

Satellite Telecommunications (Satcoms)

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Space Moves!

September 2017

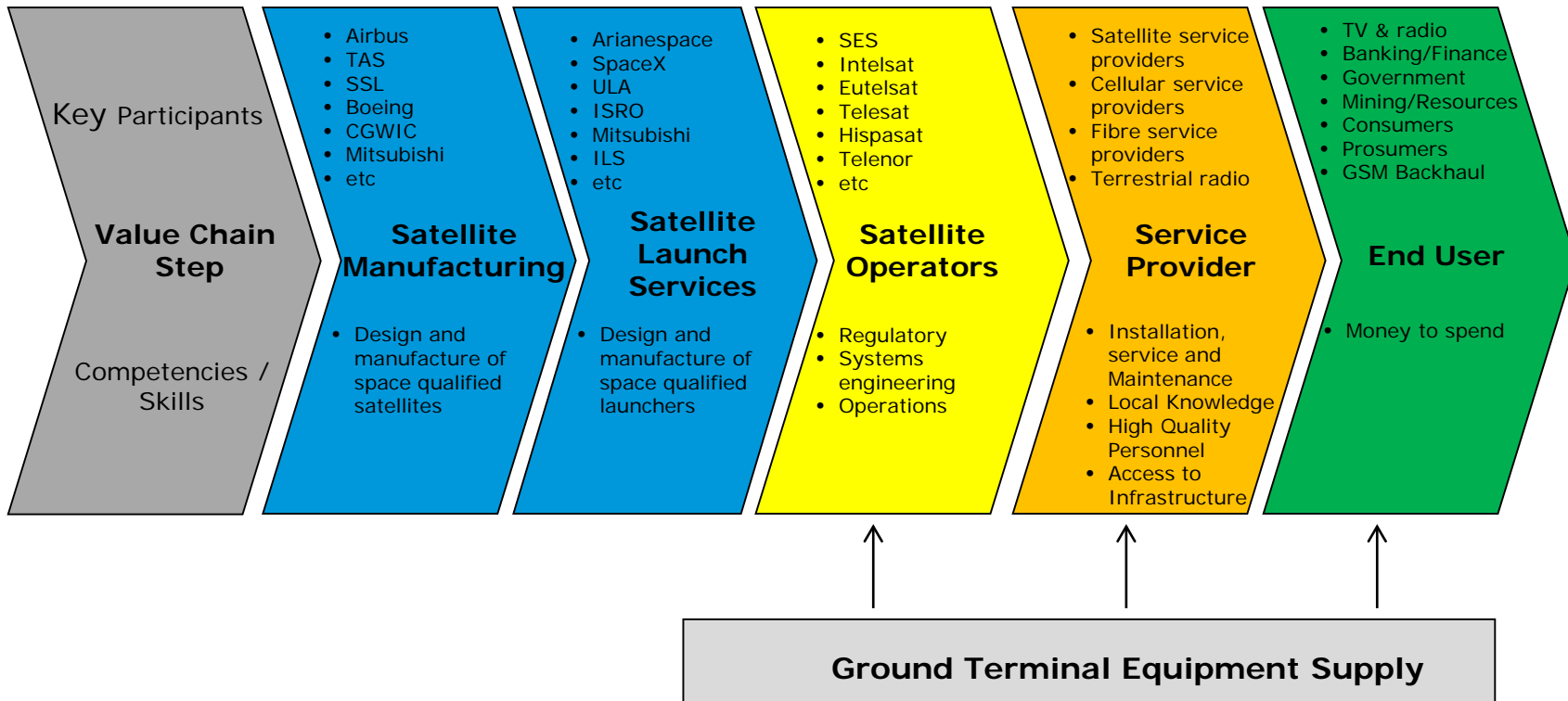
Satcoms is a niche of telecoms...



1. The global telecommunications industry is worth around \$5 trillion per annum
2. The global satellite industry is worth about \$260 billion per annum – about 5% of the global telecommunications industry
3. Satcoms is a niche of telecoms but has several key advantages:
 - Ubiquitous service – the same level of service is available across the entire planet irrespective of local telecoms infrastructure
 - Rapid deployment – satellite services can be installed in days rather than waiting for a terrestrial infrastructure roll-out



Satcom value chain – key players



Some lies

1. Satcoms is only viable beyond the reach of the terrestrial network
2. Satcoms is unreliable
3. Voice services are not possible
4. Terrestrial services are of superior quality
5. Satcoms cannot support the Internet Protocol



Some half truths

1. Satcoms is complicated (so are computers)
2. Satcoms is expensive (so is cellular data)
3. A voice circuit over a satellite is inferior to terrestrial links
4. Satellites are best used for television services



The truth

1. Satcoms offer ubiquitous, instant coverage that spans beyond national boundaries
2. Cost effectiveness relative to terrestrial services varies
3. Satellites offer a unifying technology solution
4. Satellites are generally more reliable than terrestrial lines which suffer from cable breaks, “elephant outages”, cable theft, etc



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28 June 2013 Last updated at 19:59 GMT

Oldham cable theft attempt disrupts TV for 2.5m

Thieves trying to steal metal cable under a Greater Manchester street disrupted television services to 2.5m addresses, police have said.



TV, broadband and telephone services were all affected when the cables were severed

The attempt was made after a manhole was forced open on Manchester Road in Oldham, on Wednesday night.

A spokesman said those responsible climbed down into a "complex cable system" and cut lines, but could not gather them and "left empty-handed".

Engineers restored TV services within an hour of the damage being discovered.

The police spokesman added broadband and telephone services, which were also affected, had been restored within hours by the BT team, who had worked "around the clock".

Supt Craig Thompson said Greater Manchester Police had been working with the telecommunications company for "some time and when the alarm was raised, our BT colleagues immediately put in place their full-scale response".

"We are appealing for any witnesses who may have information to call us and assist our investigation," he added.

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Some forthcoming developments in satcoms



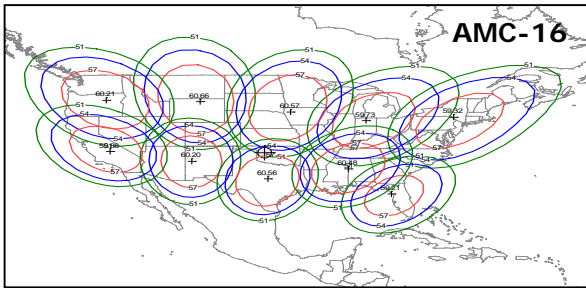
1. High Throughput Satellites (HTS) and Very High Throughput Satellites (VHTS)
 - 100 times the data rate for twice the satellite + launch cost
 - Cheaper satcoms solutions
 - Available today and increasingly in the coming years
2. Megaconstellations
 - Very large constellations of hundreds or thousands of small, cheap mass-produced satellites
 - Much cheaper satcoms solutions
 - Available from 2020



Three generations of HTS systems

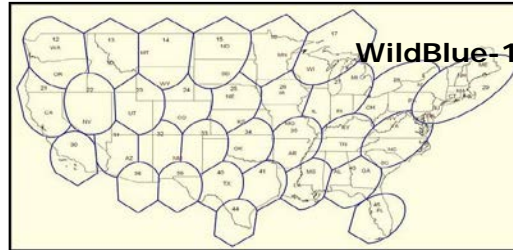
1st Generation

- AMC-15 (2004), AMC-16 (2004), etc
- Hybrid Ku/ Ka satellites pioneered Ka band
- Lower power and larger beams
- Gross throughput to **~2 Gbps** (125MHz per spot beam)



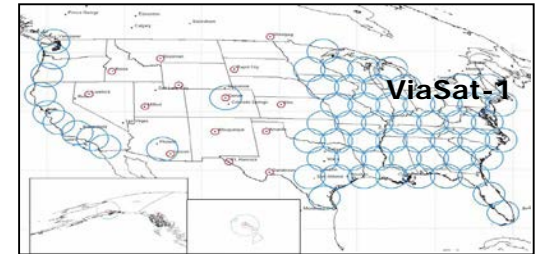
2nd Generation

- WildBlue-1 (2006), Spaceway-3 (2007)
- Pure Ka band satellites
- 63-125 MHz per downlink spot beam
- **~5-10 Gbps** gross throughput



3rd Generation

- ViaSat-1 (2011), Jupiter-1 (2012)
- Smaller, tighter spot beams provide more efficient frequency reuse
- 500-1000MHz per downlink spot beam
- **~100 Gbps** gross throughput



WildBlue / Viasat first to market and have become the benchmark for others

Fourth and fifth generation HTS and VHTS systems

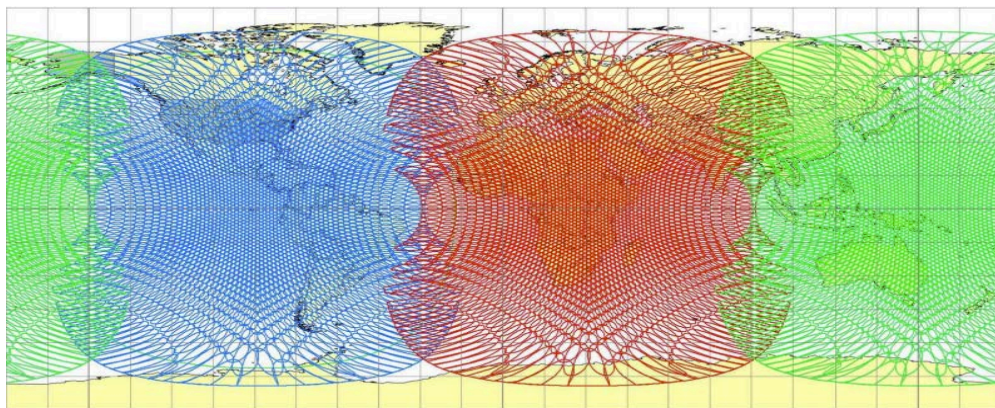


Jupiter 2

- 220 Gbps
- Launched Q4 2016

ViaSat-2

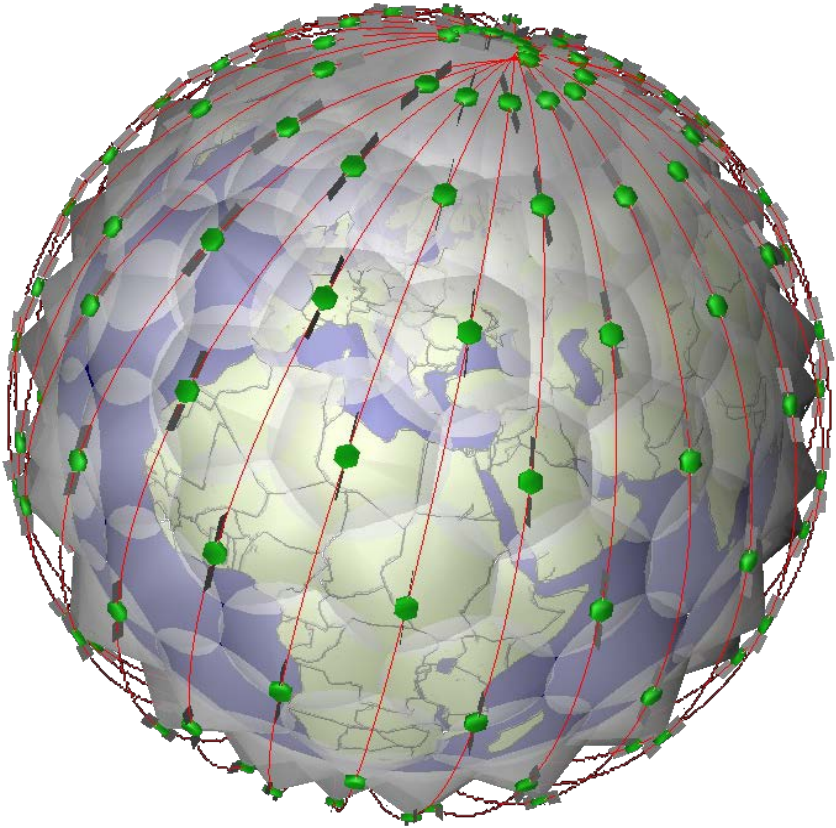
- 300 Gbps
- Launched Q2 2017



ViaSat-3

- 1 Tbps per satellite
- 3-10 satellites
- First two satellites in production with Boeing as prime and ViaSat as payload provider
- Third satellite in negotiation

Megaconstellations



Some of today's Megaconstellations projects



Operator	Orbit	Number of Satellites
SpaceX Q/V-band	LEO	11,943 ¹
SpaceX Ku-band	LEO	4,425 ²
Boeing Q/V-band	LEO	2,956
OneWeb Q/V-band	MEO	1,280
OneWeb Q/V-band	LEO	720
OneWeb Ku-band	LEO	648
Kepler	LEO	140
Telesat Ka-band	LEO	117
Theia	LEO	112
LEOSat	LEO	108
O3b	MEO	60
Boeing Ka-band	LEO	60
ViaSat Ka-band	MEO	24

Note 1: SpaceX Q/V-band

11,943 satellites x 386kg = 4,610 tonnes = 73 x Falcon Heavy or 231 x Ariane 5 launches

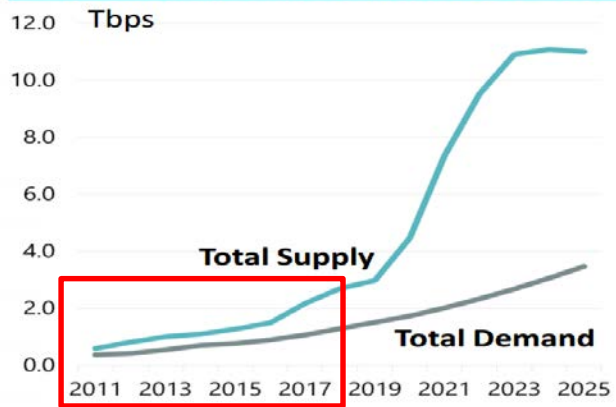
Note 2: SpaceX Ku-band

4,425 satellites x 386kg = 1,710 tonnes = 27 x Falcon Heavy or 86 x Ariane 5 launches

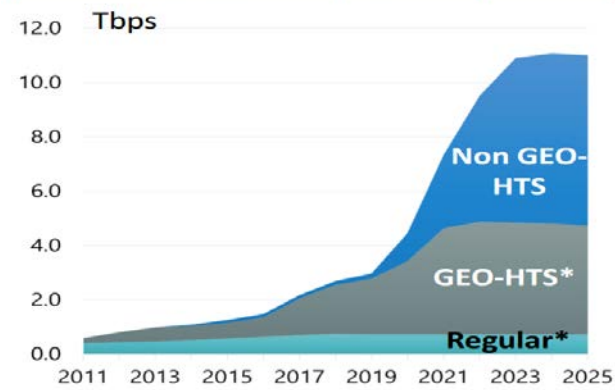


So satcoms prices really are going to fall...

FSS SUPPLY VS. DEMAND (2011-25)

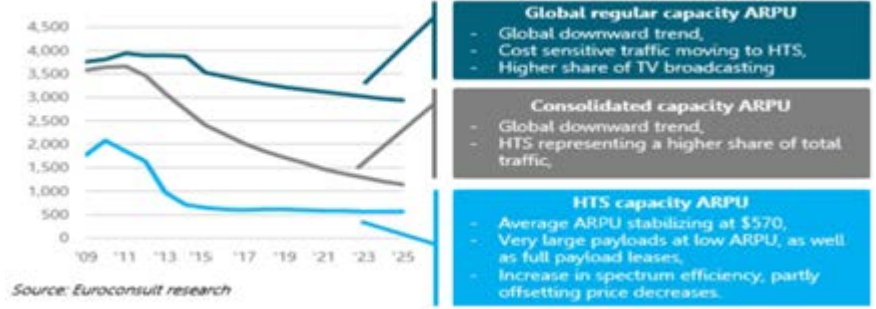


FSS SUPPLY (2011-25)



*Note: Regular and GEO-HTS supply includes only contracted satellite systems

GLOBAL AVERAGE CAPACITY ARPU BY TYPE (\$/MHZ/MONTH)



Source: Euroconsult research

- Global regular capacity ARPU**
 - Global downward trend,
 - Cost sensitive traffic moving to HTS,
 - Higher share of TV broadcasting
- Consolidated capacity ARPU**
 - Global downward trend,
 - HTS representing a higher share of total traffic,
- HTS capacity ARPU**
 - Average ARPU stabilizing at \$570,
 - Very large payloads at low ARPU, as well as full payload leases,
 - Increase in spectrum efficiency, partly offsetting price decreases.



Questions?

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