Mobile connectivity with HIBS

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SoftBank Corp. / HAPSMobile Inc.

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About SoftBank / HAPS Mobile

SoftBank

President and CEO | Ken Miyauchi

Business Activities
- Provision of mobile communications services
- Sale of mobile devices
- Provision of fixed-line telecommunications and ISP services

AeroVironment™

AeroViroment is an aircraft manufacturer which has been developing aircrafts for HAPS/HIBS use. Aerovironment has professional experiences to design and assemble aircrafts.

HAPS MOBILE

President and CEO | Junichi Miyakawa

Business Activities
- R&D, operation and management of HIBS and network devices
- Core network building, management and operation
- Business development using HIBS

Agenda

1. Why the world needs HIBS
2. HAPSMobile Activities
3. WRC-23 Agenda Item 1.4

HAPS MOBILE

1. Why the world needs HIBS

HIBS =

High Altitude IMT Base Stations

IMT: International Mobile Telecommunications

Technology Development

Mobile technology evolves every 10 years

3G

Text

Image

4G

Movie

HD

5G

4K

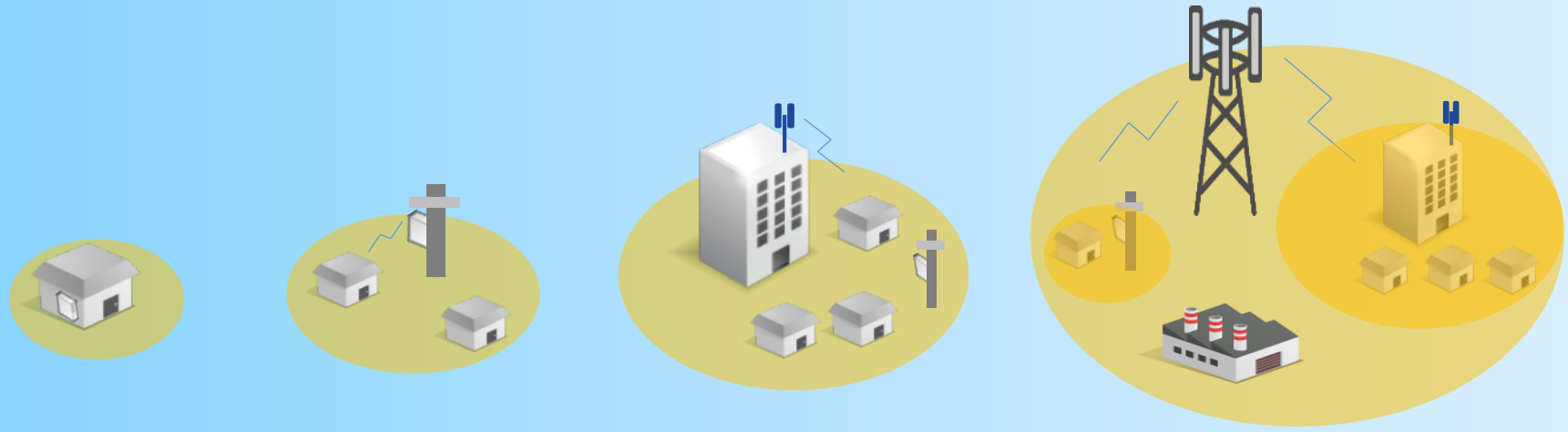
8K

2000s

2010s

2020s

Current Area Coverage Method



Picocell (indoor)

Microcell (hotspot)

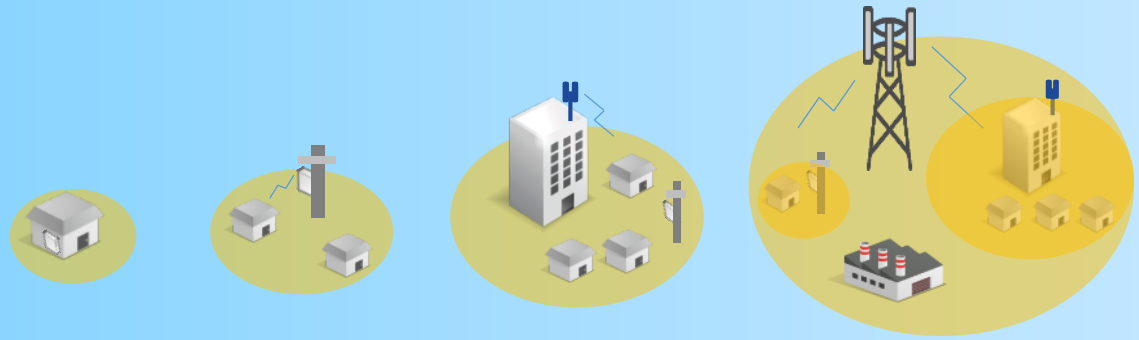
Macrocell (rooftop)

Wider Macrocell (tower)

There are **3.6 billion** people around the world without Internet access

SOURCE
・World Coverage Map from Agoop 9/1/2016 - 8/31/2017 (1-year)
・Plotting area where any OK log(LTE/3G/2G) is collected (including “Time Out”)

New Area Coverage Method Needed



Picocell (indoor)

Microcell (hotspot)

Macrocell (rooftop)

Wider Macrocell (tower)

Super Macrocell (・・・・)

Create New Generation with HIBS

GEO	LEO	HIBS
		
Altitude 36,000km	**600-1,200km**	**20km**

Create New Generation with HIBS

GEO	LEO	HIBS
		

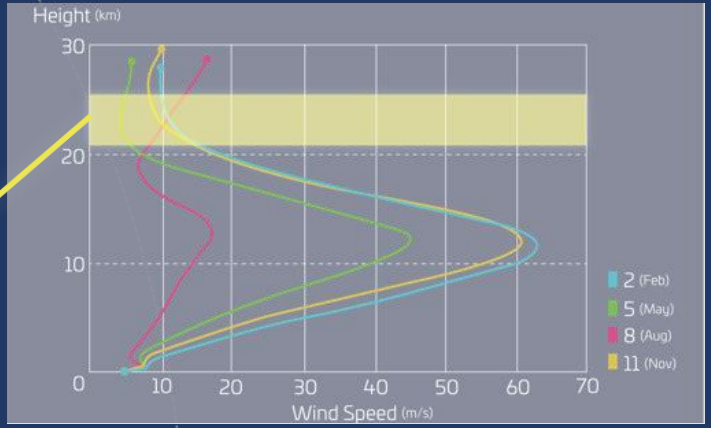
Direct communication with a regular user terminal is difficult due to the long distance

Altitude 36,000km	600-1,200km	**20km**

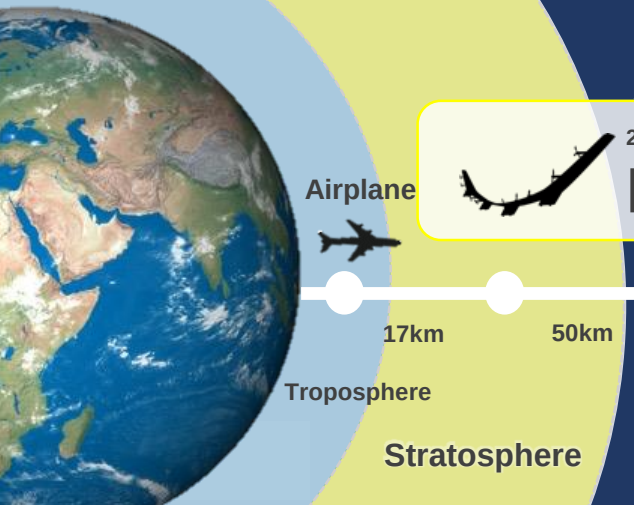
Provide Connectivity in Wide Areas from the Stratosphere

Why the Stratosphere?

1.Annual average wind speed: 5-15m/s
Capable of staying in the high altitude leveraging the stable air flow



2. Unexplored area
with no other flying objects like the artificial satellites



20km
HIBS

Airplane

LEO

MEO

GEO

17km

50km

~2,000km

2,000Km~36,000km

36,000km

Troposphere

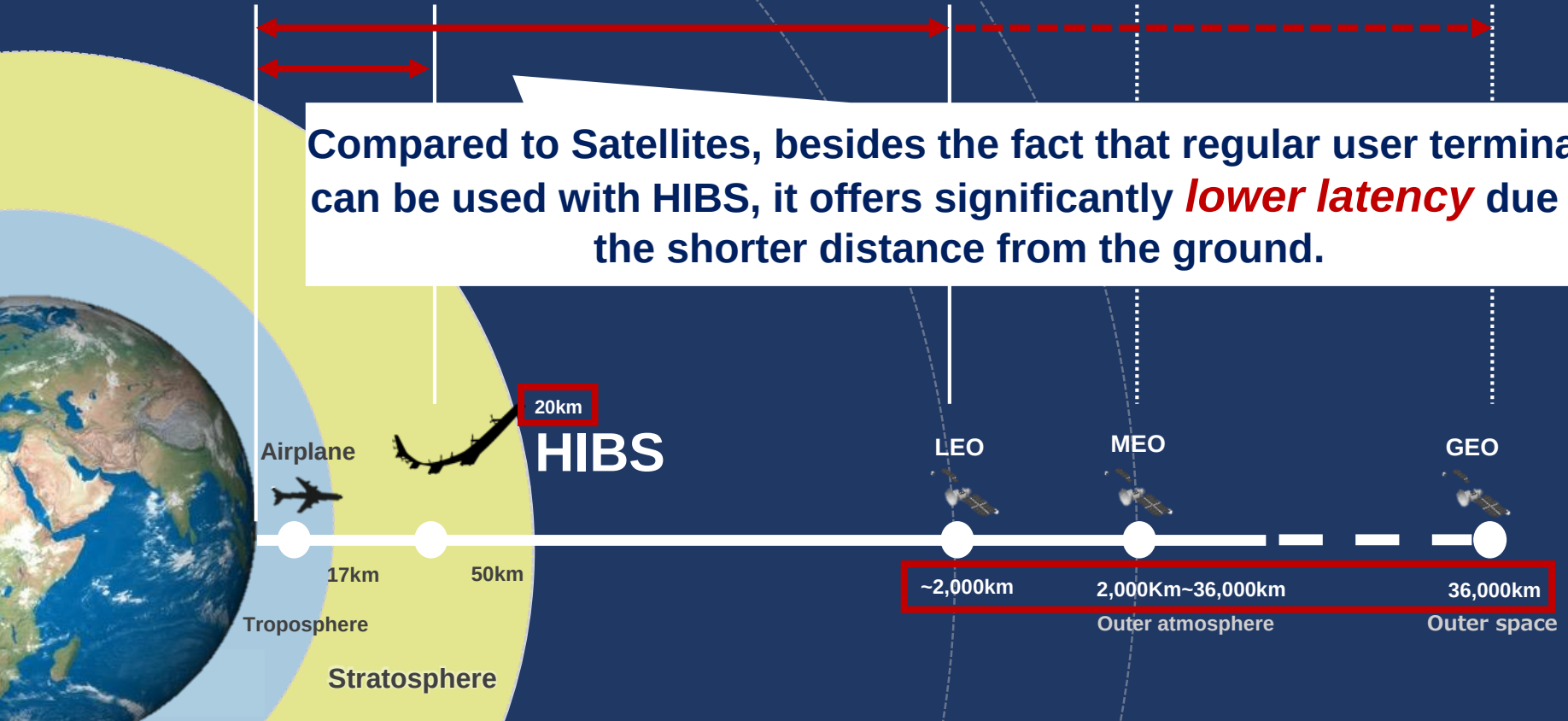
Outer atmosphere

Outer space

Stratosphere

Why the Stratosphere?

Compared to Satellites, besides the fact that regular user terminals can be used with HIBS, it offers significantly *lower latency* due to the shorter distance from the ground.



Primary Use Cases

Bridge the digital divide

- HIBS can broadly cover 200 km in diameter, which can offer low-cost services to the locations with no NW
- Contribute to the areas where they have challenges to build ground stations such as isolated islands, mountainous areas and deserts

Provide uninterrupted network during disaster

- Despite disconnection caused by significant typhoons, earthquakes and tsunami between the ground stations, HIBS can seamlessly provide services above the sky

Various Use Cases

3D Area

HIBS is capable of providing services not only to the ground but also the sky so that the network can be leveraged to the flight vehicles like drones and air taxis.

Tower optimization

HIBS is capable of offering the network to the wide range, which enables to replace existing unprofitable terrestrial towers, therefore, MNO can optimize NW OPEX cost.

IoT

HIBS allows us to design a broad range of network area, which can be leveraged to IoT services like agricultures, dairy farming and smart mobility.

Complement base stations

Enables MNO to achieve high quality network deployments since HIBS can build a network with less uncovered areas by combination of the ground stations and HIBS

Generation Migration

HIBS is capable of covering wide ranges at low cost, which allows us to migrate from the old generations (2G/3G) to the next generation (4G/5G) in the broad areas all together

Landscape preservation

HIBS can give the connectivity without terrestrial towers, which enables to provide the NW coverage where building tower is prohibited such as historical heritage or national parks

*MNO: Telecom operator who offers services with its own line networks for the mobile communication

HAPS MOBILE

2. HAPSMobile Activities

Sunglider

- **Wingspan: 78.9** [meters]
- **Weight: 1,134** [kg]
- **Payload weight: 75** [kg]
- **Payload max power: 1.5** [kW]
- **Max speed: 140** [km/h]
- **Cruise speed: 110** [km/h]
- **Cruise altitude: 20,000** [m]
- **Flight duration: over 6 months**
  （operated by solar power）
- **Cover area: 200 diameter** [km]
  （Internet access by mobile devices）

HAPS MOBILE

Photo credit: NASA/Carla Thomas

Stratospheric Test Flight

Successful Test Flight on September 21, 2020

Delivered LTE Connectivity from a Fixed-Wing Autonomous Aircraft in the Stratosphere

Milestones

Commercialization

Establishment of Rules and Regulation

2016
Project Started

2017
HAPSMobile Established

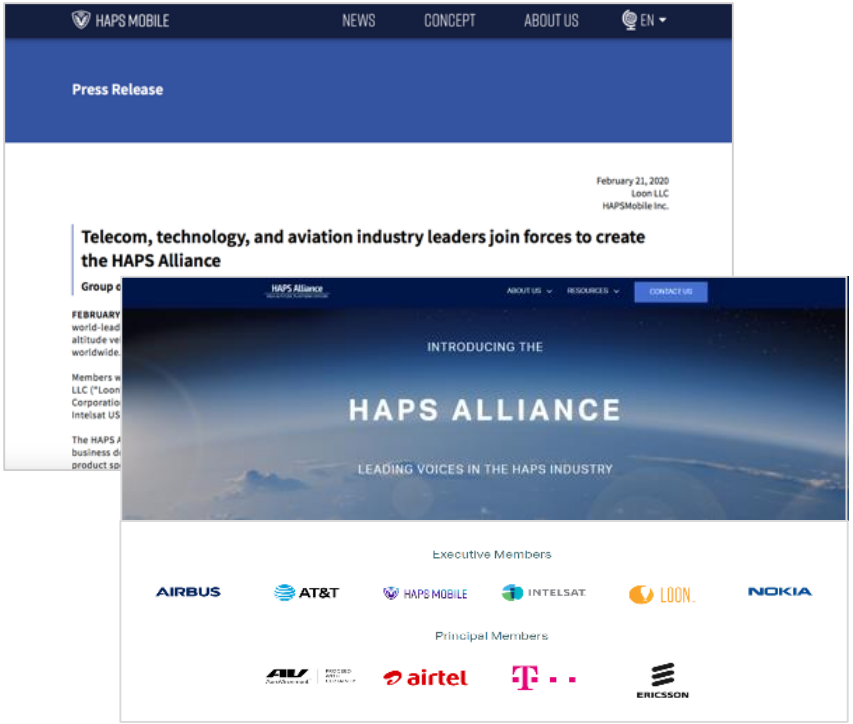
2019
Aircraft Completed

2019
Low Altitude Flight Test

2020
Stratospheric Flight Test

Formation of HAPS Alliance

・Leading companies from the telecom and aviation industry are the members
・Encourage cooperation to the regulatory officials and government agencies on organizing regulations of the aviation and the telecom
・Standardize guideline and regulations for the entire telecom and aviation industries in order to interoperate services and encourage the development as well as utilization of the HAPS/HIBS technologies.



Aviation

Promote and build standards and guidelines for the upper airspace while cooperating with ICAO, FAA and other aviation regulators

Telecom

・Advocate for global harmonization of HAPS/HIBS spectrum at global/national level
・Influence commercial standards including 3GPP NTN

Interoperability

・Develop product specifications
・Standardization of HAPS/HIBS network interoperability

Commercialization

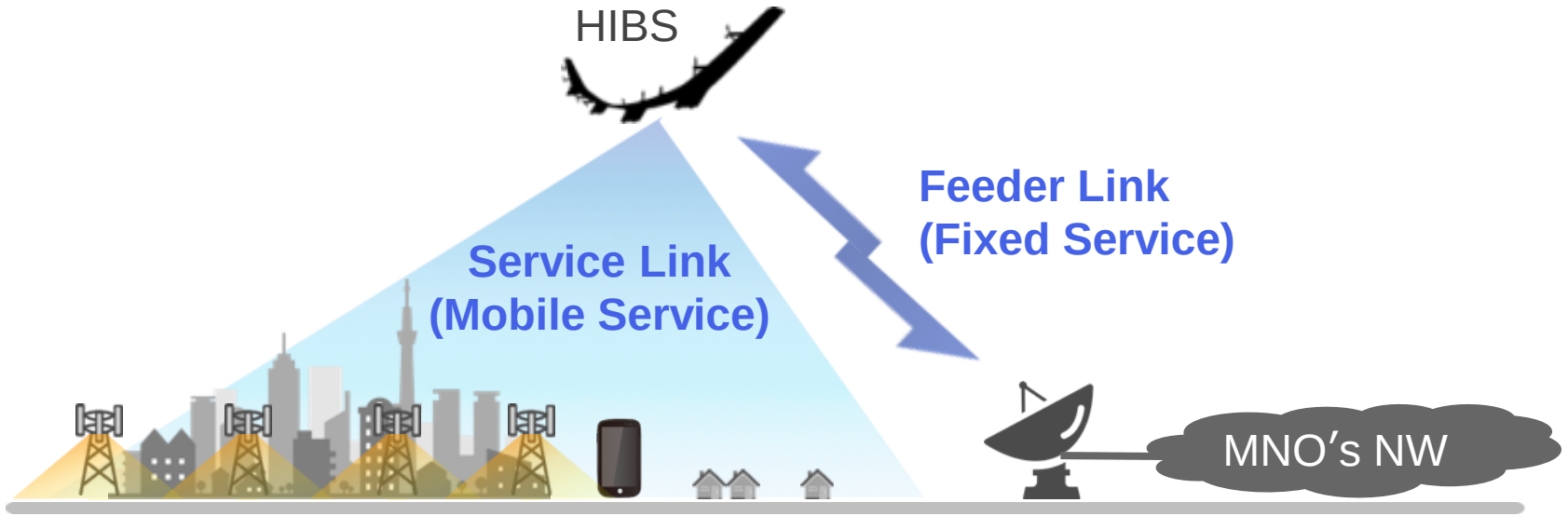
・Publish case studies/whitepapers
・Joint pilot/Proof of Concepts
・Build a cooperative HAPS/HIBS ecosystem

* SOURCE: HAPSMobile website
* SOURCE: HAPSALLIANCE website

HAPS MOBILE

3. WRC-23 Agenda Item 1.4

Frequencies needed for HIBS



Ground-Based
IMT Base Station

Regular User Terminal
(e.g. Smartphone)

Gateway

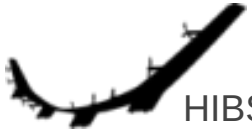
Basic concept of spectrum usage

- IMT spectrum assigned to MNOs can be used for HIBS service links

Local MNO's mobile service

All communications via HIBS will go through local MNO's network and will be subject to all local rules

HIBS Service
carrier's carrier

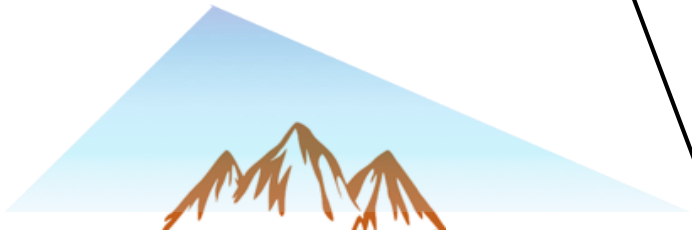


HIBS

Ground-Based
IMT Base Station

Dense Urban

Urban

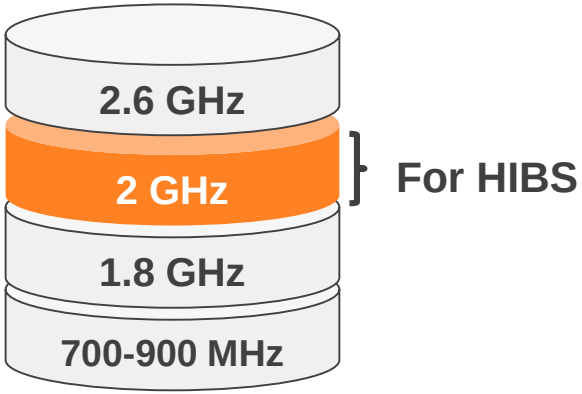


Rural

Frequency Bands for HIBS Service Link

- Aiming at expansion of available frequency bands at WRC-23

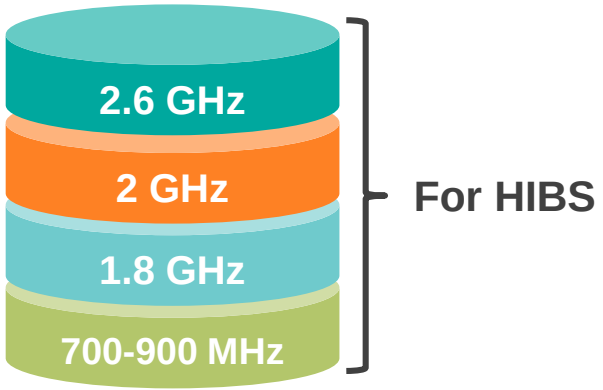
Current Regulation



NO FLEXIBILITY

Only 2GHz is allowed in the RR

Candidate bands for WRC-23



FLEXIBILITY

HAPS MOBILE

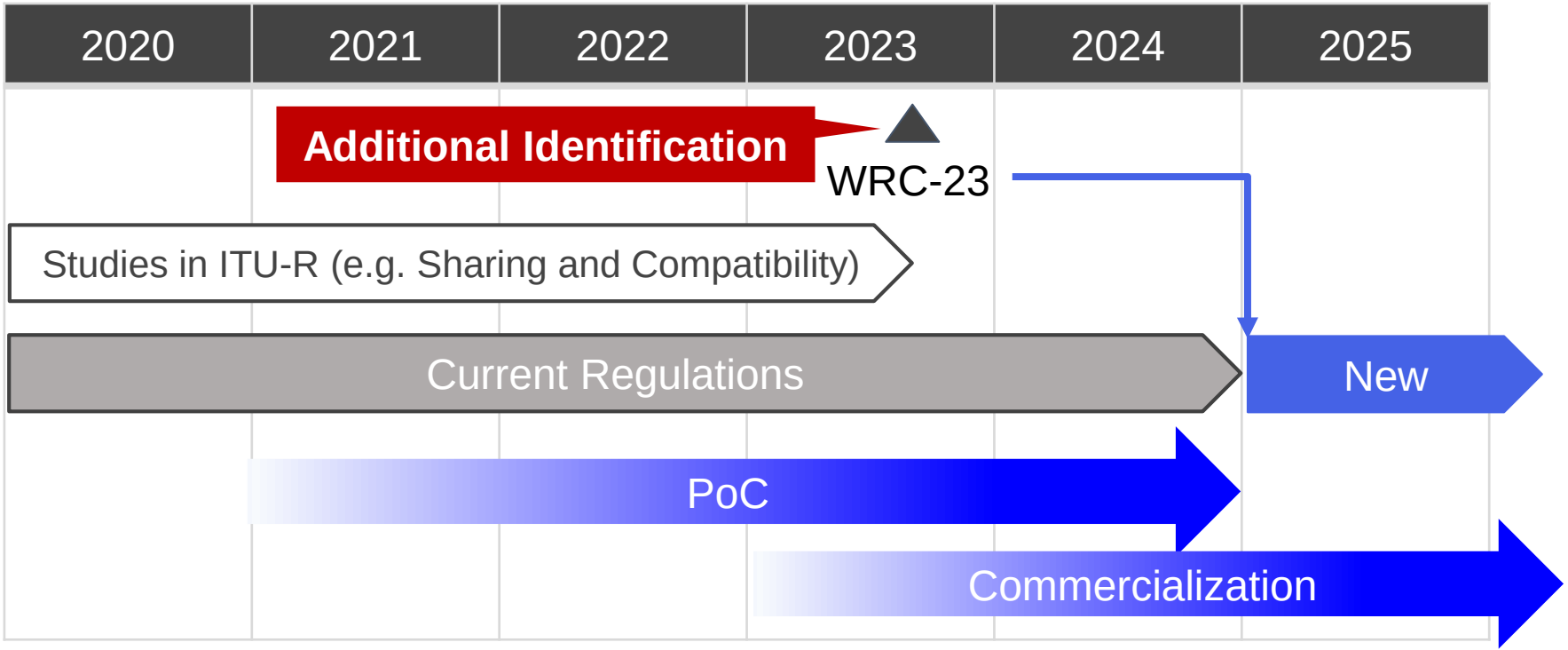
WRC-23 Agenda Item 1.4

to consider, in accordance with **Resolution 247 (WRC-19),**
the use of high-altitude platform stations as IMT base stations (HIBS) in the mobile service in certain frequency bands below 2.7 GHz
already identified for IMT, on a global or regional level;

Studies invited for ITU-R (Resolution 247)

1. to study spectrum needs, as appropriate, for HIBS to provide mobile connectivity in the mobile service, **taking into account:**
   – the existing identification in recognizing b);
   – the usage and deployment scenario envisioned for HIBS as complementary for terrestrial IMT networks;
   – the technical and operational characteristics and requirements of HIBS;
2. to conduct and complete in time for WRC-23, taking into account the results of studies already performed and those in progress within ITU-R, sharing and compatibility studies to ensure the protection of services, **without imposing any additional technical or regulatory constraints in their deployment, to which the frequency band is allocated on a primary basis, including other IMT uses**, existing systems and the planned development of primary allocated services, and adjacent services, as appropriate, for certain frequency bands below 2.7 GHz, or portions thereof, globally or regionally harmonized for IMT, i.e.:
   – 694-960 MHz;
   – 1 710-1 885 MHz (1 710-1 815 MHz to be used for uplink only in Region 3);
   – 2 500-2 690 MHz (2 500-2 535 MHz to be used for uplink only in Region 3, except 2 655-2 690 MHz in Region 3);
3. to study appropriate modifications to the existing footnote and associated resolution in **the identification referred to in recognizing b)** in order to facilitate the use of HIBS with the latest radio interface technologies of IMT;
4. to study the definition of HIBS, including possible modifications to the provisions of the Radio Regulations, as appropriate;
5. to develop ITU-R Recommendations and Reports, as appropriate, taking into account resolves to invite the ITU Radiocommunication Sector 1, 2, 3 and 4 above,

Expected Schedule for New Regulations



Takeaways

- ✓ **HIBS concept is beneficial to the world in terms of bridging the digital divide and providing uninterrupted network during disasters**
- ✓ **Technology to utilize the stratosphere layer of the sky is just around the corner**
- ✓ **Activities concerning WRC-23 AI 1.4 is really vital for the practical utilization of HIBS system**

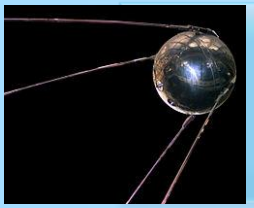
Mankind's Dream to reach the sky

1903 1957 2020

It's not unusual anymore!

Airplane

No one imagined it would be possible

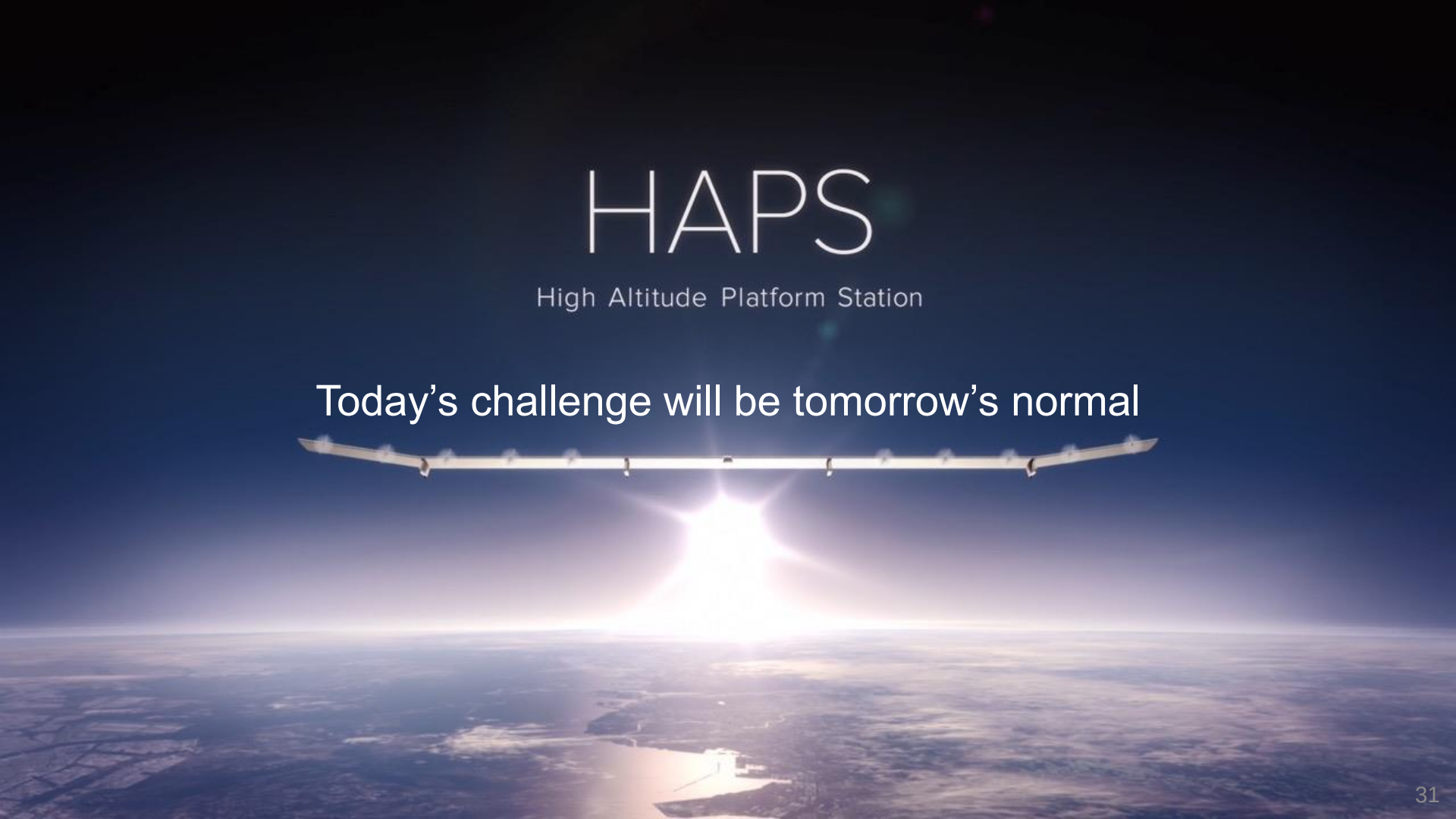


It's not unusual anymore!

Satellite

HAPS

Now it's time for HAPS!


HAPS
High Altitude Platform Station
Today’s challenge will be tomorrow’s normal