

# High-Throughput Satellites

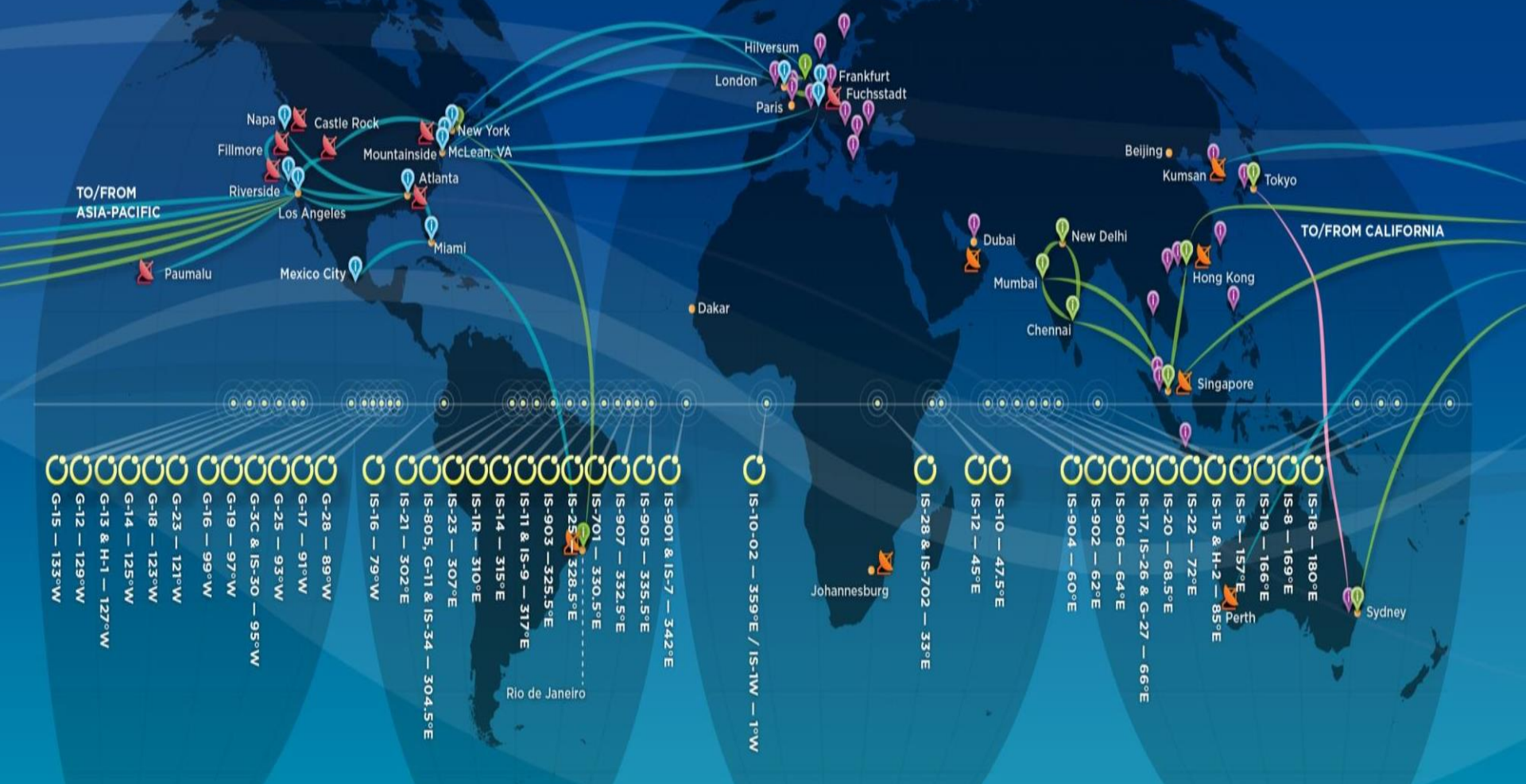
## Technology Trends

Gonzalo de Dios

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ITU Regional Radiocommunication Seminar  
2017 for the Americas (RRS-17-Americas)  
Lima, Peru

# The Intelsat Globalized Network Infrastructure



Over 50 satellites plus IntelsatOne, a fully-integrated ground infrastructure incorporating teleports, points of presence and IP/MPLS fiber network

# Building Blocks of Transformation of the Satellite Industry - A Renaissance Period -

1

**Satellite Launch  
Innovation**

2

**Spacecraft  
Innovation**

3

**Constellation  
Innovation**

4

**Ecosystem  
Innovation**



# The Technology CEO Space Race Is Heating Up



Investments split between satellite and stratospheric balloon connectivity, and earth observation data



Design, manufacture and launch of advanced rockets and spacecraft

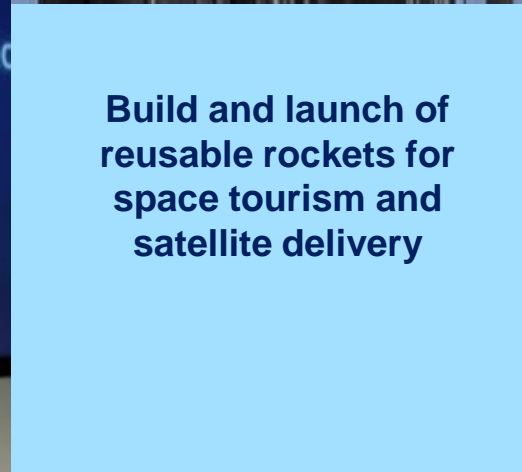


Plans to launch over 4,000 NGSO satellites starting in 2019

OneWeb investor



Use of drones, lasers and satellites for Internet access



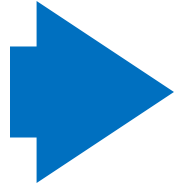
Build and launch of reusable rockets for space tourism and satellite delivery



Develop commercial spacecraft, and provide suborbital spaceflights

# Evolving Role of Satellite Operators

From  
wholesale  
providers of  
bandwidth



To value-  
added  
partners  
for 5G

IoT/M2M

Connected  
Cars/Trains  
/ITS

Multi-  
media/Video

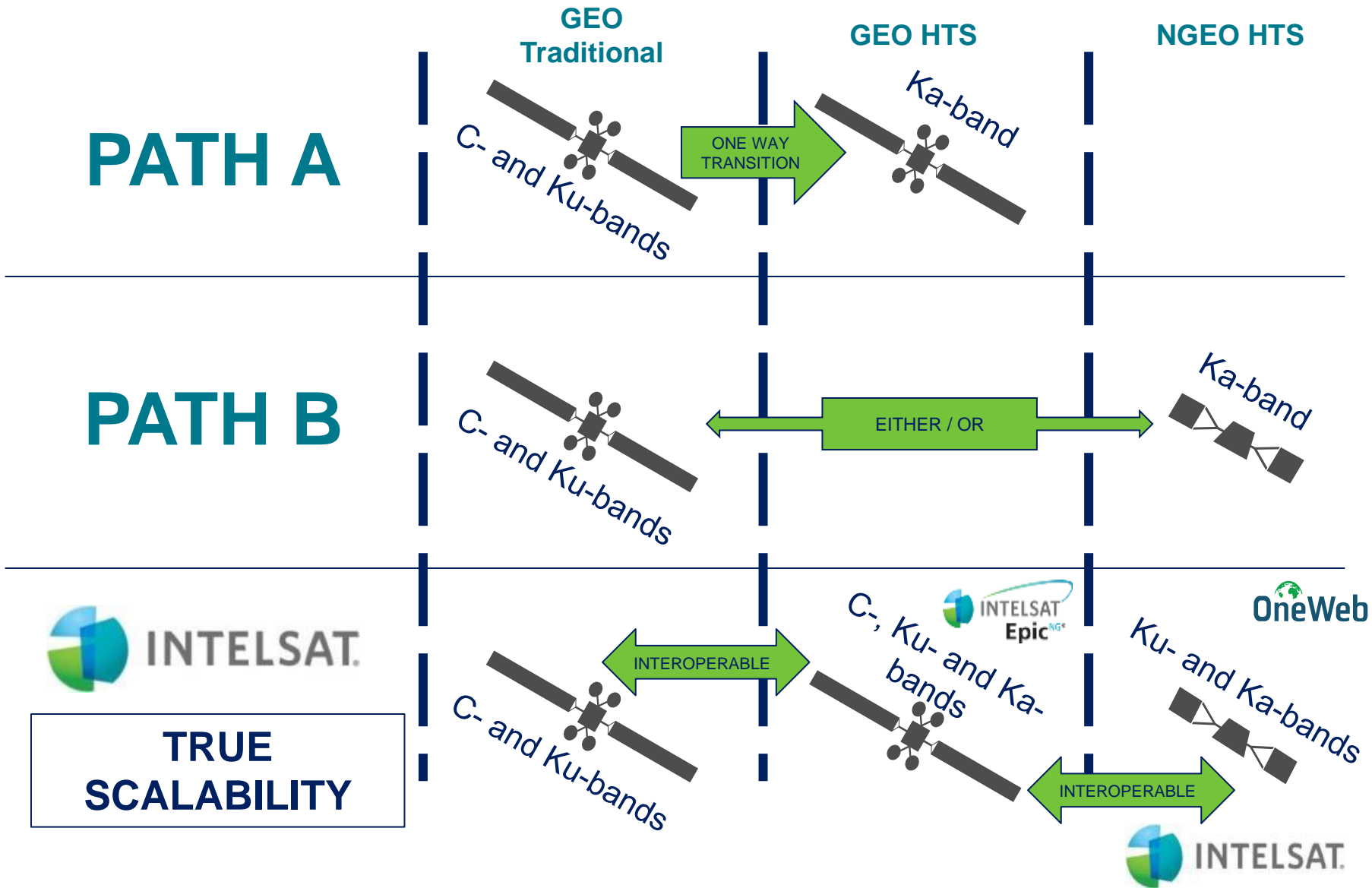
Broadband  
Access

Smart  
Cities

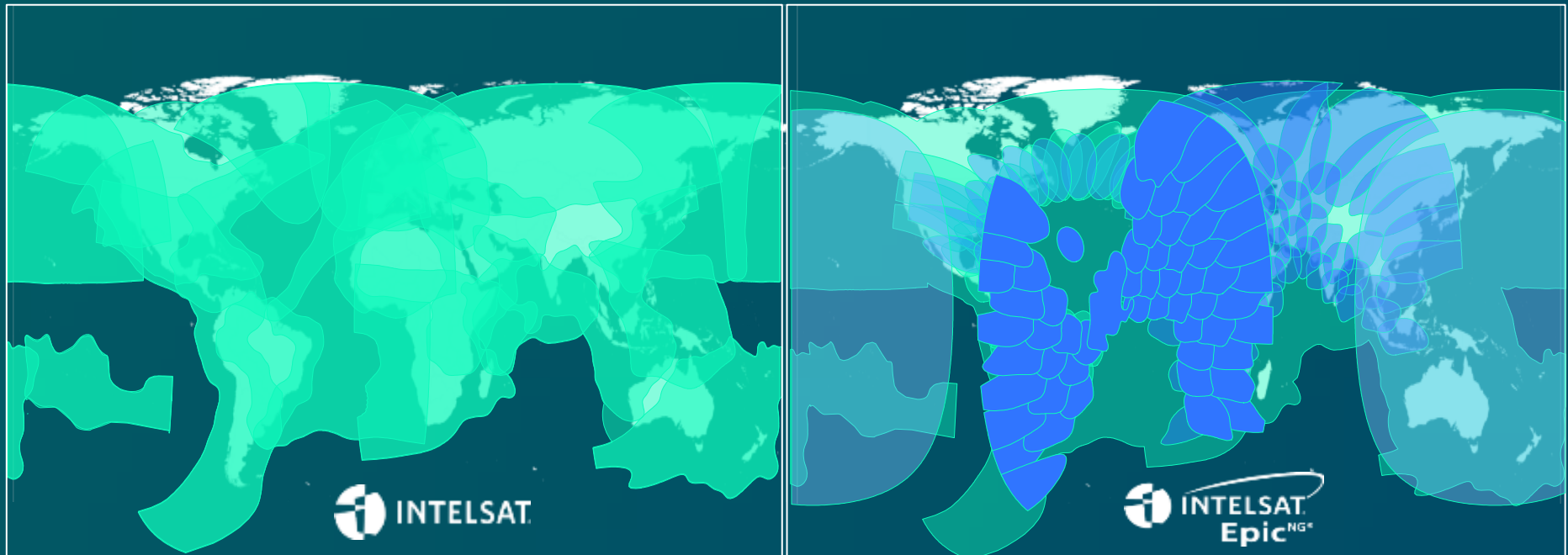
Smart  
Agriculture

Aero-  
connectivity

# Different Paths to High Throughput Satellites (HTS)



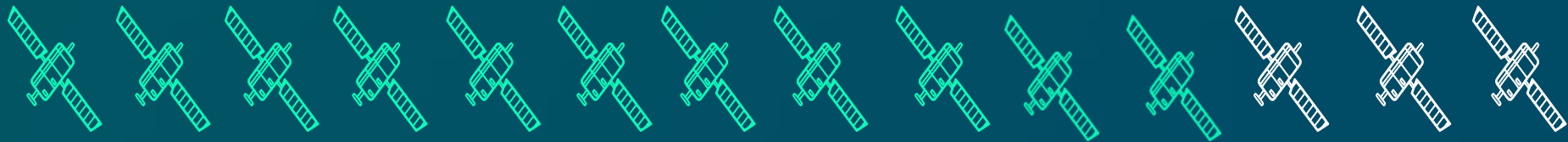
# Building a Global C- and Ku-band Network



Up through 2015

2016-2017

2018 onwards

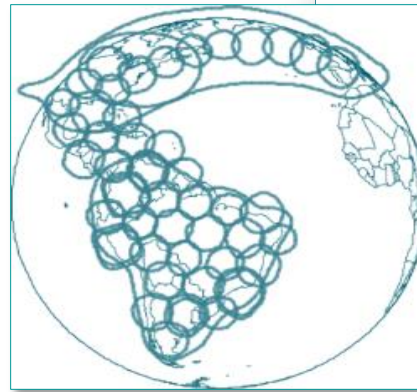
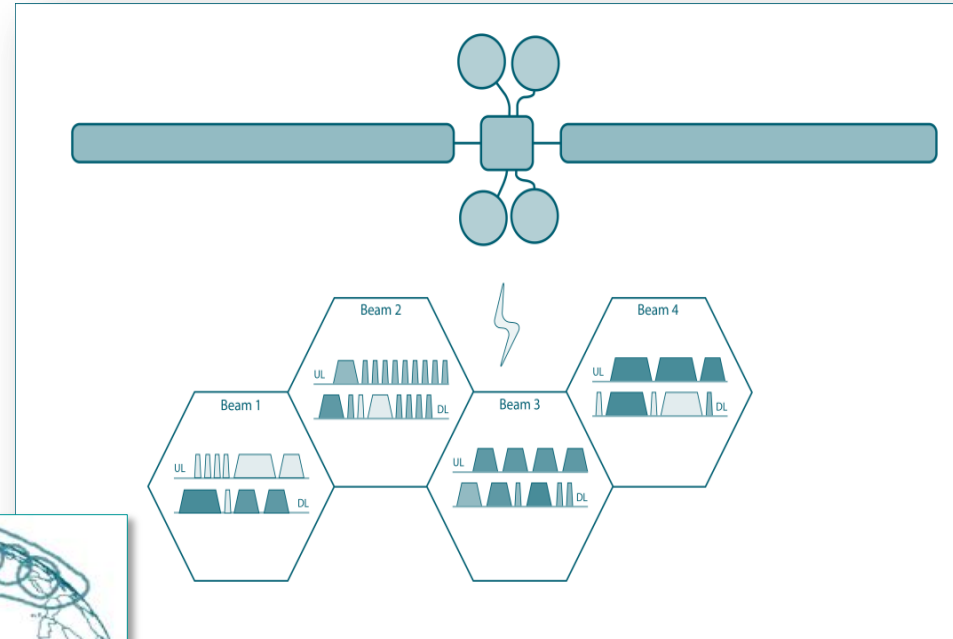


IS-21 IS-23 IS-30 IS-34 IS-29e IS-31 IS-33e IS-36 IS-32e IS-35e IS-37e IS-38 H-3e IS-39



# Intelsat Epic<sup>NG</sup> Features

- Satellites utilize small multi-spot uplink and downlink beams covering the desired area
- Why?
  - Frequency reuse – more bandwidth
  - Better G/T – better performance
  - Higher EIRP
  - Higher throughput



Throughput is 25-60 Gbps, or 10X that of traditional bent pipe payloads



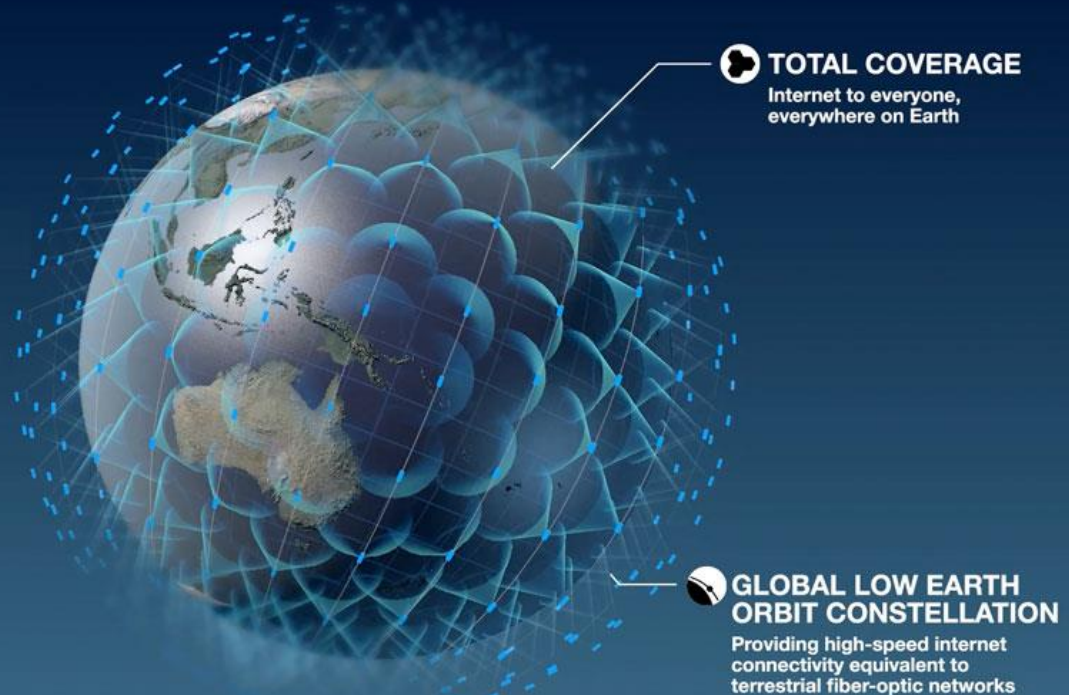
## First Fully Global, Pole-to-Pole HTS System

Total throughput of the system:

**5** terabits per second

The OneWeb satellite constellation:

- › 650 satellites (18 planes of 36 satellites)
- › Low latency (<30ms round trip delay)
- › Look angles > 57°



## DESIGN PHASE

### LEO HTS

- Pole-to-pole coverage
- Small terminals, low latency

### HTS 2.0

- Software defined payloads with flexible coverage, power and connectivity

- 2 additional HTS satellites already contracted
- OneWeb

OneWeb  
HELPING THE FUTURE

INTELSAT  
Epic<sup>NG</sup>

## LAUNCH AND DEPLOYMENT PHASE

### HTS 1.0

- HTS spots positioned in high traffic areas
- Complements first layer, not replaces it
- Provides depth of coverage

- 5 HTS satellites

INTELSAT  
Epic<sup>NG</sup>

## COMPLETED

### WIDEBEAM SATELLITES

- Uniform quasi-global coverage
- Base layer of the network
- Provides breadth of coverage

- 50+ satellites
- 7 wide beam mobility satellites
- 100% complete

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Up through 2015

2016-2017

2018 onwards

**GEO**

- Wide beams
- HTS overlay for high density areas
- Global coverage

# Ku-band

Flexible,  
high-performance  
Interoperable user  
terminals

- Additional capacity
- High look angle
- Low latency
- Pole-to-pole coverage

**LEO**



OneWeb



# Designed with Interoperability in Mind

## Interoperability triggered by:

### Remote Situation

Shifting to the stronger signal based on geographic location or remote attitude

### Capacity Availability

Shifting depending on local capacity availability

### Application-based

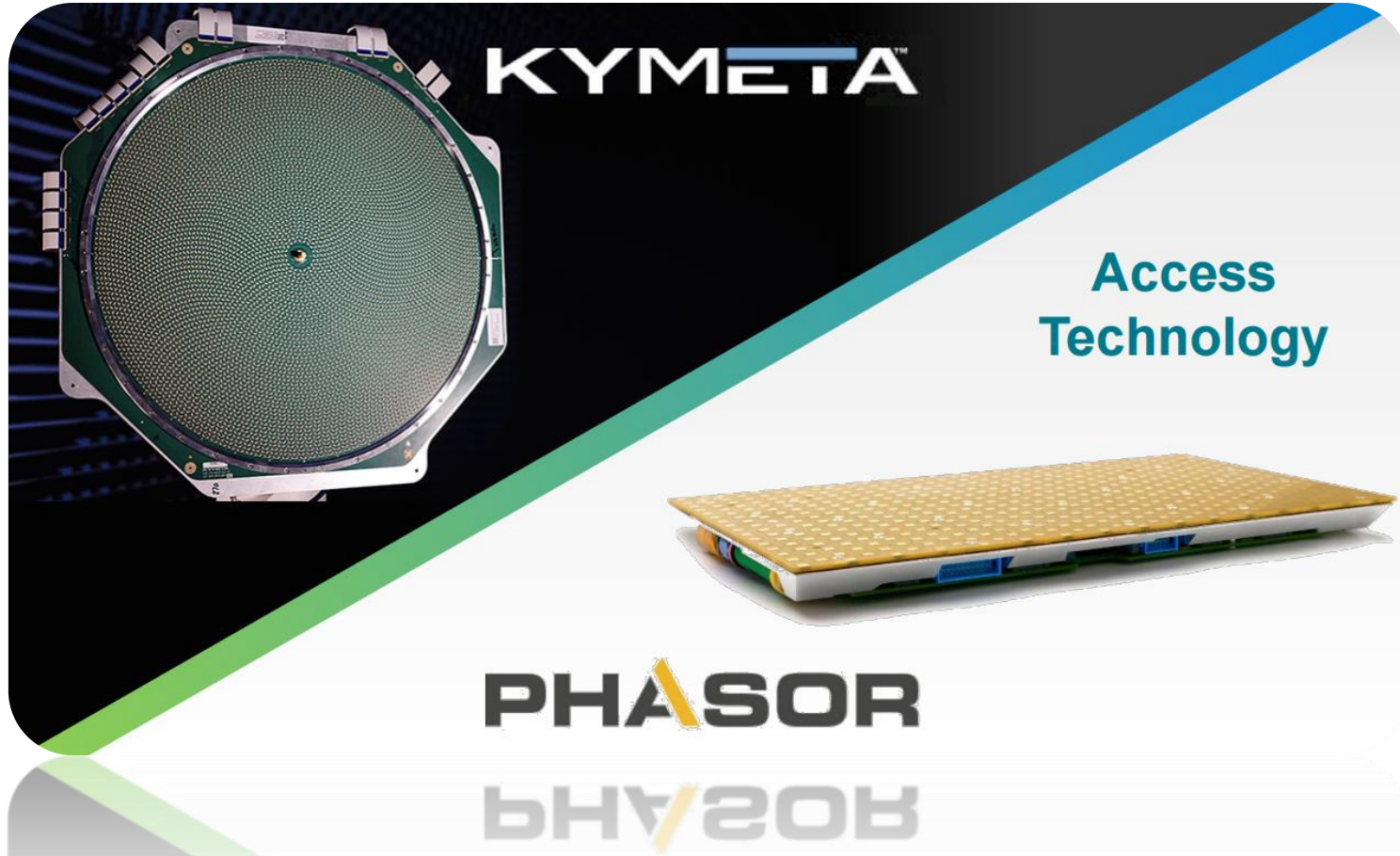
Ability to route IP traffic depending on application





# Innovation in Ground Technology

- Business and small jets
- Vehicles
- Hand-held devices
- IoT applications
- Sensors

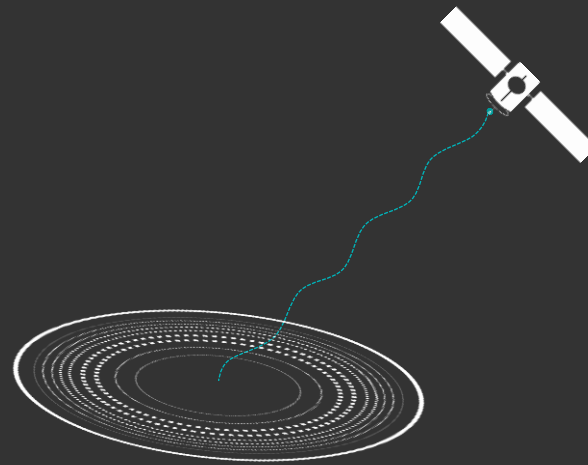
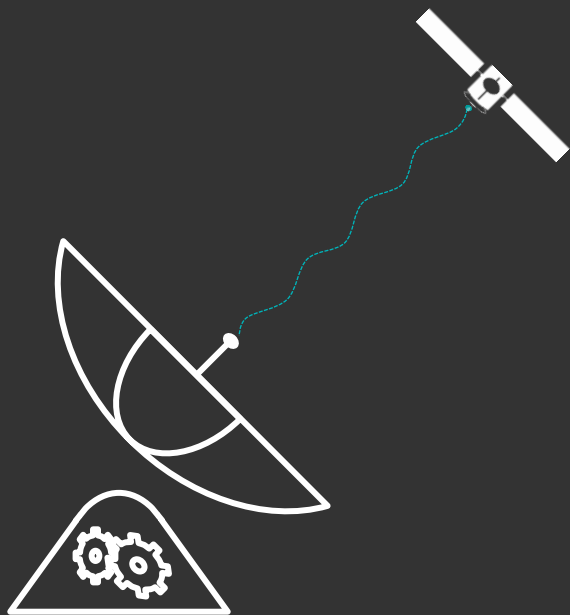


Advancements in ground segment technology are enabling access to new and previously unserved segments

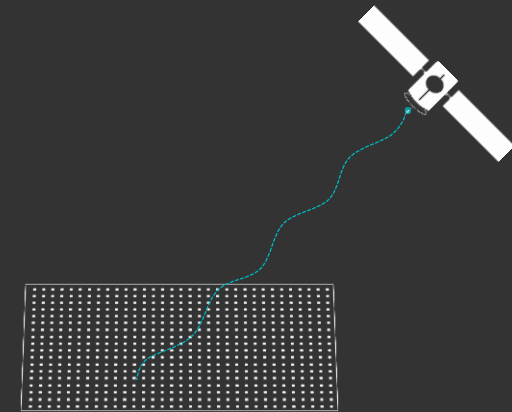


# Redefining the Satellite Antenna

- Electronically Steered Antennas (ESA)
- No moving parts
- Ultrathin and light



- Metamaterials
- Passive array



- Active phased array
- Panels may be laid conformably



# The Connected Car



Onboard sensors  
with Internet  
connectivity

Self-driving /  
autonomous

Operation and  
maintenance, self-  
optimization

A component of the  
'Internet of Things'



Service based on  
connectivity to the  
'cloud'

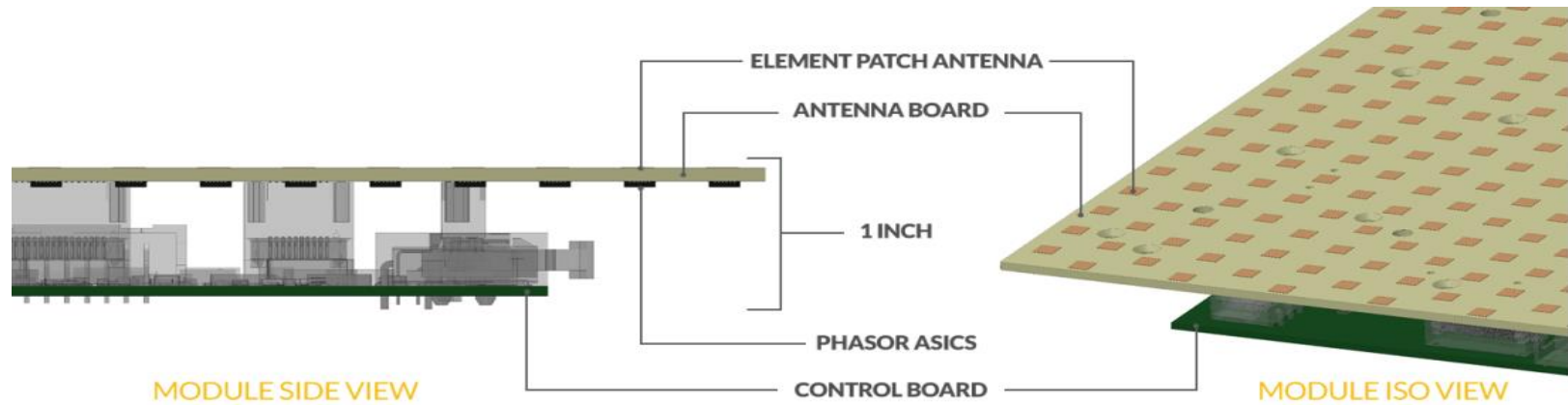
"Driver centric" for  
increasing functions  
and improved safety

Increased passenger  
convenience and  
comfort

## The Future

Kymeta and Intelsat solution is being designed to deliver 1TB of data per month to each car

# Phasor for the Connected Jet





# GEO and N GEO

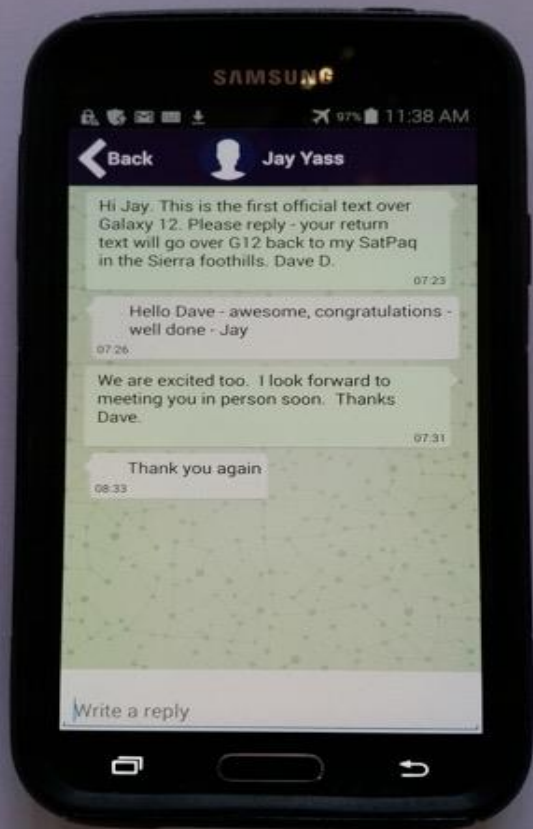
## Phased Array Antenna Technology





# Higher Ground

## Smartphone-sized Antenna for Text Messaging, IoT Applications



June 3, 2015

- First ever text messaging exchanged directly over FSS satellite (Galaxy 12) with a SatPaq smart phone sized terminal



January 18, 2017

- FCC grant of blanket earth station license to operate up to 50,000 SatPaq earth station terminals

# FCC Mobility Rules in C- and Ku-bands

- FCC created **Blanket Licensing Rules** for Earth Stations on Vessels (ESVs), Vehicle-Mounted Earth Stations (VMESs) and for Earth Stations Aboard Aircraft (ESAAs)

Earth Station Type	Frequency Bands	FCC Rules	ITU-R Recommendation
ESV	C-band <sup>1</sup> , Ku-band <sup>2</sup>	C.F.R. 47 §25.222	ITU-R S.1587
VMES	Ku-band <sup>2</sup>	C.F.R. 47 §25.226	ITU-R S.1857
ESAA	Ku-band <sup>2</sup>	C.F.R. 47 §25.227	ITU-R M.1643

*Note 1.* The following C-band frequencies are covered: 3700-4200 MHz (space-to-Earth) and 5925-6425 MHz (Earth-to-space).

*Note 2.* The following Ku-band frequencies are covered: 10.95-11.2 GHz (space-to-Earth), 11.45-11.7 GHz (space-to-Earth), 11.7-12.2 GHz (space-to-Earth) and 14.0-14.5 GHz (Earth-to-space).

- CITEL PCC.II Recommendation under development (CCP.II-RADIO/doc. 4265/17 rev.2)



## Connecting the Unconnected

The ability to seamlessly communicate with anyone, anywhere is an expectation

Yet, the physical and financial constraints of traditional networks have left more than 60% of the world's population unconnected

The promise of ubiquitous, affordable access to all requires a new approach which the satellite industry is addressing



# The Way Forward

## Accessible and Efficient High Speed Connectivity

**Deliver More Bits**

**Performance**

**Economics**

**Accessibility**



Thank You!



**INTELSAT.**

*Envision. Connect. Transform.*