



September 20, 2017

**VIA ELECTRONIC DELIVERY**

Marlene H. Dortch, Secretary  
Federal Communications Commission  
445 Twelfth Street, SW  
Washington, DC 20554

**Re: Errata - Thirteenth Broadband Progress Notice of Inquiry, GN  
Docket No. 17-199**

Dear Ms. Dortch:

SIA submits this document as Annex A to previous SIA comments into the Thirteenth Broadband Progress Notice of Inquiry<sup>1</sup>. This Annex depicts the 2016 State of the Satellite Industry Report and was inadvertently omitted from our comments.

Respectfully submitted,

/s/

SATELLITE INDUSTRY ASSOCIATION

Tom Stroup, President  
1200 18th St., N.W., Suite 1001  
Washington, D.C. 20036

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<sup>1</sup> SIA comments filed on Sept 20<sup>th</sup>, 2017, GN docket 17-199





20<sup>th</sup> Edition

# 2017

# State of the Satellite Industry Report

Prepared by:

June 2017



space and technology

Formerly Tauri Group Space and Technology



# Satellite Industry Association:

## 21 Years as the Voice of the U.S. Satellite Industry



### SIA MEMBER COMPANIES





# Study Overview



- SIA's 20<sup>th</sup> 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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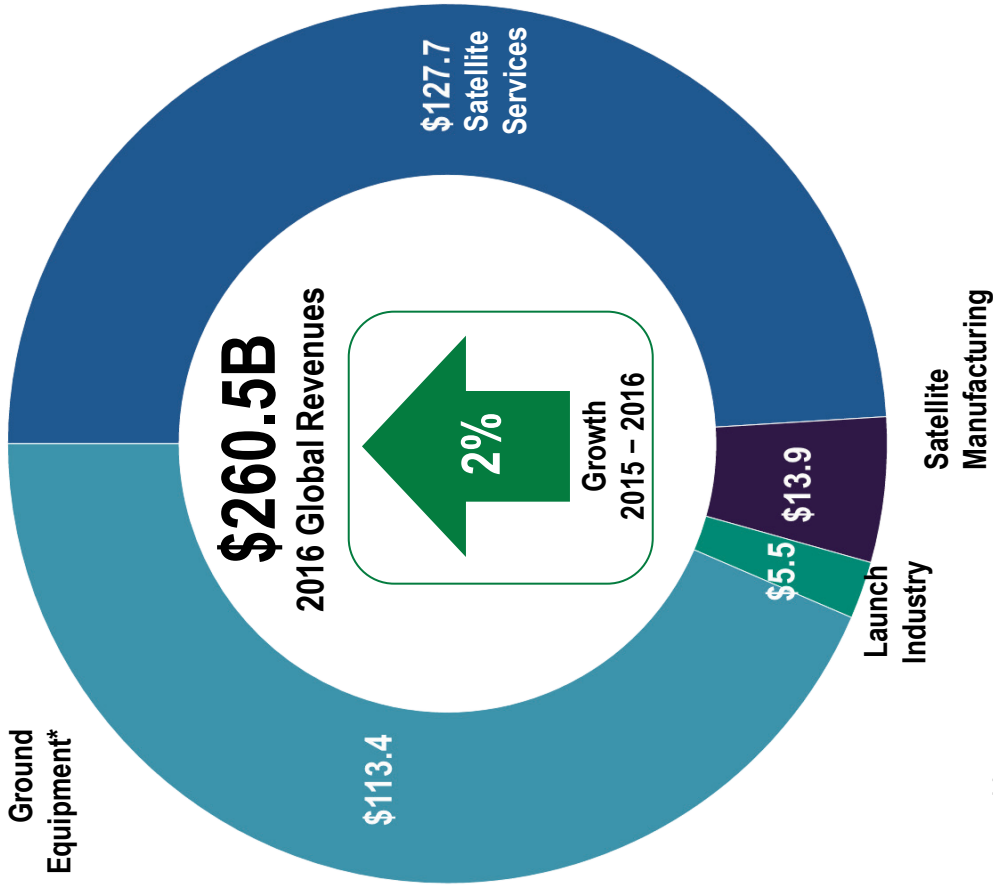


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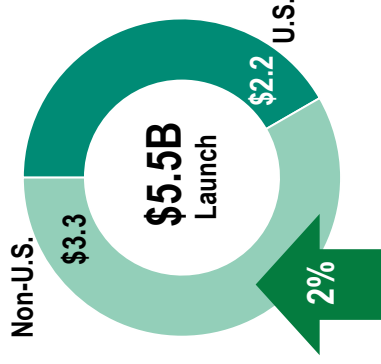
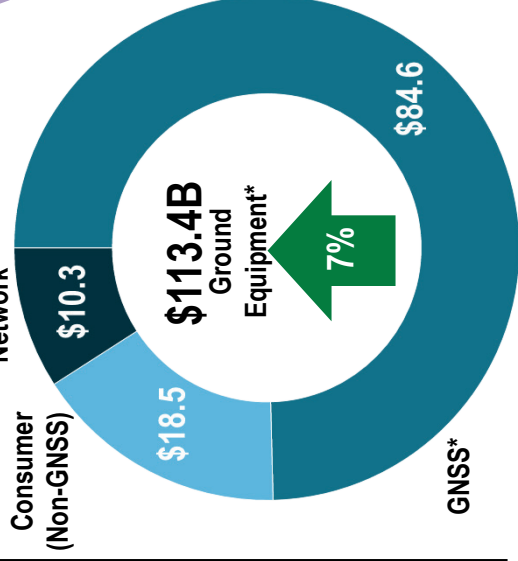
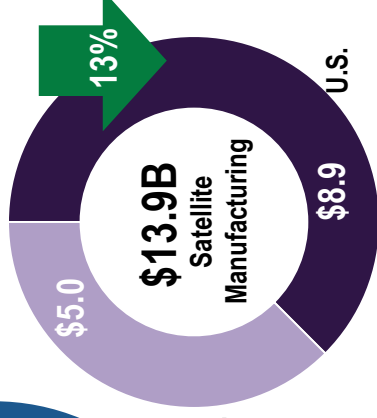
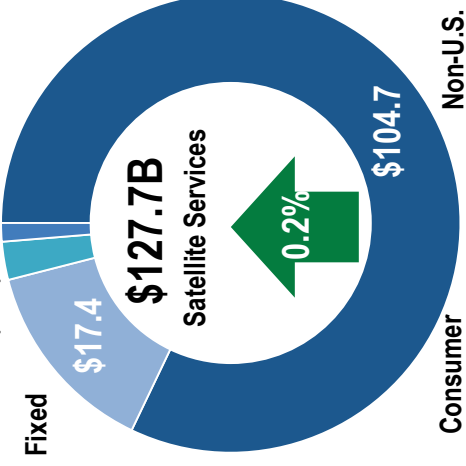


# 2016 Satellite Industry Indicators

## Summary



Mobile (\$3.6) Earth Observation Services (\$2.0B)



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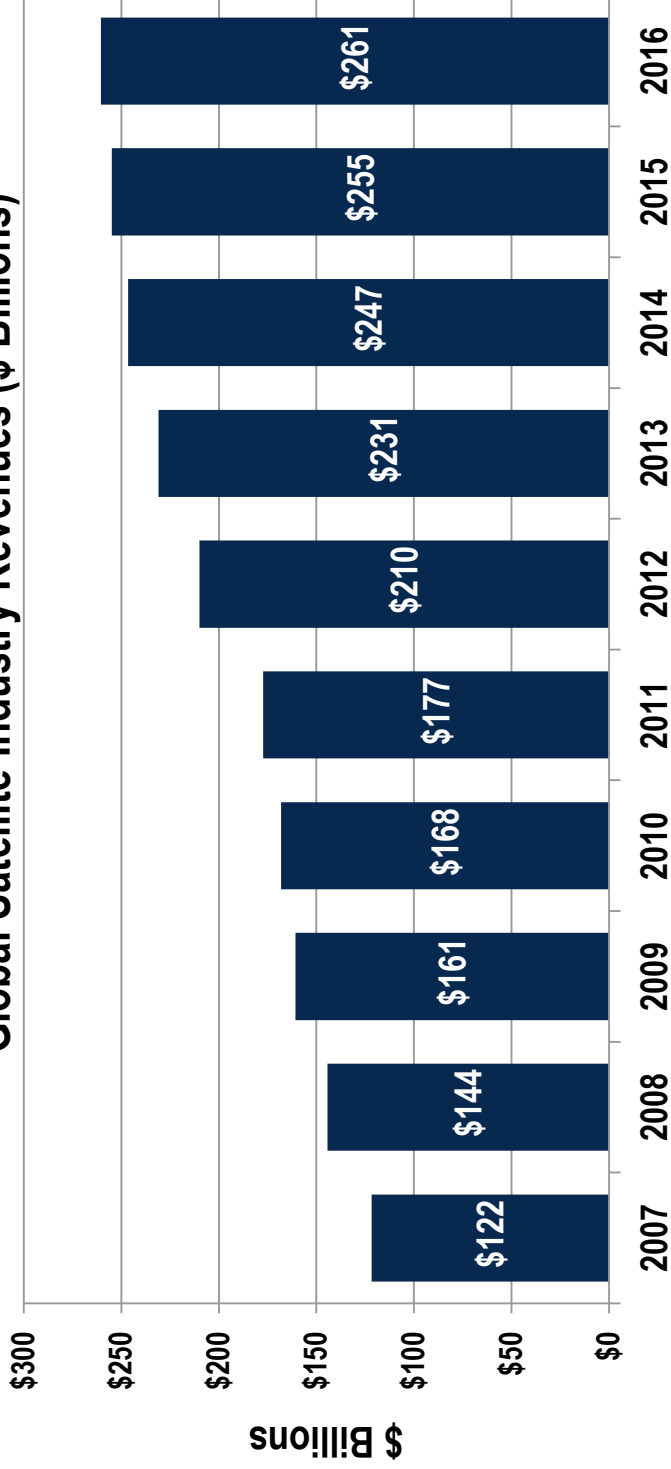
\*Ground equipment revenues include the entire GNSS segment: stand-alone navigation devices and GNSS chipsets supporting location-based services in mobile devices; traffic information systems; aircraft avionics, maritime, surveying, and rail.



# Global Satellite Industry Revenues



Global Satellite Industry Revenues (\$ Billions)



2X  
Ten-Year  
Global Industry  
Growth

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%)

\*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.

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# U.S. Portion

## of Global Satellite Industry Revenues



Average yearly U.S. market share  
**44%**  
of global industry

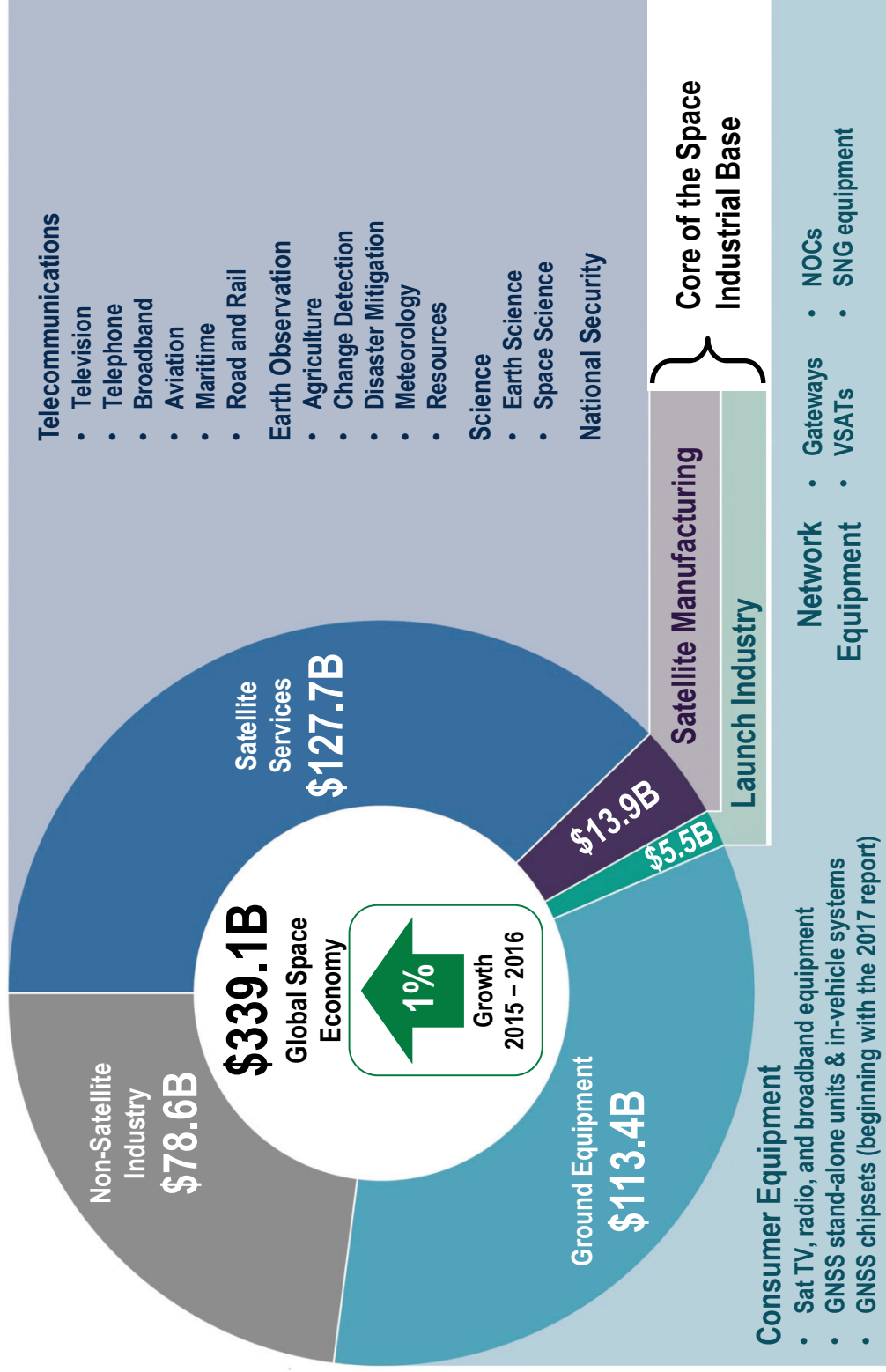
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# The Satellite Industry in Context



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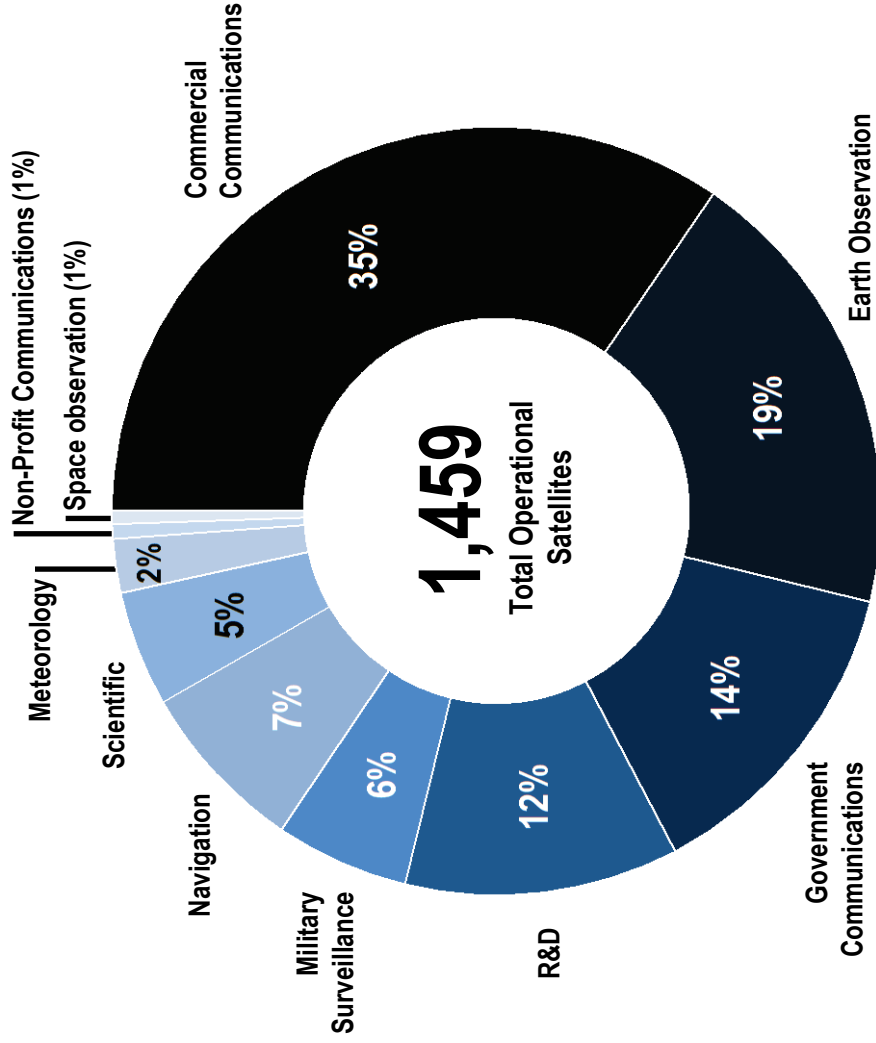
Notes: Network operations centers (NOCs), satellite news gathering (SNG), very small aperture terminal (VSAT) equipment, global navigation satellite systems (GNSS)



# 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



# 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

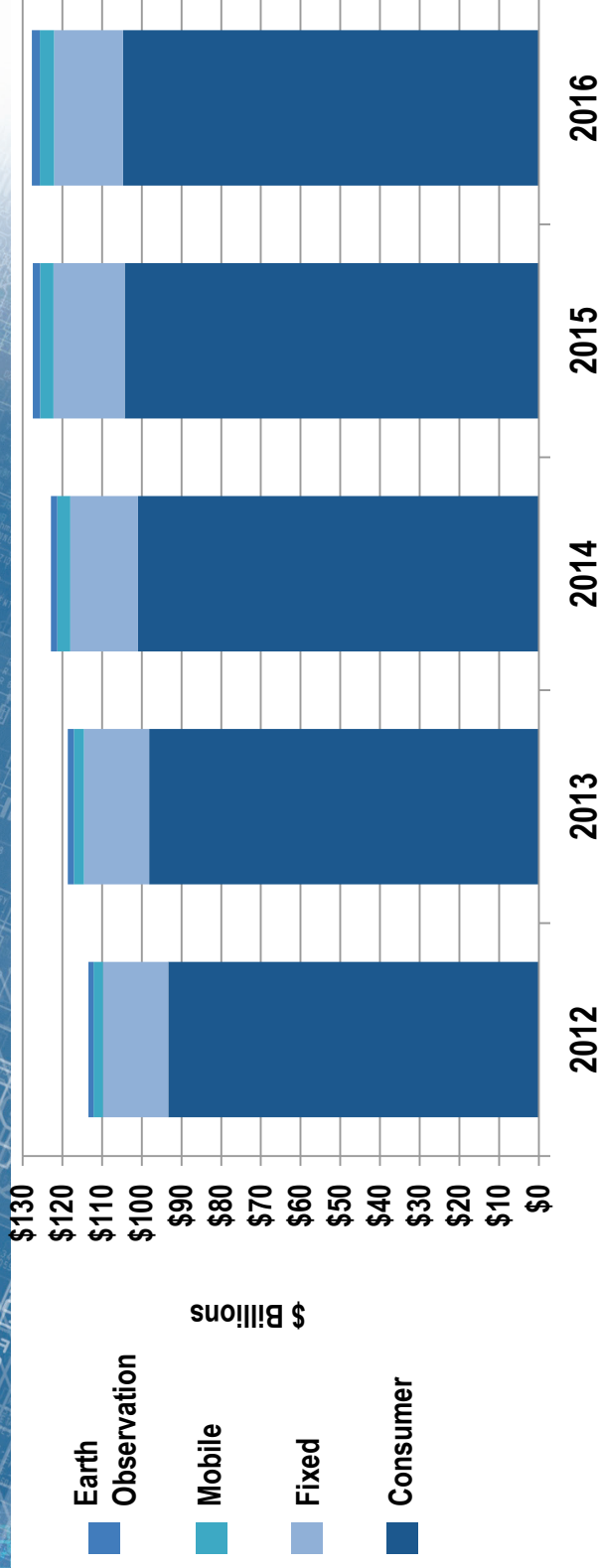


## Satellite Services

- 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



# Global Satellite Services Revenue



Earth Observation

Mobile

Fixed

Consumer

\$ Billions

0.2%

2015 – 2016  
Global  
Growth

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

40%

Growth Rate

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

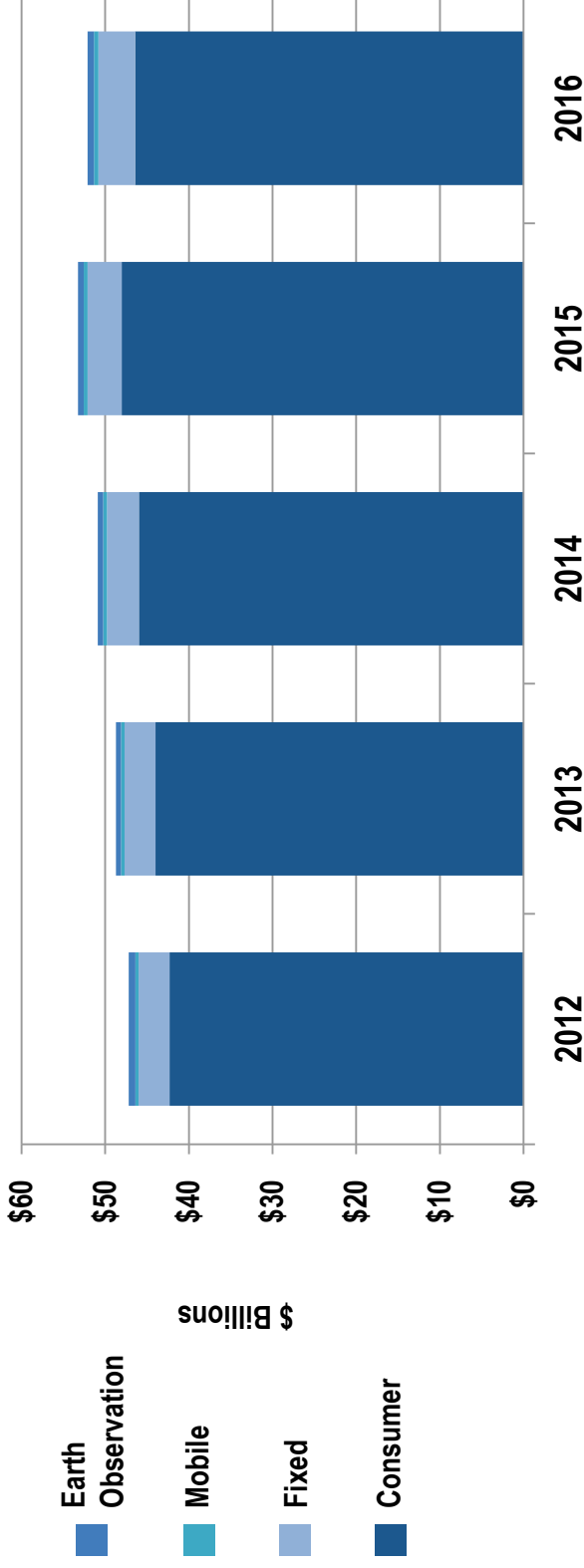
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Notes: Numbers may not sum exactly due to rounding. (1) Includes capacity for DTH satellite TV and some mobility service platforms. (2) Includes VSAT, mobility, and in-flight connectivity.





# U.S. Satellite Services Revenue



Earth Observation

Mobile

Fixed

Consumer



2015 – 2016  
U.S.  
Growth

Growth Rate

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

The U.S. share of global 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.





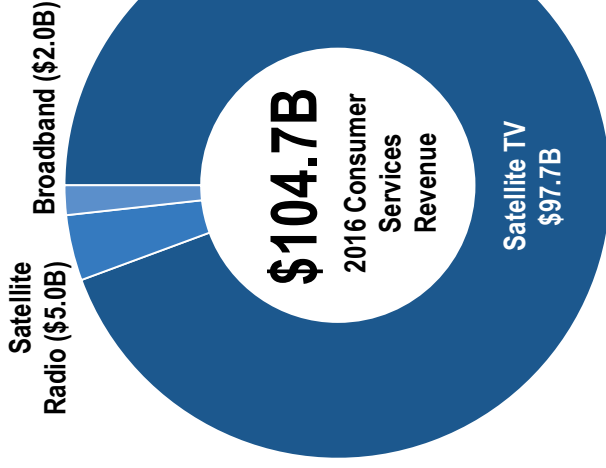
# Satellite Services Findings: Consumer Services Highlights



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)

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- 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 (<1dy)	Sensor Description	System Size	Sat Mass (kg)
Large Sats						
Airbus D&S	●			Optical and radar	4	1,000
DigitalGlobe	●	●		Optical	5	2,800
MDA	●	●		Radar	1	2,300
DMCii	●			Optical	6	450
ImageSat	●			Optical	3	350
UrtheCast	●	●		Optical and radar	24	1,400
Astro Digital	●	●		Optical	30	20
Axelspace	●	●		Optical	50	95
BlackBridge (Planet)	●	●		Optical	5	150
BlackSky Global		●		Optical	60	50
Capella Space		●		Radar	30	TBD
XpressSAR	●			Radar	4	TBD
GeoOptics		●		Radio occultation	24	115
HawkEye360		●		RF mapping	21+	TBD
Hera Systems		●		Optical	48	24
ICEYE	●	●		Radar	50	<100
PlanetiQ		●		Radio occultation	12	22
Planetary Resources	●	●		Optical	10	TBD
Planet		●		Optical	100+	3
Satelloptic	●	●		Optical	25+	35
Spire Global				Radio occultation	50	3
Terra Bella (Planet)		●		Optical	24	120
Small Satellites (<200 kg)						



# Satellite Industry Segments

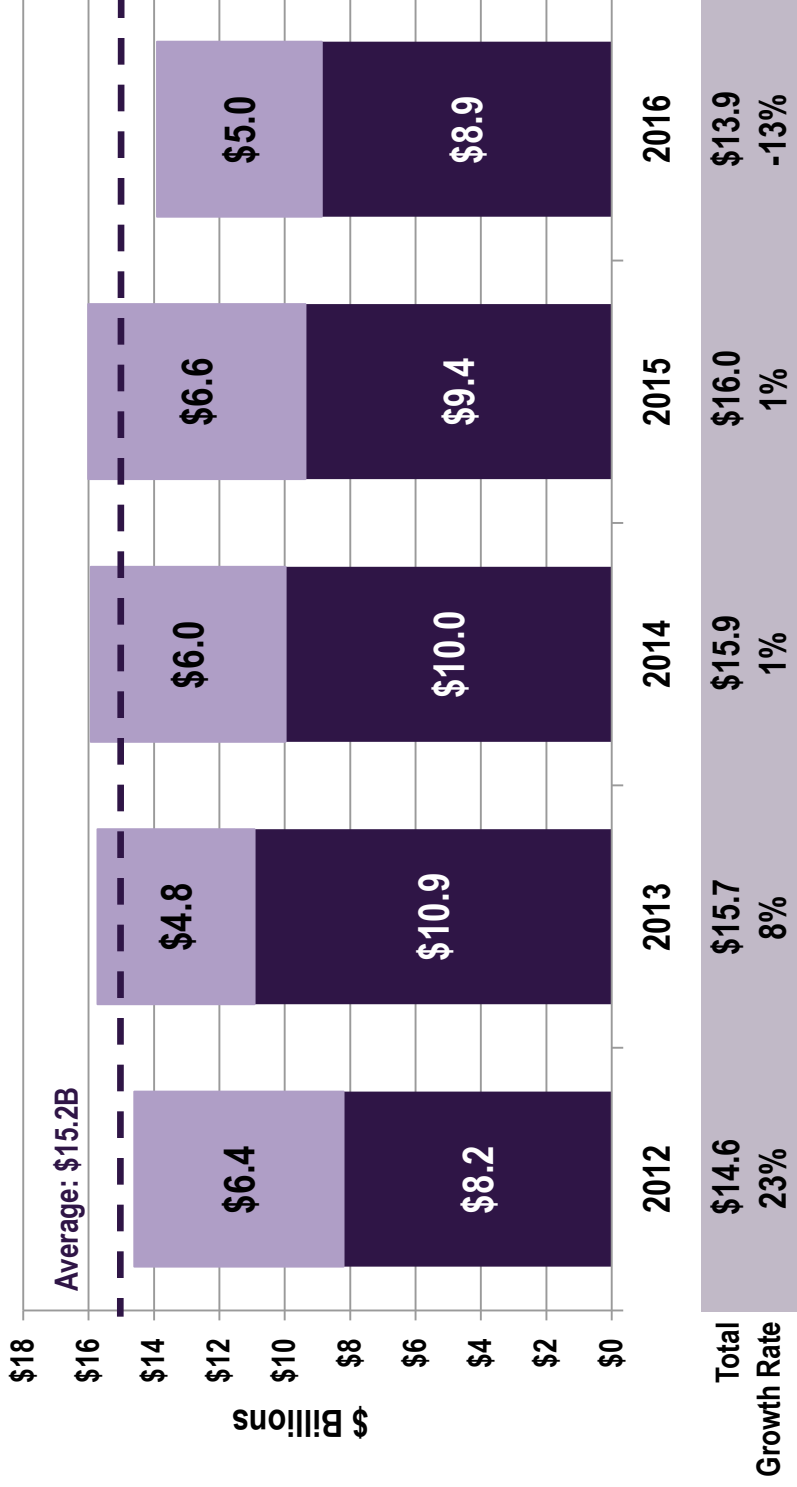


## Satellite Manufacturing





# Satellite Manufacturing Revenues



2015 – 2016  
Global  
Growth

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

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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

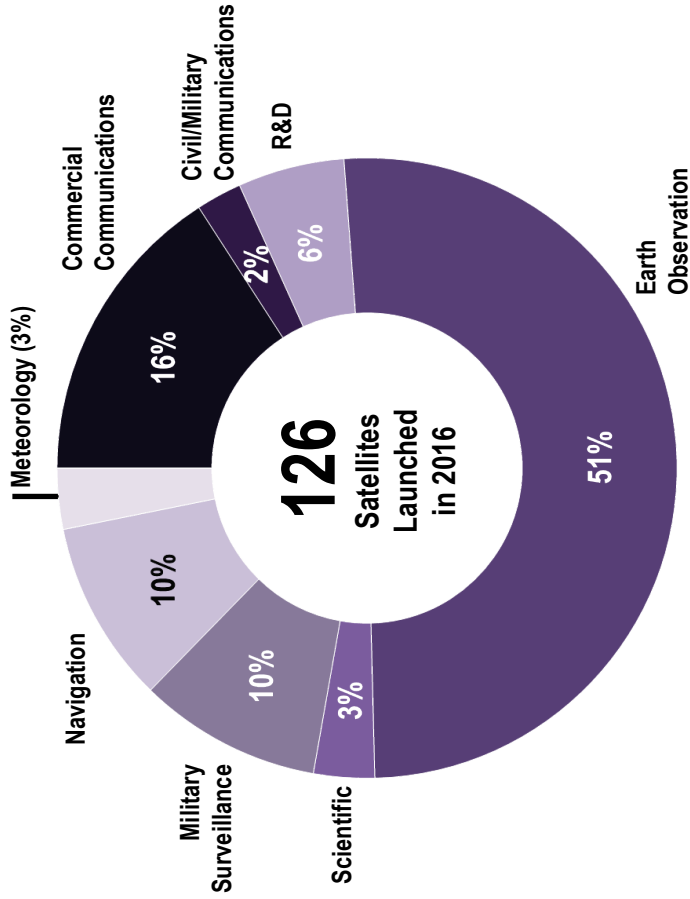




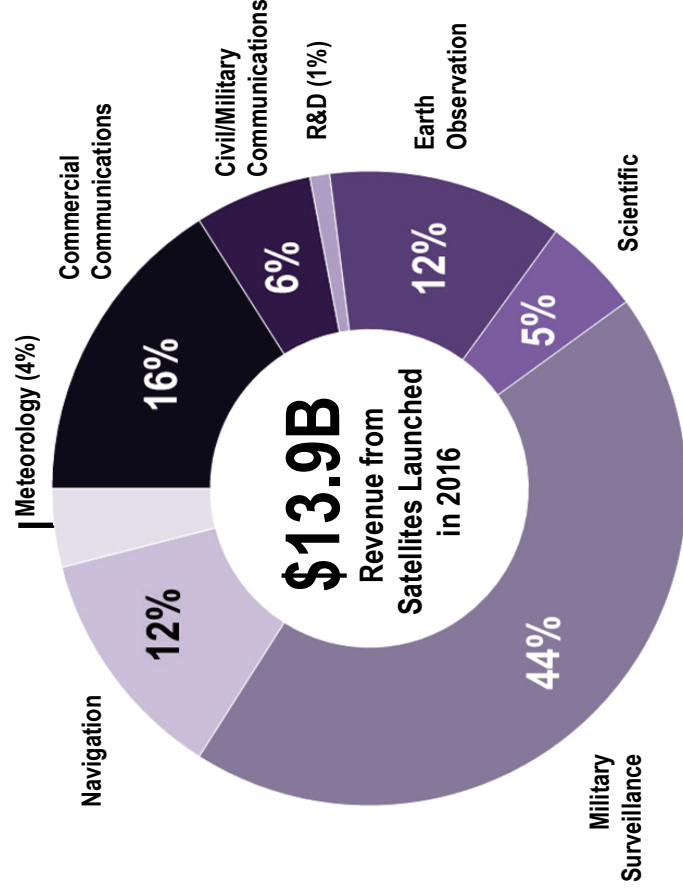
# Satellite Manufacturing Findings



- 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)**



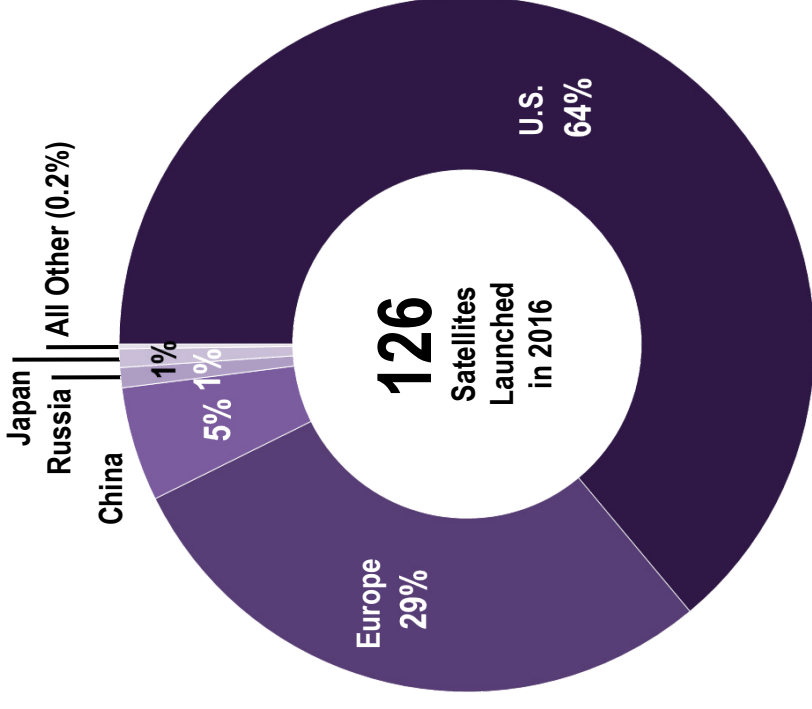
**Value of Spacecraft Launched Estimated by Mission Type (2016)**





# 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)**





# Satellite Manufacturing Revenue Comparison to 2015

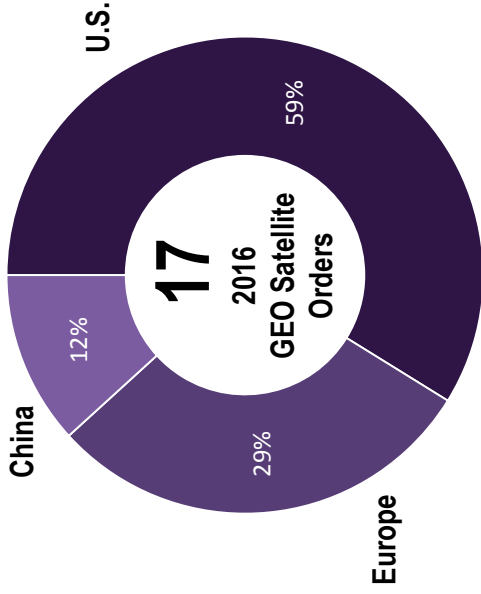


- Decline of \$2.1B in satellite manufacturing, compared to 2015, due to fewer satellites launched
  - » One European-manufactured commercial satellite launched, compared to 9 in 2015 (\$1B revenue decline)
  - » Less expensive U.S. government satellites (\$0.65B revenue decline)
  - » Outside the U.S. 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

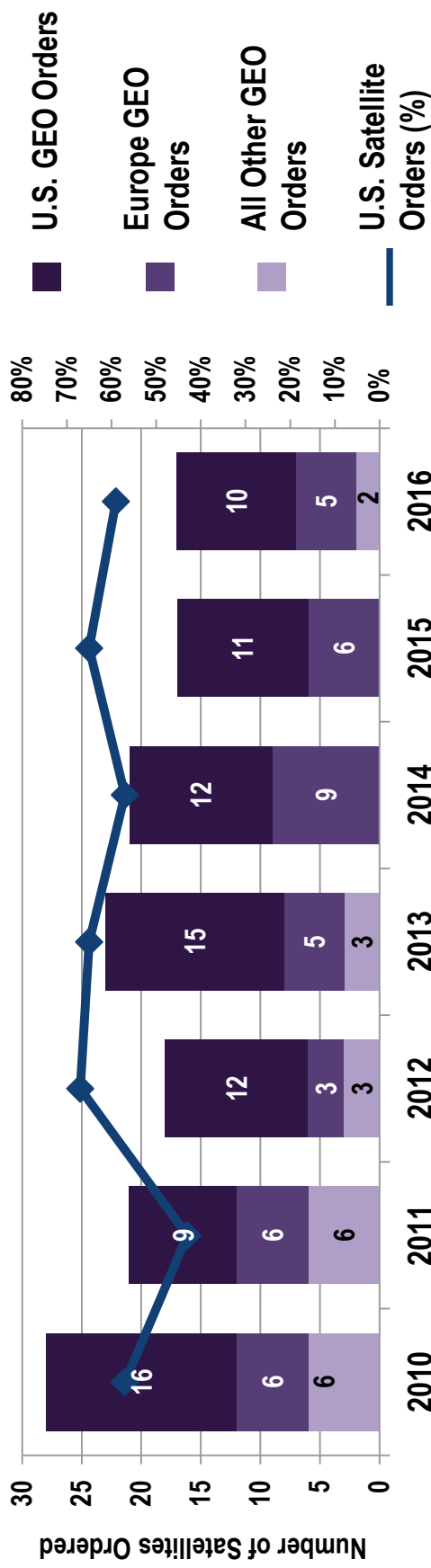




# Future Indicator: Commercial Satellite Manufacturing Orders



- 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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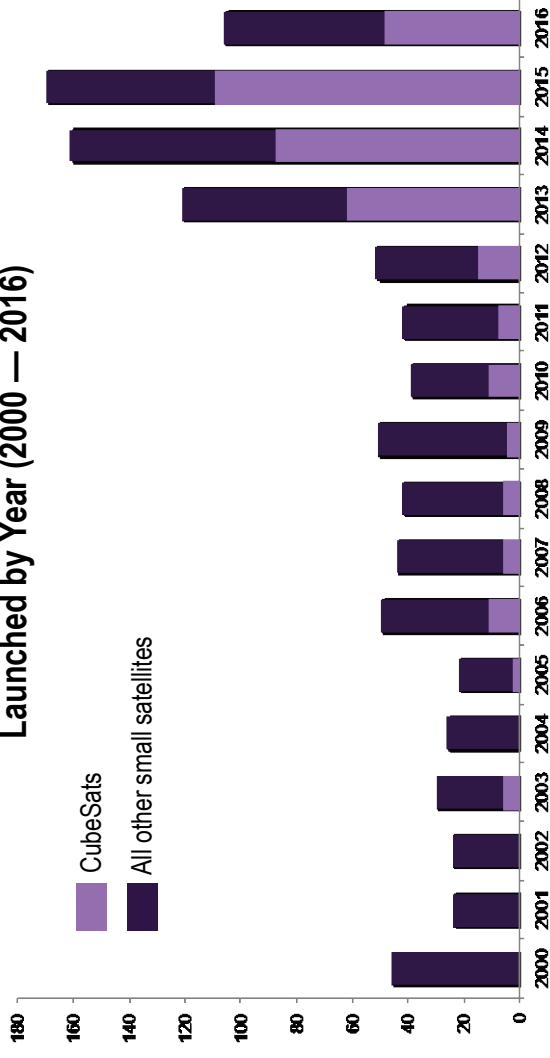


# Case Study: Very Small Satellites



- 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 ( $\leq 600$  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/SSL, SSL, Spaceflight Industries, York Space Systems, and others

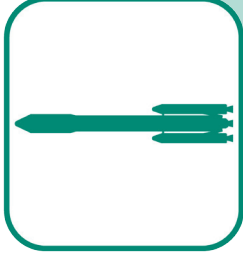
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# Satellite Industry Segments



## Launch Industry

- Launch Services
- Launch Vehicles

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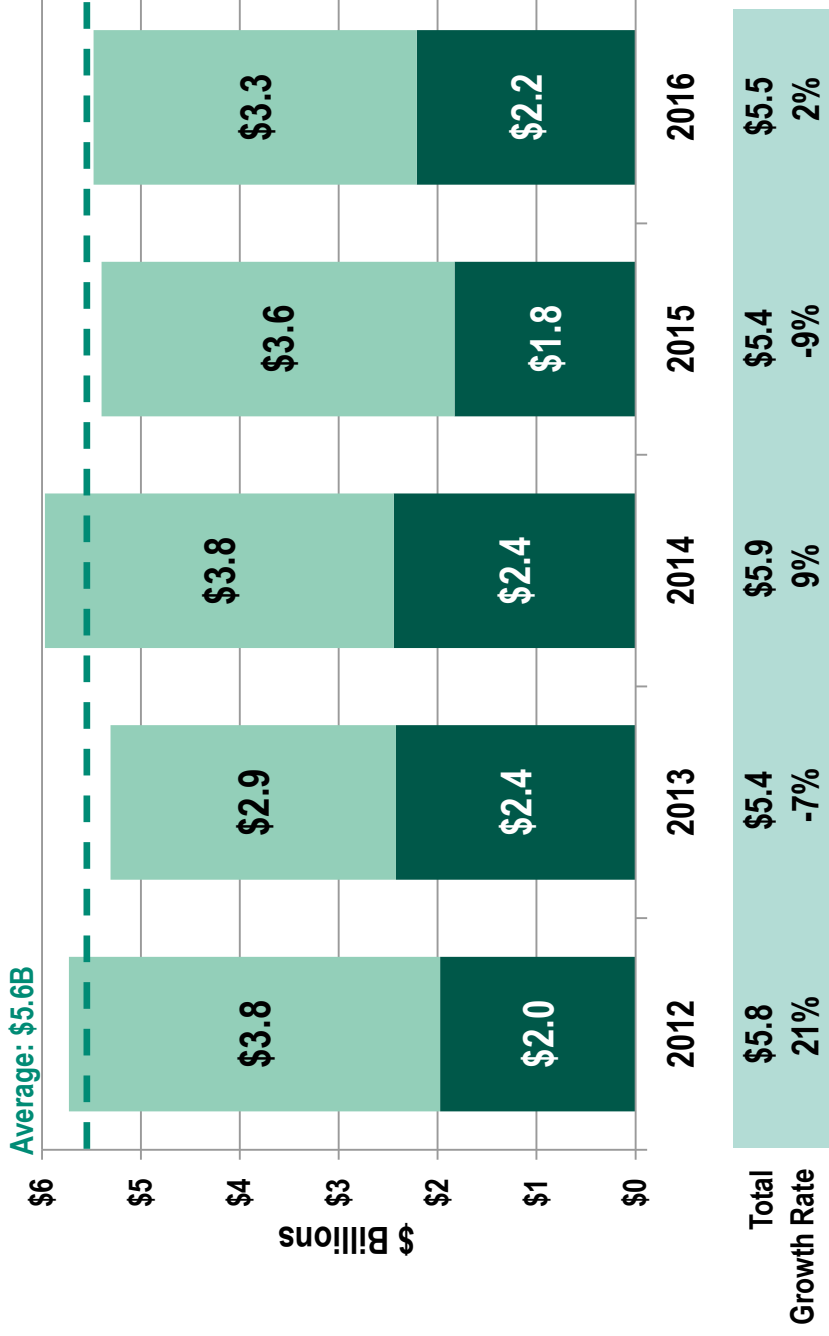


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# Satellite Launch Industry Revenues



- \$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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Note: Launch industry revenues are recorded in the year the launch was conducted.

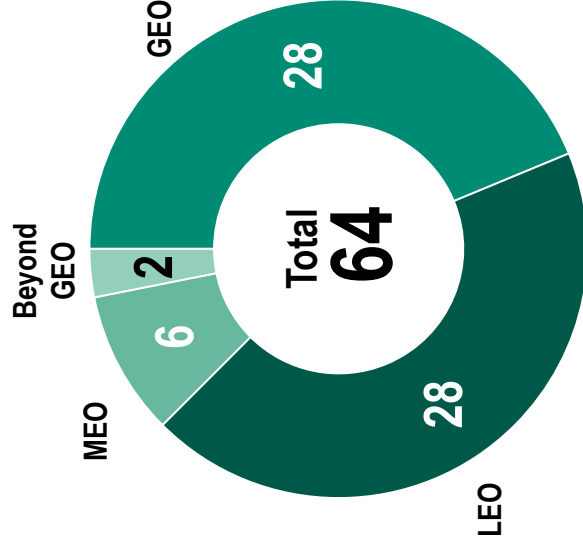




# Satellite Launch Industry Findings



- 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

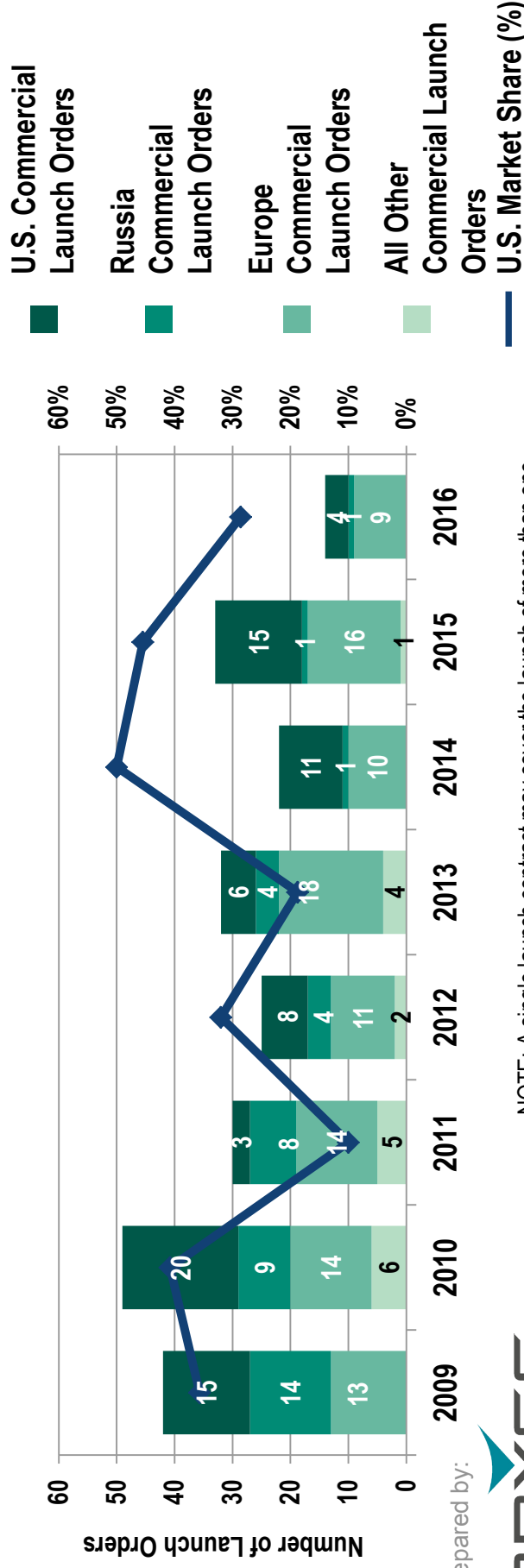
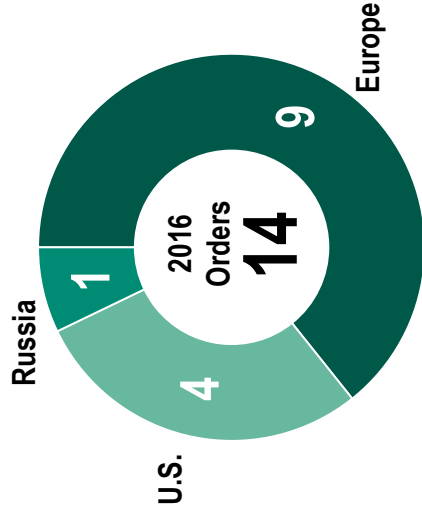




# Future Indicator: Commercial Satellite Launch Orders



- 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



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



	Electron	LauncherOne	Vector H	Vector R
Company	Rocket Lab	Virgin Galactic	Vector Space Systems	Vector Space Systems
LEO Capacity	150 kg	400 kg	100 kg	60 kg
First Flight	2016	2017	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 (Blossar)

\* 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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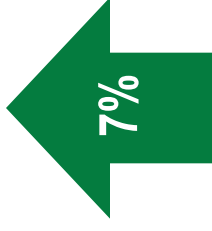
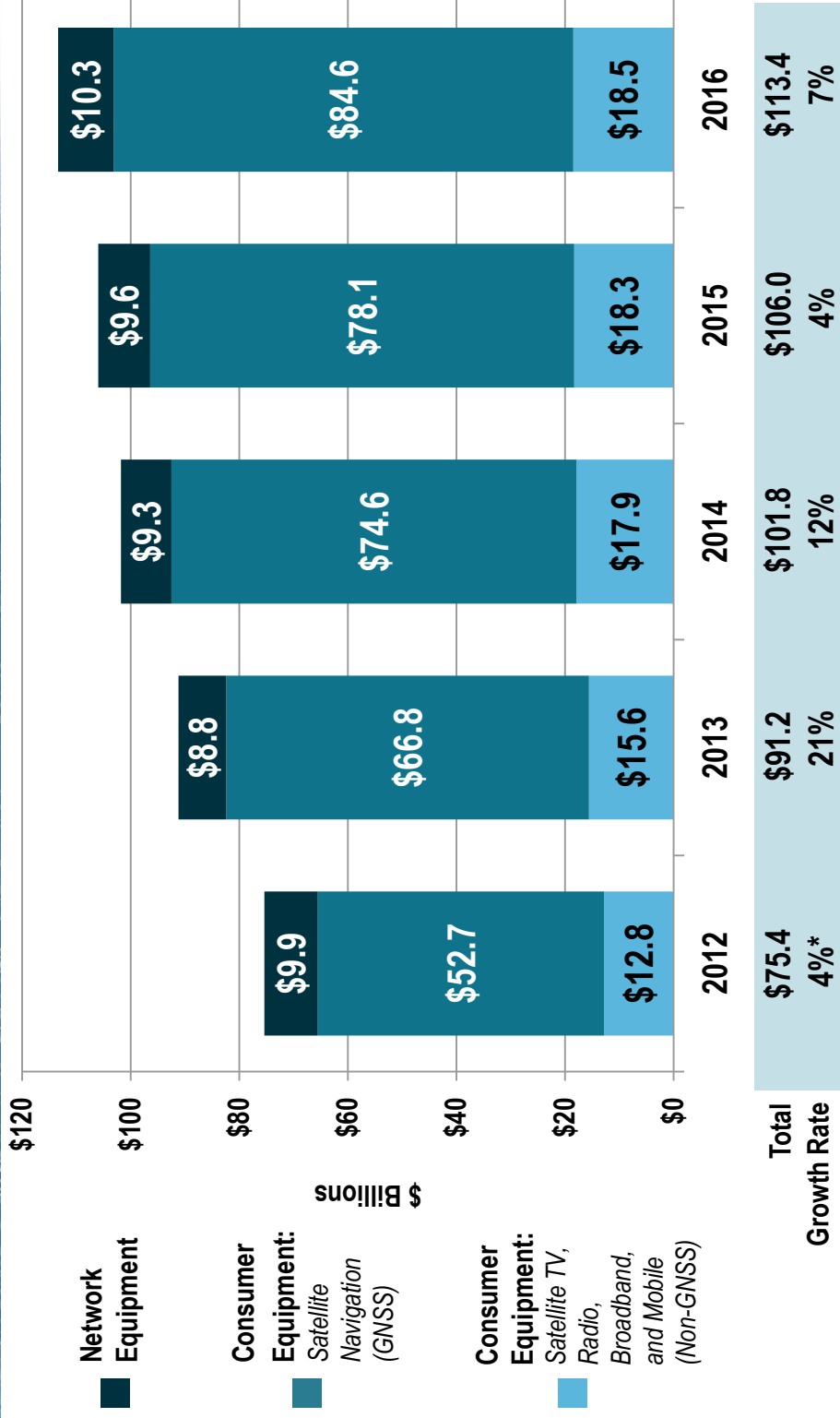


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# Global Satellite Ground Equipment Revenues



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



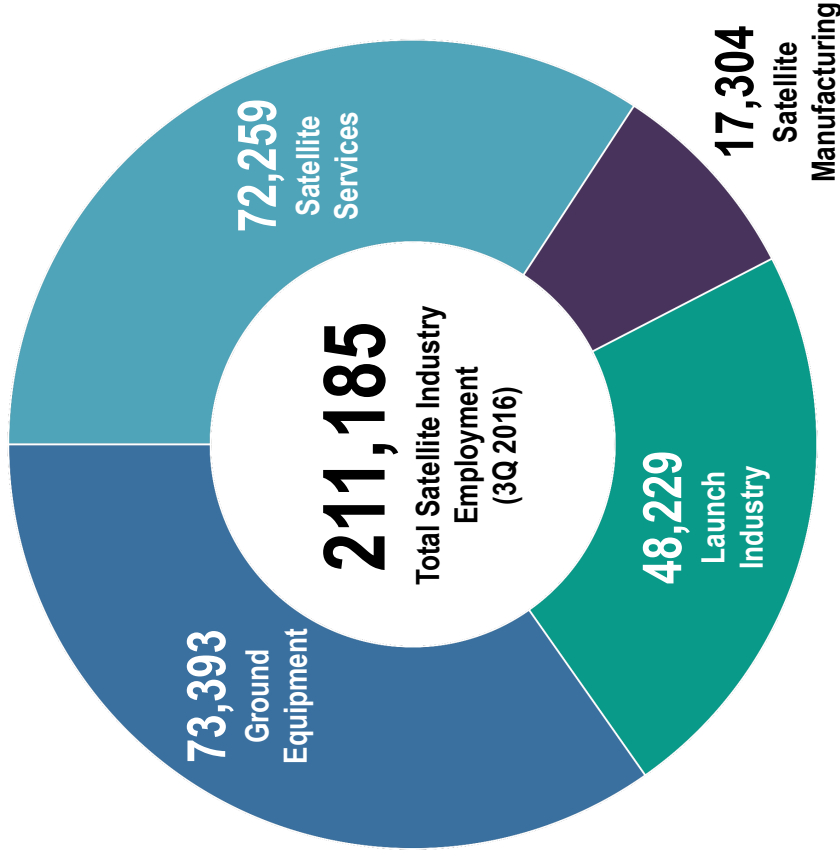
- Total satellite ground equipment revenues increased 7% in 2016
- Network equipment revenues increased 7%, tracking the growing demand for managed network services (including but not limited to in-flight connectivity services)
- Satellite navigation (or GNSS, for global navigation satellite systems) 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



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



- In September 2016 (latest BLS report for the year), satellite industry employment in the U.S. was 211,185
- Slight decrease from same time in 2015 (-1%)
- Employment in satellite services increased by 1% between Sep 2015 and Sep 2016





# Summary: Top-Level Global Satellite Industry Findings



Satellite industry revenue was \$260.5 billion in 2016

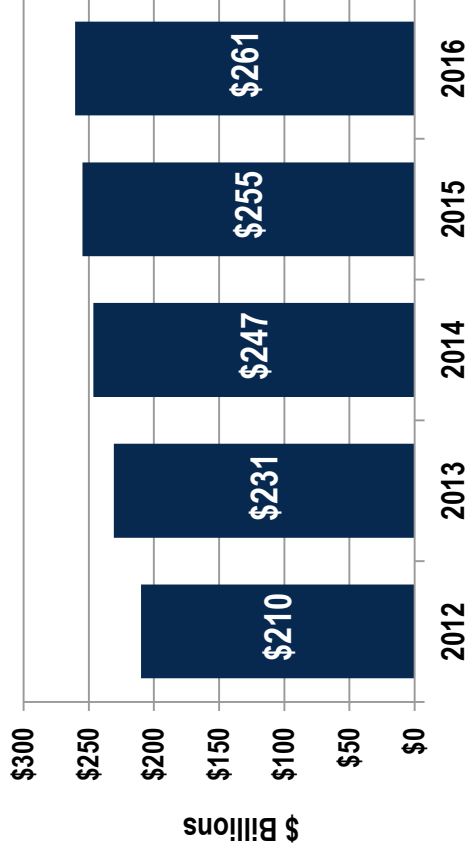
- » Growth of 2% worldwide in 2016
- » Decrease from 3% growth rate in 2015

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



Global Satellite Industry Revenue (\$ Billions)



2%  
2015 – 2016 Global Growth

Prepared by:



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# Contact



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