



Broadband & Mobility from Space

Connecting the future

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Leader in L-band MSS

Inmarsat-3

- GMDSS (Global Maritime Distress and Safety System)
- Aero safety



Inmarsat-4

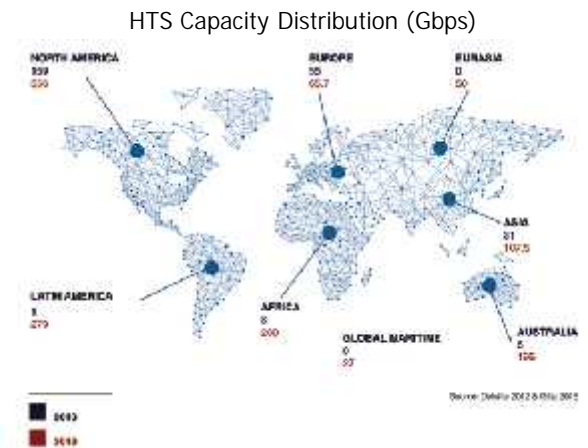
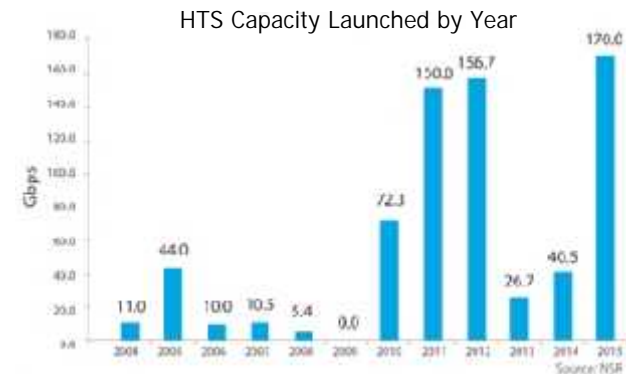
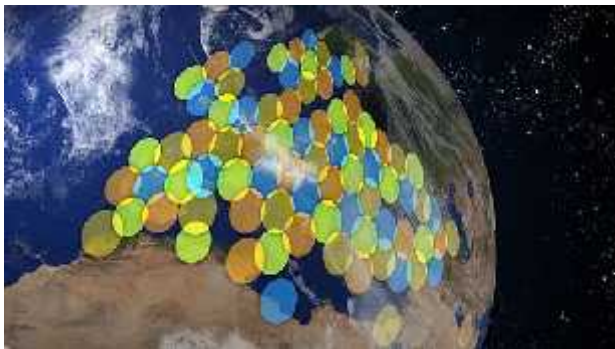
- Broadband data (BGAN – SBB - FBB)
- High quality voice
- Into 2020s



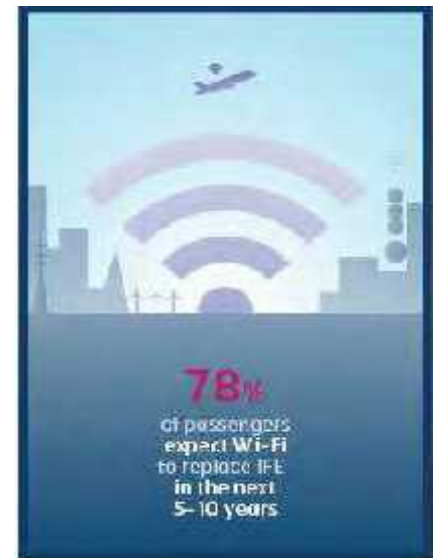
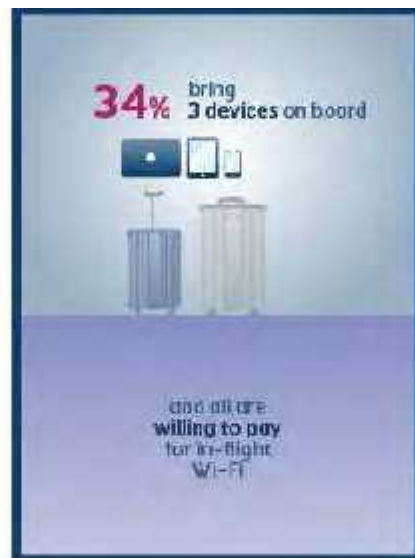
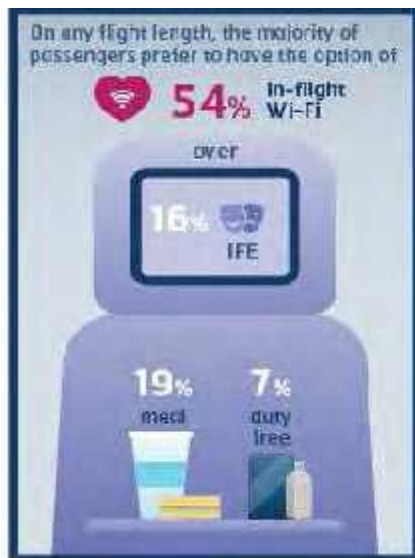
Broadband Satellite Communications

Increasing Demand

- Increase in bandwidth hungry media streaming services
- Migration to cloud based applications requiring connectivity
- Global bandwidth consumption doubling every 2 or 3 years
- Growth in expectations for in-flight passenger connectivity



Passenger demand for in-flight connectivity (IFC) is only going UP



>80% of passengers would opt for an airline with IFC than one without

Internet of Everywhere: a new vision for extending the reach of the IOT

Satellite technology: a key enabler for the IOT across industries and geographical borders

Infinity of applications wherever terrestrial network non existent/viable:

Remotes sites/Remote sensing

Transport

Offshore

Safety and security/ civil protection

Smartgrids

+ Maritime & Aviation!

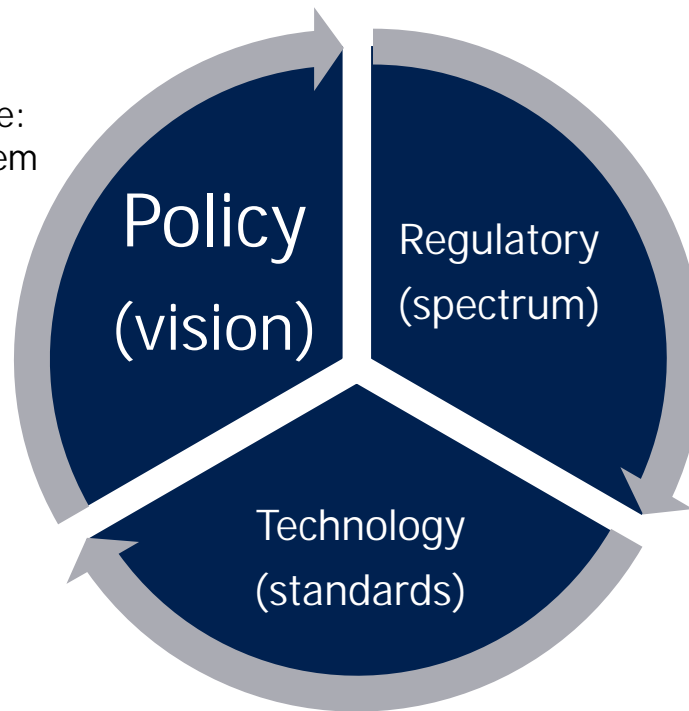


New era with a key role for satellites and this is just the beginning.....



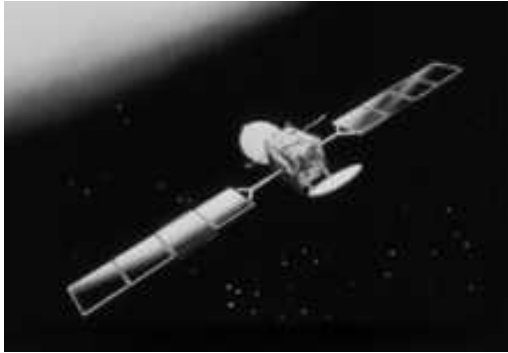
The role of satellites

Satellite:
integral part of the ecosystem

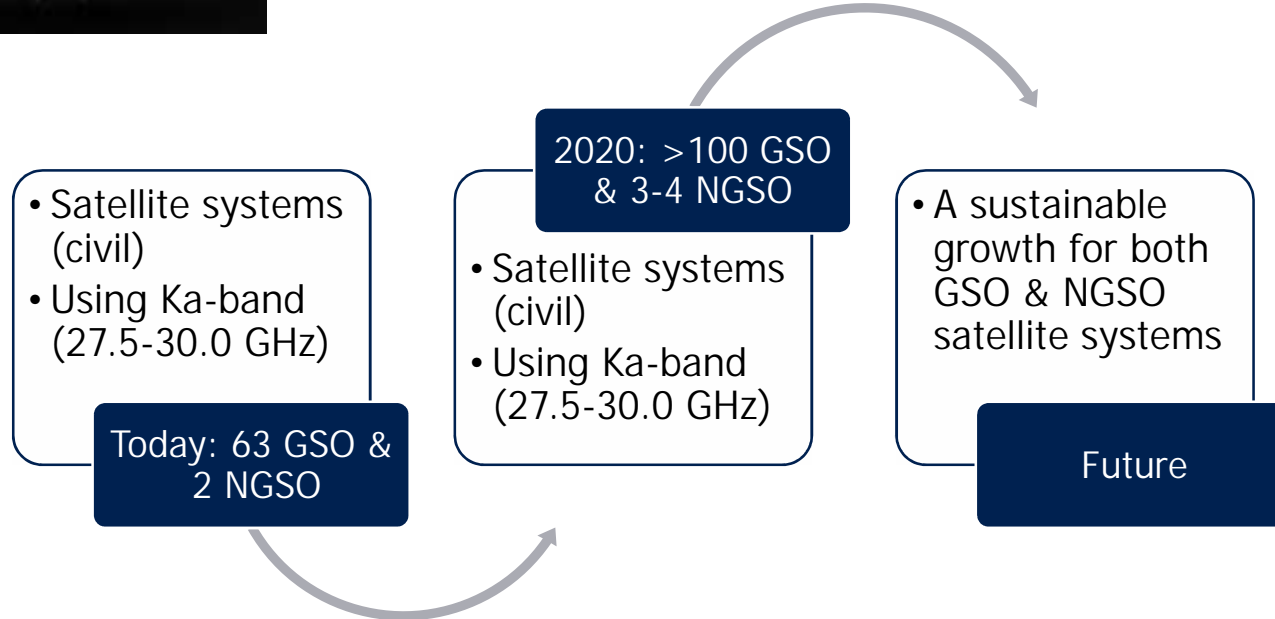


Satellite & terrestrial spectrum:
win-win solution

Satellite integration into the service & application platform



THE CONTINUED GROWTH OF SATELLITE INDUSTRY INCLUDING OF KA-BAND SATELLITE SYSTEMS





Global Xpress

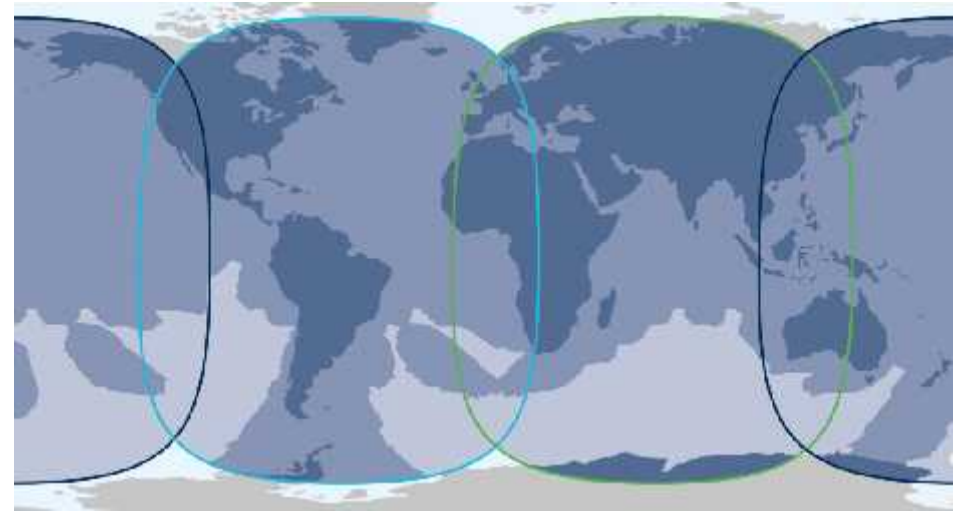
ESIMs (Earth Stations In Motion)



Global Xpress

First global Ka-band satellite system

- Operational system
- Scalable technology
 - Additional satellites (5F4, 16)
- High availability & reliability
 - Mature, proven technology
- Wide range of terminals available
- Wide range of service plans
- And applications

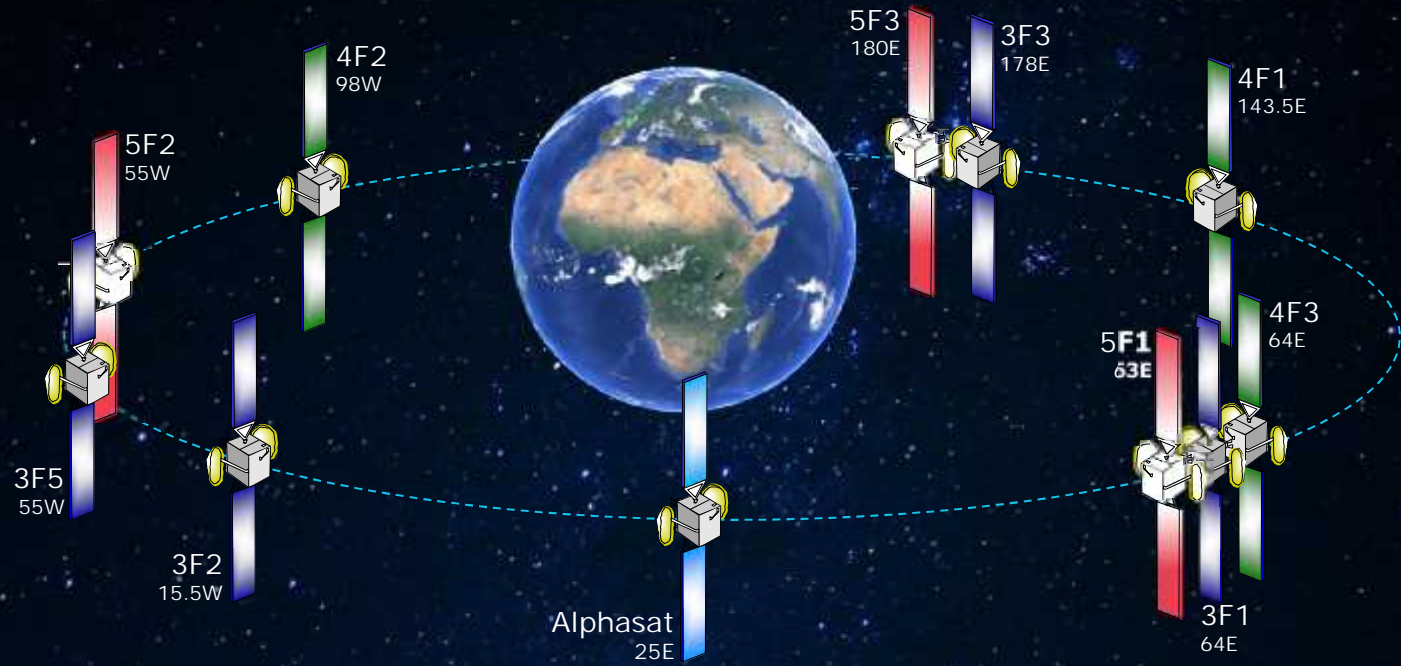


ESIMs
Earth Stations In Motion
(rx 19.7-20.2 - tx 29.5-30GHz)



Current Inmarsat Fleet

...and more to come!





Integrated MSS-MS systems

Broadband connectivity to aviation



European Aviation Network

The scalable answer to high density traffic



4G LTE network technology – CGC

- > Complementary Ground Component (CGC)
- > 30MHz (2x 15MHz) contiguous S-band spectrum across the European Union
- > High performance, high efficiency, high capacity

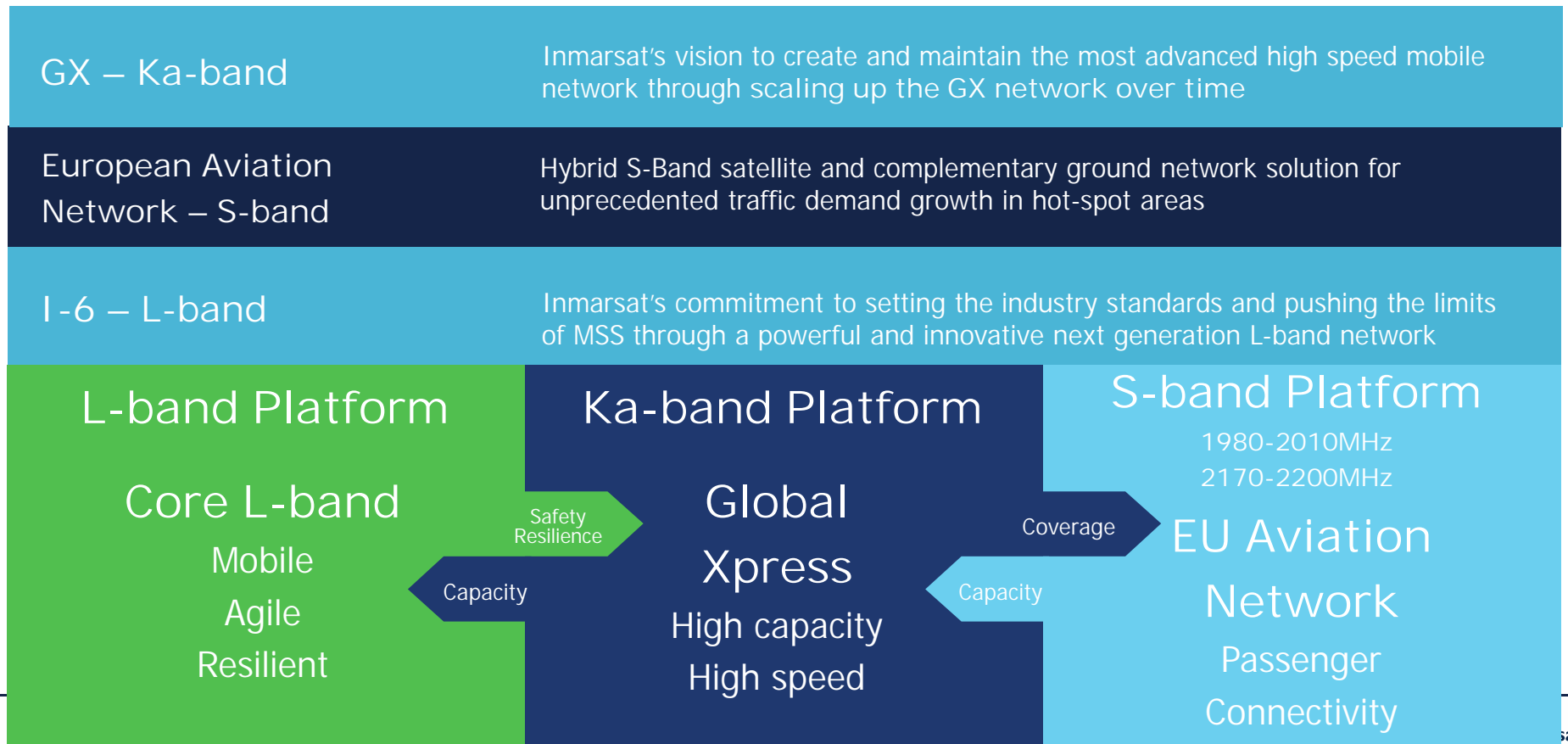
Integrated with the Europasat MSS S-band satellite

Superior passenger experience thanks to high throughput, capacity and low latency

- > Overall network capacity up to 36Gbps to aircraft
- > Low latency (40ms)
- > Cell densification and sectorisation will deliver capacity growth

Inmarsat- the future: driving mobile Satcom

Successful innovation building sustained differentiation and value in the marketplace





Next generation of Inmarsat satellites

Inmarsat-6



Inmarsat 6

Space for the future



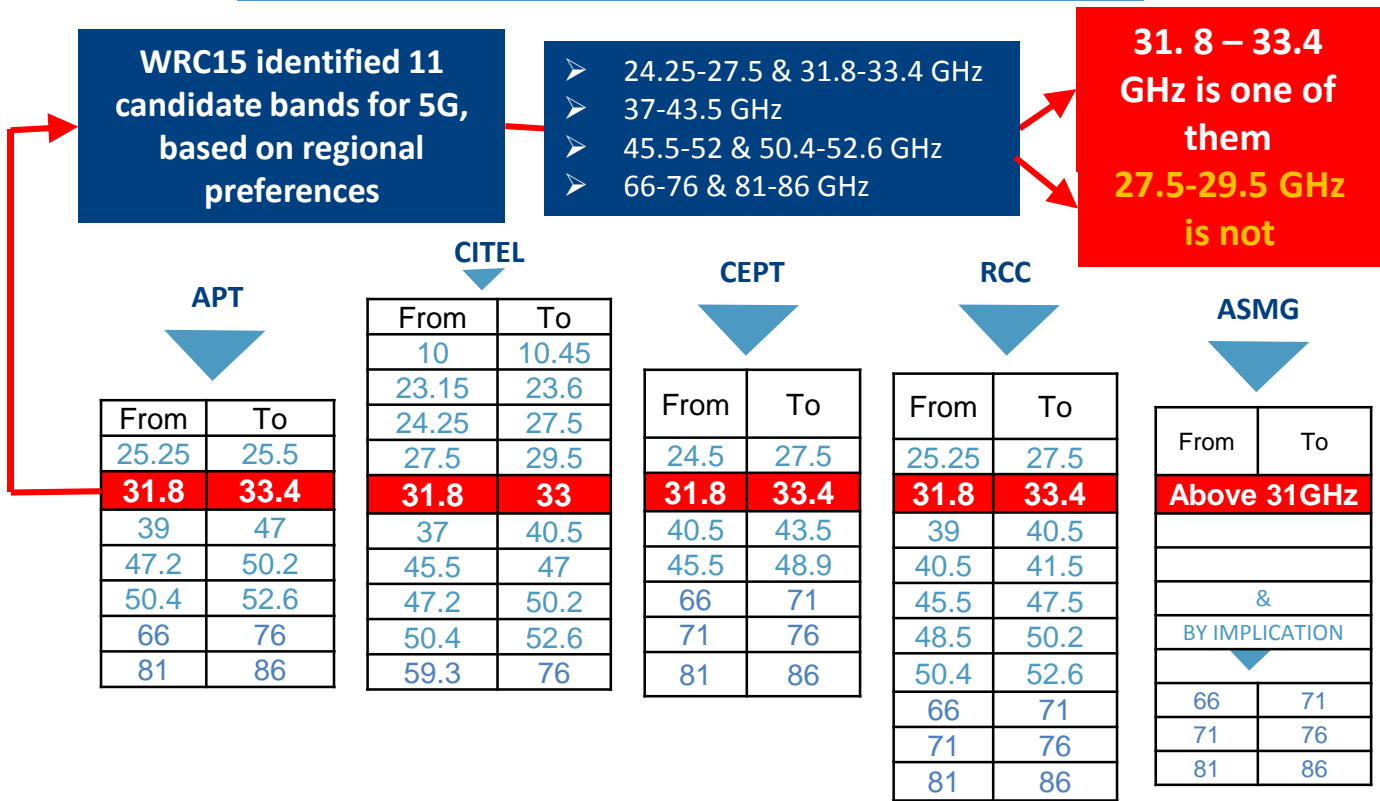
- Advanced L-band services and Ka-band expansion
- First satellite I-6 F1 to be delivered by 2020 and designed to remain in service at least 15 years
- I-6 will be fully electrical, requiring no chemical propulsion which will increase the L-band processing power and provide for the Ka-band payload capacity
- Feeder links in Q/V Band:
 - Releases Ka spectrum for user link
 - Very narrow beamwidth; therefore high link margin
 - Developing technology to cope with high atmospheric losses

Finding 5G / IMT-2020 Spectrum at ITU WRC-19 A Constructive Path Forward

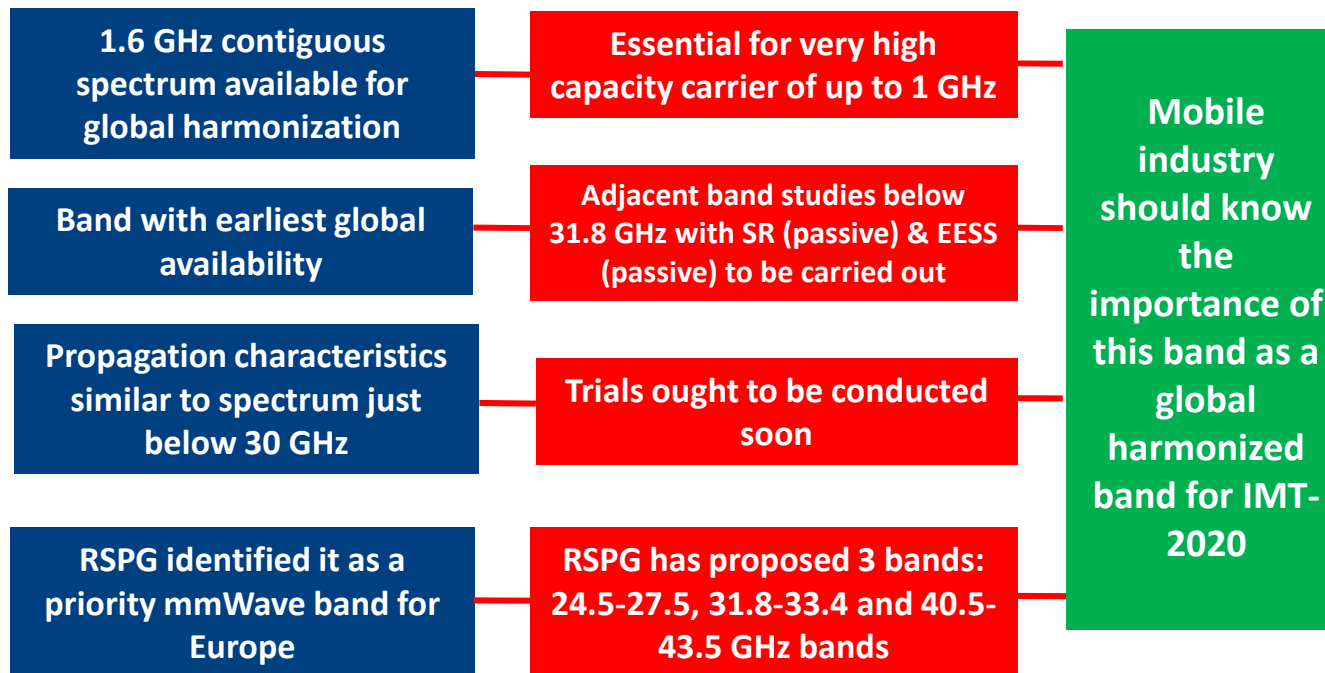
www.esoa.net

1. 5G/IMT can be realistically developed as below:
 - ◆ Phase 1 By 2018-2020: **5G networks /devices in cm wave frequencies below 6GHz**
 - ◆ existing identified IMT bands for 5G/IMT
 - ◆ refarming existing 2G/3G/4G bands
 - ◆ Phase 2 By 2023-2025: **5G networks / devices in mm wave frequencies above 31 GHz**
 - ◆ in particular 31.8 – 33.4 GHz
 - ◆ above 66 GHz
2. 5G/IMT services can be effectively deployed using multi-band radios in 5G devices

Why the 32 GHz band has been supported



Why the 32 GHz band is a very good solution



- ◆ **While 32 GHz band is a good solution, alternative frequency bands also have merit & should be considered**
- ◆ **The 66 - 76 GHz range & the 81 – 86 GHz range for 5G will present viable alternatives :**
 - ❖ Chipset manufacturers are already making devices in these ranges – 180M WiGiG devices will be shipped in 2017!
 - ❖ WiGiG is already being deployed in 61 GHz & by Samsung!
 - ❖ The oxygen absorption provides an inherent buffer from interference
 - ❖ Perfect for high density indoor use & near indoor use
 - ❖ Identified by WRC-2015 as candidate 5G/IMT band

- ◆ **Realistically mobile operators & manufacturers will rely & deploy using / reusing existing 3G/4G RF infrastructure in cmWaves**
 - ❖ Nokia/Ericsson/ Vodafone have done Gbps (high throughput) trials in cmWave bands that also **benefit from high coverage both indoor & outdoor**
 - ❖ Use of carrier aggregation in LTE already allows for > 1 Gbit/sec data rates to be supported

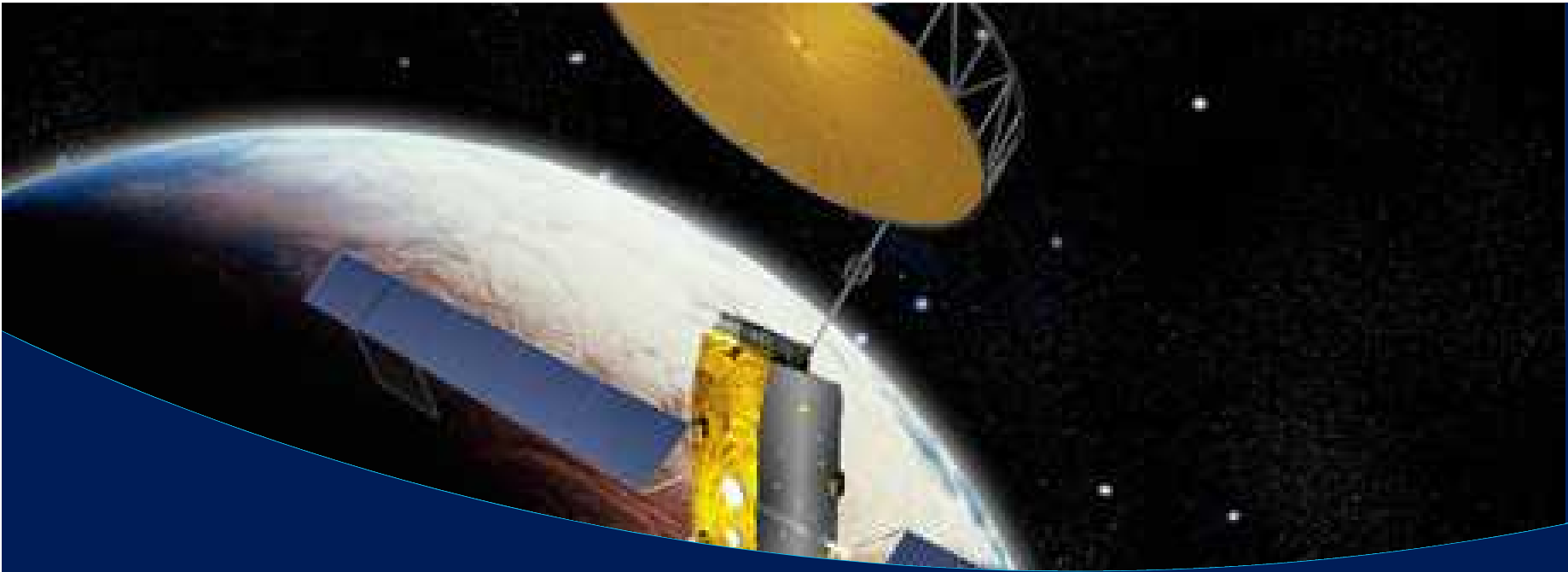
- ◆ **Mobile operators like Vodafone, Huawei & vendors like Samsung, QUALCOMM will look at mmwaves**
 - ❖ To deploy improved WiGIG devices for multiple Gbps for high density areas indoors (e.g. office, malls etc) & outdoors (e.g. stadiums, campuses etc)

REF: <http://mobileeurope.co.uk/press-wire/nokia-to-debut-5g-network-in-london>

<http://www.mobileeurope.co.uk/press-wire/vodafone-checks-out-70ghz-in-5g-field-trial>

FURTHER CONSIDERATIONS:

- ◆ **WiFi Off-Load was always a mitigating factor of IMT spectrum requirements, WiGiG strengthens the case for Off-Load**
- ◆ **Most mobile data consumption heavily VIDEO based**
- ◆ **Consumers do not want to pay MNOs for video consumption, where WiFi / WiGiG is available they WILL use it**



Thank you!