LEO X GEO = Innovation Squared

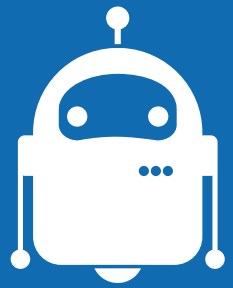
Amy Kemp | Intelsat

17 October 2018

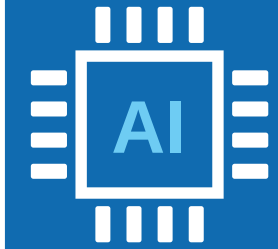
Photo courtesy of Scripps Institution of Oceanography, UCSD

The fourth industrial revolution on the horizon

Autonomous Vehicles



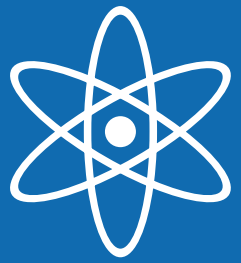
Robotics



Artificial Intelligence

> "A fusion of technologies that is blurring the lines between the physical, digital and biological spheres"

Biotechnology



Quantum Computing

Energy storage

?

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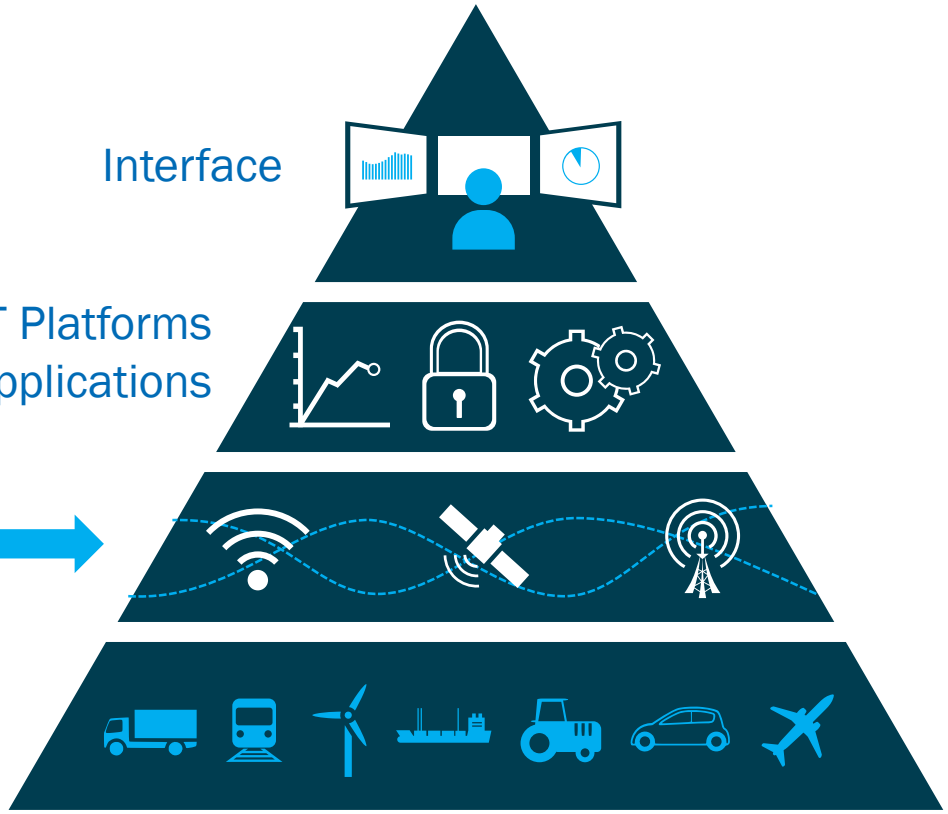
Intelsat Innovation Strategy

We need a new approach to build the **networks of tomorrow**



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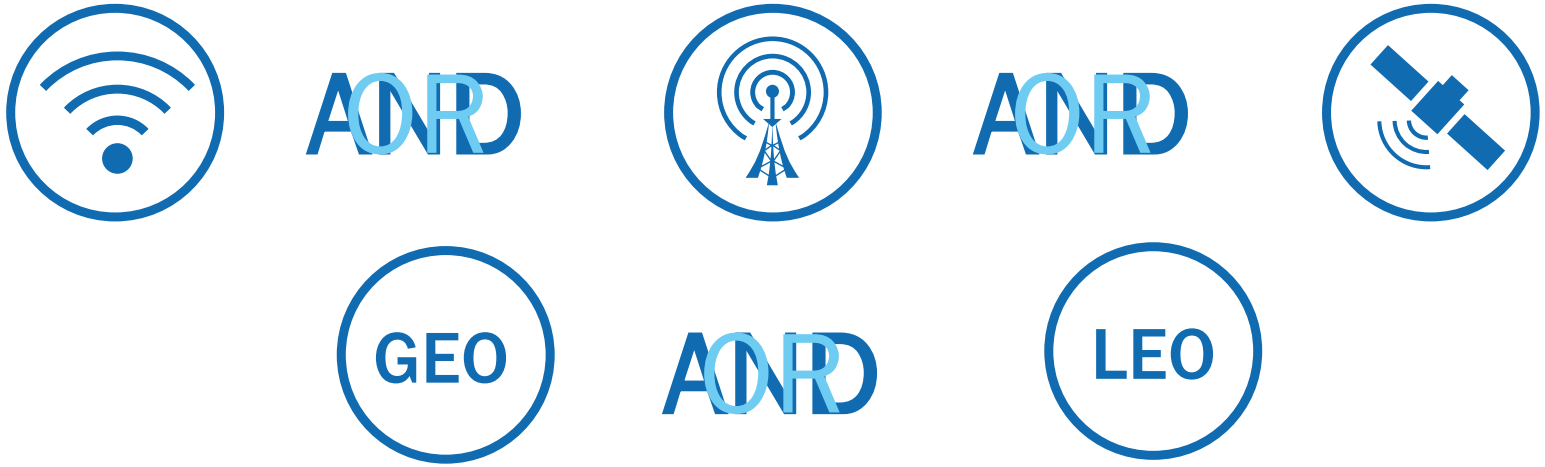
Mindset must change: big challenges require many solutions



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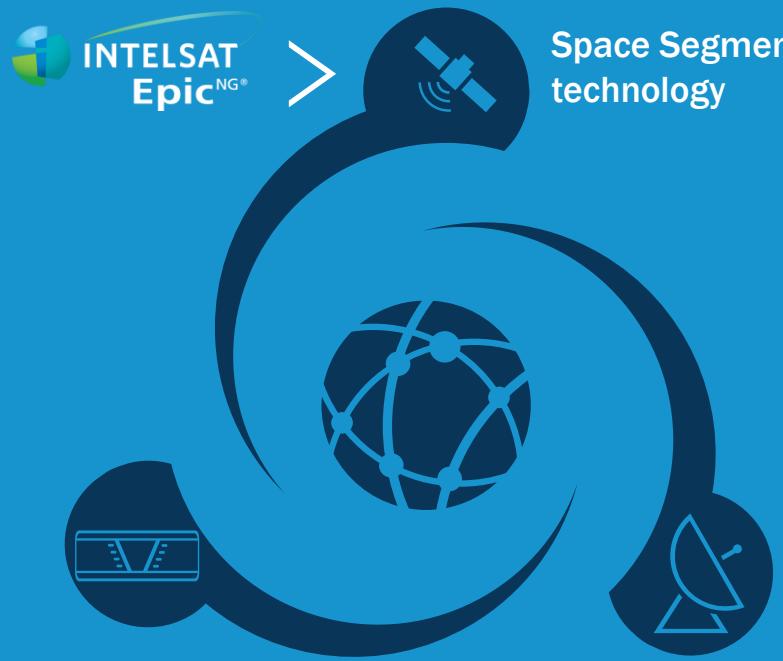
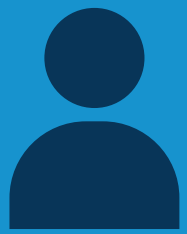
Two-step transformation

Transform technology



Transform network integration



End-customers

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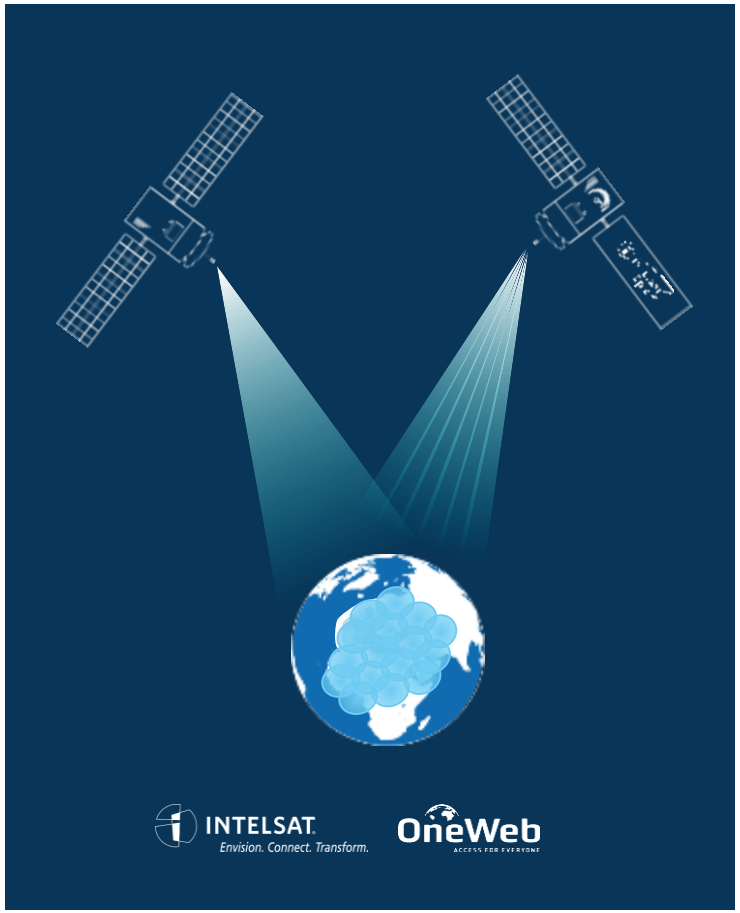
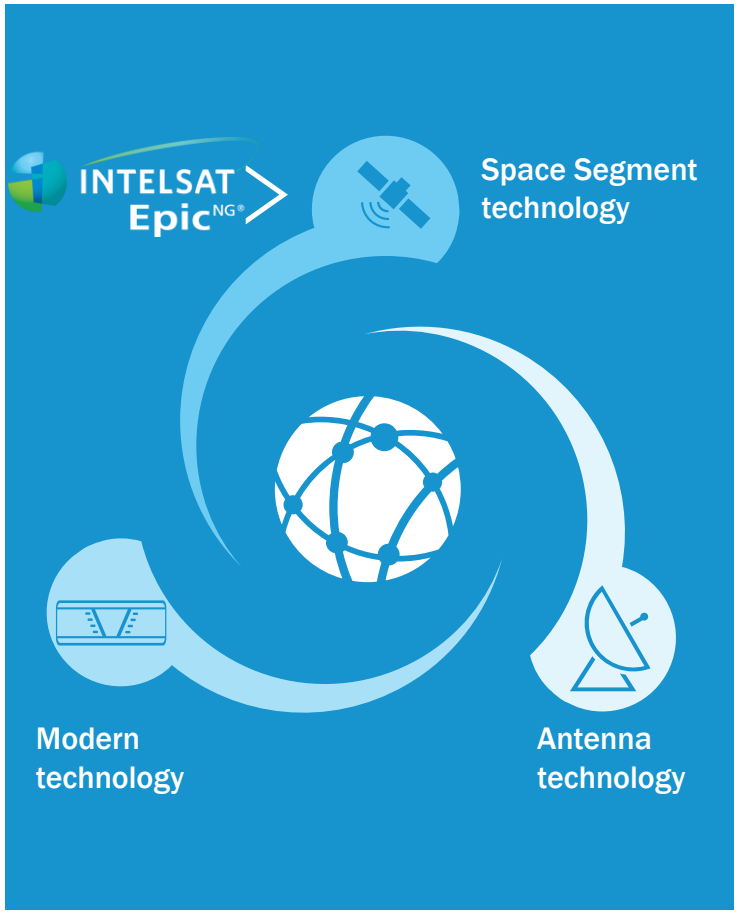
Innovation and disruption come hand in hand

Space race

Satellite innovation



Ecosystem innovation



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The disruptors in a space industry worth >$300bn

planet.
See Change.
Change the World.

In Feb 2017, Planet launched 88 Dove satellites into orbit – the largest fleet of satellites to be launched in history; and then another 48 in Jul 2017.

With over 200 Earth observation satellites, Planet Labs now operates the largest satellite constellation.

ROCKET LAB

Rocket Lab is the only rocket firm in the world with its own launch complex (on North Island's Mahia Peninsula).

The Electron satellite test program launched 3 shoe-boxed satellites in Jan 2018, and projected to cost <$5 million per launch.

Virgin ORBIT

Virgin Orbit will launch small satellites using its LauncherOne orbital launch vehicle.

Essentially LauncherOne is a Boeing 747-400 airplane designed to hold a rocket under its wing. Once it reaches an altitude of ~35,000 feet, the rocket would be fired into space.

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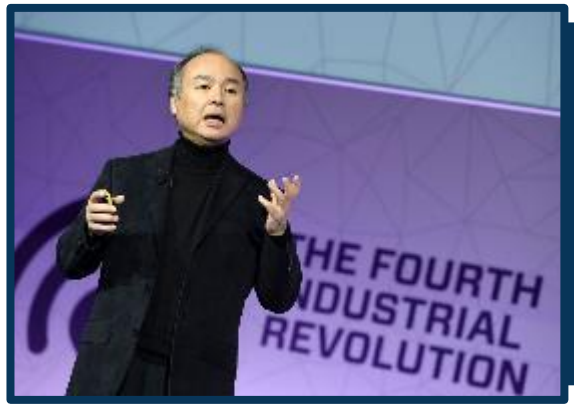
Internet giants turned space entrepreneurs

In 2015, Google and Fidelity invested $1 billion in SpaceX

Larry Page



Softbank to invest over $1 billion in OneWeb

Masayoshi Son

SpaceX
- Commercial launch services
- Mars Colony Plan

Elon Musk

Facebook launching rural internet access via satellite for Latin America

Mark Zuckerberg

Virgin Orbit
- Small satellites

Virgin Galactic
- Space tourists

First round investor of OneWeb

Richard Branson

Owns Blue Origin
- Private spaceflight services & science missions

Jeff Bezos

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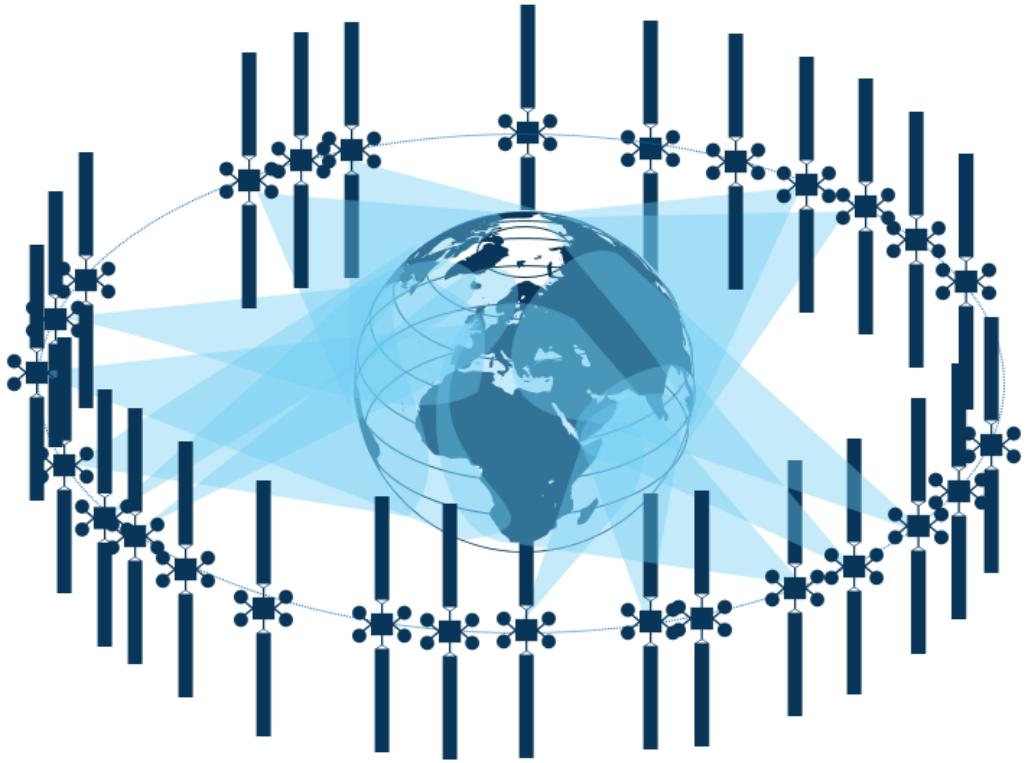
Largest collection of orbital slots in most valuable C and Ku spectrum bands

Multi-layer resilient infrastructure



Adding 6 Epic^{NG} HTS-satellites covering high-density areas

INTELSAT

LEO X GEO

=

INNOVATION SQUARED

INTELSAT®

Envision. Connect. Transform.

OneWeb

ACCESS FOR EVERYONE

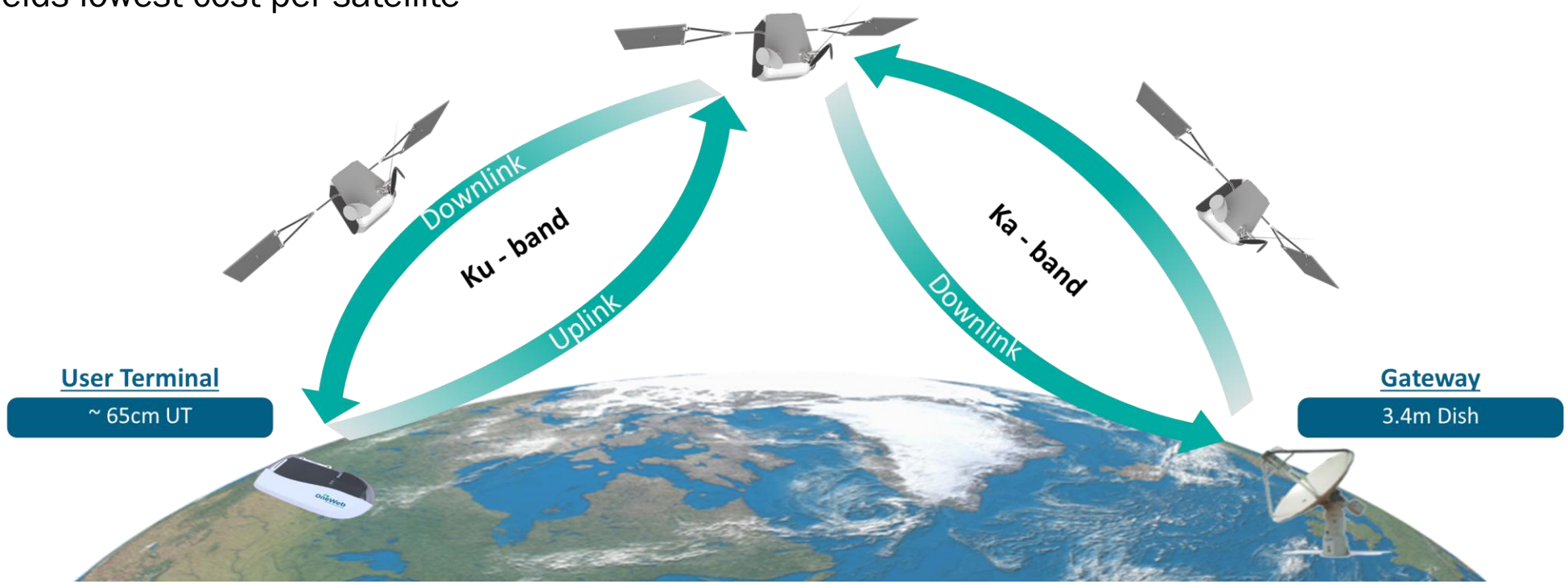
OneWeb system overview

Constellation

- 18 orbital planes; multiple satellites per plane
- Innovative beam technology
- World's only high volume satellite production yields lowest cost per satellite

Ground

- Affordable, compact, multi-user access terminals
- Easily installable without position aiming
- 40+ gateways across the globe



The OneWeb satellite constellation

First and only fully global, pole-to-pole high throughput satellite system

- High capacity:
- >7 Tbps
- Up to 882 LEO satellites
  (Full constellation: 18 planes of 49 satellites)
- Inclination 87.9°
- Low latency < 50ms round trip delay
- Small terminals ~30-65cm
- Altitude 1,200km

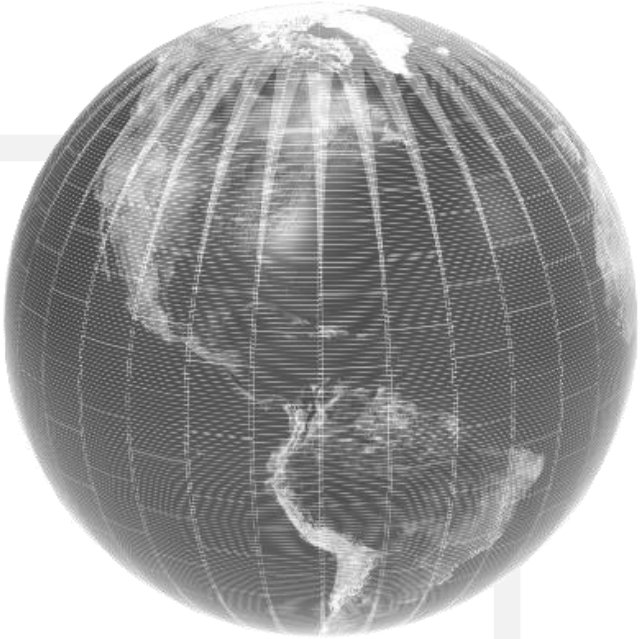
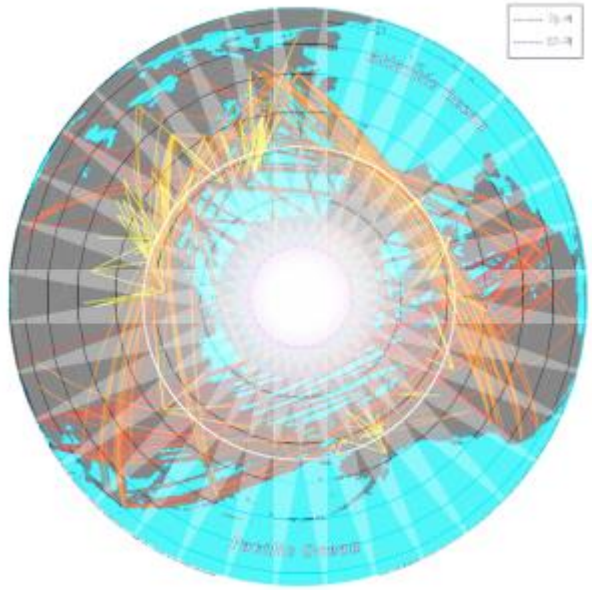


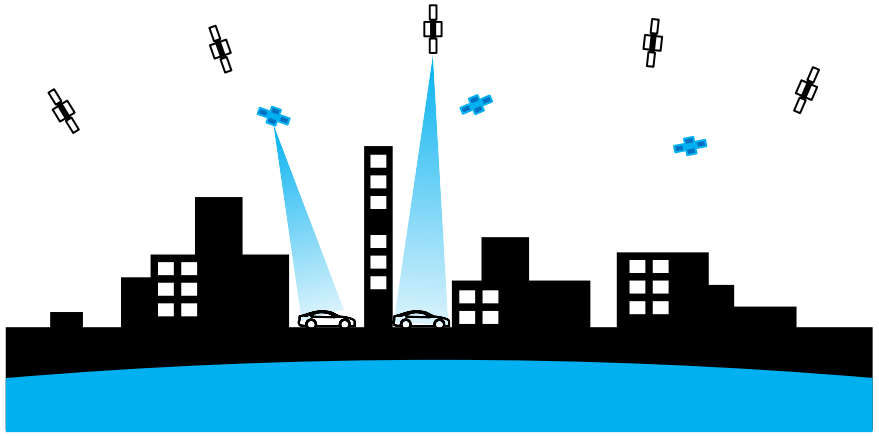
Image credit: OneWeb

OneWeb will complement our current capabilities

LEO adding coverage at the poles



More line of sight options



Source: Mia Bennett / Cryopolitics

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OneWeb system: constellation

Up to 18 planes of 36 satellites to initiate service in 2021

Innovative beam technology

Small, inexpensive satellites using existing technologies

Polar coverage

The OneWeb System is becoming REALITY

TT&C Antenna Installation in Inuvik, Canada

Florida Satellite Production Facility Construction

Inuvik, Canada TT&C -- Northern Lights

Toulouse Satellite Production Facility Underway

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GEO

Wide beams
HTS overlay for high density areas
Global Coverage

Premium Spectrum

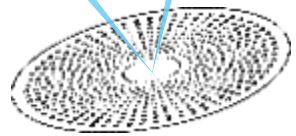
Ku-band

Flexible high-performance Interoperable User terminals

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

LEO

ESA
Electronically Steered Arrays



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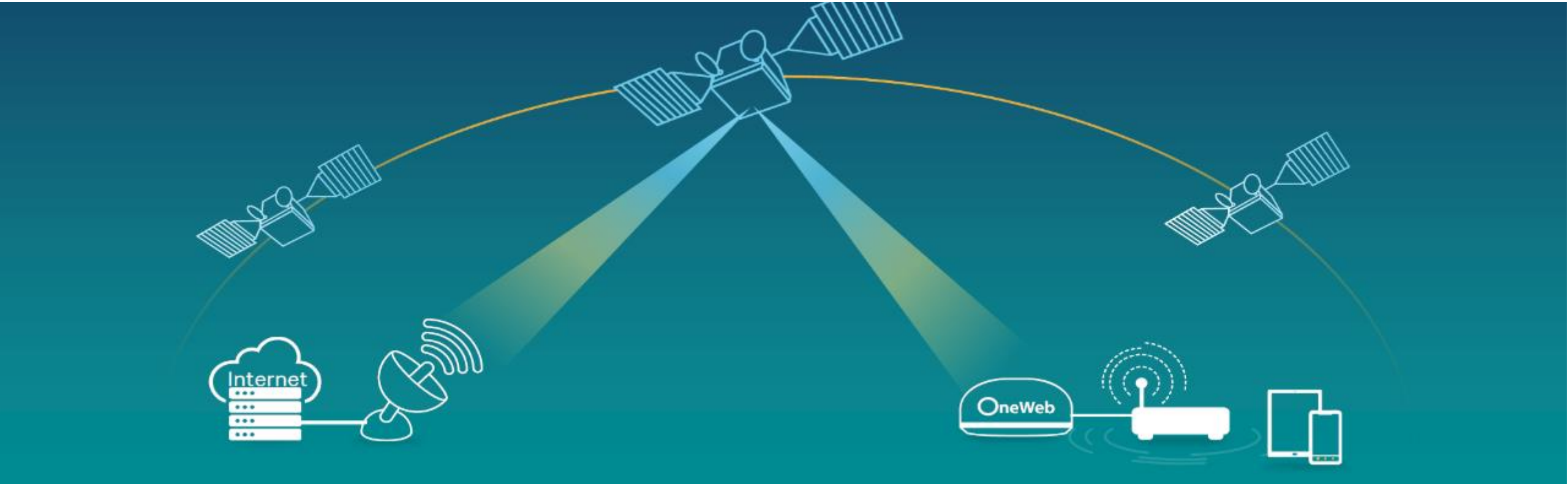

Why Intelsat and OneWeb?

The two global Ku-band constellations on different orbital planes are complementary.

Interoperability allows dynamic access to both the Intelsat and OneWeb constellations from a single integrated satellite terminal.

Synergies enabled by a larger and richer ecosystem around Ku-band for enterprise & carrier-grade solutions.

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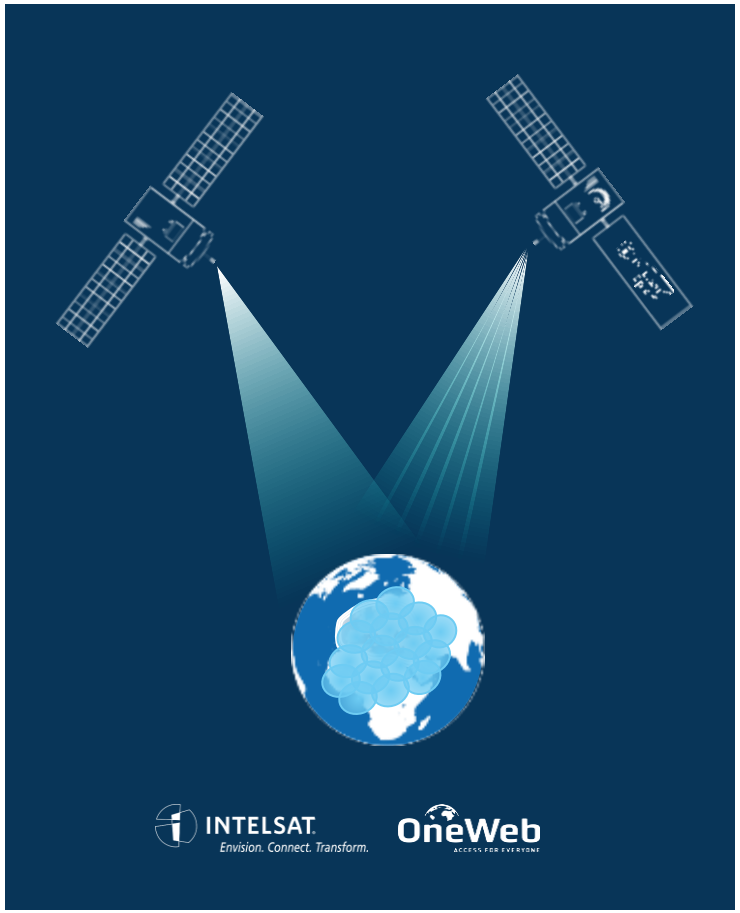
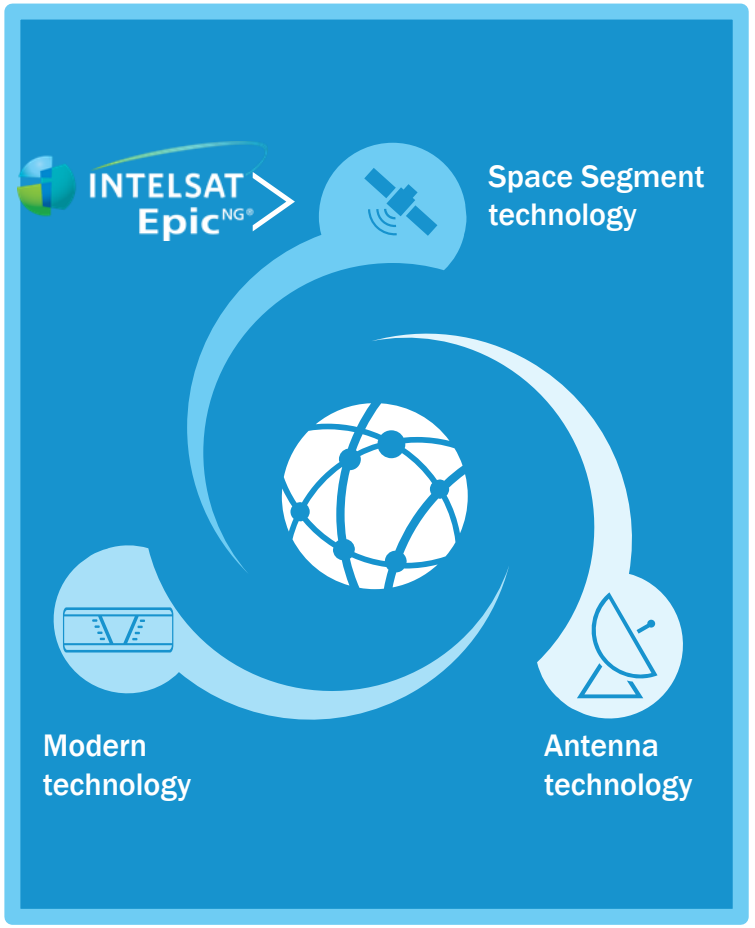
Innovation and disruption come hand in hand

Space race

Satellite innovation



Ecosystem innovation



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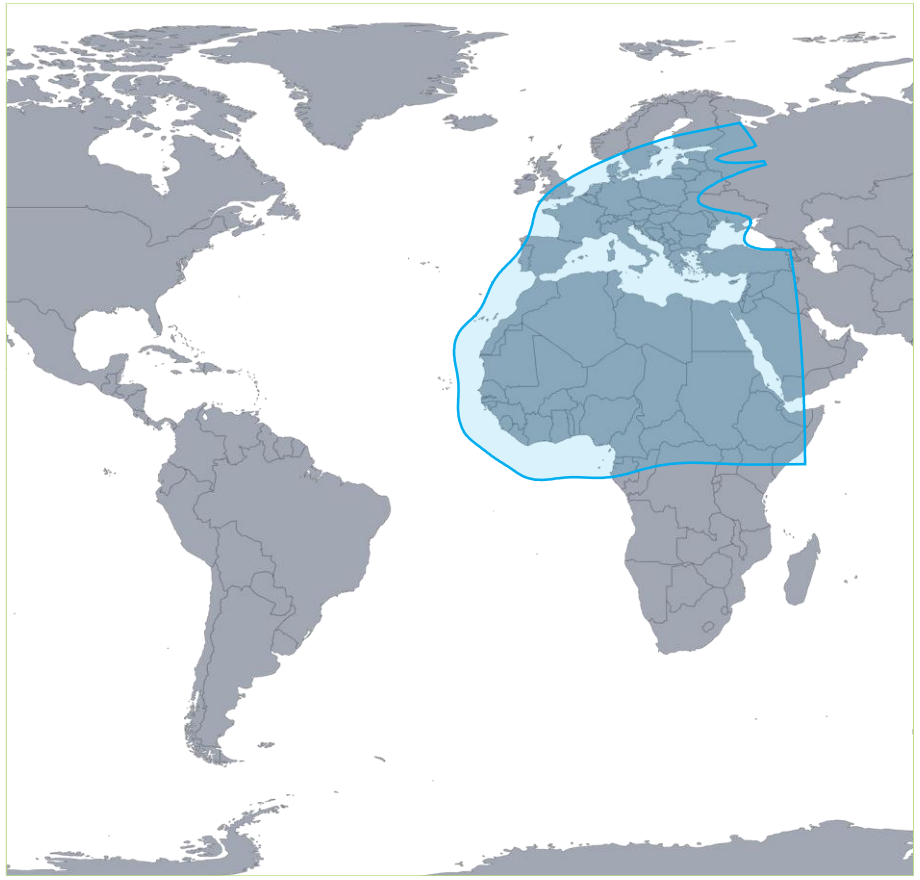
What is Epic about Intelsat Epic^{NG}?

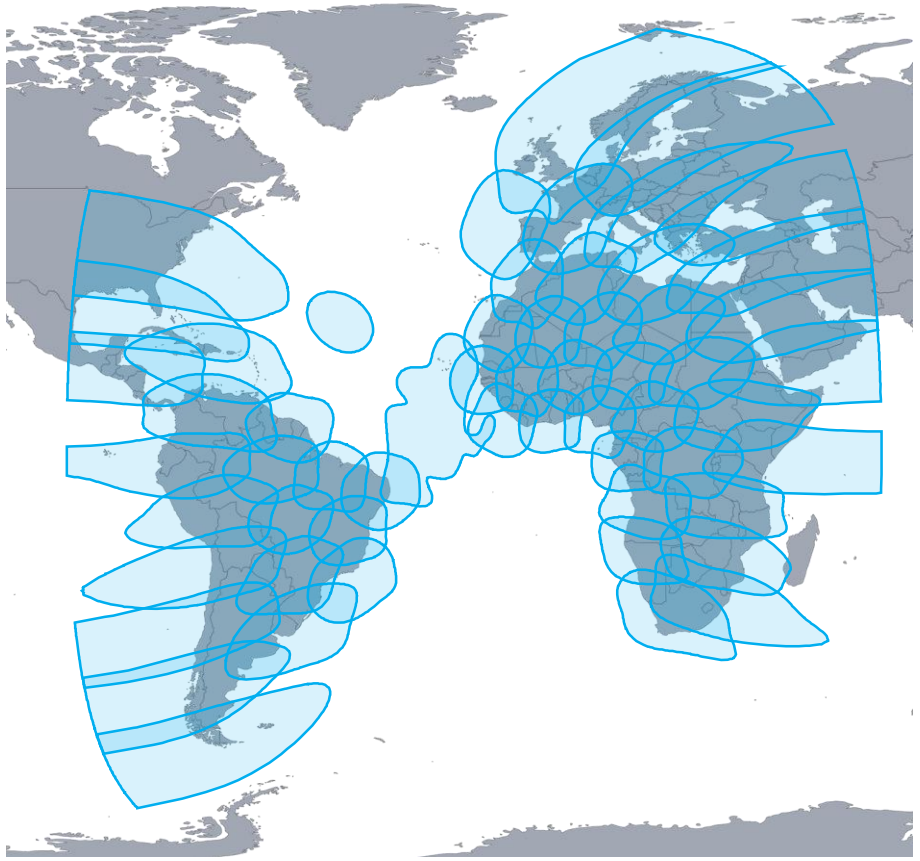
Successful launch of Horizons 3e on 25th September

Defining high throughput satellites from wide beams to spot beams



Modern wide beam

AND



High throughput spot beams

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The impact of closed architecture on performance

- Ka-band HTS systems which are managed or shared have a closed architecture
- A closed architecture requires that all ground terminals use common equipment. Each closed HTS service is based upon a single platform and all terminals must use that platform.
- Thus, the customer is locked into this proprietary system and cannot easily take advantage of future modem technology improvements until the satellite operator is ready to upgrade their entire platform.

Intelsat Epic^{NG} results

Increased link margins, increased spectral efficiency and/or higher Mbps throughput

With Deployed Hardware

165%

Increase

With New Generation Modems

Up to

330%

Increase

INTELSAT

Intelsat Epic^{NG} furthers our vision to make satellite easier to access

OPEN: Remain independent from technology and satellite vendors

SCALABLE: Make your network more and more capable over-time

DIGITAL: Reach a whole new level of control and flexibility

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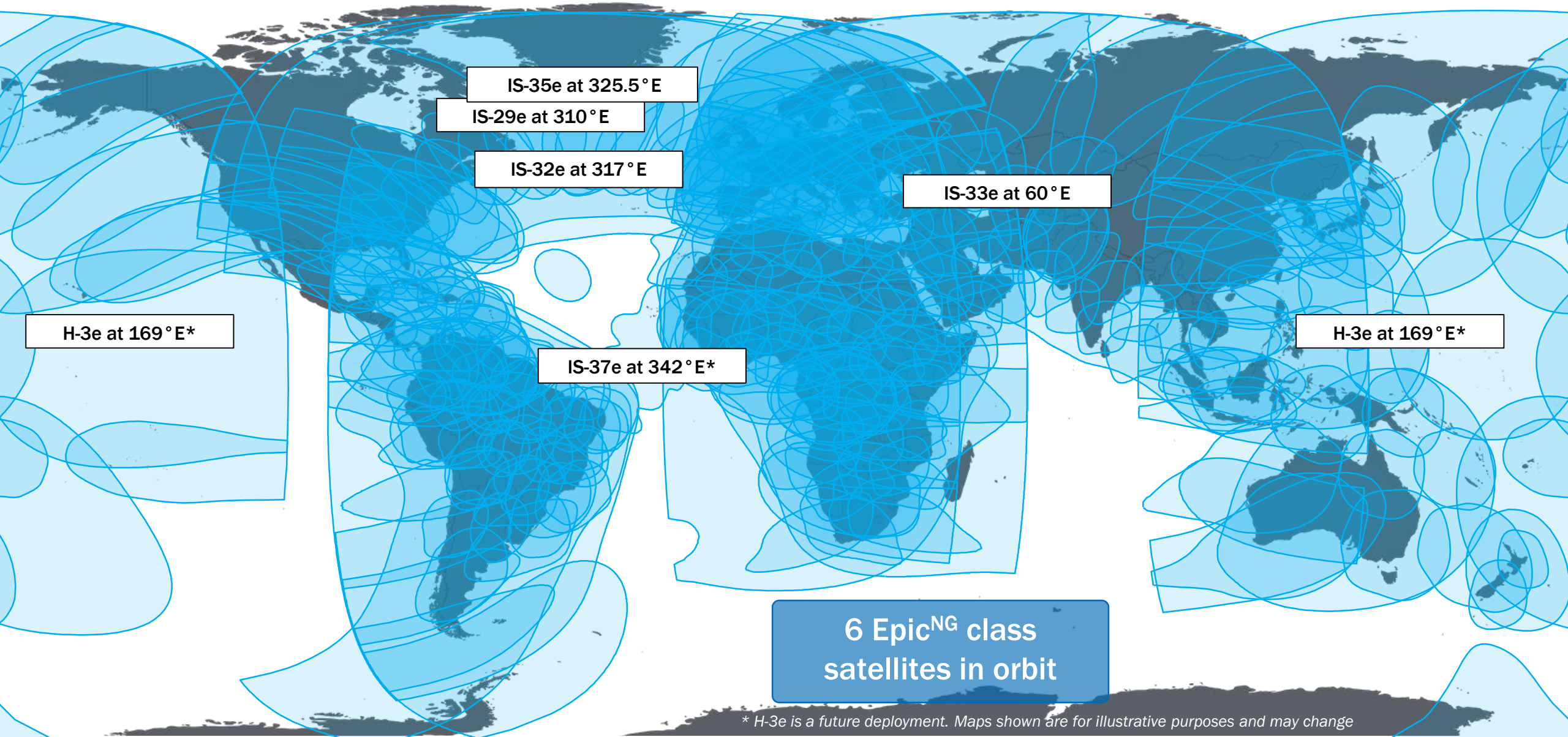
Intelsat Epic^{NG} satellites



** H-3e is a future deployment. Maps shown are for illustrative purposes and may change*

Intelsat's next generation fleet plan

Satellite	Location	2016	2017	2018	2019	2020
Intelsat 29e	310°E	Launched on 27 January 2016				
Intelsat 31	95°W	Launched on 9 June 2016				
Intelsat 33e	60°E	Launched on 24 August 2016				
Intelsat 36	68.5°E	Launched on 24 August 2016				
Intelsat 32e	316.9°W	Launched on 14 February 2017				
Intelsat 35e	325.5°E	Launched on 5 July 2017				
Intelsat 37e	342°E	Launched on 29 September 2017				
Intelsat 38	45°W	Launched on 25 September 2018				
Horizons 3e	169°E	Launched on 25 September 2018				
Intelsat 39	62°E	2019				

6 INTELSAT Epic NG satellites

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What is different about Intelsat Epic^{NG}?

- Global coverage
- Multiple satellites layered: redundancy & scalability
- Wide & spot beams combined
- Multi-frequency
- Connectivity between all beams
- Open architecture
- Guaranteed bandwidth

Other HTS Systems

- Often limited (regional) coverage
- Single HTS satellite in given region
- Spot beams only
- Single frequency band
- Fixed (user beam to GW only)
- Designed for consumer services
- Best effort bandwidth

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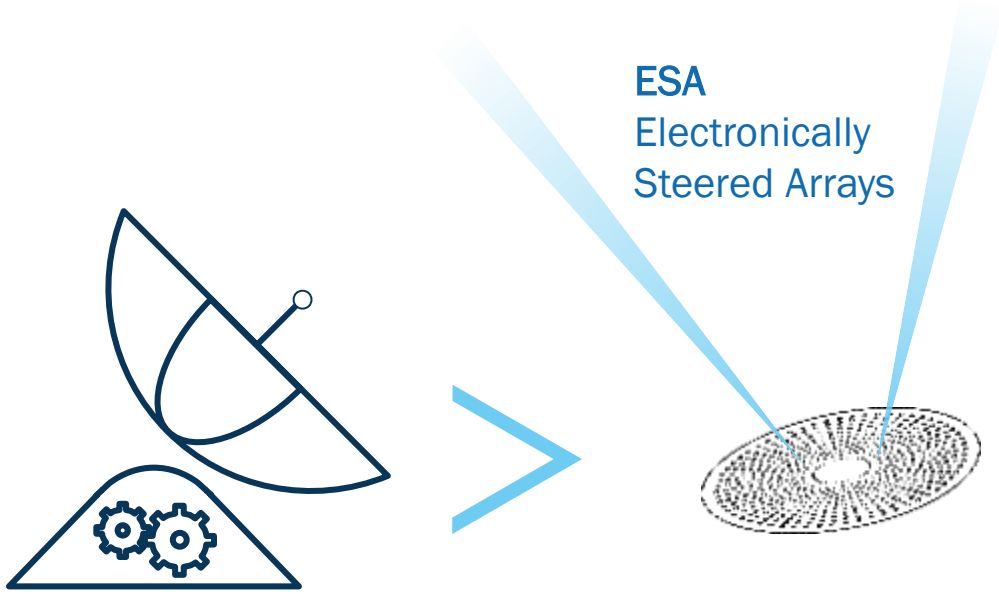
Antenna technology is evolving



ESA
Electronically Steered Arrays

- Smaller
- Thinner
- Lighter
- No moving parts
- Auto-acquiring
- Self provisioning
- Access to multiple satellites

KYMETA™

- Metamaterial
- Passive array

PHASOR SOLUTIONS

- Active phased array

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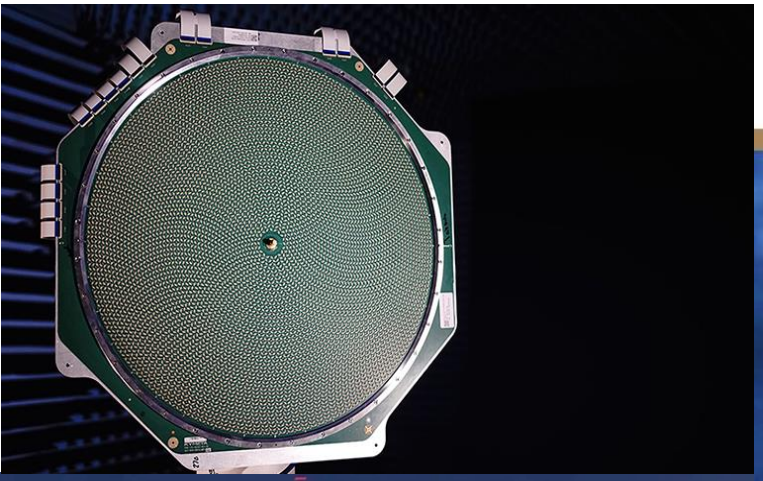
Intelsat and Kymeta

Changing how satellites are accessed



KYMETA

CURRENT

KYMETA NEWS | UPCOMING E

‹ BACK TO KYMETA NEWS

Kymeta and Intelsat Announce KĀLO™, a New Service to Revolutionize How Satellite Services Are Purchased

Kymeta's KĀLO redefines satellite connectivity with services purchased in familiar, flexible data packages combined with radical pay-for-what-you-use pricing. KĀLO to leverage Intelsat's IntelsatOne® Flex managed services platform and address the

Intelsat Buys Equity Stake in Kymeta; Stephen Spengler Joins Antenna Manufacturer's Board

Anna Forrester | March 8, 2017 | M&A Activity, News | 112 Views

Intelsat has purchased an equity stake in satellite communications antenna manufacturer **Kymeta** following joint efforts to develop the *Kalo* satellite services and *mTenna* antenna technology.

The satellite operator said Tuesday the transaction comes with the appointment of Intelsat CEO Stephen Spengler into Kymeta's board of directors.

"The demand for fast, reliable broadband connectivity requires innovation in-orbit and across the entire satellite ecosystem to unlock new growth opportunities," said Spengler.

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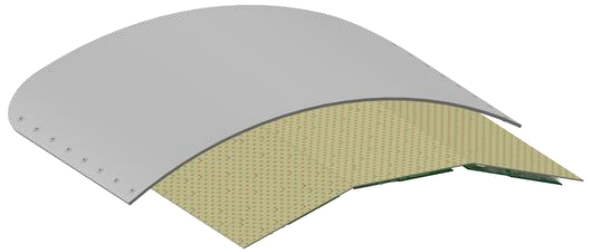
For the connected ship, plane, and car



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Intelsat brings it all together

- **One network**
  - Global Ku-band
  - Multi-Layer
  - Multi-Orbit
- **Simple access**
  - Range of terminals
  - Tailored for each vertical

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Thank you

Amy Kemp

amy.kemp@intelsat.com

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