

## Satellite Telecommunication Market

**Alban Duverdier**

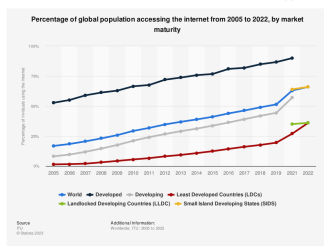
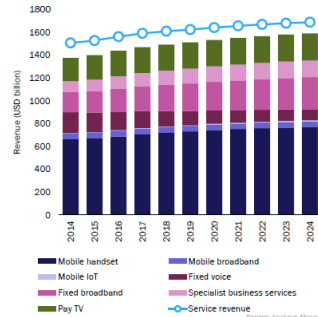
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## Outline

- Market trends
- Industry sectors
  - Satellite manufacturing and Launch industry
  - Ground industry
  - Satellite services
- Commercial satellite systems
  - Satellites for Mobile Satellite Services in L/S bands
  - Satellites for Fixed Satellite Services in C/Ku/Ka bands
  - GEO and non-GEO High Throughput Satellites
- Drivers for growth
  - Connectivity
  - Mobility
  - Government & Hosted payloads
- Next steps

## Trends in Telecommunications



- 150Tbps of average-hour IP traffic in 2017 (Cisco)
  - 58% for metro traffic
  - 55% for wireless and mobile devices
  - 82% for consumer traffic (55% Internet & 19% Managed IP & 8% Mobile data)
  - 80%-90% of consumer Internet traffic for all forms of video (TV, VoD, Internet, P2P)
- Internet in 2023 (Cisco, 2020)
  - 66% of the population (51% in 2018)
  - 3.6 networked devices per capita (2.4 in 2018)
  - 74% of the devices for the consumer segment
  - 50% of the connected devices for M2M (33% in 2018)
  - 48% of M2M for connected home applications
- Mobility in 2023 (Cisco, 2020)
  - 71% of the population with mobility (66% in 2018)
  - 13.1 billion of mobile devices (8.8 billion in 2018)
  - 10% of mobile devices in 5G
  - Mobile M2M +30%, Smartphones +7% (since 2018)
- Network speeds in 2023 (Cisco, 2020)
  - 110.4 Mbps for fixed broadband (45.9 Mbps in 2018)
  - 43.9 Mbps for mobile cellular (13.2 Mbps in 2018)
  - 92 Mbps for Wi-Fi (30.3 Mbps in 2018)
  - 575 Mbps for 5G connection

## Trends in Space

### Government space programs (Euroconsult 2022)

~100 countries investing in space  
 % for US, China, Russia, Japan, India, EU  
 Global space budgets totaled 103B\$  
 53% for civil programs

Satellite Quick Facts (1/05/2023)		
Total number of operating satellites: 7560		
LEO: 6768, MEO: 143, GEO: 590, Elliptical: 59		
U.S.: 5184		
Military: 246, Government: 167, Civil: 30, Commercial: 4741		
Russia: 181	China: 628	Other: 1572

Source: UCS Satellite Database

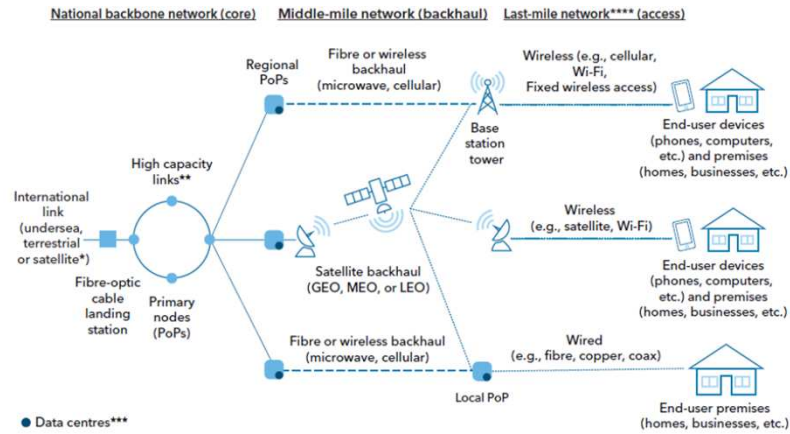


Steps: Chinese ASAT test, Accidental collision Iridium 33 / Cosmos 2251, Russian ASAT test

	2014	2015	2016	2017	2018	2019	CAGR
Global IP Traffic in Exabytes per Month	59.9	72.4	88.4	109.0	135.5	168.0	23%
Satellite Data Traffic %	0.15%	0.16%	0.17%	0.18%	0.17%	0.20%	

Source: Cisco Visual Networking Index and NSR

## Satellites for Telecommunications



\*Satellite as main, or only, source of international connectivity in few countries

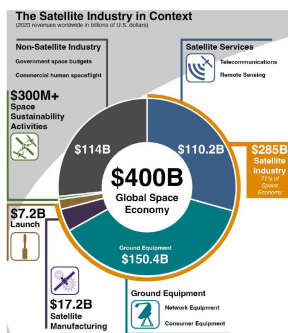
\*\* Backbone networks utilizing predominantly terrestrial and undersea fibre-optic links (rarely microwave and satellite links)

\*\*\* Data centres in core, middle mile or last-mile networks, depending on the need to aggregate data

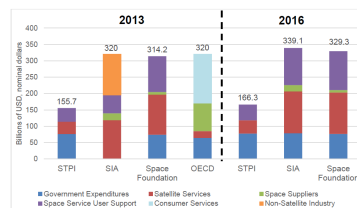
\*\*\*\* Non-exhaustive list of technologies for the last mile

The Last-mile Internet Connectivity Solutions Guide, ITU-D, 2020

## Satellite Industry Sectors (2023)

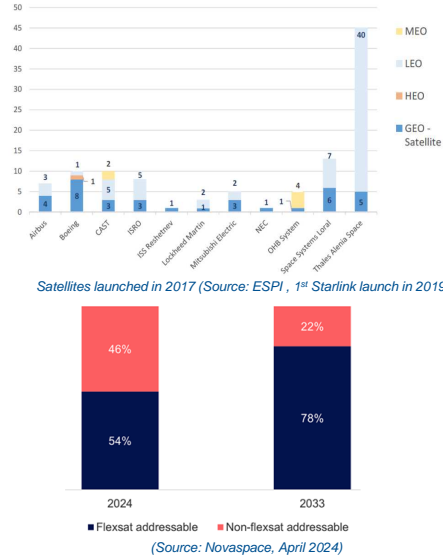
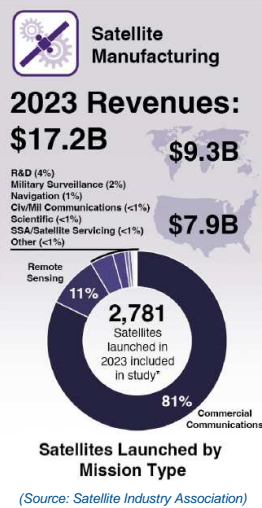


Satellite services  
Telecommunications: Television, Telephone, Broadband, Aviation, Maritime, Road and Rail  
Remote Sensing: Agriculture, Change Detection, Disaster Mitigation, Meteorology, Resources, Earth Science  
Space Science  
National Security  
Consumer Equipment  
Sat TV, radio, & broadband equipment  
GNSS (Global Navigation Satellite Systems) units, in-vehicle systems & chipsets  
Network Equipment  
Gateways  
VSATs (Very Small Aperture Terminals)  
Network operation centers  
Sat news gathering equipment

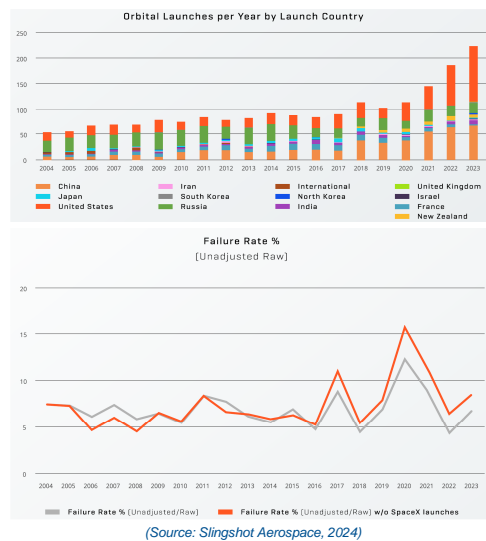
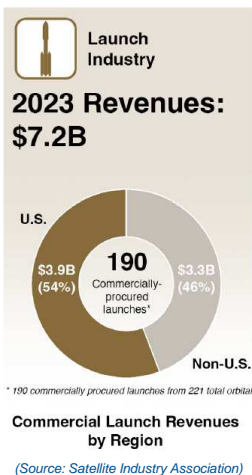


Not double counting of expenditures on purchases of goods and services and revenues from sales of those goods and services  
-\$20 billion for STPI vs. SIA  
Satellite services limited to services generated in space excluding payments for royalties and marketing expenses  
-\$80 billion for STPI vs. SIA  
Counting only the part of value of a good or service linked to space signals, such as for cell phones that receive GNSS data  
-\$70 billion for STPI vs. SIA

## Satellite Manufacturing (2023)



## Launch Industry (2023)

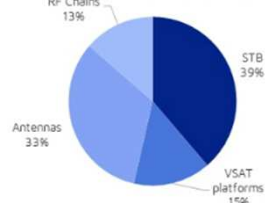


## Ground Industries (2023)



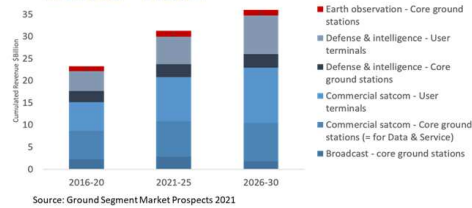
(Source: Satellite Industry Association)

**2018-2028 Cumulative Revenues Share by Equipment Type**



Source: NSR

**Euroconsult**



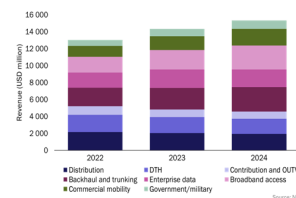
Source: Ground Segment Market Prospects 2021

## Consumer & Professional Services (2023)

Application	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Television	95.0	97.8	97.7	97.0	94.2	92.5	88.4	88.4	82.4	77.2
Radio	4.2	4.6	5.0	5.4	5.8	6	6.3	7	6.6	6.8
Broadband	1.8	1.9	2.0	2.1	2.4	2.6	2.8	3	3.7	4.8
Fixed (*)	17.1	17.9	17.4	17.9	17.9	17.7	15.7	15.2	15.7	16.1
Mobile	3.3	3.4	3.6	3.6	4.1	2	2	2	2	2.1
Remote Sensing	1.6	1.8	2.0	2.0	2.1	2.3	2.6	2.7	2.9	3.2
Total	122.9	127.4	127.7	128.7	126.5	123	117.8	118.3	113.3	110.2

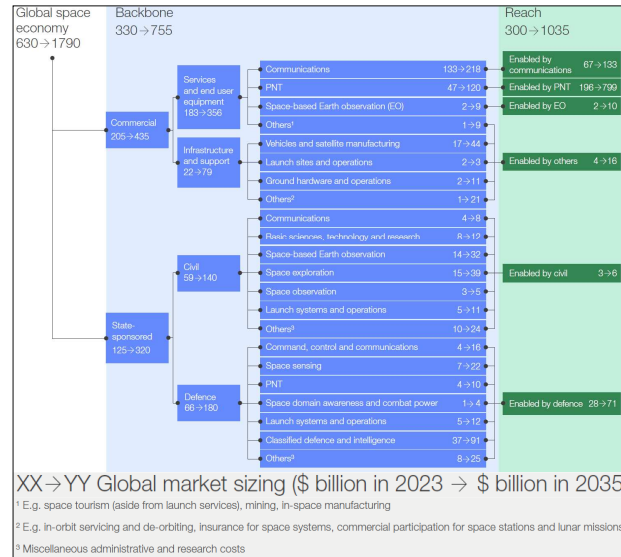
(\*) Includes capacity for DTH satellite TV, VSAT, mobility service platforms, mobility, and in-flight connectivity  
(Source: Satellite Industry Association)

- Fixed Satellite Services
  - Transponder agreements including capacity for TV platforms
  - Managed services and in-flight services
- Mobile Satellite Services
  - Ku/Ka-band FSS capacity provided by MSS operators
  - Automatic Identification System (AIS)
  - Automatic Dependent Surveillance-Broadcast (ADS-B)
- Remote Sensing Services
  - Government sales driving demand



Source: NSR

## Global Space Economy Growth

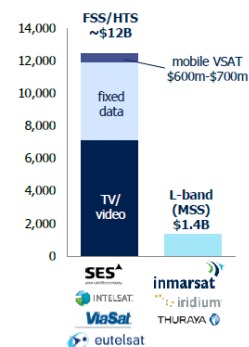


(Space: The \$1.8 Trillion Opportunity for Global, World Economic Forum, April 2024)

## Satellites for Mobile Satellite Services (MSS) in VHF/L/S

GEO	<ul style="list-style-type: none"> <li>Inmarsat in L band <ul style="list-style-type: none"> <li>Inmarsat-2 1991-2014</li> <li>Inmarsat-3 since 1996-1998</li> <li>Inmarsat-4 and Alphasat since 2005-2013</li> <li>Global Xpress in Ka band since 2013-2019</li> <li>European Aviation Network (HellasSat3) since 2017</li> <li>Inmarsat-6 BGAN &amp; Global Xpress since 2021-2023</li> </ul> </li> <li>Thuraya in L band <ul style="list-style-type: none"> <li>Thuraya 2&amp;3 since 2003&amp;2008 (Thuraya 4 in 2024)</li> </ul> </li> <li>Ligado (ex-SkyTerra/MSV/LightSquared) in L band <ul style="list-style-type: none"> <li>MSAT1&amp;2 since 1995&amp;1996</li> <li>SkyTerra-1 since 2010</li> </ul> </li> <li>Dish Network (Echostar) in S band <ul style="list-style-type: none"> <li>EchostarG1 since 2008 (ex-DBSD/ICO)</li> <li>EchostarT1&amp;21 since 2009&amp;2017 (ex-Terrestar)</li> </ul> </li> </ul>
	<ul style="list-style-type: none"> <li>Iridium in L band with Ka crosslinks <ul style="list-style-type: none"> <li>95 first generation satellites</li> <li>65 of 75 IridiumNEXT with ADS-B and AIS since 2017 (1&amp;4 replacement satellites in 2019&amp;2023)</li> </ul> </li> <li>Globalstar in S/L band <ul style="list-style-type: none"> <li>48 first generation satellites</li> <li>24 Globalstar2 since 2010-2013</li> <li>17 Globalstar 3 in 2025</li> </ul> </li> <li>Orbcomm in VHF band <ul style="list-style-type: none"> <li>25 OG1 since 1997</li> <li>6 Quick Launch non-operational in 2010</li> <li>2 AIS VesselSat1&amp;2 since 2011&amp;2012</li> <li>17 OG2 with AIS since 2014-2015</li> </ul> </li> </ul>

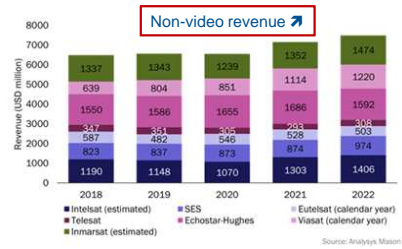
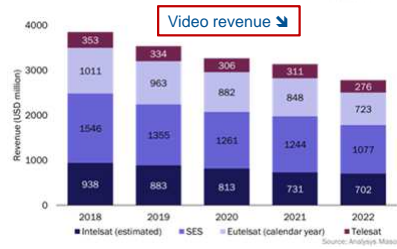
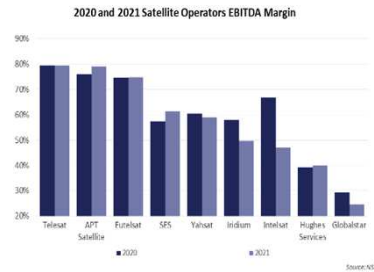
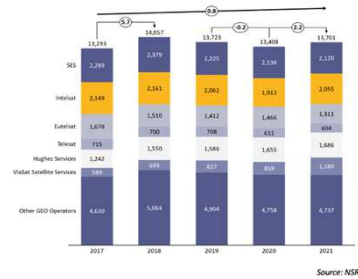
### Satcom Operator Wholesale Revenue in 2015\*



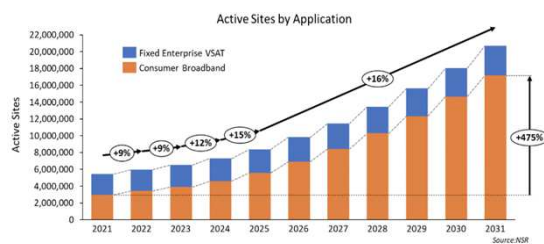
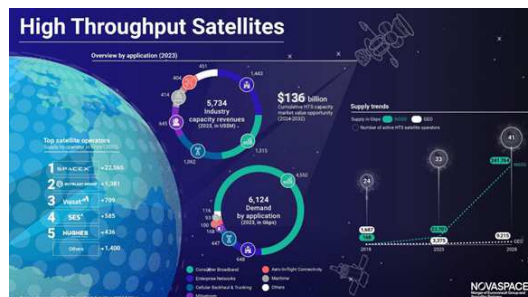
**Mobile users**  
35% for Land, 53% for Maritime, 12% for Aeronautical  
(30% for governmental operations)

## Satellites for Fixed Satellite Services (FSS)

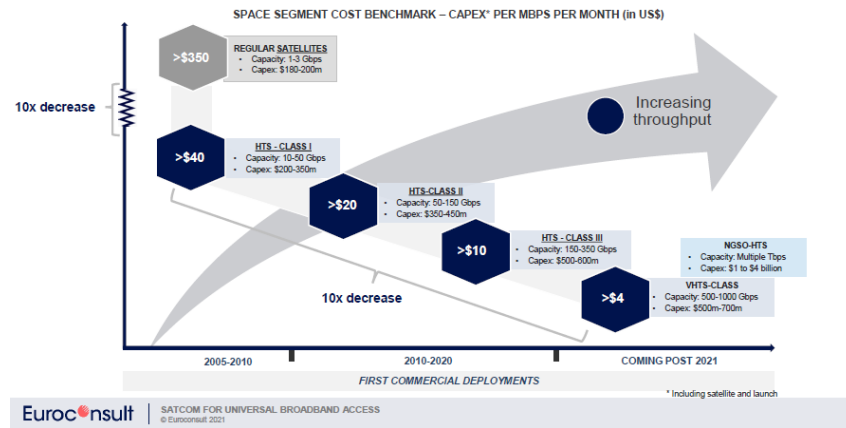
51% for the top four: SES, Intelsat, Eutelsat, Telesat (64% in 2014) - 2 big HTS companies: Hughes, Viasat



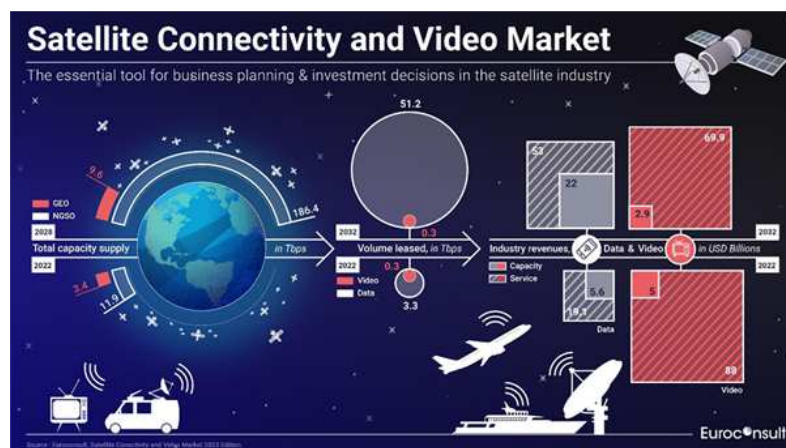
## GEO&LEO High Throughput Satellites (HTS)



## HTS CAPEX/Mbps/Month



## Video and Connectivity Market





## Business Plan for Connectivity

	Cost in USD	Contribution to TCO
Terminal Cost	\$ 350	13.7%
Installation	\$ 100	3.9%
Other SAC	\$ 300	11.8%
250 Kbps @ 200 USD/Mbps/month x 36 months	\$ 1,800	70.6%
TCO over 3 Years	\$ 2,550	

Source: NSR

Margins for GEO operators in the 35-40% range

	Cost in USD	Contribution to TCO
Terminal Cost	\$ 2,000	51.3%
Installation	\$ -	0.0%
Other SAC	\$ 100	2.6%
1,000 Kbps @ 50 USD/Mbps/month x 36 months	\$ 1,800	46.2%
TCO over 3 Years	\$ 3,900	

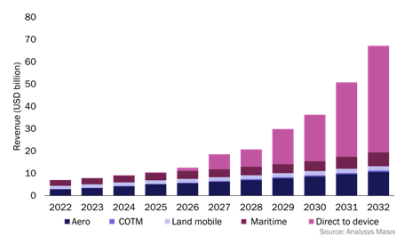
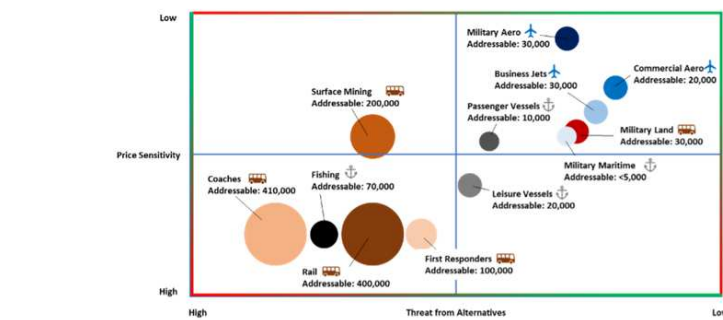
Source: NSR

Margins for Starlink using Rural Digital Opportunity Fund (RDOF) of 20%

TCO: Total Owner Cost

ARPU: Average Revenue per User

## Satellites for Mobility



Maritime connectivity by end of 2023 (Valour Consultancy.)

116000 MSS terminals (mainly Inmarsat, Iridium)

42000 vessels using GEO VSAT

>20000 vessels using Starlink

Commercial offer by Oneweb

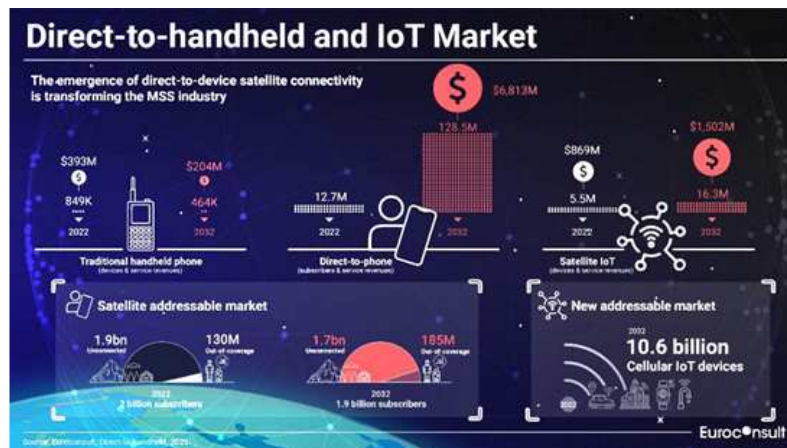
More vessels using LEO than GEO VSAT in 2026

MSS and GEO VSAT as backup with declining market

2.1G\$ (vs. \$1.8G\$ in 2022) with 470M\$ for MSS

Source: Analysys Mason

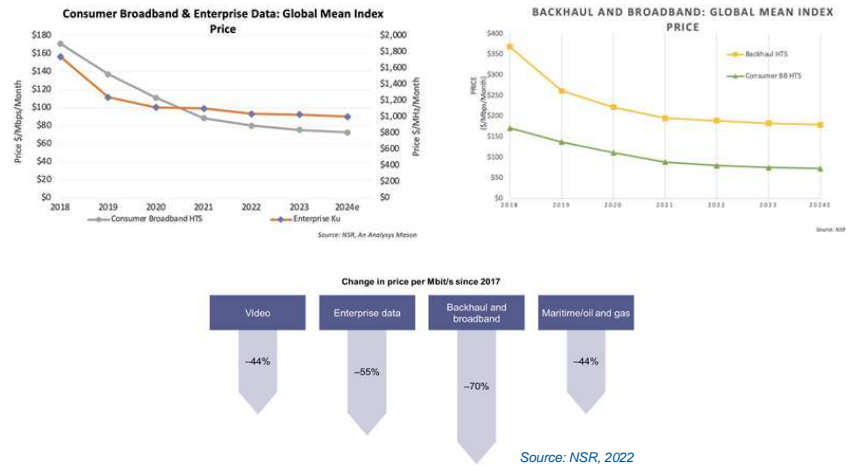
## IoT and Direct-to-Handheld Market



## Hosted Payloads on Commercial Satellites

- GPS augmentation
  - L band WAAS (Wide Area Augmentation System) on Eutelsat-117WB since 2016, SES-15 since 2019
  - L band EGNOS (European Geostationary Navigation Overlay Service) on SES-5 since 2012, ASTRA-5B since 2014, EUTELSAT 5WB since 2020
- Military payloads
  - US DoD IRIS (Internet Router in Space) on Intelsat 14 since 2009
  - US DoD CHIRP (Commercially Hosted Infrared Payload) on SES-2 since 2011
  - Australian Defense Force UHF package on Optus C1 since 2003, Intelsat 22 since 2012
  - Canadian X-band Payload on Anik G1 since 2012
- Scientific payloads
  - NASA TEMPO (Tropospheric Emissions: Monitoring of Pollution) on Intelsat40e since 2023
- New global systems on constellations
  - Automatic Identification System (AIS) on Orbcomm 2 since 2014 and on IridiumNext since 2017
  - Automatic Dependent Surveillance-Broadcast (ADS-B) on IridiumNext since 2017
- ESA European Data Relay Satellite System (EDRS)
  - EDRS-A payload on Eutelsat 9B since 2016, Avanti Hylas-3 payload on EDRS-C since 2019

## Satellite Capacity Price



Consumer broadband < \$15/Mbps/month - Backhaul < \$30/Mbps/month - Aero < \$60/Mbps/month  
 Break-even pricing of \$12/Mbps/month including ground segment for VHTS payloads

## Next Steps

- Mobile systems
  - New generations after Globalstar 2 and Iridium NEXT
  - New 5G, IoT and AIS constellations
  - Combination of MSS and FSS services with operators that merge (Viasat+Inmarsat)
- Fixed systems
  - Flat market for Direct-to-Home (DTH) and video distribution due to better compression
  - Demand limitation due to new optical fiber capacity
  - Pricing decline depending on regions and applications due to HTS even if there is demand growth
- HTS systems
  - New systems with Q-band and V-band
  - New LEO solutions based on massive satellite constellations
  - Risk of excessive satellite capacity for a broadband market in development
- Market evolution
  - New technologies to improve performances of platforms and payloads
  - New players for commercially-procured launches and satellite manufacturing
  - New small satellite systems and increased governmental use