

Advancements in Satellite Technologies

Focus on India

Ground Segment

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Advances in Satellite Communication Industry...

Satellites



- HTS
- NGSO
- CUBESATS
- High Gain Satellite Antennas
- On-board Processing/Hosted Payloads
- Beam Forming
- Qubits

5G/IOT/4K-8K Video



Teleport/Hub/Gateway

- Cloud based and virtual solutions, SDN/NFV
- Universal modems
- Data Analytics



Ground Terminal

- DVB-S2X, adaptive inbound
- ~ 0.5 Gbps TT
- Flat panel antennas
- Hand held terminals

Ground Segment - Teleports/Hub/Gateways

1. Cloud-based environments and virtual solution

- Those that replace hardware with software implementations - SD-WAN, NFV
- RF to IP - the satellite world has been a bit slower to fully adopt them
- Unique technical difficulties associated with converting and working with RF analog signals within a digital, IP environment.
- Cloud based software modem available for TT&C, Kratos

2. Universal Modems

- Software defined radios for different waveforms on a single hardware
- UHP Networks, others

3. Data Analytics

- End customer application data metrics on cloud/teleport
- Amazon Web Services, etc.

Ground Segment - Terminal

1. Baseband unit

- Price: ~ USD 100 cost to OEM for baseband indoors unit, consumer type
- Technology: DVB-S2X, adaptive inbound, ~ 0.5 Gbps TT, shortest latency 19ms for 5G over LEO, orbit switching
- “Office in the Sky” from Viasat
- CDMA reducing AES/maritime/transportable return link antenna size
- Form factor: Aero, maritime, drones, all outdoors, desktop, hand-held
- Approaching all in one unit with flat panel antenna, IDU, BUC/LNB – only cable is power, WiFi access or Ethernet

2. Handheld Terminals

- Satbridge: Using 5G protocol stack, software defined solution
- With satellite/terrestrial roaming and tie-in to MNO for billing, etc.

Ground Segment – Terminal Antennas

1. Antennas

- Low profile, mechanically steered antennas, aero markets
- Parabolic, mechanically steered antennas, maritime markets, LEO/MEO terminals
- Flat panel antenna, all markets, fixed/aero/maritime, LEO/MEO terminals

2. Flat panel antenna

- Types: Phased array, beam forming or high efficiency waveguide panels
- ESA, MSA, single/dual panels, single Ka/Ku band or dual bands, multiple satellites tracking, 3-axis
- ESA current/near-future OEMs/users
 - Rantec, Tachyon, Kymeta, OneWeb (Isotropic), Inmarsat (Isotropic), Thinkom, C-COM, SES O3B mPower, AvL, Phasor, Alcan Systems, Gilat/Raysat, Satixfy, GEE/QEST/TECOM, Panasonic Aviation

3. Tracking dish antennas

- LEOs, MEOs – Ku, Ka bands
- Two dish tracking antennas
- Current/near-future OEMs/users
 - O3B, OneWeb, SES, CPI, AvL Technologies, Intellian, Viasat, others

Ground Segment - Terminal Antenna \$ & ¢

1. Flat panel antenna

- Kymeta - \$39K, for big yachts, first responders, etc.
- Isotropic Systems - \$300 - \$700 target, as stipulated by OneWeb
- Alcan Systems – Target < \$1K for consumer, < \$10K for business grade

2. Tracking dish antennas

- O3B - \$250K
- Others – Low \$1Ks to \$20K

3. Flat Panel Antennas - Bottom Line

- Currently expensive, only military or high-end commercial users
- Predictions – 1 to 2 decades away to replace traditional dishes
- Cannot use a \$20K antenna for connected cars, while car is \$25K priced
- Parabolic dish ~ \$25 today
- A must for LEOs, MEOs
- Industry is currently trying to reach < \$1K for consumers

Ground Segment – Summary

1. What is happening around the world is also applicable in India
2. Baseband, BUC/LNB have achieved cost target. Flat panel antenna needs to catch up
3. COTM Antennas – not taken root in India, opens up IOT, driverless cars, fleet/asset tracking
4. One OEM player entering in India
 - SpaceNet from Bangalore based Astrome
 - ~ 200 satellites, 24Tbps throughput
 - Historically, no VSAT OEMs in India
5. Some 20 space related startups in India from the last 3 years
6. HTS GEO – Started with GSAT-11 in India, new entrants soon
7. Satellite IOT – not taken off in India
 1. Traditional players, low bandwidth: Iridium, Globalstar, Inmarsat, Orbcomm
 2. New players, high bandwidth with LEOs, MEOs, Cubesats: Astrocast, SAT4M2M, Nano Avionics, Kepler, Lacuna, HeliosWire, many more...