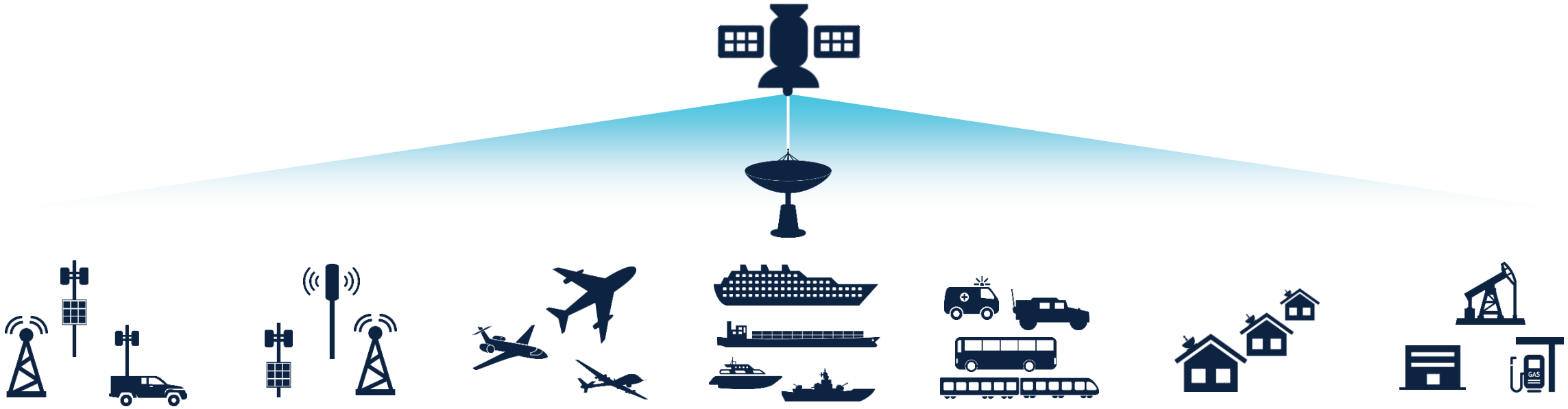
DRIVERS FOR NEXT GENERATION SATCOM APPLICATIONS & SERVICES

November 2018

NASDAQ, TASE: GILT

GILAT – BOUNDLESS COMMUNICATIONS



4G/5G | 2G/3G | Air | Sea | Land | Consumer | Enterprise

MOBILE | MOBILITY | RURAL BROADBAND

MOST ADVANCED TECHNOLOGY
Terrestrial-grade user experience

END-TO-END SERVICE
Most stringent service levels

GLOBAL PRESENCE
20 sales offices

Established 1987 | NASDAQ / TASE: GILT | ~1,100 employees

GLOBAL FOOTPRINT – EXPANDING A DIVERSE CUSTOMER BASE

SATELLITE OPERATORS

SES
CHINA SATCOM
eutelsat
inmarsat
INTELSAT
JSAT
hispasat
avanti
GAZPROM SPACE SYSTEMS
SYNERTONE 协同通信

CARRIERS & SERVICE PROVIDERS

Sprint
T-Mobile
SoftBank
OPTUS
KDDI
Globe
EE
gogo
BT
TRICOLOR TV
bharti
Claro
Telstra
vodafone
orange
Telefónica

SYSTEM INTEGRATORS

Honeywell
LOCKHEED MARTIN
BOEING
AIRBUS DEFENCE & SPACE
GENERAL DYNAMICS
L3 communications

GOVERNMENTS

FITEL
FONDO DE INVERSIÓN EN TELECOMUNICACIONES
nbn
Inatel
Instituto Nacional de Telecomunicações
Compartel

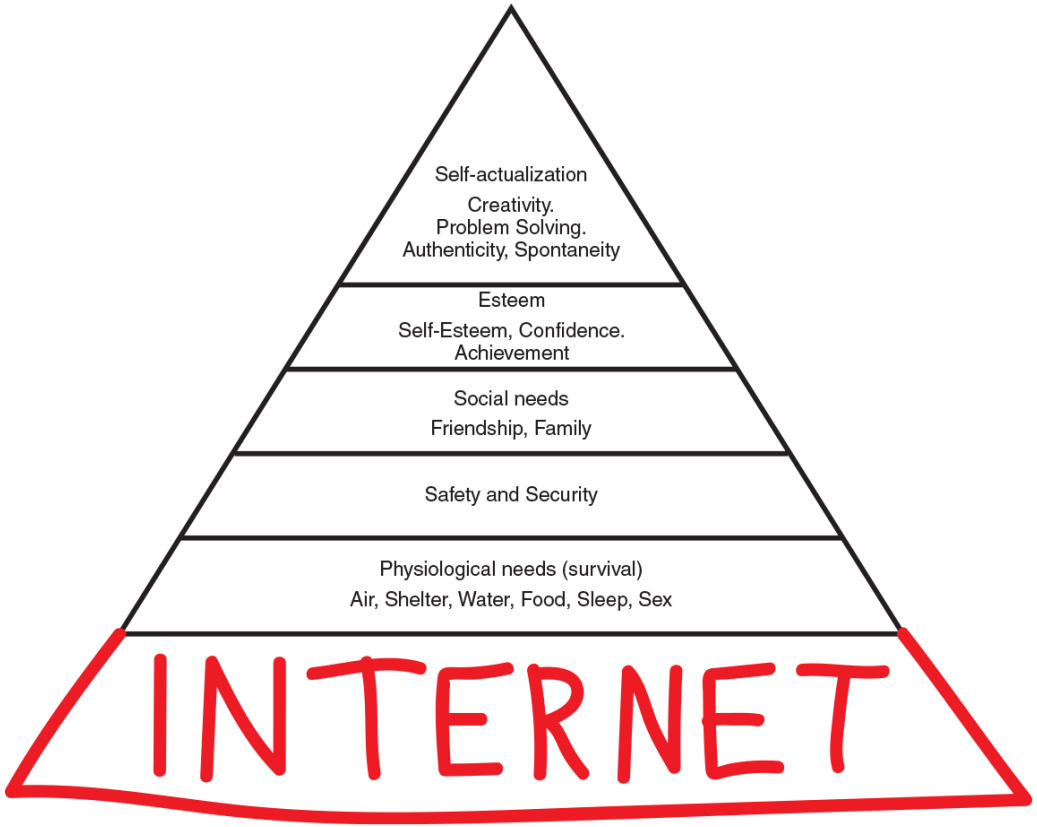
300+ customers

500+ Networks

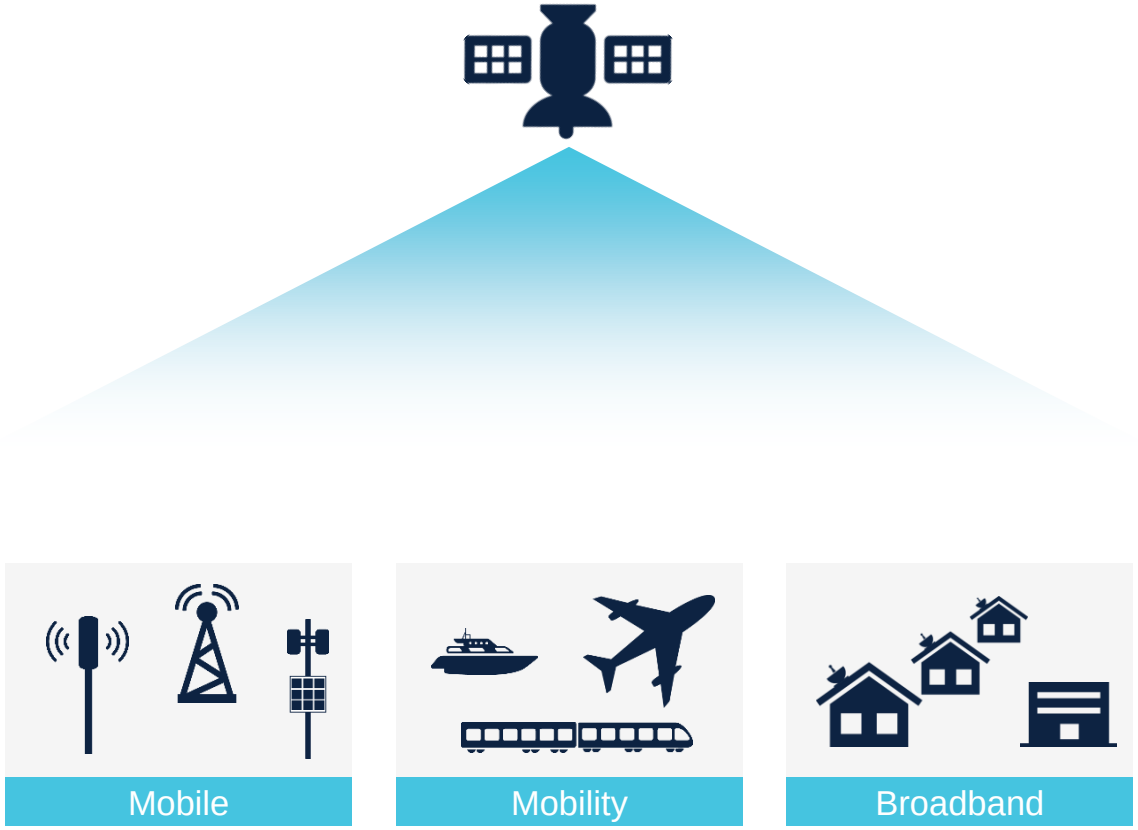
90+ countries

AFFORDABLE INTERNET EVERYWHERE IS BECOMING A "BIRTH RIGHT"

WE ALL WANT BROADBAND
Everywhere. Anytime. Affordable.



SATELLITE DELIVERS
Affordable, Plentiful, Terrestrial-grade User Experience



HTS/LEO

CONSTELLATIONS AND NETWORKS ARE GETTING MORE COMPLEX

Multi-satellite	Multi-orbit	Multi-beam	Multi-band
1K-10K/constellation	GEO/MEO/LEO	Thousands per satellite	Ku, Ka, C

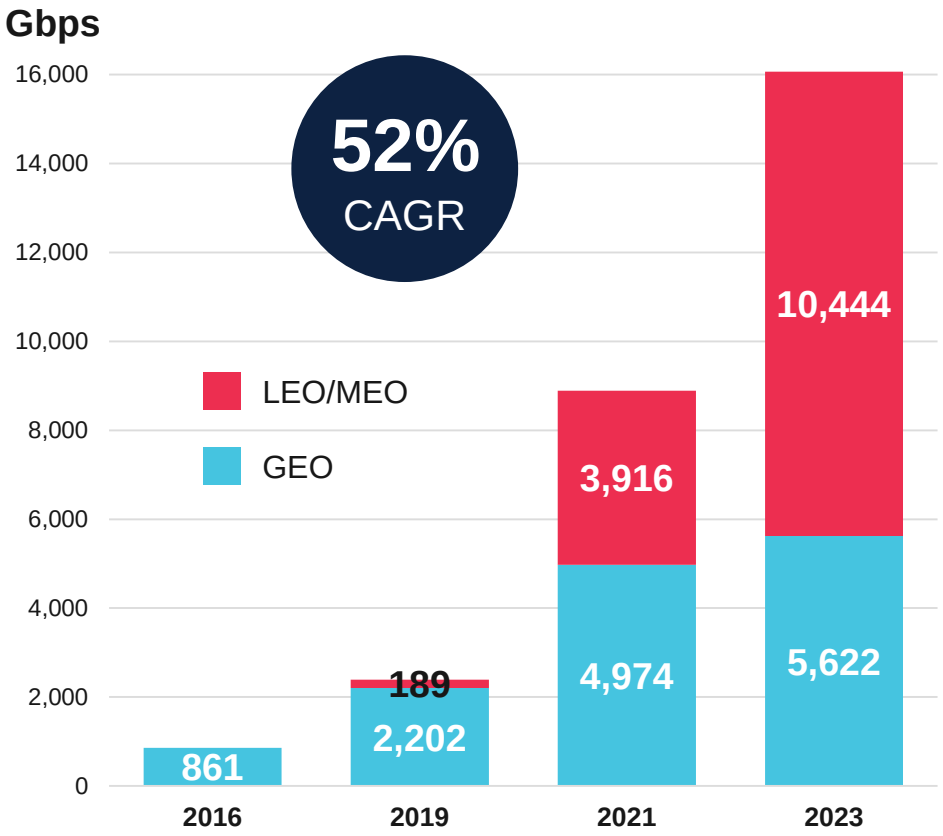
GEO
35,786 km

MEO
2,000-10,000 km

LEO
500-2,000 km

Next-Gen Technologies Needed – Complex NMSs, Strong Modems, ESA

ORDER OF MAGNITUDE MORE SUPPLY COMING

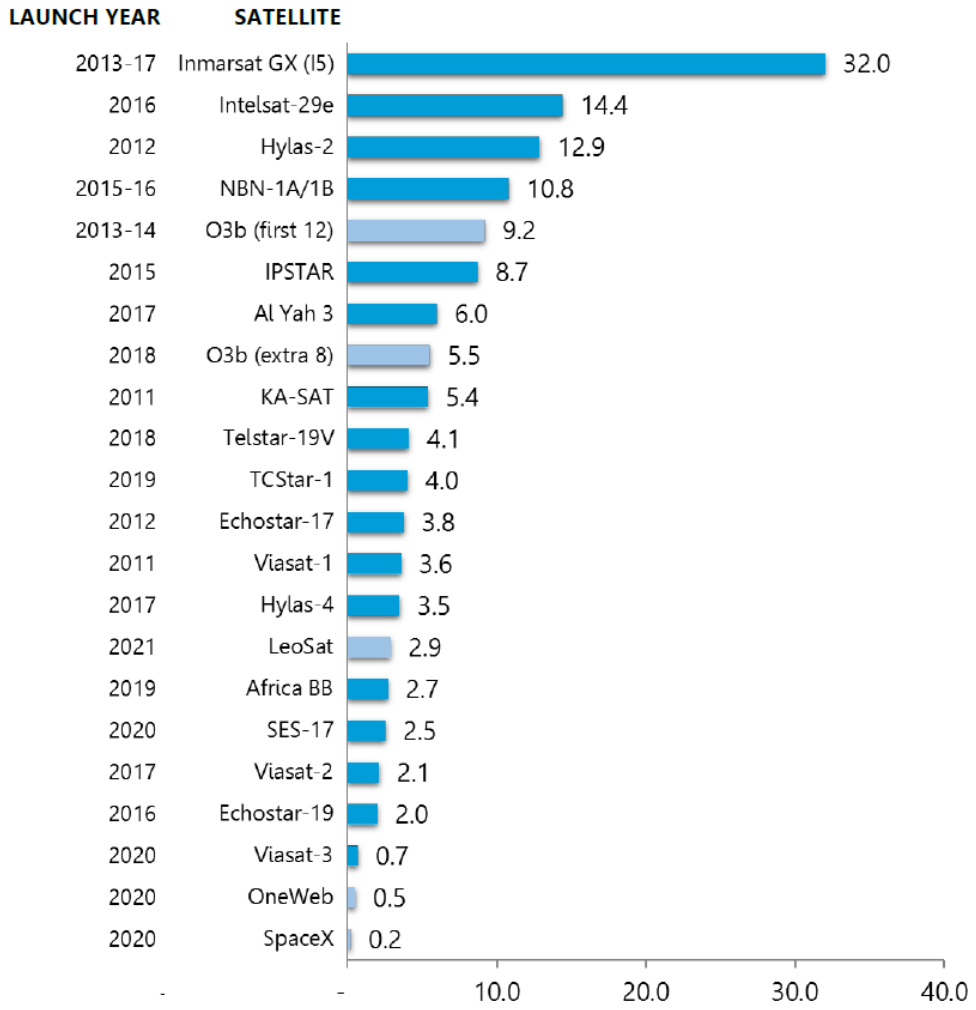


HTS capacity supply to exceed 16 Tbps by 2023 compared to ~1 Tbps today

Source: EuroConsult 2018

COST BASE OF HTS SATELLITES IS FALLING DRAMATICALLY

CAPEX per GBPS (in US$ millions)



*Generally includes satellite, launch, insurance and ground infrastructure costs

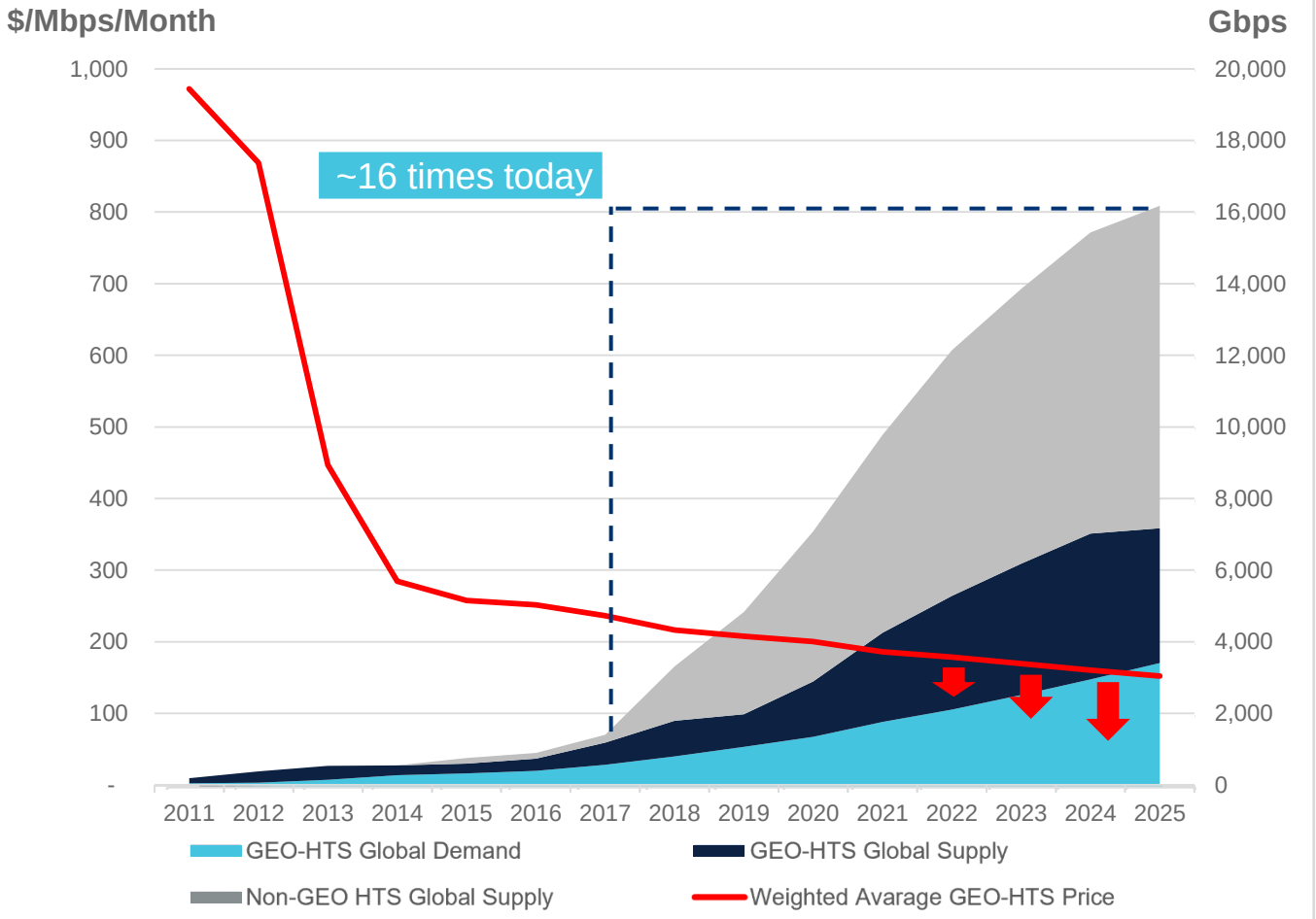
HTS cost base is going under

$1M per Gbps

Source: EuroConsult 2017

BOOMING CAPACITY – GEO + LEO/MEO

Global HTS Bandwidth Supply, Demand and Price per Mbps



Source: Euroconsult, NSR, 2017

ABUNDANCE OF CAPACITY UNLOCKS NEW MARKETS

NGSO DEVELOPMENT – GENESIS CONSORTIUM

Israel Innovation Authority

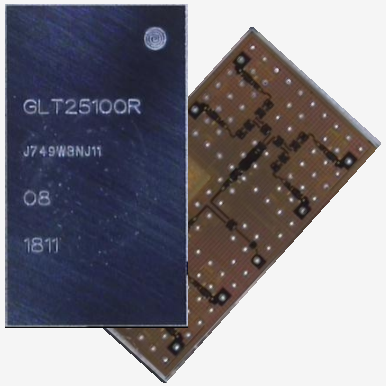
Genesis – Global Earth, Low Latency, Extreme Broadband Satellite Access

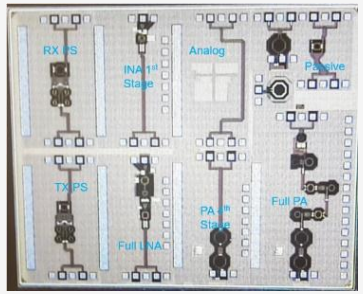
- Develop technologies for **Extreme Throughput Constellation Systems**
  - Ground segment – hubs and terminals
  - Radio Resource Management (RRM)
  - Phased array antennas
- Multi-year program with Industry & Academy
- 3 Main Working Groups:
  - **Architecture** – Define efficient architecture for NGSO constellations that combines programmable ground & space segment
  - **Network Algorithms** – Define algorithms for resource management in highly dynamic distributed constellation systems
  - **Air Interface** – Define new communication waveforms and techniques to handle the highly dynamic constellation systems

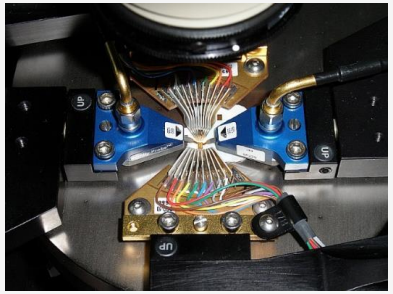
AT THE FOREFRONT OF ELECTRONICALLY STEERED ANTENNA (ESA) DEVELOPMENT

ESA Technology

- RFIC technology
  - Single Die SiGe, Rx And Tx
  - Status
    - Ka Chips already in lab
    - Tx & Rx
    - Using ST FAB

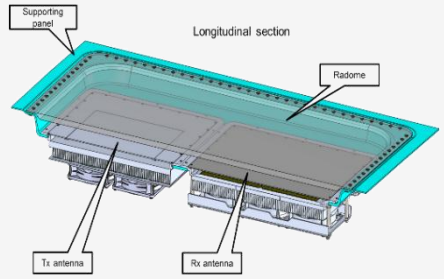




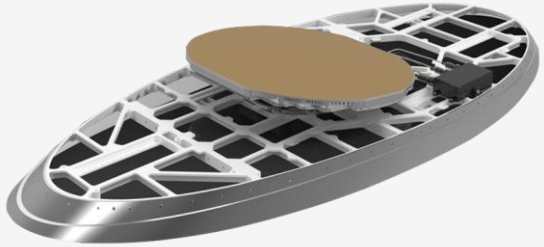


ESA Systems and Projects

- **Integrated Aero ESA**
  - Integrated in wing – fuselage airframe fairing
  - For Airbus



- **Commercial Aviation Antenna**
  - Better-than-industry spectral efficiency
    - Higher G/T
    - Higher EIRP
  - Dual simultaneous Rx channels



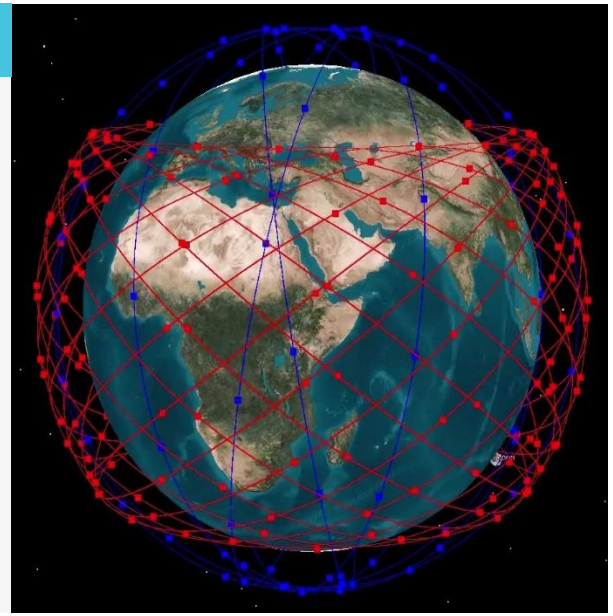
ESA is imperative for LEO/MEO satellites

NGSO DEVELOPMENT – GILAT & TELESAT R&D PROJECT

The Canada-Israel Industrial Research and Development Foundation (CIIRDF)

Broadband Terminal for LEO Satellites

- Develop a prototype terminal
  to operate and tested over Telesat phase-1 LEO satellites
- Develop a waveform and broadband modem
  to meet the communication challenge of the LEO constellation
- Overcome all Doppler effects
  - Time synchronization, symbol duration changes, and frequency changes



Canada-Israel Industrial Research and Development Foundation
Fondation Canada-Israël pour la recherche et le développement industriels

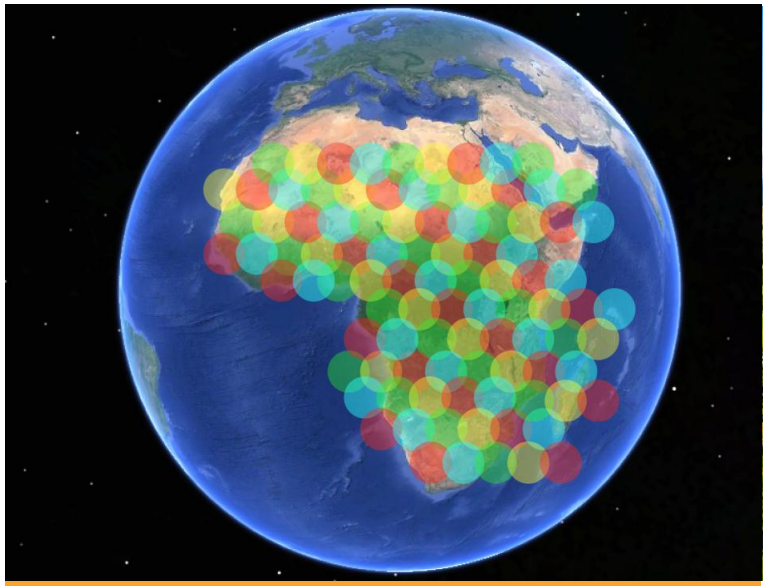
ACCELERATING CONNECTIVITY – GROWTH AREAS

Mobile

Cellular Backhaul,
Network Resilience, Public Safety

Mobility

In the Air, at Sea, on the Ground



Broadband

Broadband to the
Unserved and Underserved

MOBILE

LEADING THE FAST GROWING SATELLITE BACKHAUL MARKET

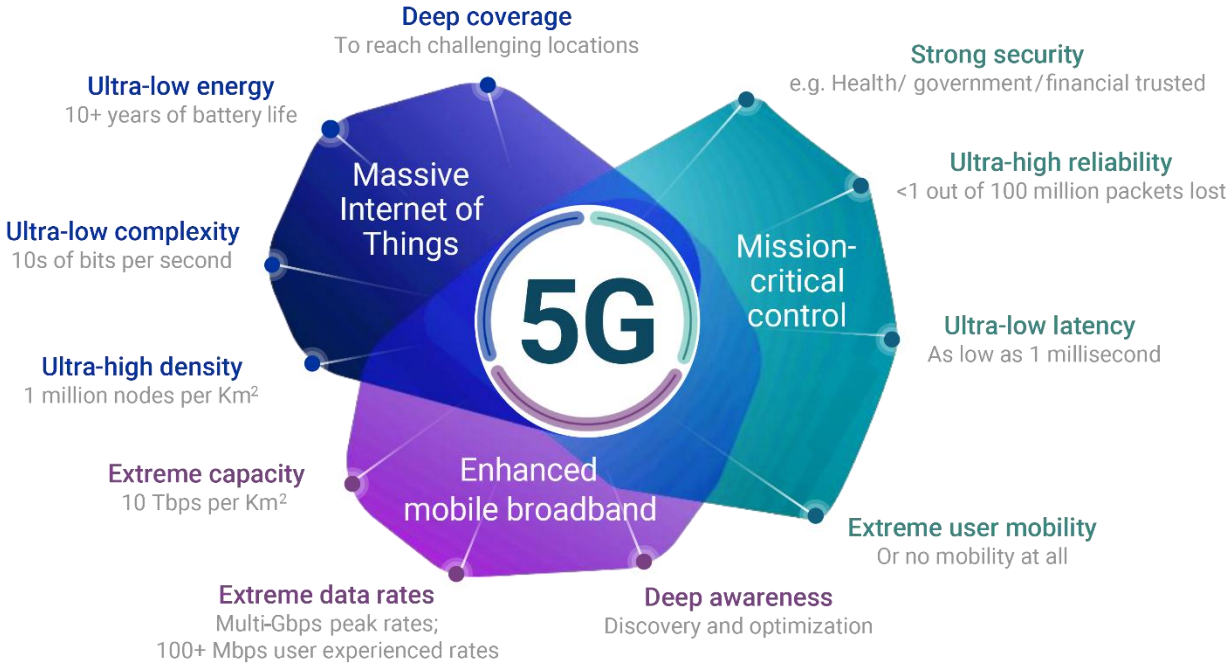
“Gilat continues to unlock new opportunities and capture a bigger share of the pie…”

Source: NSR, April 2018

5G-READY SATELLITE CONNECTIVITY

WHAT IS 5G?

- Next generation of wireless networks
- Will provide higher speeds and capacity, deeper coverage and lower latency
- Will be capable of supporting billions of connected devices and ‘things’
- Distributes intelligence throughout the network



Source: Qualcomm

GILAT DRIVING HIGH IMPACT IN 5G SATELLITE FUTURE

Collaborating to accelerate satellite role, technology, and standards

5G Backhauling and Mobility – GEO & LEO

- Delivering 5G backhauling via satellite to cellular towers, enterprises, commercial and business aviation, maritime and high-speed trains
- Leveraging upcoming LEO constellations to deliver **low latency and extreme throughput** 5G mobile backhauling
- Technology innovation includes:
  - Advanced **phased array terminals** for IoT aggregation and connected cars
  - Close **integration of 5G core**, ground infrastructure and satellite
  - **Virtualization**, **SDN/NFV** to simplify operations and increase service flexibility
  - **Gigabit multi-orbit terminals**

5G Fixed Backhaul

Moving Platforms

Content Delivery

IoT & Connected Cars

SAT 5G H2020

avanti communications

AIRBUS DEFENCE & SPACE

SES

ThalesAlenia Space

BT

Gilat

TNO

broadpeak

imec

iDIRECT

i2cat

ZODIAC AEROSPACE

UNIVERSITY OF OULU

ONEACCESS Fast Network Virtualization

UNIVERSITY OF SURREY

GILAT DELIVERS BEST USER EXPERIENCE ON THE PATH TO 5G

Leveraging a strong 4G foundation

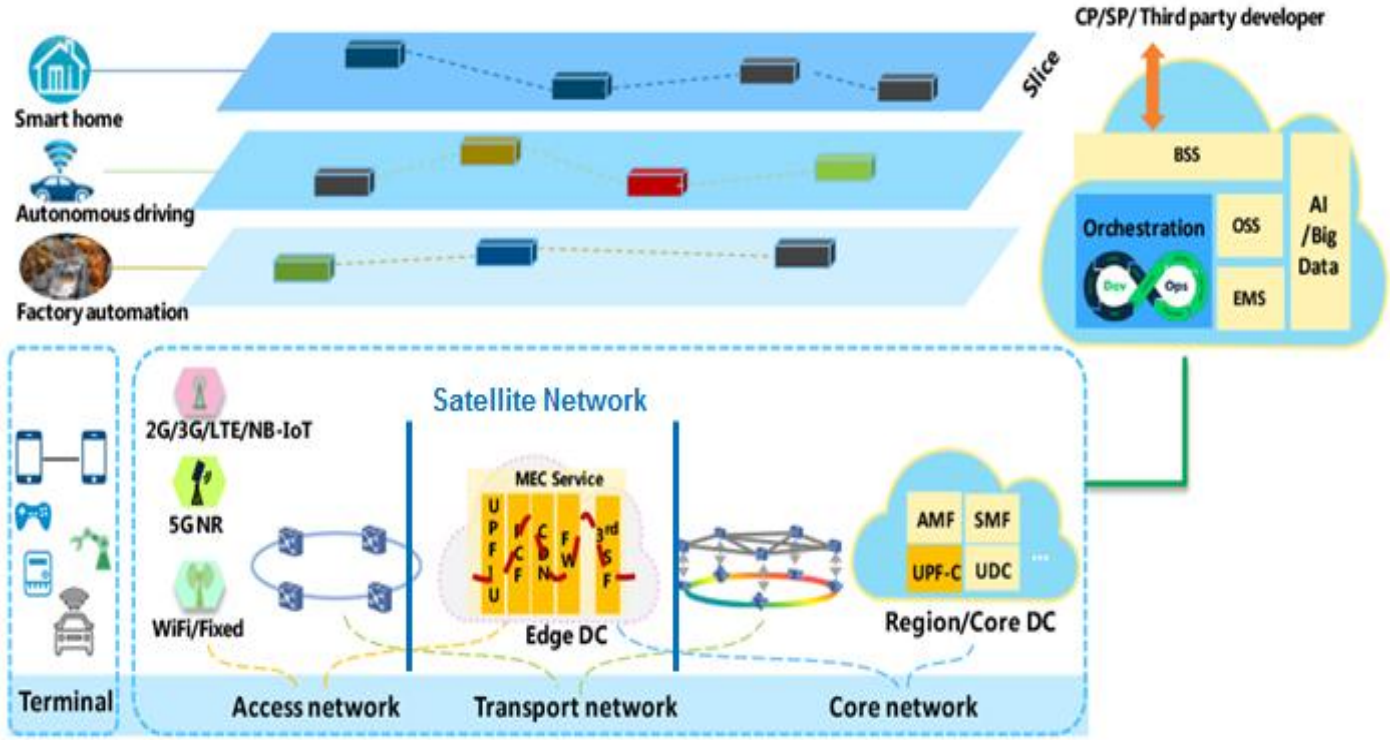
4G-5G Cellular Backhaul

- Delivering “terrestrial-grade” User Experience
- Expanding network coverage from rural to metro-edge and metro areas
- Powering cellular backhaul, network resilience and public safety deployments
- Expertise in integrating mobile and satellite networks
- Experience with tier-1 MNOs worldwide

Sprint SoftBank OPTUS T-Mobile KDDI Globe

EXTENDING 5G SERVICES VIA SATELLITE

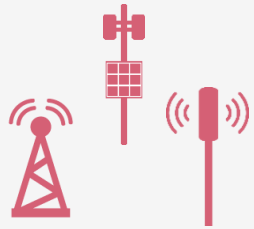
- Fixed and on-the-move high throughput satellite backhaul
- Extending coverage for massive 5G IoT everywhere
- Content delivery to the edge via multicast



ENABLING “TERRESTRIAL-GRADE” USER EXPERIENCE

Affordable true **LTE Backhaul**

- Delivering “terrestrial-grade” User Experience
- Rapid network deployment
- Expanding coverage to: rural, highways, islands, tourist centers, campuses, metro-edge and metro areas
- Replacing leased lines and upgrading T1s/E1s

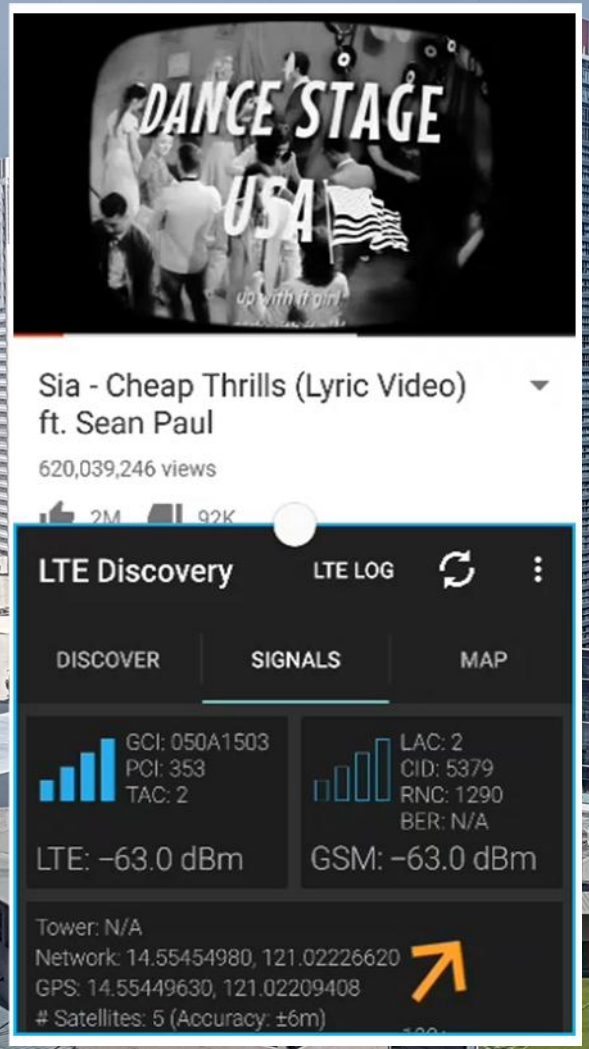


Global End-to-End **Services**

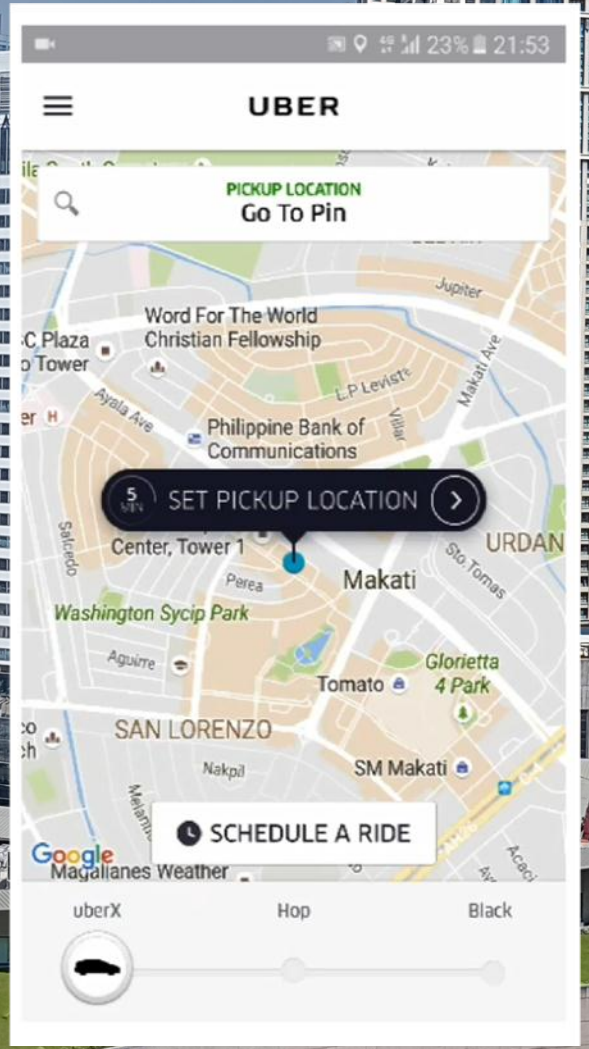
- Delivering comprehensive services
- Expertise in integrating ground and sat networks
- Experience with Tier-1 MNOs worldwide
- Generating **recurring revenues**

Sprint
SoftBank
T-Mobile
KDDI
EE
OPTUS
Globe
Telstra

METRO AREA - A LIVE EXMPLE



YouTube



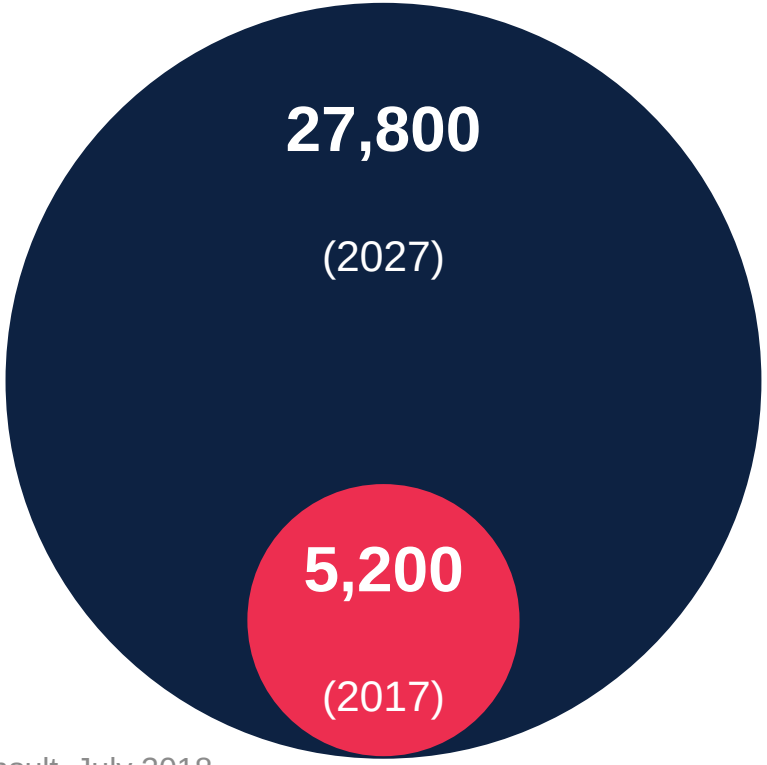
UBER

MOBILITY

MOBILITY – SUPERIOR PASSENGER EXPERIENCE DRIVES DEMAND

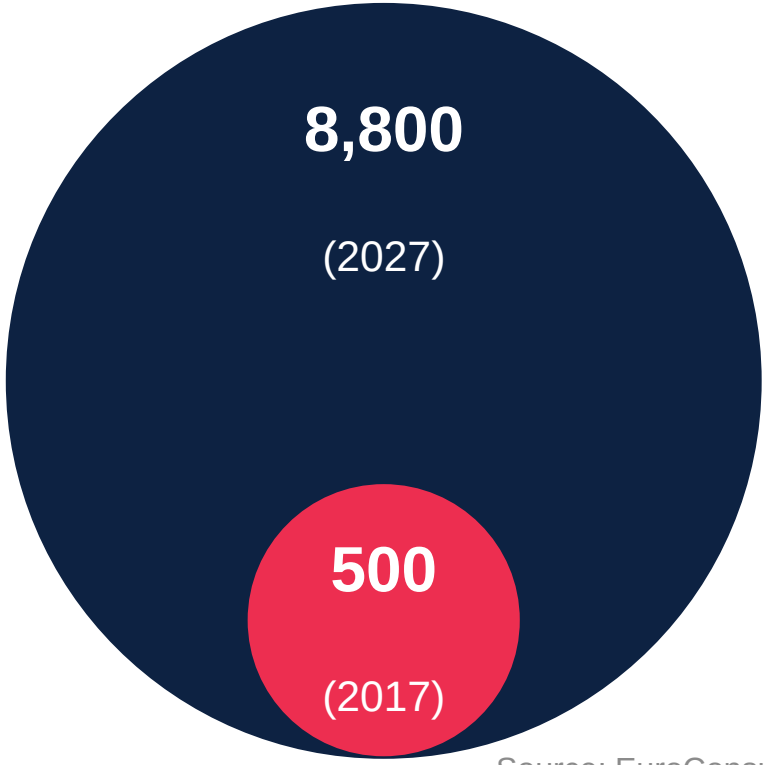
Satellite Broadband Connected Aircrafts

Commercial Aircrafts



Source: EuroConsult, July 2018

Business Aircrafts



Source: EuroConsult, July 2018

gogo

AirMedia 航美传媒

Honeywell

DELIVERING SUPERIOR PASSENGER EXPERIENCE

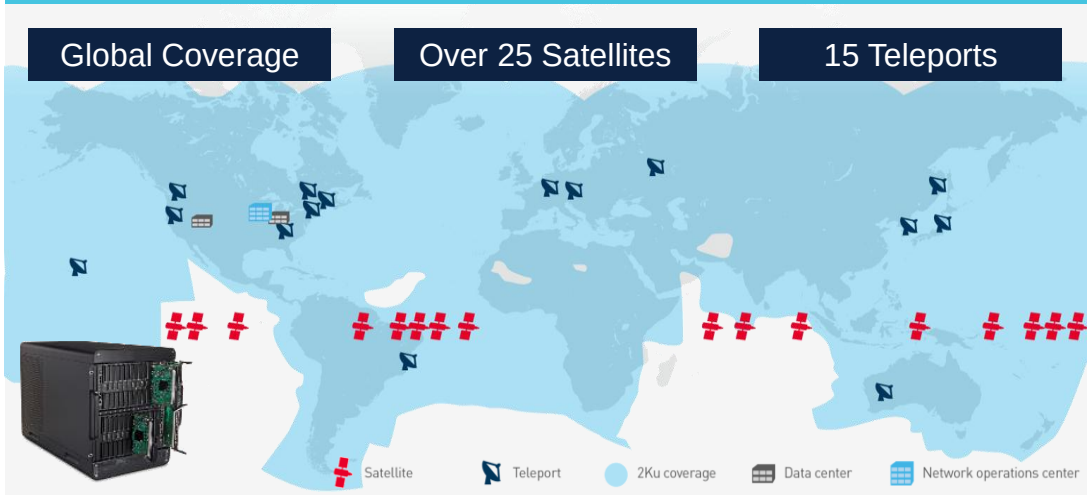
World's **Fastest Speed** In-Flight Connectivity

Gogo @Gogo · May 10, 2017

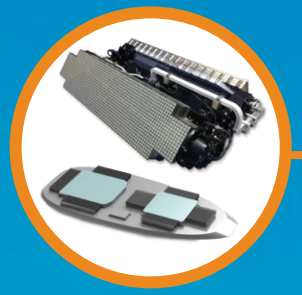
This is some real record smashing performance from #2Ku, delivered at 34,000 feet on #N321GG #FastestInflight

>2,200 aircrafts

One Network



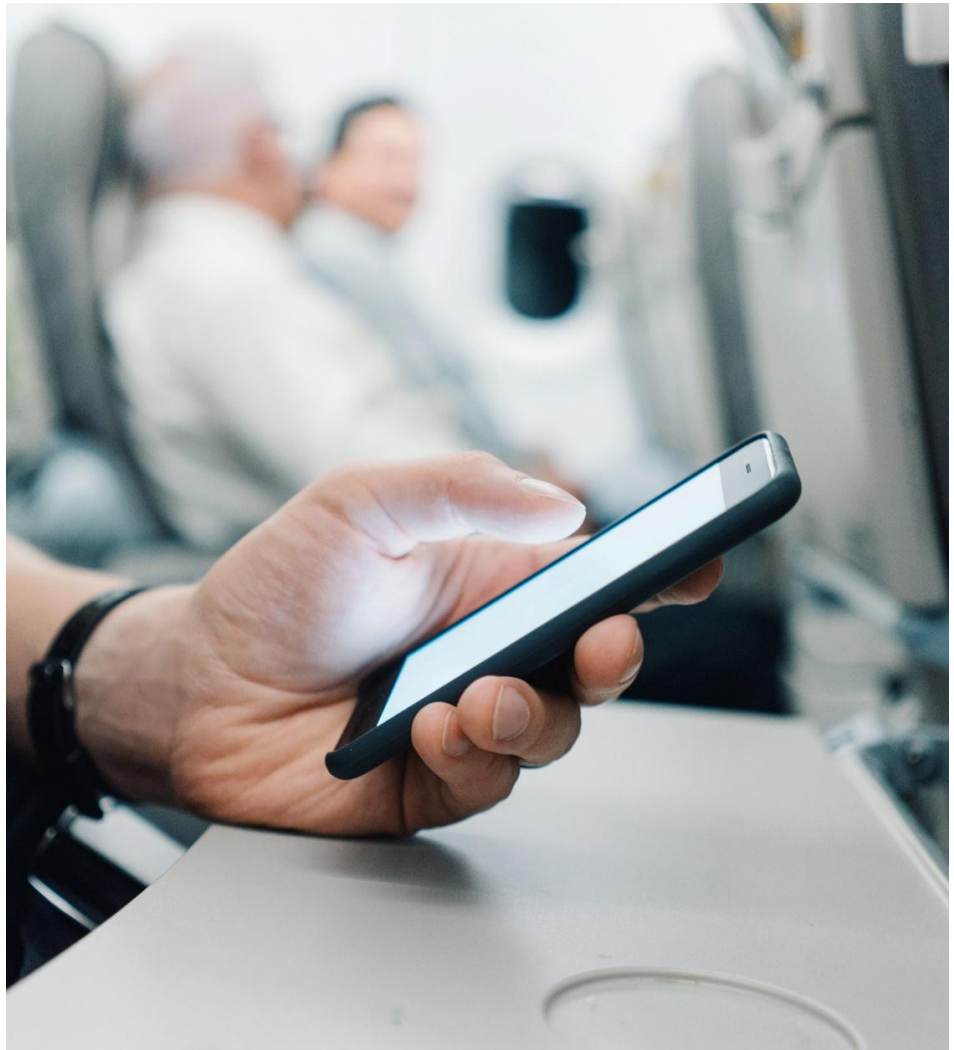
Leading Performance Solutions for All In-Flight Connectivity Modules



Dual Band Ku/Ka Antenna

ESA/PAA

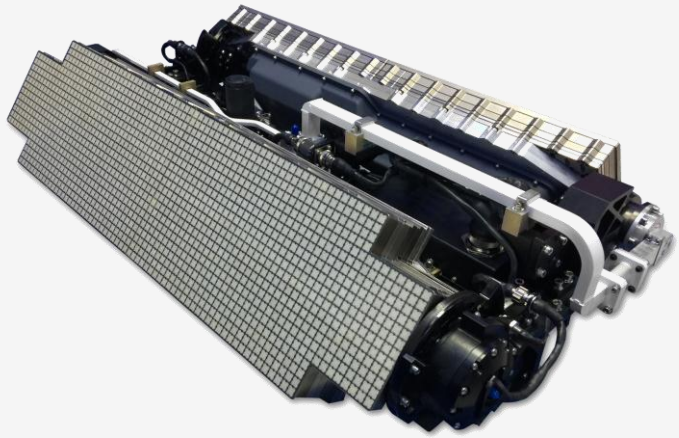
Ku and Ka Transceivers

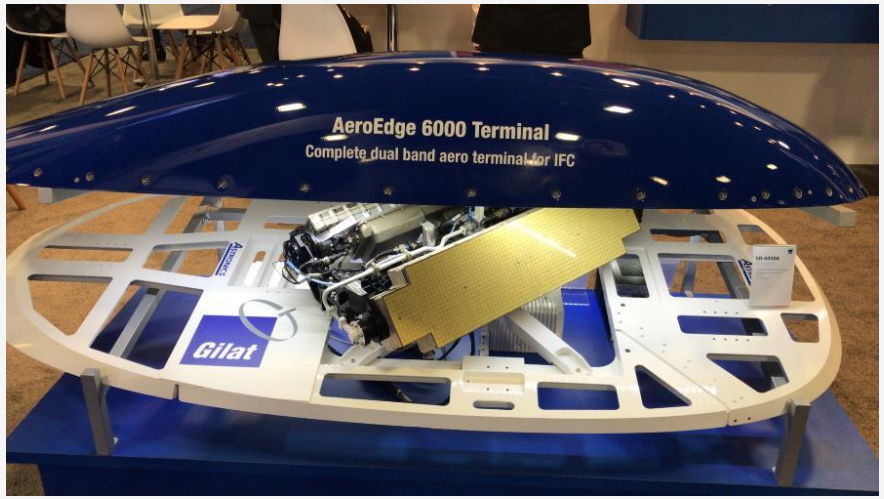


400Mbps Modem

KU/KA AERO TERMINAL NOW DO-160 CERTIFIED

AeroEdge 6000– Ku/Ka Dual Band





DO-160 Certification
Environmental Testing of Avionics Hardware

Now Qualified for Installation on Aircrafts

AirMedia 航美传媒

DEMONSTRATING WORLD'S FIRST MULTI-ORBIT NETWORK

Telesat, Global Eagle and Gilat – First Ever IFC with LEO

- Multi-orbit GEO-LEO

  seamless connectivity and switchover

- Live in-flight broadband connectivity

- Terrestrial-like broadband performance

BROADBAND

The Space Silk Road

One Belt, One Road, One Ground Segment

Gilat Ground Network – From Asia to Europe
Powering China Satcom, Eutelsat and Gazprom Satellites

DELIVERING CORE INFRASTRUCTURE FOR NATIONAL BROADBAND

Broadband to unserved & underserved

- Bridging the digital divide
- Connecting communities and individuals to the world via broadband
- Innovating to deliver plentiful affordable Consumer and Enterprise solutions

Large governmental projects in **Peru and Colombia**

- Peru – FITEL projects
  - A $2B+ program to build terrestrial networks across Peru
  - 14 Regional Projects awarded so far - 6 to Gilat (~$553M)
    - ~$335M construction revenue
    - ~$218M operational revenue over 10 years
  - Target: Recurring revenues >$50M / year, profitable, starting 2020

NBN

Connecting nationwide businesses and enterprises in regional and rural Australia

Gazprom

Providing broadband connectivity across Russia over new satellite – Yamal 601 Ka

China Satcom

Extending satellite coverage throughout China with new satellite – CS-18, sole solution to China's HTS Ka

JSAT

Delivering wide range of mobility and fixed broadband applications in Japan

THANK YOU

Gilat Satellite Networks | info@gilat.com | www.gilat.com