



SATELLITE 101: Satellite Technology and Services

SIA MEMBER COMPANIES





Satellites in the World's Communications Industry

Commercial satellites are an essential component of the global communications infrastructure

- Satellites carry the world's media content around the globe
- Satellites deliver satellite television, radio and broadband services directly to consumers
- Satellites offer mobile and portable voice, data and video globally
- Satellite networks link businesses among widely-dispersed locations
- Satellites provide connectivity and network restoration for remote and rural telecommunications operators

The U.S. military relies on the commercial satellite industry

- U.S. satellite companies manufacture military satellites and systems
- Commercial U.S. satellite owner/operators and integrators provide 80 percent of Department of Defense communications

Satellites are critical to disaster recovery and emergency preparedness

- Satellites have provided critical communications and network restoration services following U.S. and international natural disasters
- Satellites are designated a critical infrastructure by the Department of Homeland Security

Basics of Satellite Systems

- Satellites perform like “cell towers in the sky,” transmitting data from one point on the Earth to another
- Unique attributes of satellite systems:
 - **Large Geographic Coverage**
 - interconnecting widely distributed networks,
 - providing broadcasting services over a country, region, or entire hemisphere
 - providing “last mile” connectivity for telecom services, broadband and video services
 - **Instant infrastructure**, whether for network redundancy or emergency connectivity
 - **Mobility**, whether for voice, data or broadband or mobile video

Satellite Industry Segments Surveyed

Satellite Services

- Consumer Services
 - Satellite Television
 - Satellite Radio
 - Satellite Broadband
- Fixed Satellite Services
 - Transponder Agreements
 - Managed Network Services
- Mobile Satellite Services
 - Mobile Data
 - Mobile Voice
- Remote Sensing
- Space Flight Management Services

Satellite Manufacturing

- Satellite Manufacturing
- Component and Subsystem Manufacturing



Launch Industry

- Launch Services
- Vehicle Services

Ground Equipment

- Network Equipment
 - Gateways
 - Control Stations
 - Very Small Aperture Terminals (VSATs)
- Consumer Equipment
 - Direct Broadcast Satellite (DBS) Dishes
 - Mobile satellite terminals (including satellite phones)
 - Digital Audio Radio Service (DARS) Equipment
 - Global Positioning System (GPS) Stand-alone Hardware

The Satellite Industry in Context

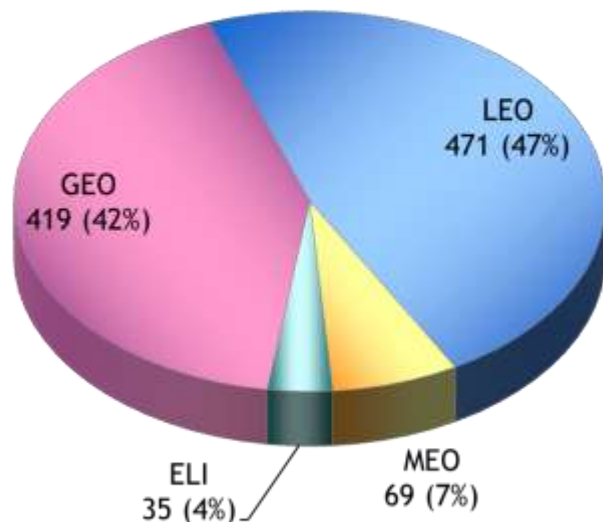
- The satellite industry is a subset of both the telecommunications and space industries
- Satellite industry revenues represent 61% of space industry revenues and 4% of overall global telecommunications industry revenues



- The global satellite industry posted growth of 5% in 2011, matching growth in 2010
- Overall global telecommunications spending rose by 4.9% in 2011, compared with 5.5% in 2010
 - U.S. telecommunications spending experienced somewhat faster growth of 5.8% in 2011, following slower 2.4% growth in 2010 and a steep decline of 8.2% in 2009
- Overall global space spending rose by 4.8% in 2011, following 7.7% growth in 2010

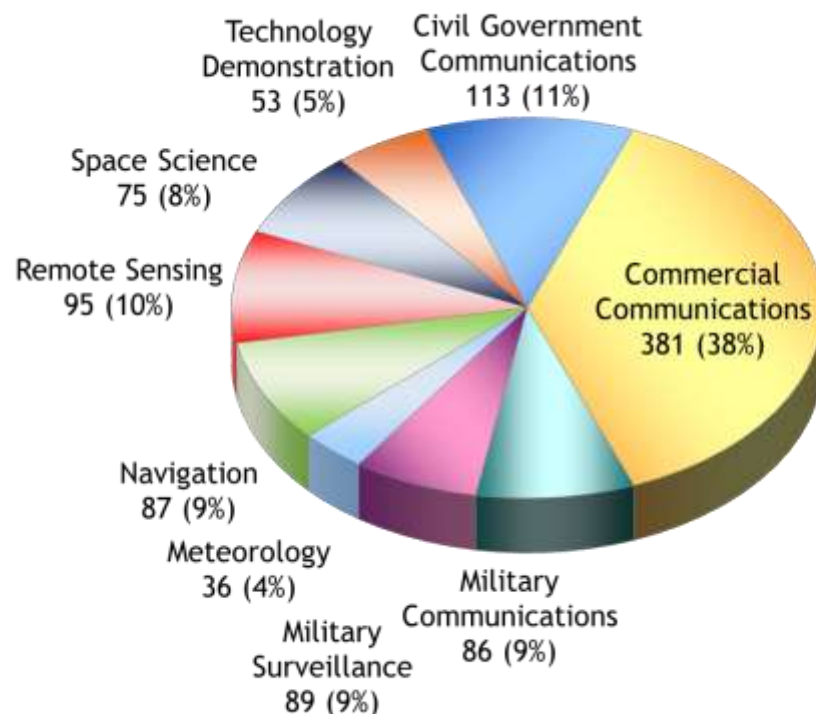
The Satellite Network in Context

Operational Satellites (May 2012)
By Orbit



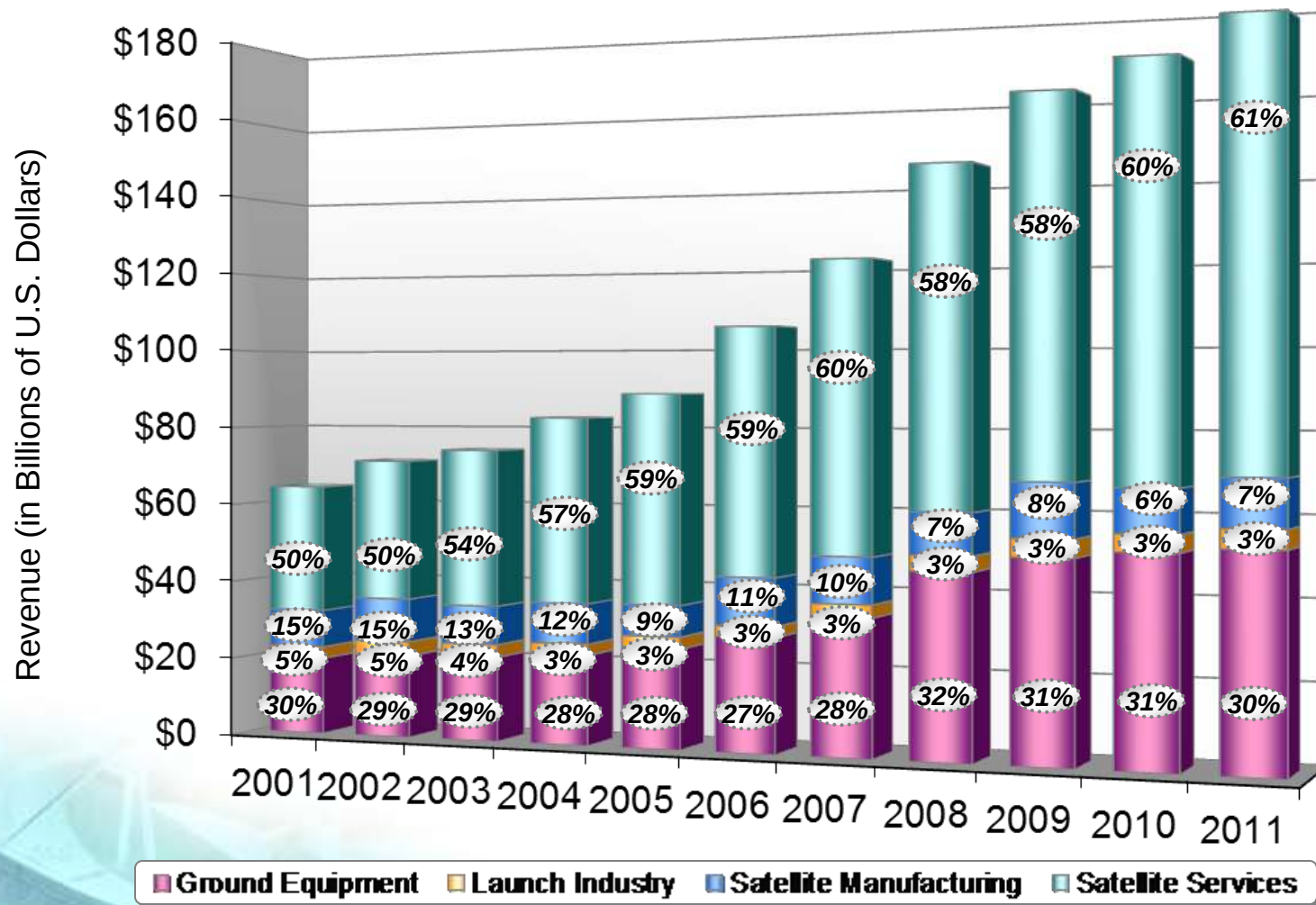
LEO = Low Earth Orbit
MEO = Medium Earth Orbit
ELI = Elliptical Orbit
GEO = Geosynchronous Orbit

Operational Satellites (May 2012)
By Function



- Of the 994 satellites on orbit, 38% are commercial communications satellites
 - An additional 20% are civil government or military communications satellites
- The relative proportion comprised by communications satellites remained consistent from 2011 to 2012

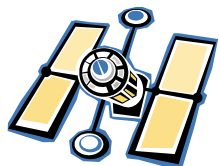
World Satellite Industry Revenues By Segment: Decade in Review



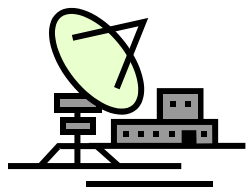
Notes:
Numbers may not sum exactly due to rounding.
Figures not adjusted for inflation.

Global satellite industry revenues grew by 175% for the period from 2001 through 2011, an average of 10.7% growth per year

Key Satellite Network Elements



- **Space Segment**– Satellite either in geostationary orbit or in low earth orbit



- **Ground Segment** – Receives signal from satellite and switches it to the PSTN, Internet, or private network, or may re-transmit



- **User Terminals** — Device used on the ground to connect to satellite network; can be receive-only or transmit; mobile or fixed; a dish, a laptop, or a handheld, depending on application, site, etc.

- Bus
 - Power Subsystem
 - Telemetry and Command Subsystem
 - Attitude and Control Subsystem
 - Propulsion Subsystem
- Payload
 - Communications Subsystem
 - Transponders



Satellites by Orbit

- **Geosynchronous (GEO)** satellite orbit (22,300 miles) rotates at the same speed as the earth's rotation. Three satellites can cover most of the globe.
- **Medium earth orbit (MEO)** satellites are closer to users on Earth but 10-18 are required for continuous coverage.
- **Low earth orbit (LEO)** satellites are closest to users (300-500 miles) but 40-70 satellites are required for full coverage.

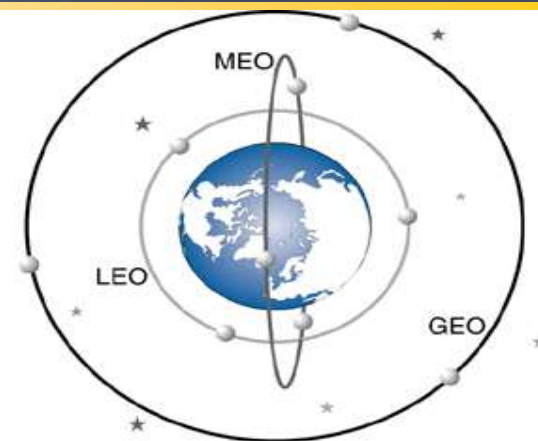
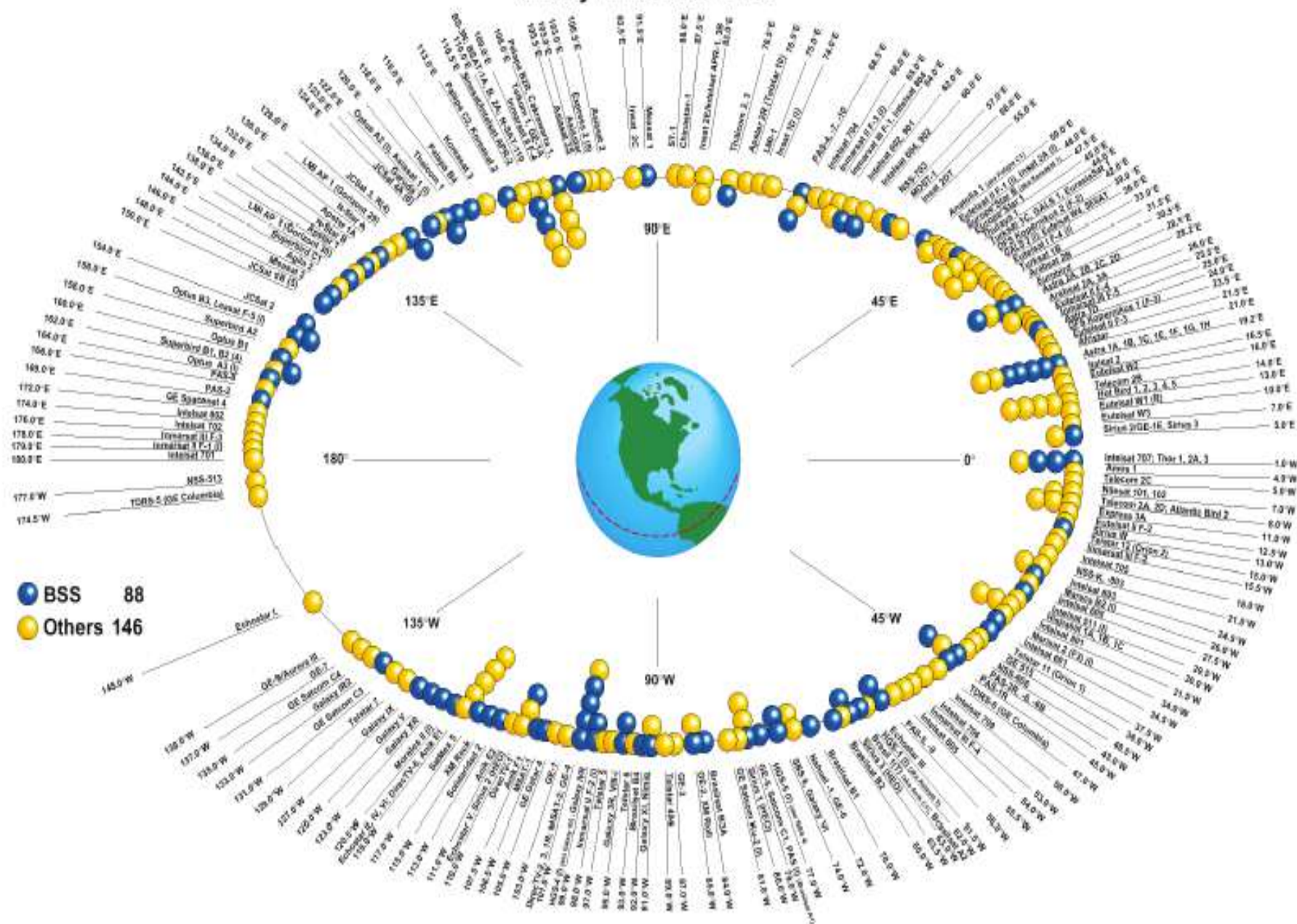
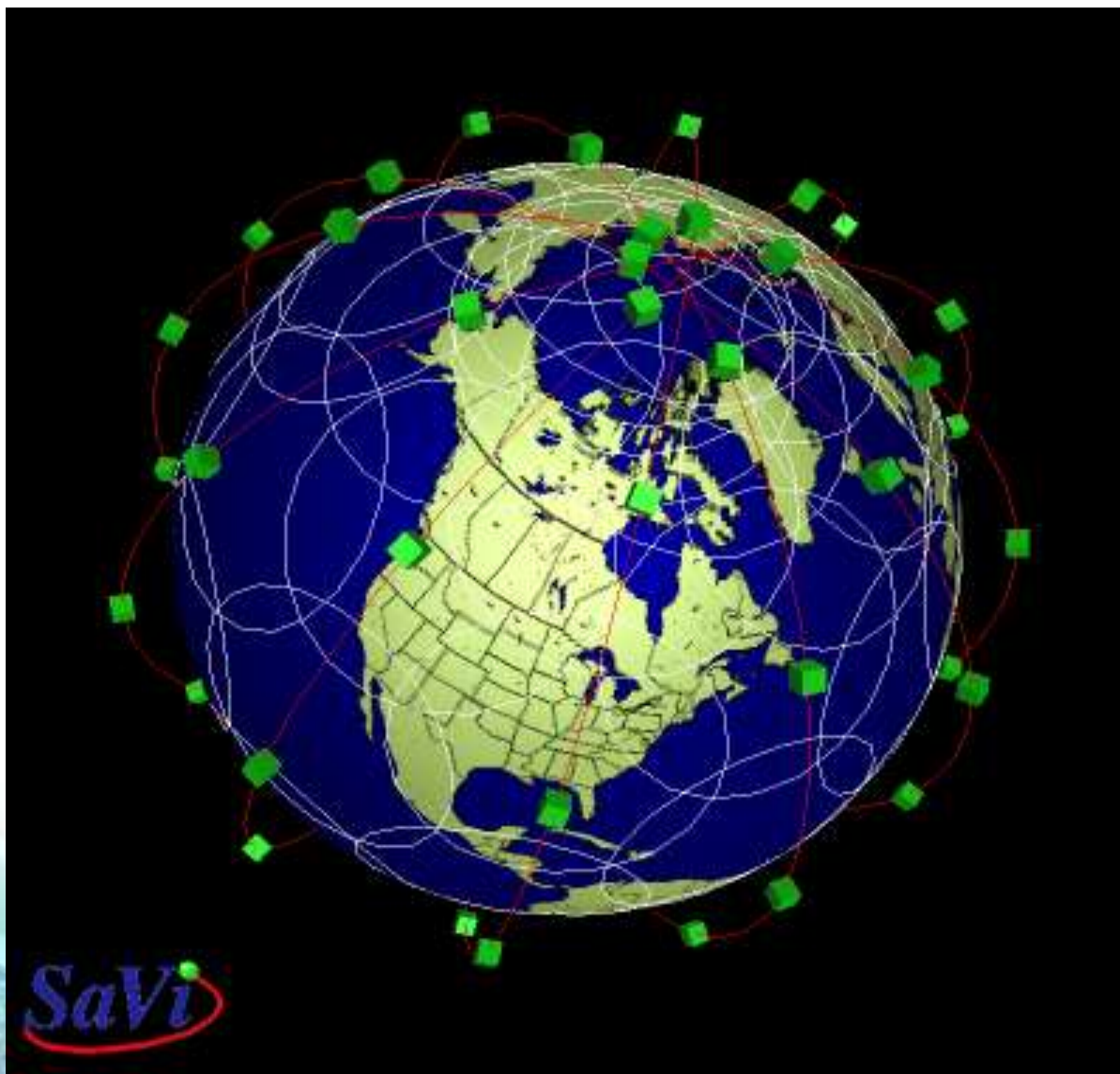


Figure 3: Geostationary Satellites by Orbital Location

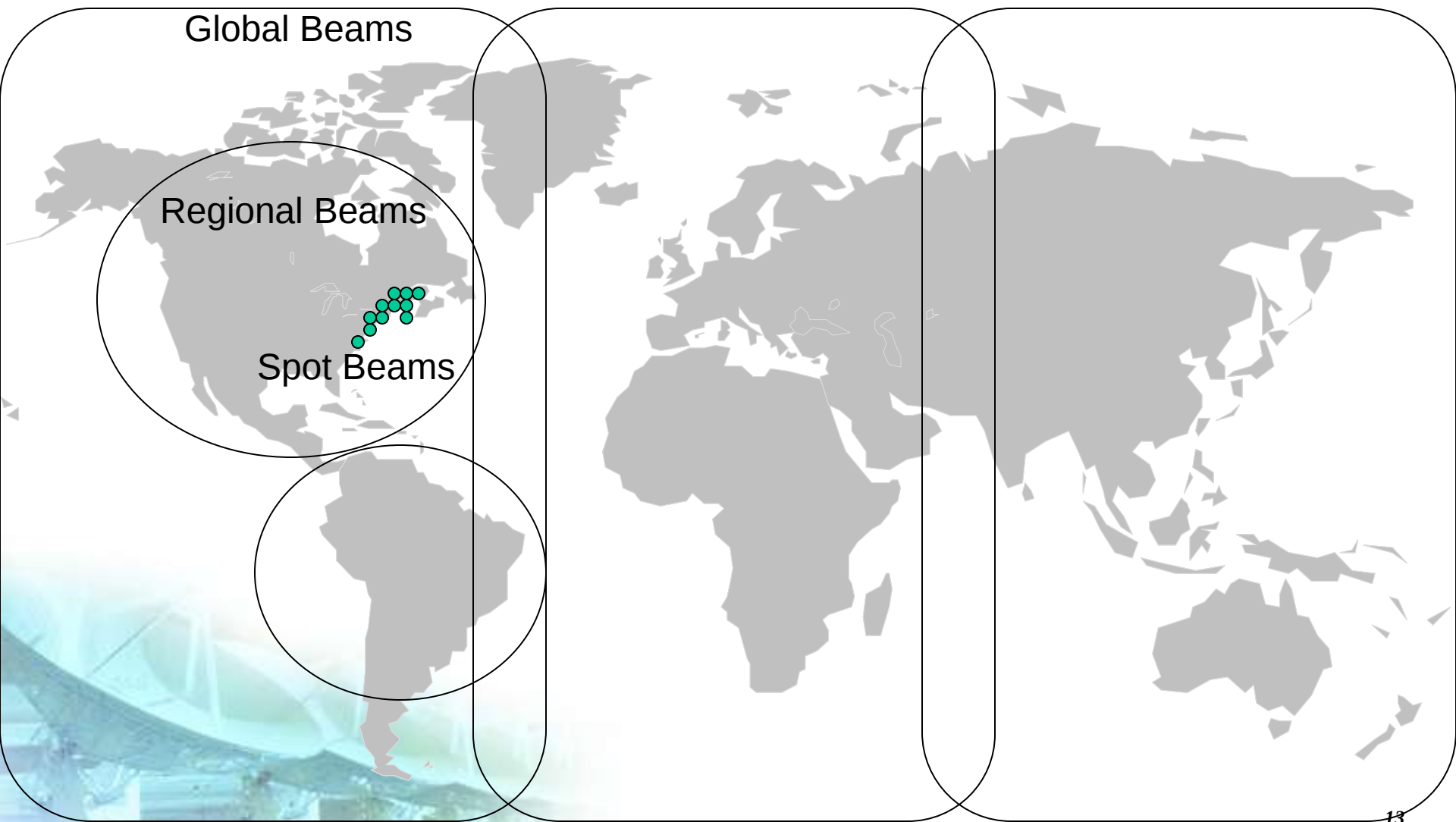
Commercial Communications Satellites Geosynchronous Orbit



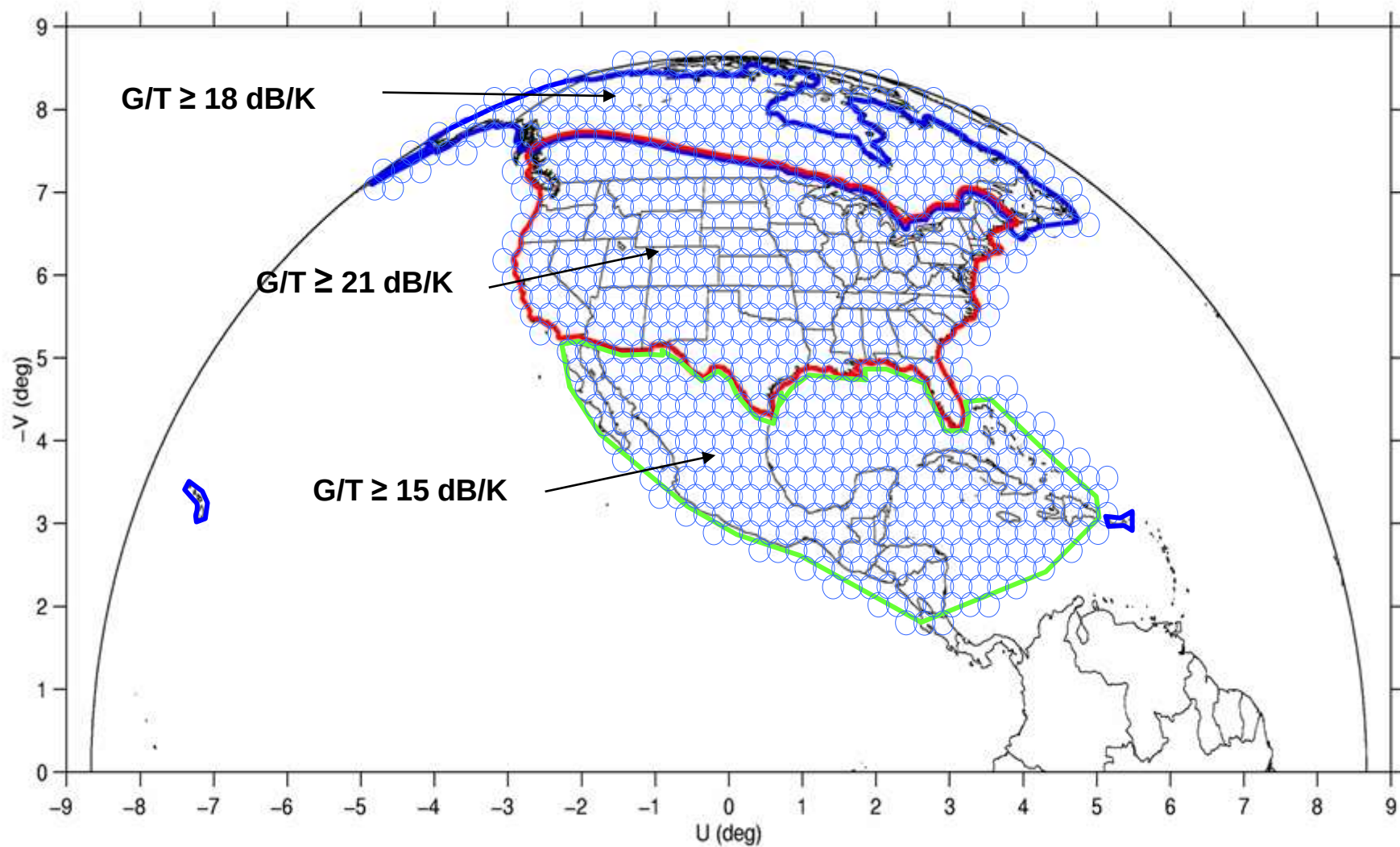
Low Earth Orbit Satellite Coverage "Footprints"



Geostationary Satellite Coverage “Footprints”



Multi-Spot Beam Coverage



Satellites by Frequency Band

The International Telecommunications Union (ITU) has allocated specific frequency ranges used by commercial satellites globally:

- | | |
|--|---|
| – L-band (1.5 – 1.7 GHz) | Mobile Satellite Services (MSS) |
| – S-band: (2.0 – 2.7 GHz) | MSS, Digital Audio Radio Services (DARS) |
| – C-band (3.4 – 7.1 GHz) | Fixed Satellite Services (FSS) |
| – X-Band (7.25 – 8.4 GHz) | Military/Satellite Imagery |
| – Ku-band (10.7–14.5 GHz) | FSS, Broadcast Satellite Services (BSS) |
| – Ka-band (17.7 - 21.2GHz
and 27.5 – 31 GHz) | FSS Broadband and inter-satellite links |

Fixed Satellite Service Operators

- 4 “global” fixed satellite service operators



- C- and Ku-: Additional 30 regional or national satellite operators
 - 15 Asian, 10 Europe/Middle East, 4 Latin America, 3 North America
- Ka-band: Multiple new operators driven by consumer satellite broadband in U.S., Europe
 - Hughes, WildBlue/ViaSat in U.S., plus Inmarsat GlobalExpress proposed global Ka-band system
- Commercial X-band: Two operators for military support
 - XTAR (US) and Paradigm (UK)

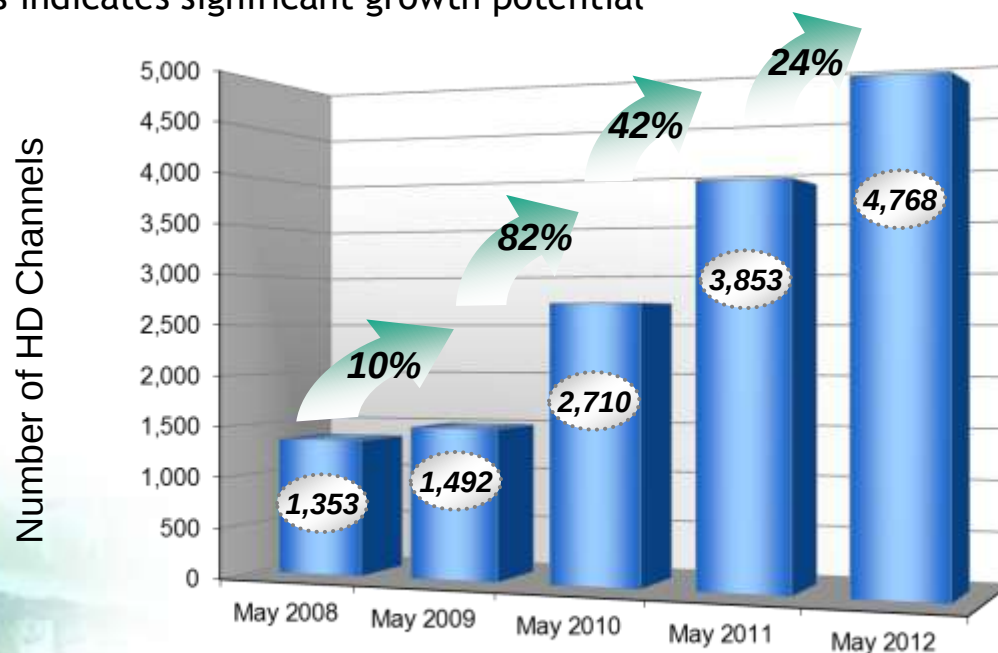
FSS Providers – Current and Planned Systems Overview

	Intelsat	SES WORLD SKIES	Eutelsat	Telesat	XTAR
Coverage	Global	Global	Global	Global	U.S., Europe, Africa, Middle East
Current Fleet	53 GSO satellites C-, Ku- and Ka-band	44 GEO satellites C-, Ku- and Ka-band	26 GEO satellites C-, Ku-, Ka- band	12 GEO satellites (+ 13 flown for others) C-, Ku-, Ka- band	2 GEO satellites X-band
Expansion Plans	9 satellites in development	11 satellites in development	7 satellites in development	3 planned for launch	n/a
Utilization Rate	80%	79%	89%	87% (North America) 78% (Int'l)	n/a

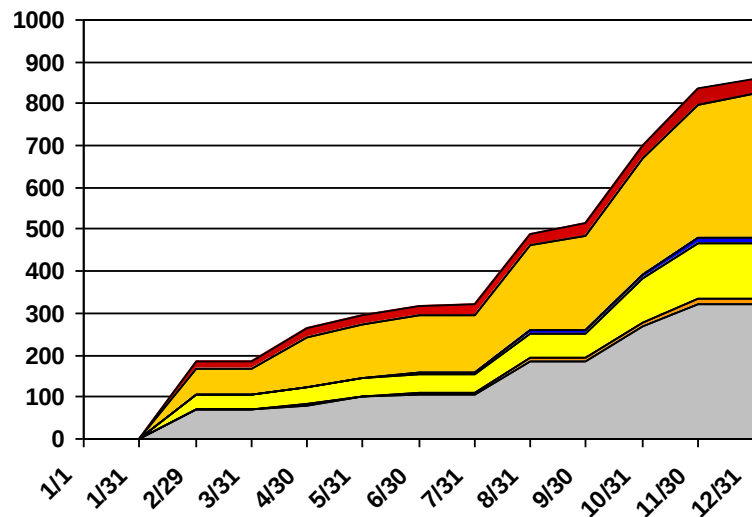
- **Video Services**
 - Video Distribution (Network and Cable Head-Ends)
 - Video Contribution (Satellite News Gathering)
 - Business TV
- **Telecom Services**
 - Private Networks/VSAT Networks
 - Data Broadcasting
 - Rural Telephony
 - Cellular Backhaul
- **Restoration and Back-up**
 - Fiber Optic trunk lines
 - Business Continuity/Disaster Recovery

Impact of HDTV on Satellite Industry

- Increasing numbers of High Definition Television (HDTV) and cable distribution channels continued to drive revenues for satellite pay TV
- HDTV contributes to both retail and wholesale revenue by driving both transponder agreement revenues and subscriber demand
 - The number of HDTV channels worldwide expanded substantially year-on-year from May 2008 through May 2012
 - Approximately 70% of HDTV channels currently serve the Americas
 - Remaining HDTV channels primarily serve Europe and Asia-Pacific, yet the gap between these markets and the Americas indicates significant growth potential



Commercial Satellite Capacity Launched 2009/ 2010 By Application*

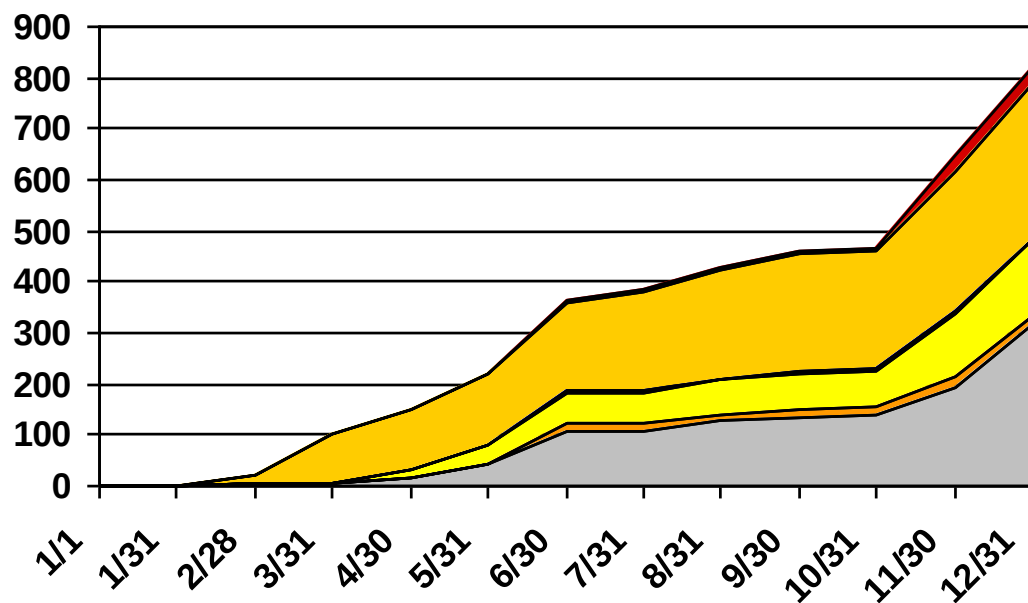


2009

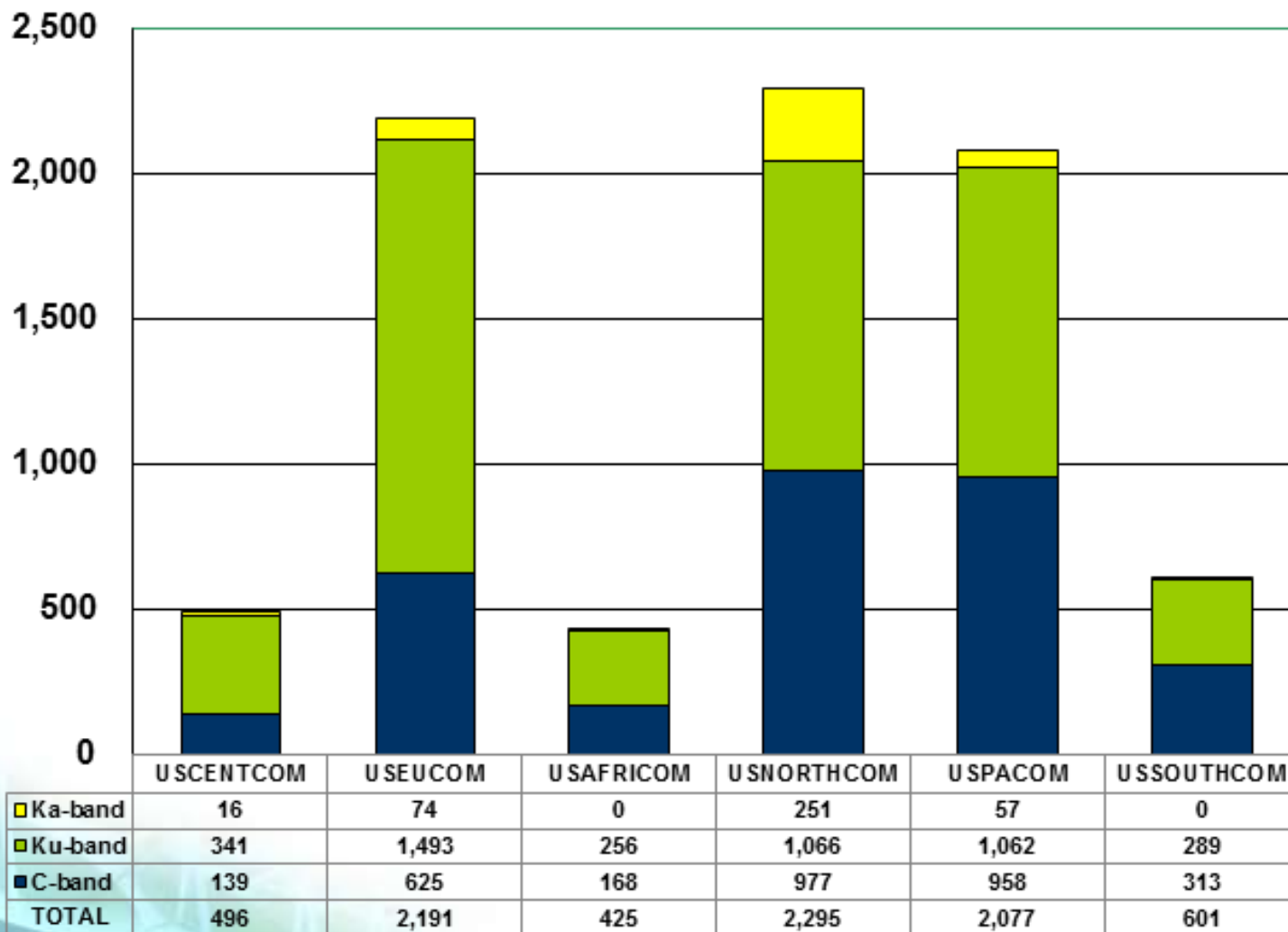
Available Other Data Radio Television Telephone

*(36 MHz Transponder
Equivalent)

2010



Overview of Supply Baseline End 2010 by Band/Region



FSS Ground Equipment

- Wide range of sizes and costs (From teleports with many earth stations to consumer satellite TV dishes)
- May be fixed, transportable (vehicle, ship-board), or mobile
- Most are transmit-receive, some are receive-only
- Some communicate just with one satellite, others with many

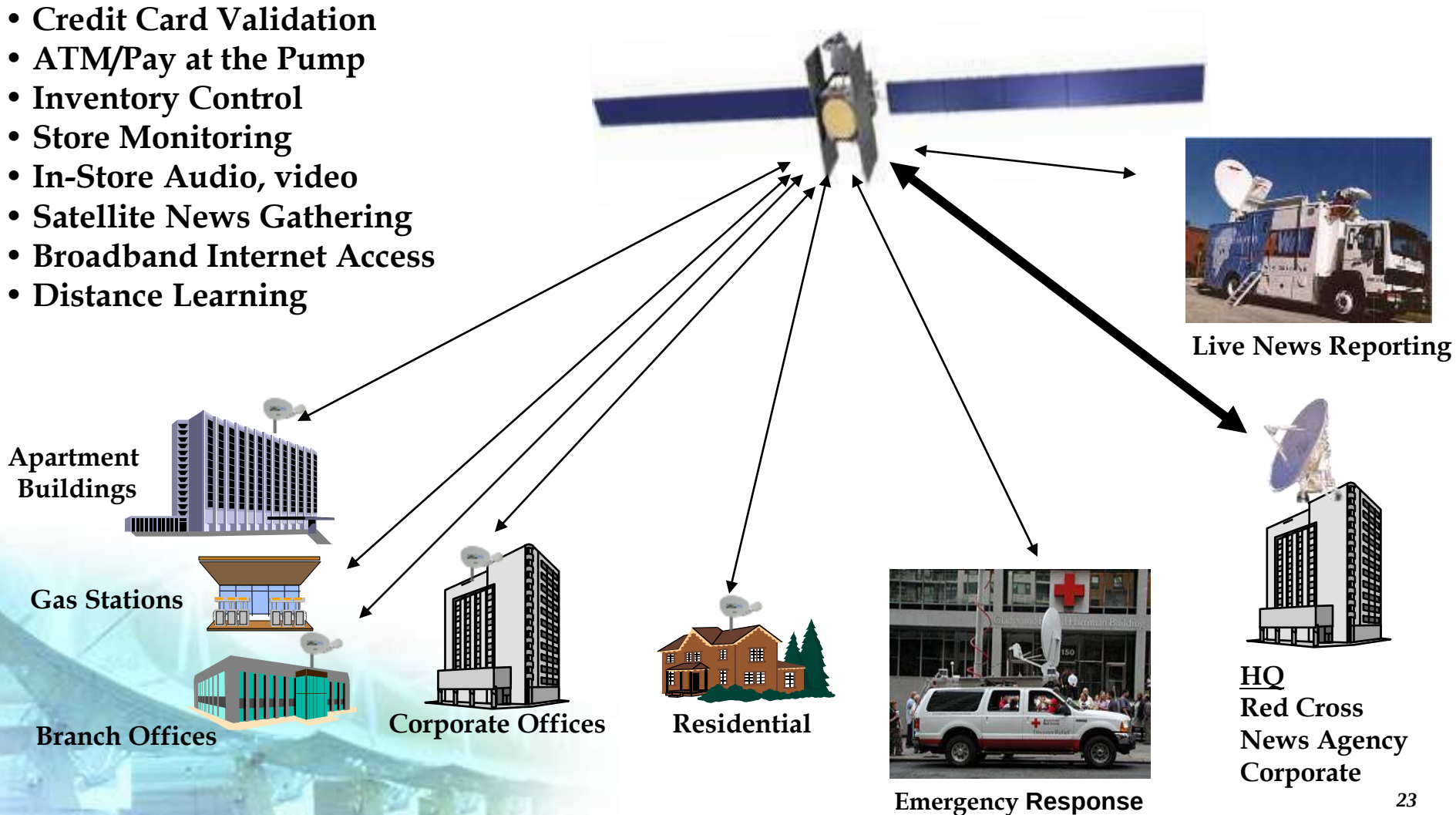


Minimal Set-Up Time, Robust, Portable, Easy To Use

Fixed Satellite Networks

Applications

- Credit Card Validation
- ATM/Pay at the Pump
- Inventory Control
- Store Monitoring
- In-Store Audio, video
- Satellite News Gathering
- Broadband Internet Access
- Distance Learning



Mobile Satellite Service Operators

- Three global mobile satellite service operators



- Three Americas Regional Operator



- Regional Operators, such as Thuraya (Africa/Middle East/Asia), ACeS (Asia)

MSS Systems Overview – GEO, MEO and Planned

	Inmarsat	Globalstar	Iridium	Skyterra	TerreStar	ICO
Coverage	Global	Americas, Europe, Australia, parts of Asia, the Middle East and Northern Africa (non continuous availability)	Full global & polar	Americas	USA and Canada	USA
System	11 GEO satellites I-5 constellation (3 satellites) under construction.	40 LEO satellites Next-gen constellation of 24 satellites will be on orbit by end of 2011	66 LEO satellites, plus 9 in-orbit spares Iridium next generation satellites to be launched between 2013 and 2017	2 GEO satellites 2 next-generation GEO satellites planned	1 GEO satellite	1 GEO satellite, 1 MEO satellite
Spectrum	L-band	L-band, S-band	L-band	L-band	S-band	S-band

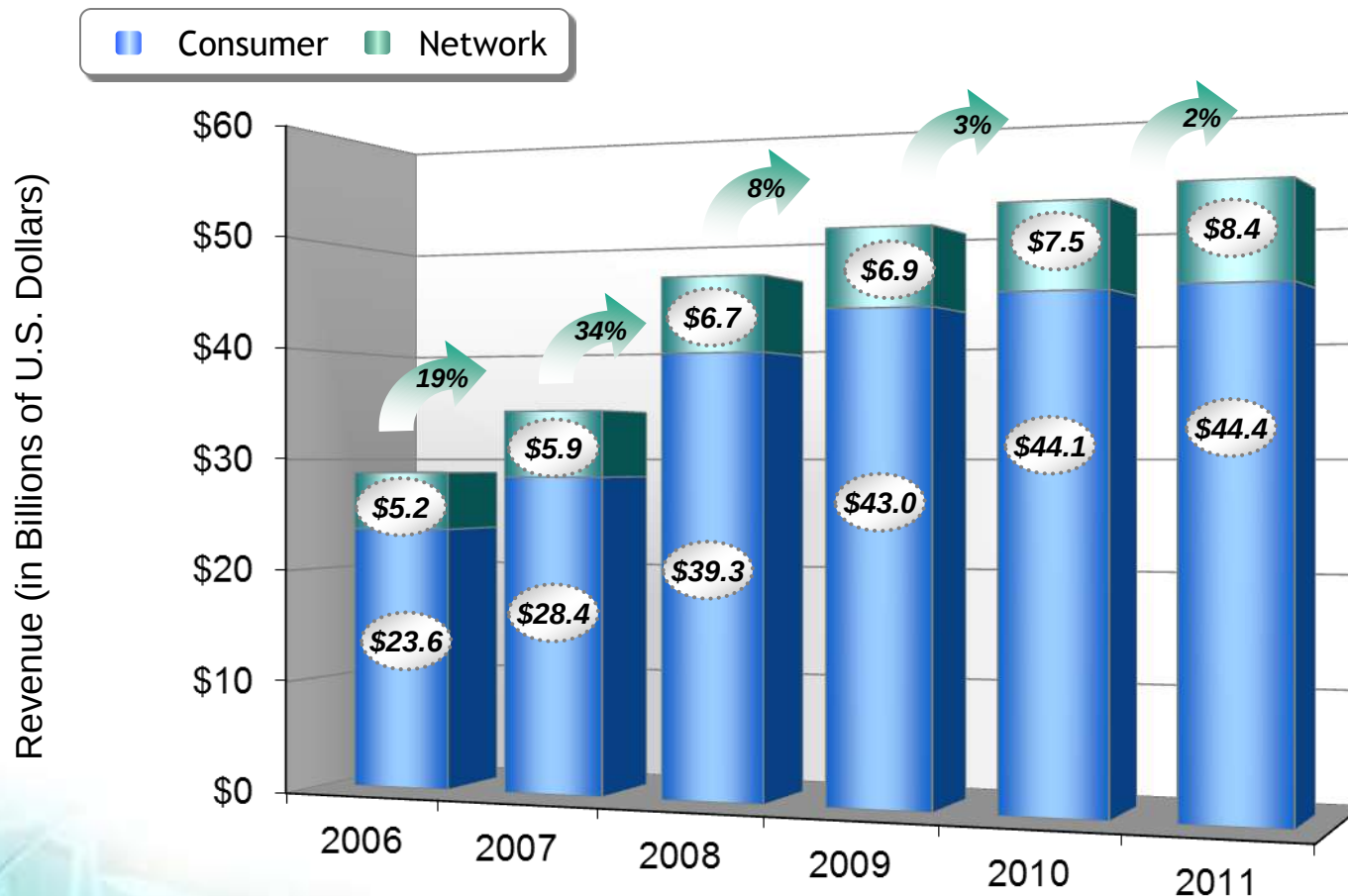
- **Voice and Data services, anytime, anywhere**
- **Critical to consumers, industry, and first responders**
- **Voice and data connectivity**
 - Ubiquitous, resilient mobile connectivity
 - Dual mode handsets for multiple network coverage
 - Broadband speeds
- **Remote data telemetry monitors US infrastructure**
 - Utilities –oil/ gas/ water pipelines, electrical distribution
 - Trains/trucks – location/status monitoring
- **Maritime/Aeronautical communication**
 - Lifeline for ships/planes/trucking/railroad
 - Emergency communications
 - Tracking dangerous shipments



Mobile Satellite Terminals



World Ground Equipment Revenues



Includes:

Network Equipment — Gateways, Network Operations Centers (NOCs), Satellite News Gathering (SNG) equipment, flyaway antennas, and Very Small Aperture Terminals (VSATs)

Consumer Equipment — Satellite TV and broadband dishes, mobile satellite terminals, and stand-alone GPS devices, not including chipsets used in devices (such as smartphones) whose primary use is not satellite navigation

Broadcast Satellite Service Operators

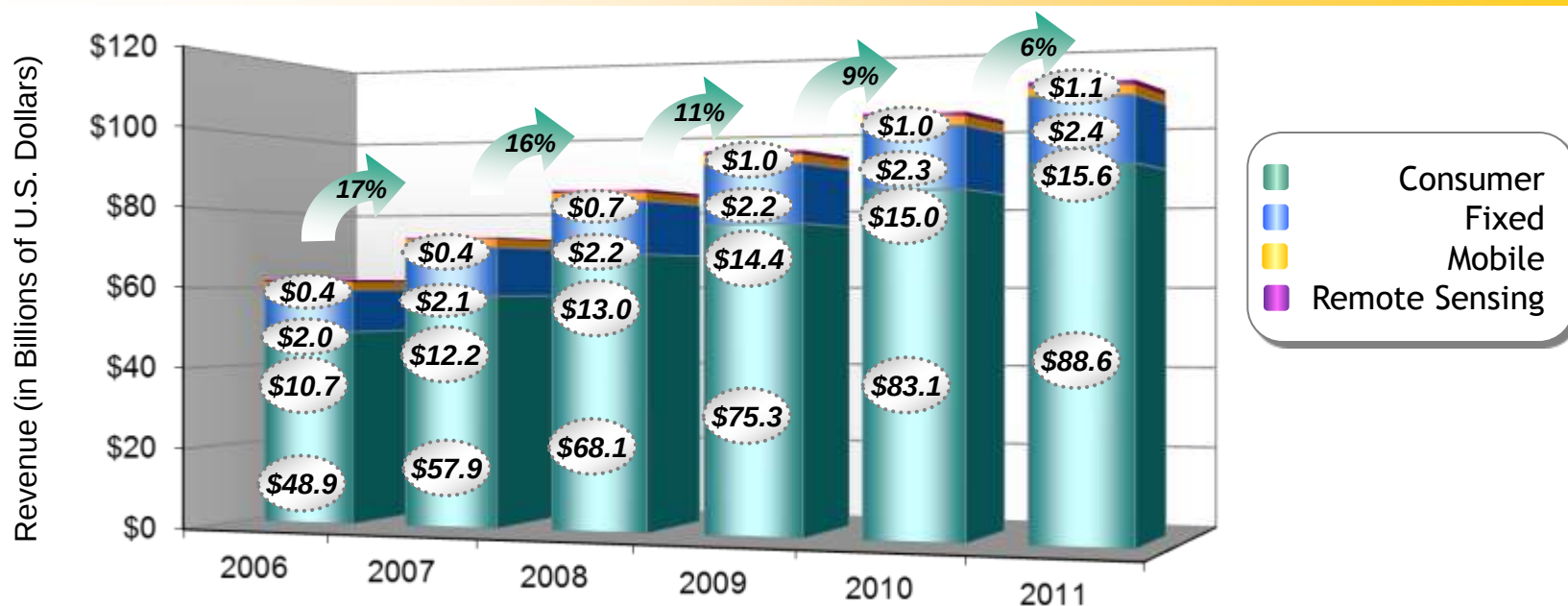
- For U.S. BSS, 3 Direct Broadcast Satellite services:



- For U.S., 1 Digital Audio Radio Service:



World Satellite Services Revenue



	2006	2007	2008	2009	2010	2011
Consumer	\$48.9	\$57.9	\$68.1	\$75.3	\$83.1	\$88.6
- Satellite TV (DBS/DTH)	\$46.9	\$55.4	\$64.9	\$71.8	\$79.1	\$84.4
- Satellite Radio (DARS)	\$1.6	\$2.1	\$2.5	\$2.5	\$2.8	\$3.0
- Satellite Broadband	\$0.3	\$0.4	\$0.8	\$1.0	\$1.1	\$1.2
Fixed	\$10.7	\$12.2	\$13.0	\$14.4	\$15.0	\$15.6
- Transponder Agreements	\$8.5	\$9.6	\$10.2	\$11.0	\$11.1	\$11.3
- Managed Services	\$2.2	\$2.6	\$2.8	\$3.4	\$3.9	\$4.3
Mobile (Voice and Data)	\$2.0	\$2.1	\$2.2	\$2.2	\$2.3	\$2.4
Remote Sensing	\$0.4	\$0.4	\$0.7	\$1.0	\$1.0	\$1.1
Total	\$61.0	\$72.6	\$84.0	\$93.0	\$101.3	\$107.7

Notes:

Numbers may not sum exactly due to rounding.

U.S. Private Sector Satellite Industry Employment (2011)

- U.S. satellite companies shed 14,309 jobs, or 5.6%, between 2006 and 3Q 2011
- Since reaching a recent employment peak in 2008, the industry has lost 21,877 jobs (an 8.3% decline), linked to the global economic downturn
- Three of the four industry segments experienced job losses in 2011
 - Satellite Services lost 1,087 jobs, or 1.4%
 - Satellite Manufacturing shed a net 941 jobs, or 3.5%
 - Launch Industry employment declined by 1,565 jobs, a decline of 3.2%
- The Ground Equipment segment grew by 1,424 jobs, or 1.6%

Satellite Industry Segment	2006 Employment	2007 Employment	2008 Employment	2009 Employment	2010 Employment	3Q 2011 Employment
Satellite Services	69,377	83,993	84,267	81,047	75,623	74,536
Satellite Manufacturing	32,368	26,724	28,014	26,854	26,611	25,670
Launch Industry*	51,262	50,670	52,007	51,984	49,195	47,630
Ground Equipment	102,367	96,190	98,663	90,651	91,805	93,229
Total	255,374	257,577	262,952	250,536	243,234	241,065

* Includes launch tracking and telemetry services

Source: U.S. Bureau of Labor Statistics (BLS). All figures are through 3Q 2011 – the most recent complete data as of June 2012

Figures derived from three inputs: BLS Current Employment Statistics Survey (CES); BLS Quarterly Census of Employment and Wages (QCEW); U.S. Census Bureau North American Industry Classification System (NAICS)

Estimates are rounded to the nearest job.

For more information on the satellite industry,
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