earth observation services revenues grew 11%**
 - » Continued growth by established satellite remote sensing companies, with new entrants reporting revenue as they continue to roll out their services

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» New entrants continued to raise capital, develop satellites, deploy orbital assets



Case Study: Earth Observation (EO) Services



- For many years, global EO services were offered by small number of operators
- New competitors and new partnerships have recently emerged
- Investment driven by interest in business intelligence products from satellite imagery
- Industry maturation
 - » New systems continue to be announced
 - » Acquisitions and mergers
 - Airbus – EADS Astrium (2013)
 - SPOT Image
 - InfoTerra
 - SSTL/DMCii
 - UrtheCast – Elecnor/Deimos (2015)
 - Planet – BlackBridge (2015)
 - Planet – Terra Bella (2017)
 - MDA – DigitalGlobe (2017)

- Operational includes initial deployment through full capacity
- UrtheCast operates cameras aboard ISS and acquired assets from Elecnor Deimos, but is also planning to deploy optical and radar satellites
- exactEarth/Harris features hosted payloads, rather than dedicated satellites
- Criteria for inclusion are satellites on orbit, announced funding, signed launch contract/agreement, or NOAA license

	Operational	Planned	High Res (<1m)	High revisit (<1day)	Sensor Description	System Size	Typical Sat Mass (kg)
Large Sats	Operational		●		Optical and radar	4	1,000
	Operational		●	●	Optical	5	2,800
	Operational		●	●	Radar	1	2,300
	Operational		●		Optical	6	450
	Operational		●		Optical	3	350
	Operational		●	●	Optical	60+	95-420
Small Satellites (<200 kg)	Planned		●	●	Optical and radar	24	1,400
	Planned		●	●	Optical	30	20
	Planned		●	●	Optical	50	95
	Operational		●	●	Optical	5	150
	Planned			●	Optical	60	50
	Planned			●	Radar	30	TBD
	Planned		●		Radar	4	TBD
	Planned			●	Radio occultation	24	115
	Planned			●	RF mapping	21+	TBD
	Planned			●	Optical	48	24
	Planned		●	●	Radar	50	<100
	Planned			●	Radio occultation	12	22
	Operational			●	Optical	100+	3
	Planned		●	●	Optical	25+	35
Operational				Radio occultation	50	3	
Operational			●	Optical	24	120	

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Satellite Industry Segments

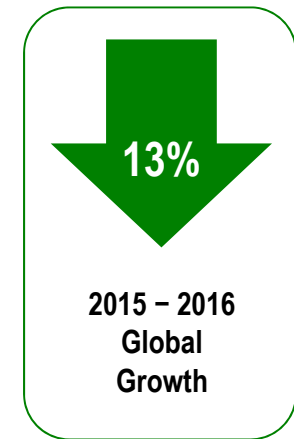
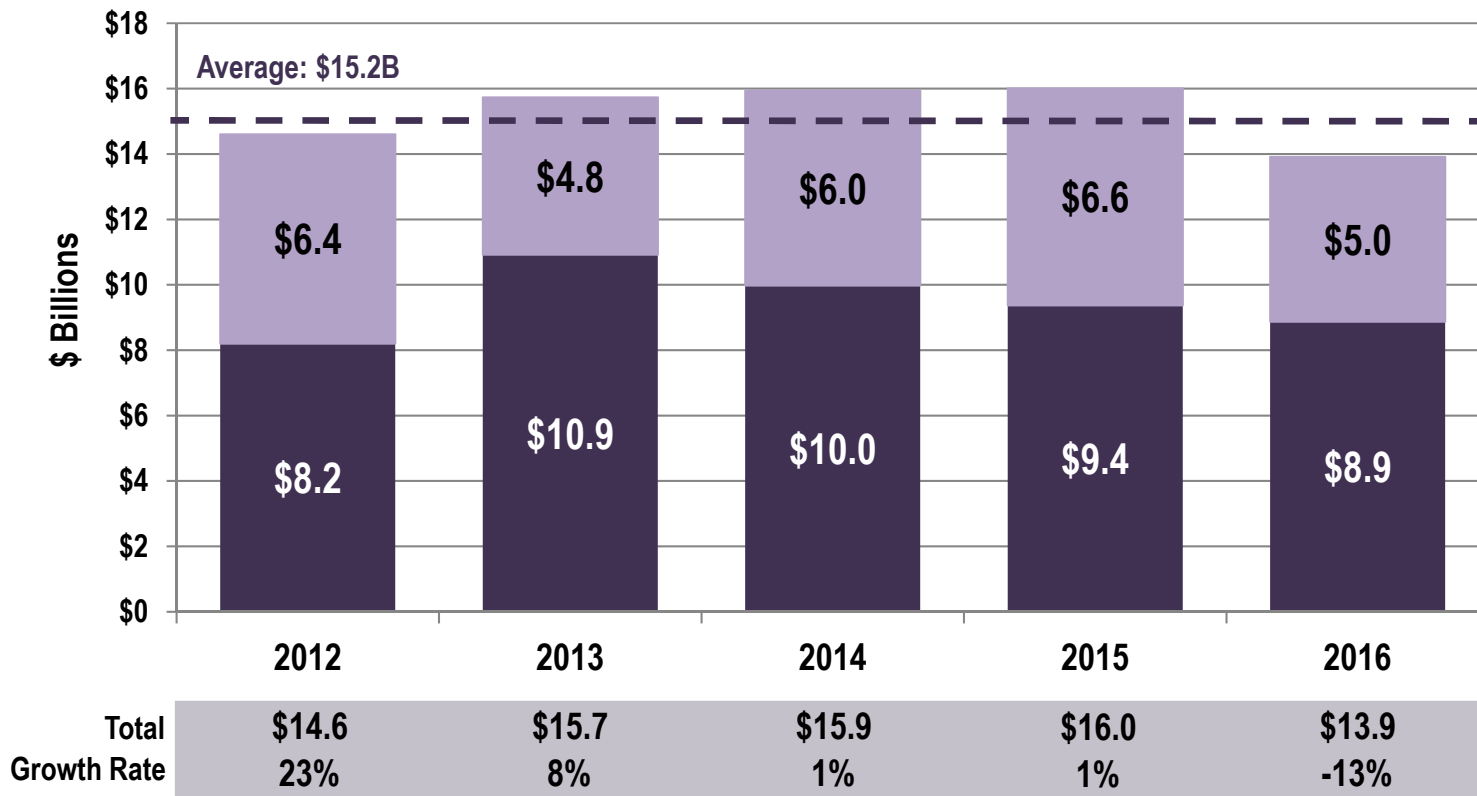


Satellite Manufacturing

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Satellite Manufacturing Revenues



■ Non-U.S.
■ United States

- Worldwide 2016 revenues totaled \$13.9 billion
- U.S. share of global revenues was 64%, an increase from 59% in 2015

NOTES: Satellite manufacturing revenues are recorded in the year of satellite launch. Do not include satellites built by governments or universities. Data based on unclassified sources.

U.S. 2015 revenues adjusted from \$10 to \$9.4 billion to reflect updated survey inputs

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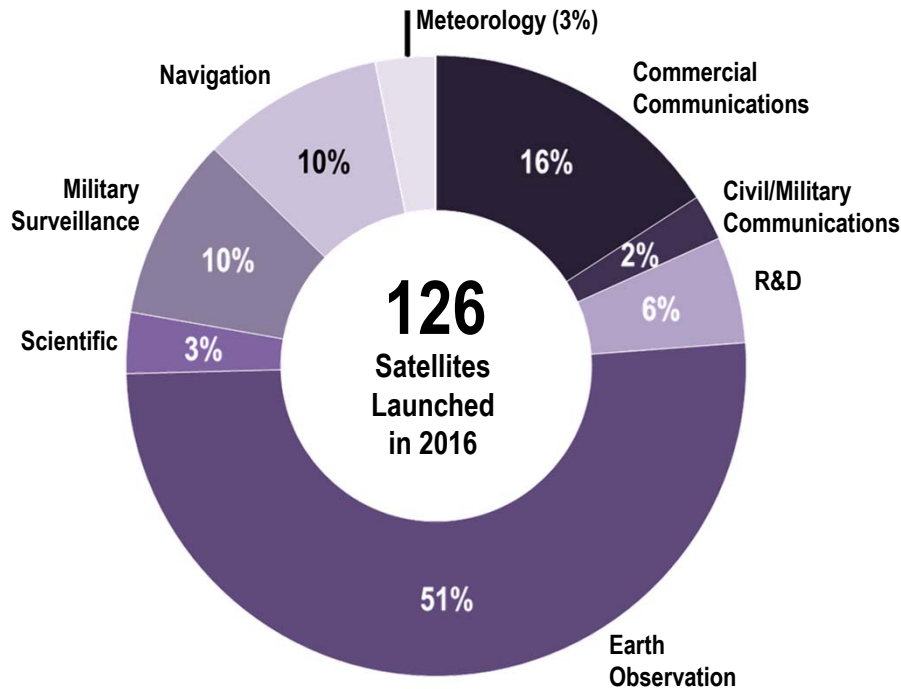




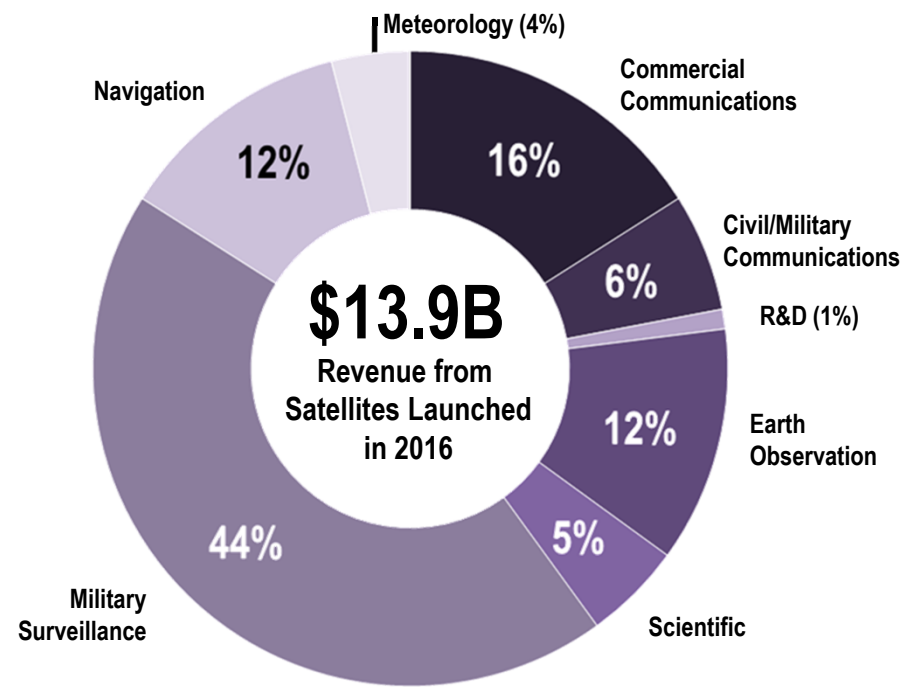
Satellite Manufacturing Findings



- 126 satellites launched in 2016
 - » Significant drop from 202 in 2015
 - » Drop largely due to delayed very small satellites
- 46 CubeSats launched, representing 37% of total; most for commercial Earth observation
- Communications satellites represented 22% of total revenues, compared to 42% in 2015
- Military surveillance satellites accounted for 44% of revenues, compared to 36% in 2015
- CubeSats represent less than 1% of total value



Number of Spacecraft Launched by Mission Type (2016)



Value of Spacecraft Launched Estimated by Mission Type (2016)

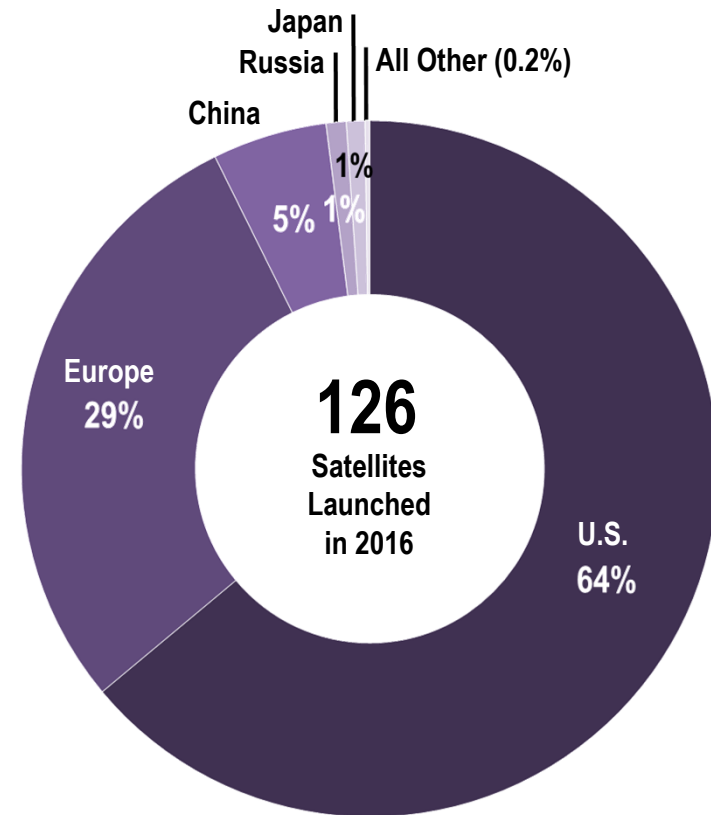
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U.S. Satellite Manufacturing Findings



- U.S. satellite manufacturing revenues decreased 5%, with commercial sector 7% higher and government sector 9% lower
- 74% of U.S. revenues were from U.S. government contracts
- Excluding CubeSats, U.S. firms built 27% of satellites launched in 2016 and earned 63% of global satellite manufacturing revenues
 - » Including CubeSats, U.S. firms built about 63% of satellites launched in 2016 and earned 64% of revenues
 - » 45 of the 79 U.S.-built satellites launched in 2016 were CubeSats



Estimated Value of Spacecraft Launched by Country/Region of Manufacturer (2016)

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Satellite Manufacturing Revenue Comparison to 2015

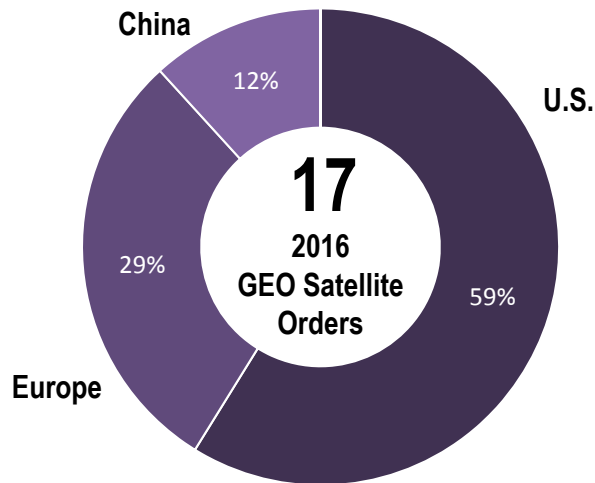


- Decline of \$2.1B in satellite manufacturing, compared to 2015, due to fewer satellites launched
 - » One European-manufactured commercial satellite launched, compared to 9 in 2015 (\$1B revenue decline)
 - » Less expensive U.S. government satellites (\$0.65B revenue decline)
 - » Outside the U.S. and Europe, 14 fewer satellites launched (\$1.4B revenue decline)
 - Russia launched 6 satellites, compared to 16 in 2015
 - Unlike in 2015, Japan and South Korea not launching expensive reconnaissance satellites
 - Smaller overall value of satellites launched by China
 - » Fewer (65, compared to 140 in 2015) very small satellites (estimated revenue decline about \$200M)
- Decrease in revenue partially offset by a larger number of commercial satellites built in the U.S. and government satellites in Europe

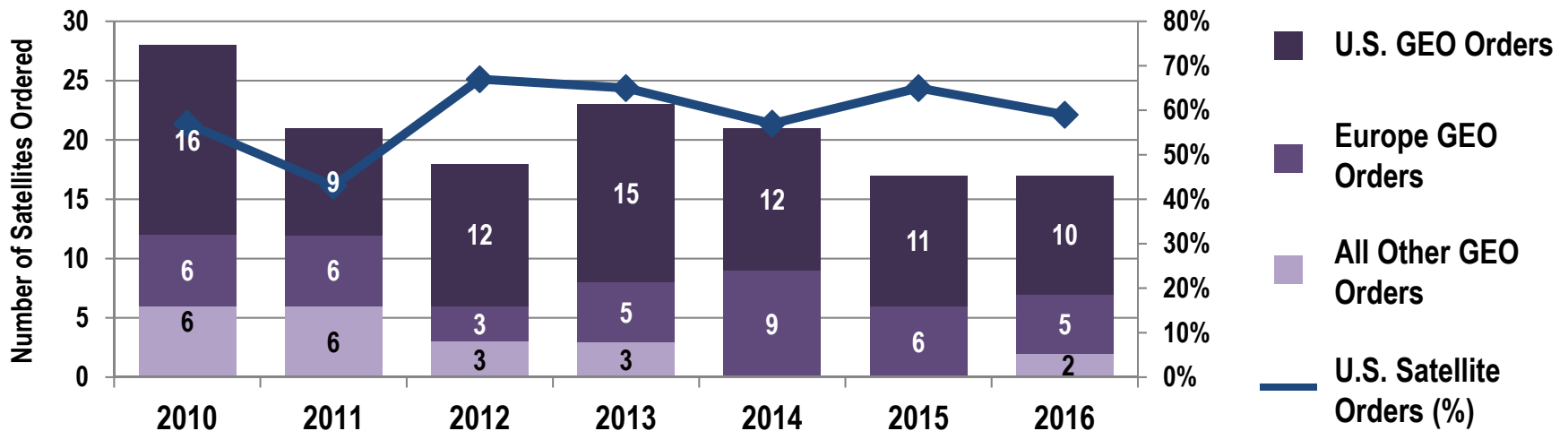
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Future Indicator: Commercial Satellite Manufacturing Orders



- Orders for 17 commercial GEO satellites announced in 2016
- 10 orders won by U.S. manufacturers
- 59% share of orders won by U.S. firms, down from 65% in 2015



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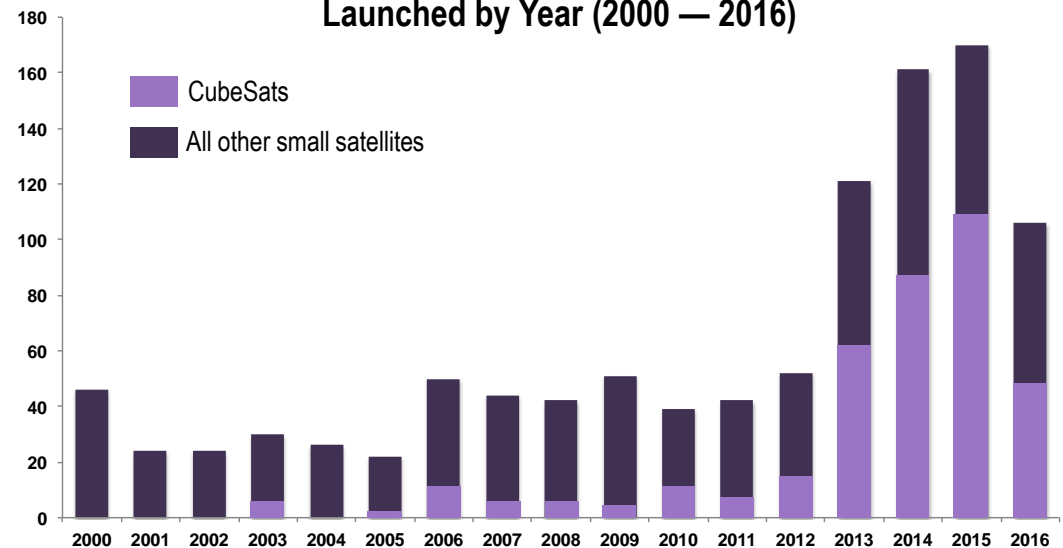


Case Study: Very Small Satellites



- Continued and growing interest in inexpensive, very small satellites, both CubeSats and customized platforms
 - Earth observation: at least 20 announced systems, CubeSat and customized
 - Telecommunications: at least 4 new announced LEO systems to use very small satellites, ranging from tens to several thousand satellites per constellation; none launched to date
- CubeSats are an established “kit” form of very small satellite, an attractive, low-cost option for commercial purposes
 - 55 CubeSats launched in 2016, down from 108 launched in 2015, with 33 sent into orbit via ISS
 - Drop in number due in part to Falcon 9 grounding following September pad explosion
 - 45 commercial CubeSats launched in 2016 (all for Earth observation services), down from 61 in 2015. Majority (32) built and operated by Planet
 - 3U CubeSats represent majority, but other systems starting to employ 6U, 12U, and even larger combinations

Number of Very Small Satellites (≤ 600 kg)
Launched by Year (2000 — 2016)



- Commercial constellations are also using or will use customized very small satellites, larger than CubeSats – including systems by Airbus/SSTL, SSL, Spaceflight Industries, York Space Systems, and others

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Satellite Industry Segments



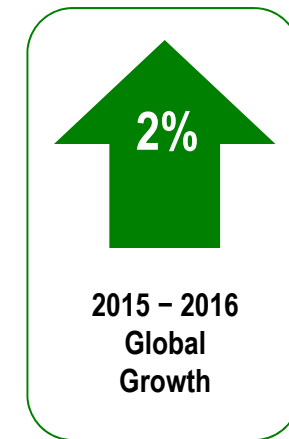
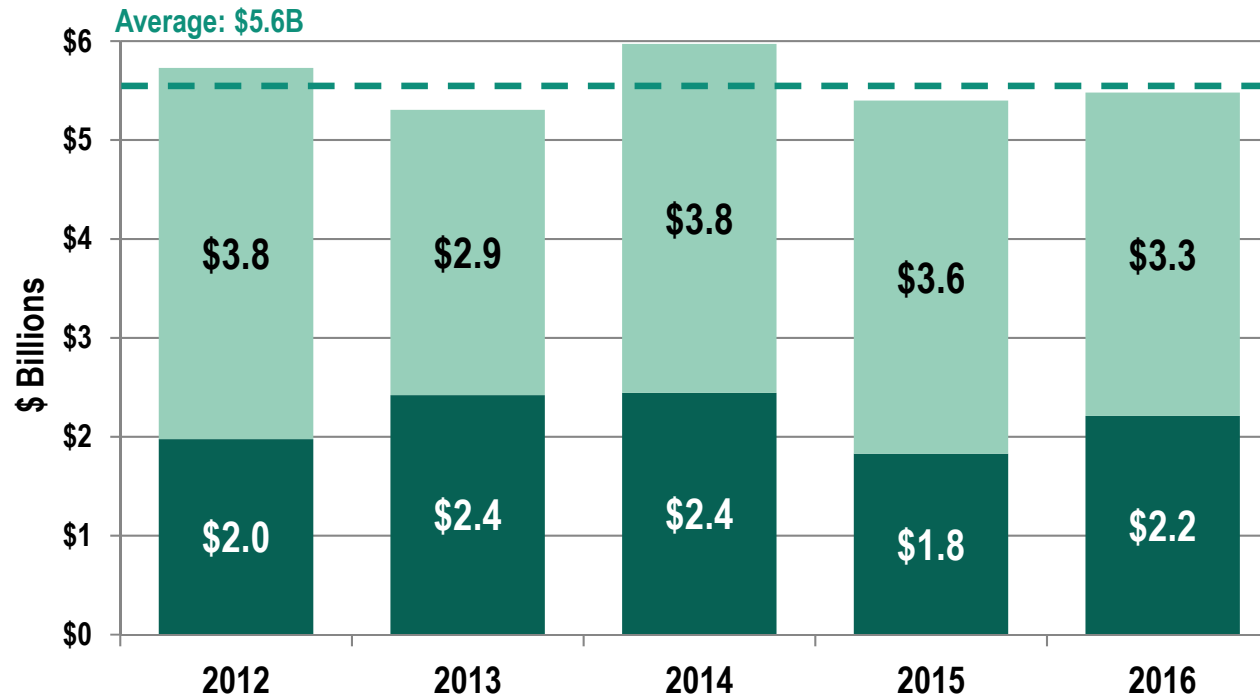
Launch Industry

- Launch Services
- Launch Vehicles

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Satellite Launch Industry Revenues



Non-U.S.
United States

	2012	2013	2014	2015	2016
Total	\$5.8	\$5.4	\$5.9	\$5.4	\$5.5
Growth Rate	21%	-7%	9%	-9%	2%

- \$5.5B global revenues in 2016 from commercially-procured satellite launches
- U.S. share of global launch revenues increased from 34% in 2015 to 40% in 2016

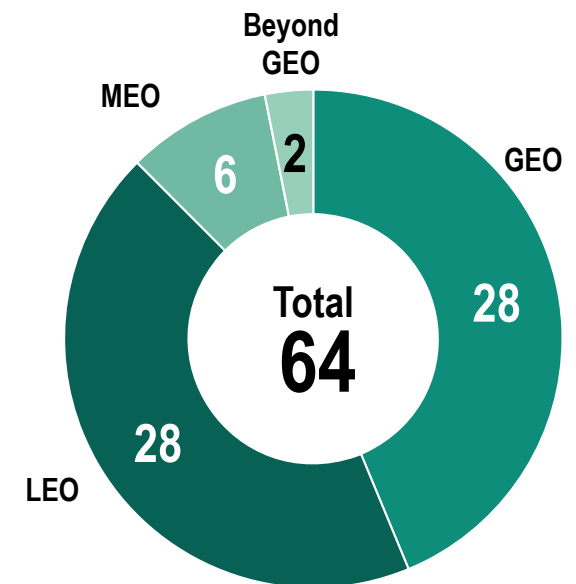
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Satellite Launch Industry Findings



- Revenues increased by about 2% globally in 2016, compared with a 9% decrease in 2015
- Worldwide commercially-procured launches in 2016 (64) down slightly from 2015 (65)
- U.S. providers conducted 18 commercially-procured satellite launches; SpaceX grounding delayed several scheduled launches to 2017
- Strong performance by providers in Europe and China in 2016
 - 11 Arianespace satellite launches, same as in 2015
 - 20 Chinese satellite launches, compared to 19 in 2015
- Weak performance by Russian providers – just two commercially-procured satellite launches by ILS
- Government customers worldwide remained the launch revenue driver, at 70%, about the same as in 2015 (69%)
- By country, the U.S. had the largest share of commercially-procured launch revenues (40%), with 32% of global revenues from launching U.S. government satellites



2016 Commercially-Procured Satellite Launches by Orbit

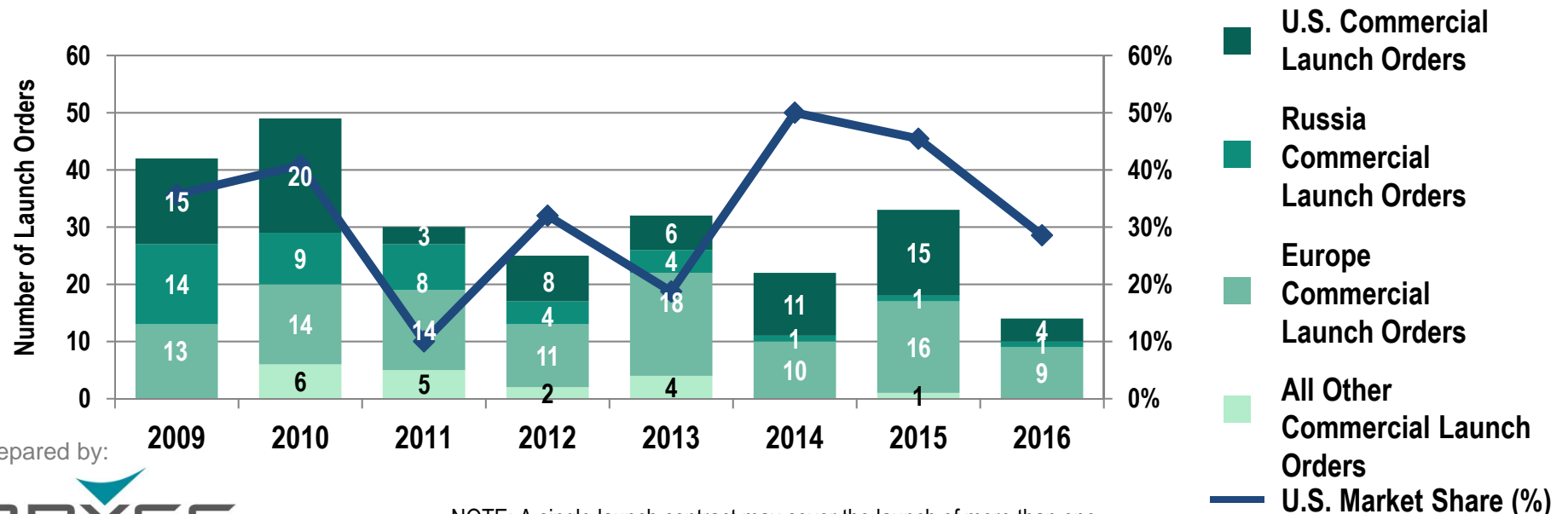
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Future Indicator: Commercial Satellite Launch Orders



- 14 commercial satellite launch orders placed in 2016, down from 33 in 2015
- 4 (29%) satellite launch orders won by U.S. companies, down significantly from 15 (45%) in 2015
- U.S. market dropped from 45% in 2015 to 29%
 - Typical year for Arianespace, though not as robust as previous years
 - Inmarsat and ViaSat shift satellites from SpaceX to Arianespace
- Note: 11 orders for government payloads not counted here



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NOTE: A single launch contract may cover the launch of more than one satellite (each described as an "order").



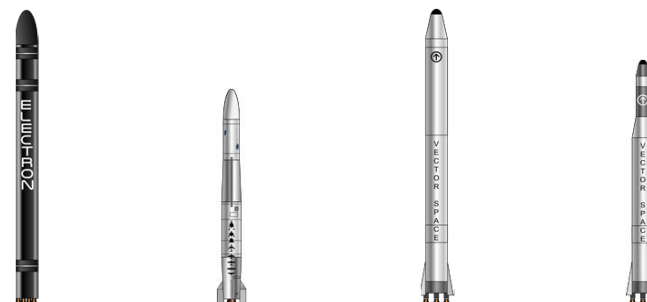
Case Study: Very Small Launch Vehicles



- At least 33 very small (LEO capacity ≤500 kg) launch vehicles under development worldwide
- Provide schedule control for small payloads and other operational benefits
- Price per kg is relatively high compared to large vehicles
- Not all are funded; high uncertainty and development risk

Very Small Launch Vehicles with Announced Investment

 Human to Scale



	Electron	LauncherOne	Vector H	Vector R
Company	Rocket Lab	Virgin Orbit	Vector Space Systems	Vector Space Systems
LEO Capacity	150 kg	400 kg	100 kg	60 kg
First Orbital Launch	2017	2018	2019	2018
Price	\$4.9M	\$10M	\$3M	\$1.5M
Price/kg	\$32,667	\$25,000	\$30,000	\$25,000

Other systems, proposed or in early development, not included in chart: ARCA Space Corp. (Haas 2C), Bagaveev (Bagaveev), bSpace (Volant), Celestia Aerospace (Arrow), CONAE (Tronador II), CubeCab (Cab-1A), Exos (SARGE), Firefly Aerospace (Alpha), Generation Orbit (GOLauncher-2), Horizon Space (Black Arrow 2), InterOrbital Systems (NEPTUNE), Lin Industrial (Taymyr), Mishaal Aerospace (M-OV), Nammo (North Star), OneSpace (OneSpace), Open Space Orbital (Neutrino), Orbital Access (Orbital 500), PLD Space (Arion 2), Rocketcrafters (Intrepid 1), Scoprius (Demi-Sprite), SpaceLS (Prometheus 1), Tranquility Aerospace (Devon Two), UP Aerospace (Spyder), Zero2Infinity (Bloostar)*

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* Formerly Firefly Space Systems – assets purchased by EOS Launcher, Inc. in 2017

Satellite Industry Segments



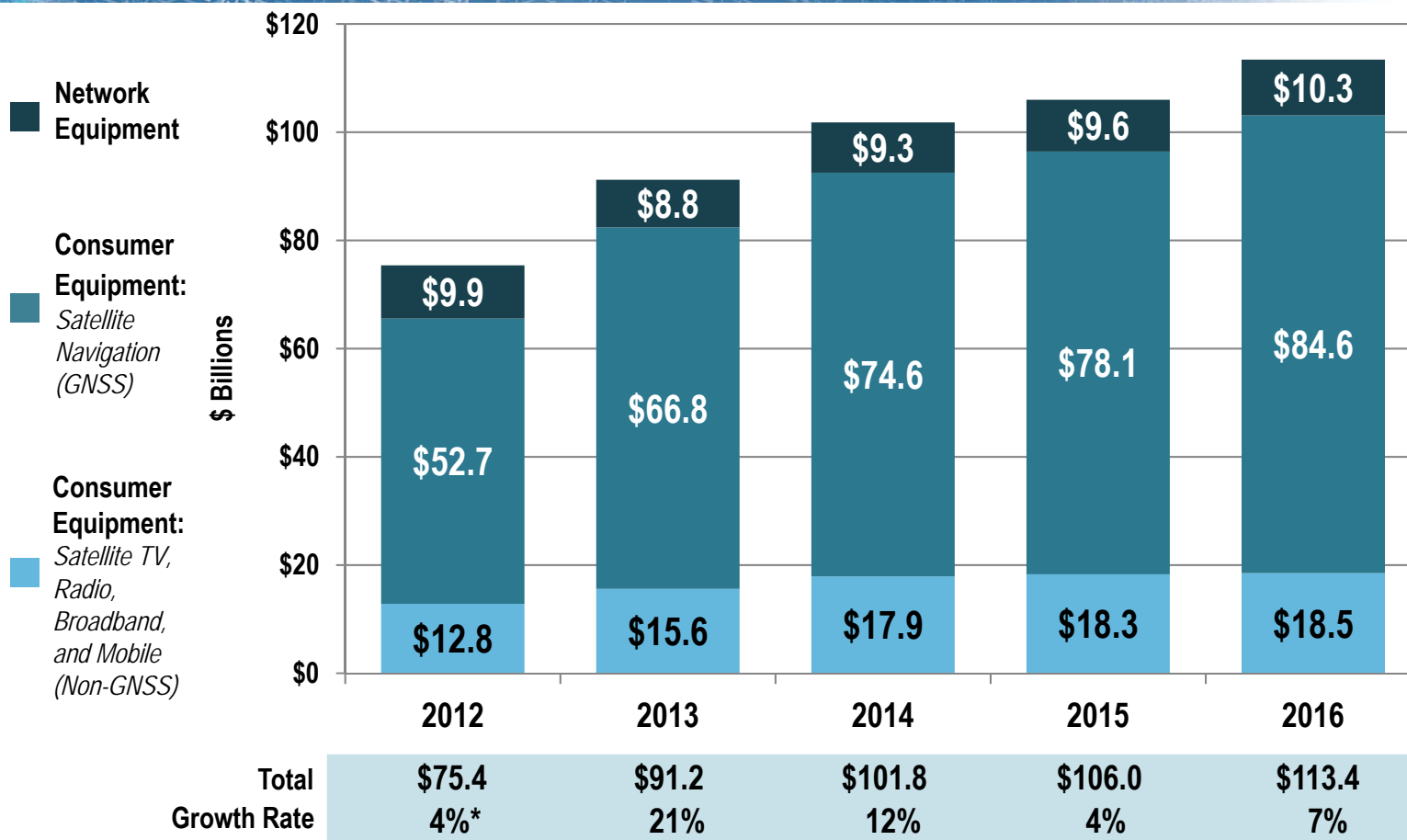
Ground Equipment

- Network Equipment
 - » Gateways
 - » Control stations
 - » Very Small Aperture Terminals (VSATs)
- Consumer Equipment
 - » Satellite TV dishes
 - » Satellite radio equipment
 - » Satellite broadband dishes
 - » Satellite phones and mobile satellite terminals
 - » Satellite navigation stand-alone hardware

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Global Satellite Ground Equipment Revenues



7%
2015 – 2016
Global
Growth

The U.S. share of
ground equipment
revenue in 2016
was
42%

Network Equipment — gateways, network operations centers (NOCs), satellite news gathering (SNG) equipment, flyaway antennas, very small aperture terminal (VSAT) equipment

Consumer Equipment — non-GNSS: satellite TV, radio, and broadband equipment, mobile satellite terminals.

GNSS — beginning with 2012, includes the entire GNSS segment: stand-alone navigation devices and GNSS chipsets supporting location-based services in mobile devices; traffic information systems; aircraft avionics, maritime, surveying, and rail.

*The 2012 growth number reflects only the stand-alone device portion of the GNSS equipment revenues

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Ground Equipment Findings



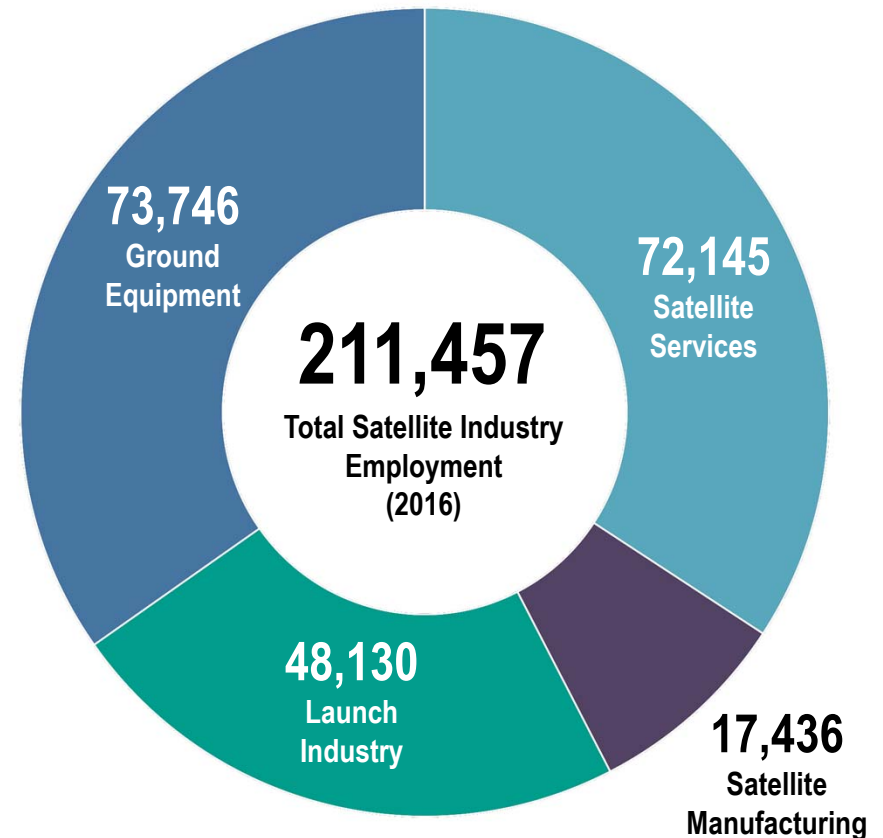
- Total satellite ground equipment revenues increased 7% in 2016
- Network equipment revenues increased 7%, tracking the growing demand for managed network services (including but not limited to in-flight connectivity services)
- Satellite navigation (or GNSS, for global navigation satellite systems) grew 8% and includes
 - » Stand-alone and in-vehicle units (\$31 — \$32 billion per year in 2012 — 2016)
 - » Chipsets supporting location-based services in mobile devices; traffic information systems; GNSS avionics in aircraft, maritime, surveying, and rail
- Consumer equipment for satellite TV, radio, broadband, and mobile satellite terminals (non-GNSS) revenues grew 1% with satellite TV terminals remaining flat or decreasing in some markets, offset by growth in broadband and some mobile equipment sales

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2016 U.S. Employment Estimates (Private Sector Employment Only)



- In 2016, satellite industry employment in the U.S. was 211,457
- Slight decrease from same time in 2015 (-1%)
- Employment decreased slightly from 2015 for satellite manufacturing and ground equipment



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Source: analysis of data from U.S. Bureau of Labor Statistics (BLS).

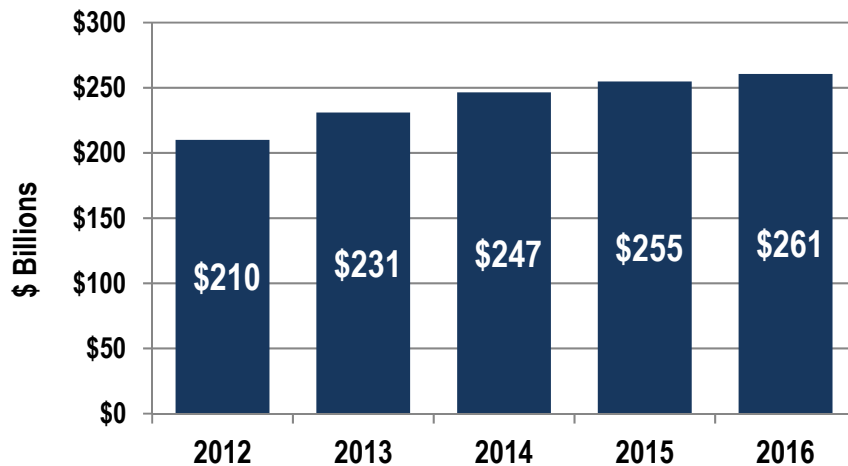
Summary: Top-Level Global Satellite Industry Findings



Satellite industry revenue was \$260.5 billion in 2016

- » Growth of 2% worldwide in 2016
- » Decrease from 3% growth rate in 2015

Global Satellite Industry Revenue (\$ Billions)



Two of four satellite industry segments surveyed posted growth

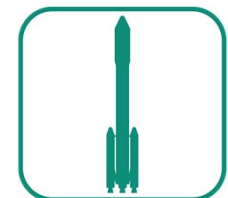
» **Satellite services**, the largest segment, stayed flat. Consumer services continues to be the largest segment of the overall satellite industry



» **Satellite manufacturing** revenues decreased by 13%. Fewer satellites launched in 2016, reflecting replacement cycles approaching an end and a bottleneck in immediate availability of launch services



» **Launch industry** revenues increased 2% in 2016. A few launches deploying government-manufactured payloads contributed to the moderate growth



» **Ground equipment** revenues increased 7% in 2016. Growth seen in GNSS and network equipment; consumer equipment revenues stayed flat



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Contact



For more information on the satellite industry,
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