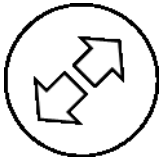

INNOVATING SES'S TECHNOLOGY SOLUTIONS

Martin Halliwell, Chief Technology Officer

Innovating SES's Technology Solutions



Expanding flexibility and scalability of SES's global network and capabilities

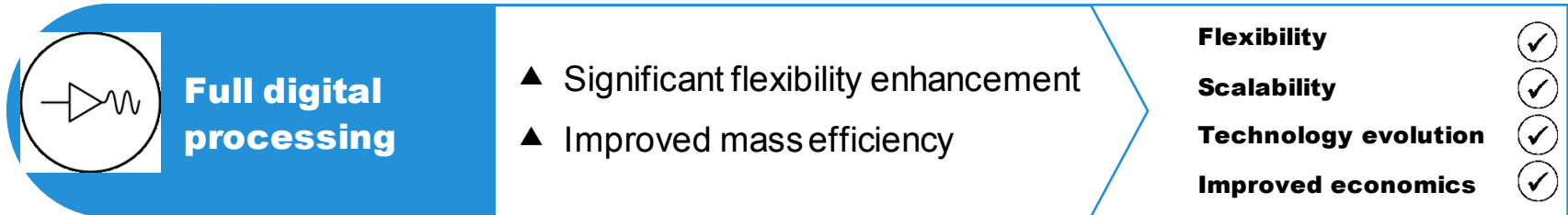


Delivering optimal end-to-end solutions by technology **innovation** across the value chain

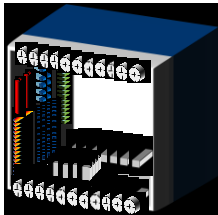


Strong track record of **enhancing** SES's economics

Expanding Flexibility with Digital Processing

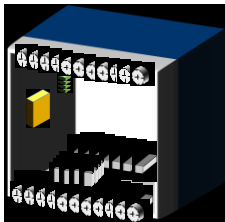


Today – Traditional payloads architecture




- ▲ Several hundred low noise amplifiers and frequency converters
- ▲ Hundreds of input and output filters and RF switches
- ▲ Difficult and costly production process

Tomorrow – Fully Digitised Satellite Payload







- ▲ Software defined payloads
- ▲ Real time resource management
- ▲ Dynamic bandwidth and coverage allocation
- ▲ Optimisation of scarce spectrum resources
- ▲ Cost reduction and payload production acceleration

Spot Beams and Digital Processing Expand SES's Capabilities



Infrastructure provision

- ▲ Customised market coverage
- ▲ Distributed network

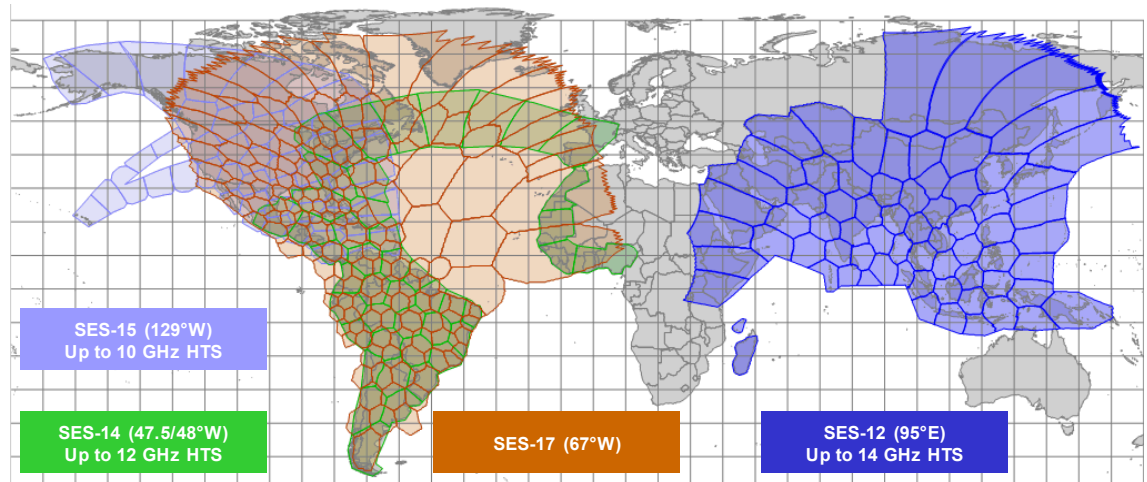
- Flexibility** 
- Scalability** 
- Technology evolution** 
- Improved economics** 

SES-12, SES-14, SES-15 and SES-17 HTS spot beam footprints augmenting MEO HTS capabilities

1 Spot beams
laying down high volume of capacity globally



2 Digital processing
optimally allocating capacity to key areas



On-orbit capability to pivot from one market opportunity to another



Boeing

Reduced Cost and Time to Market with Reusable Rockets

Re-usable
rockets

- ▲ Increased availability
- ▲ Payload diversity
- ▲ Reduced cost

Flexibility

Scalability

Technology evolution

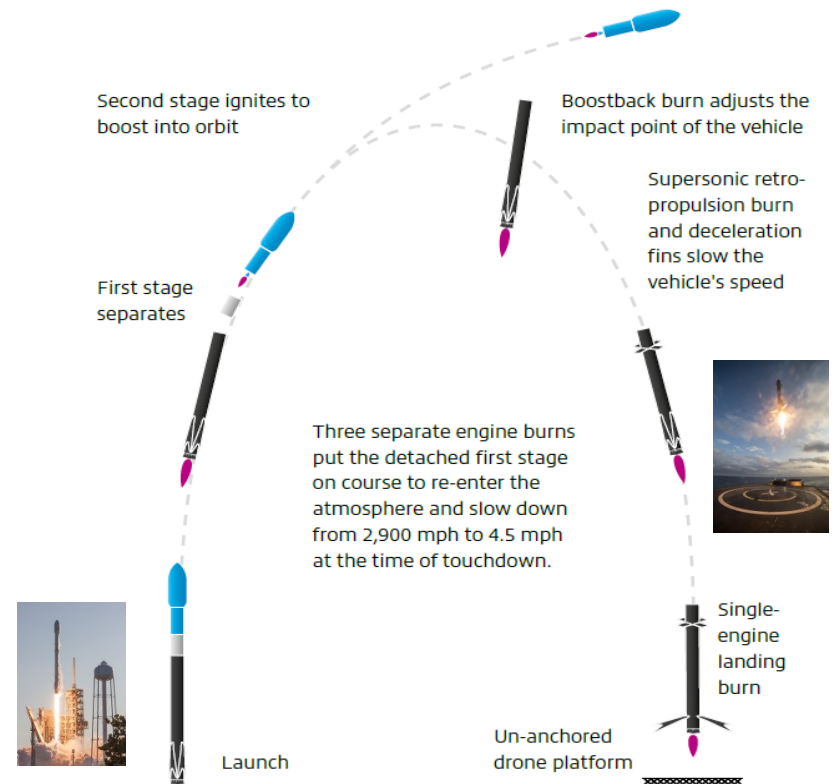
Improved economics

✓

✓

✓

✓




Photos: SES-10 launch (credit Space-X)







SpaceX

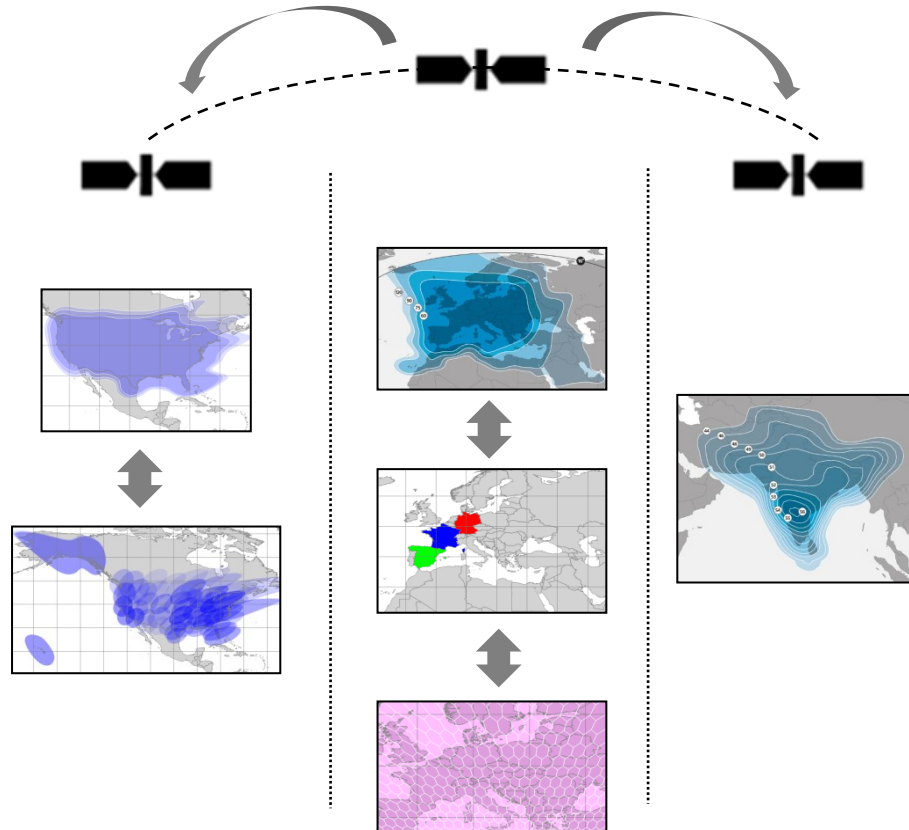
Innovation Across the Value Chain - "GEONext" (1/2)



GEO/MEONext

- ▲ Programming of beams
- ▲ Standardised payloads
- ▲ Fleet flexibility

- Flexibility** 
- Scalability** 
- Technology evolution** 
- Improved economics** 



▲ **Beams programmed in orbit** per application

- Beam forming of legacy, regional video or very small data beams
- Real time capacity allocation

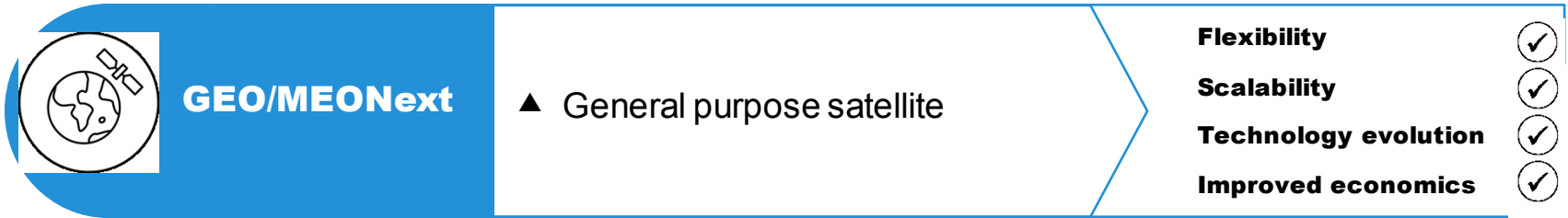
▲ **Standardised "movable" satellite payloads**

- Industrial production line integration
- Highly integrated band-specific satellites programmable to serve DTH, HTS or a combination
- Satellites deployable at different orbit locations

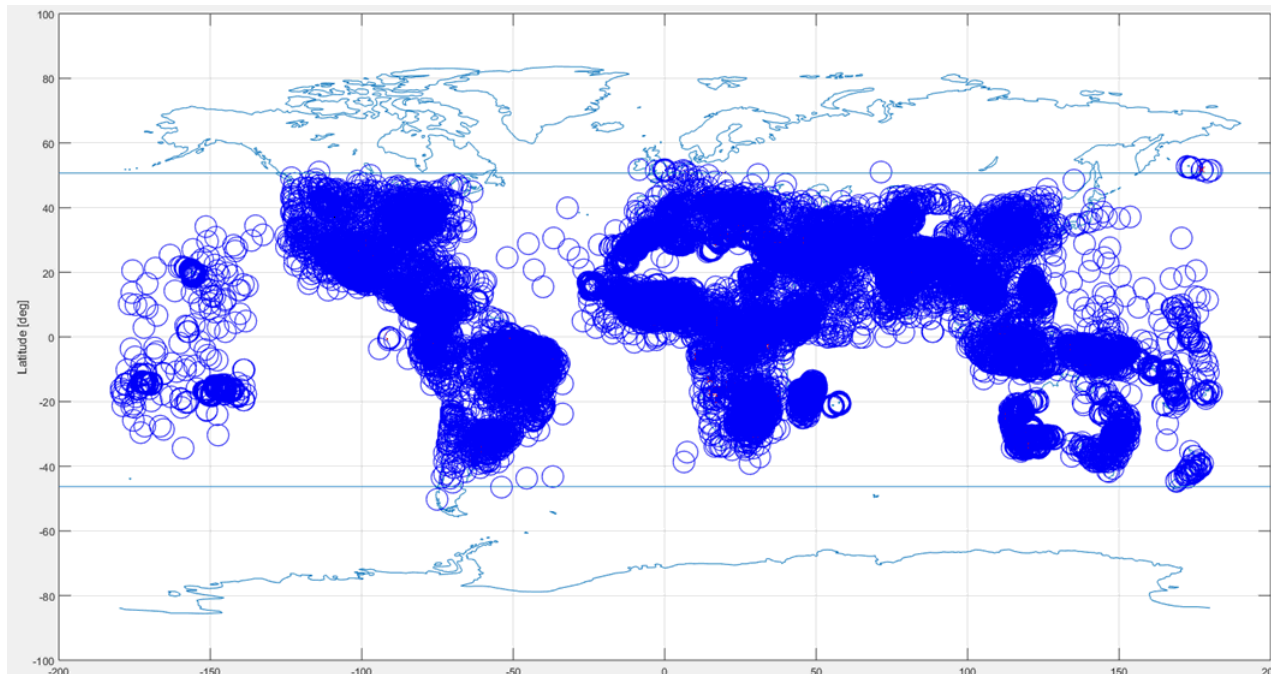
▲ **Scalability at the level of the fleet**

- Co-location of multiple small satellites for quick capacity augmentation

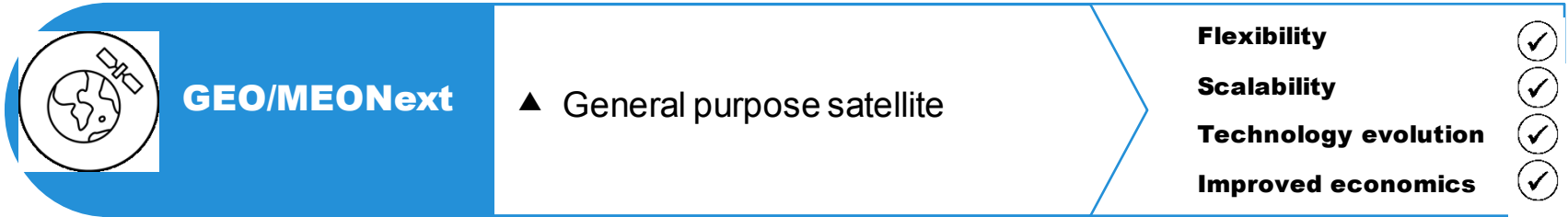
Innovation Across the Value Chain - “MEONext”



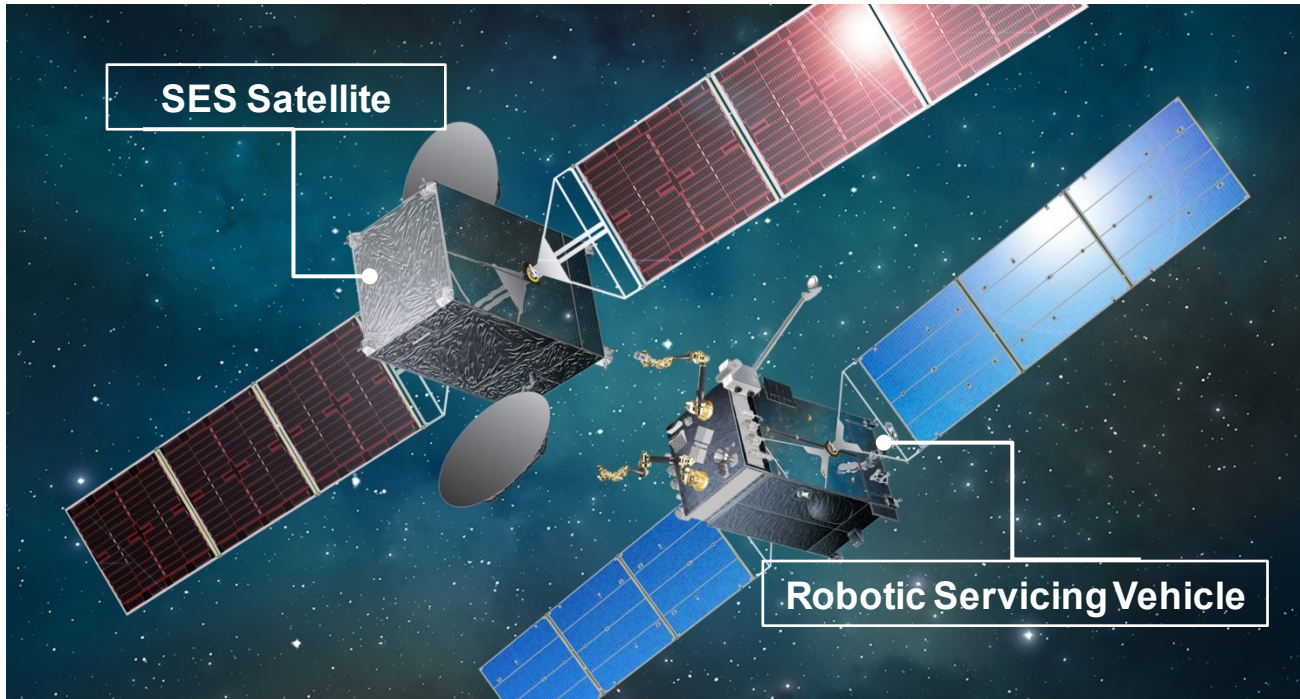
Sample operational coverage of a “MEONext” solution – Capability to change coverage in real time part of design



Innovation Across the Value Chain - Extending Satellite Life




SES and MDA entered into a partnership agreement for the first commercial refuelling of a GEO satellite in 2020+







Source: MDA

Space and Ground Infrastructure Expand SES's Capabilities

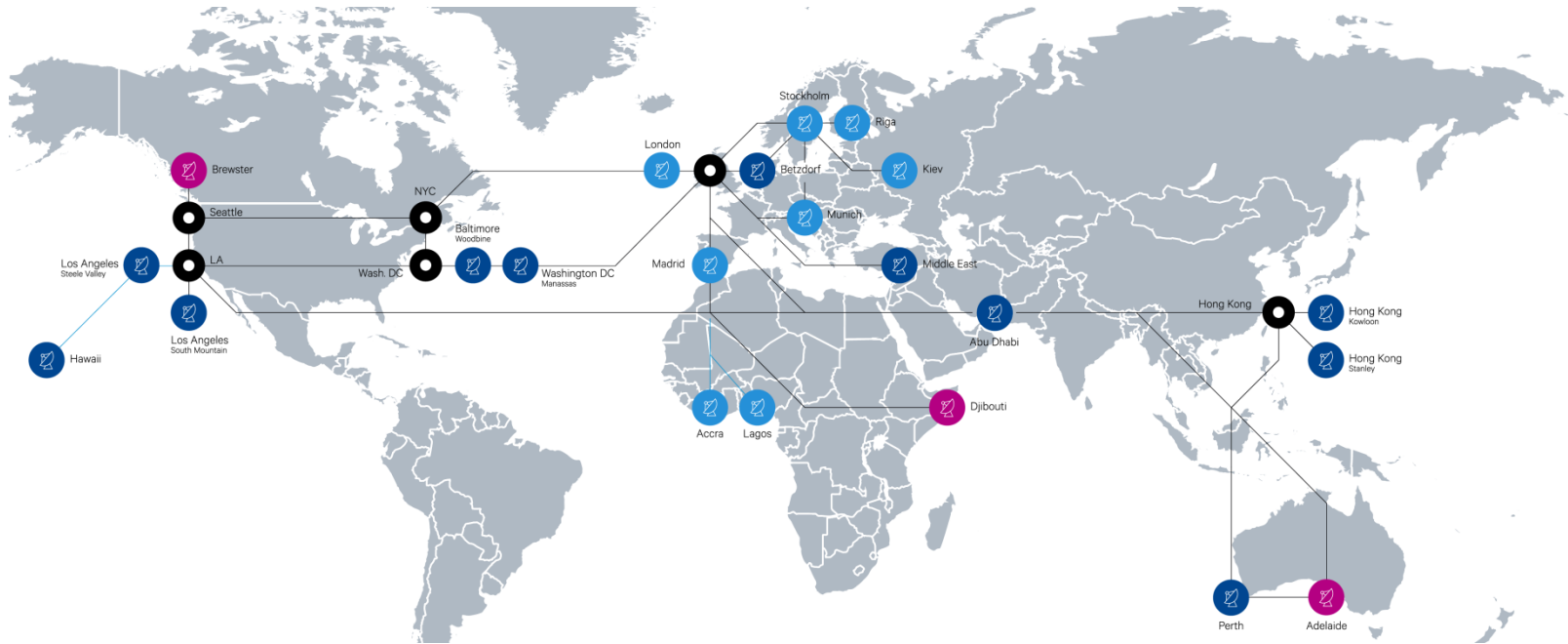


Global service provision

- ▲ Multi purpose infrastructure
- ▲ Cost efficiency

- Flexibility** 
- Scalability** 
- Technology evolution** 
- Improved economics** 

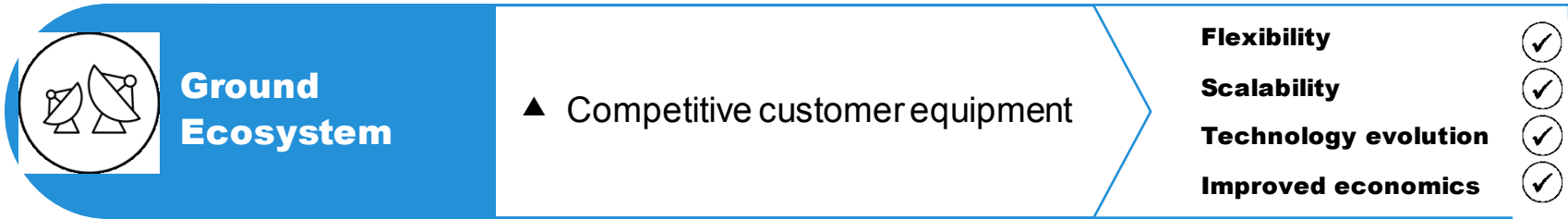
66 Teleports and 28 points of presence, including ...



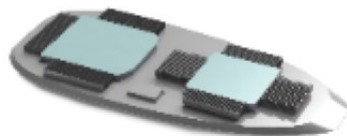
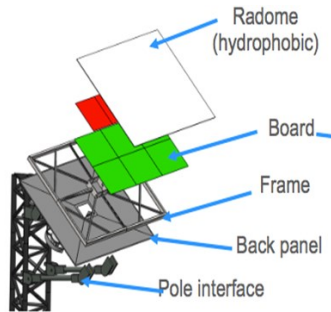
▲ **Flexibility:** Customer connects anywhere

▲ **Presence:** Licenses to operate almost all over the world

Ground Ecosystem Driving Integrated Network Management

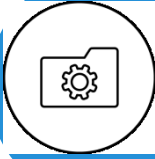


Focus on flat panel antenna



- ▲ **Flexibility** for steerability
- ▲ **Smaller** in size
- ▲ **Quick** setup
- ▲ **Lower** cost / Mbps
- ▲ **Serve** multiple applications
- ▲ **Unlock** new applications
- ▲ **Enable** seamless allocation of resources

Open Architecture Provides Interoperability

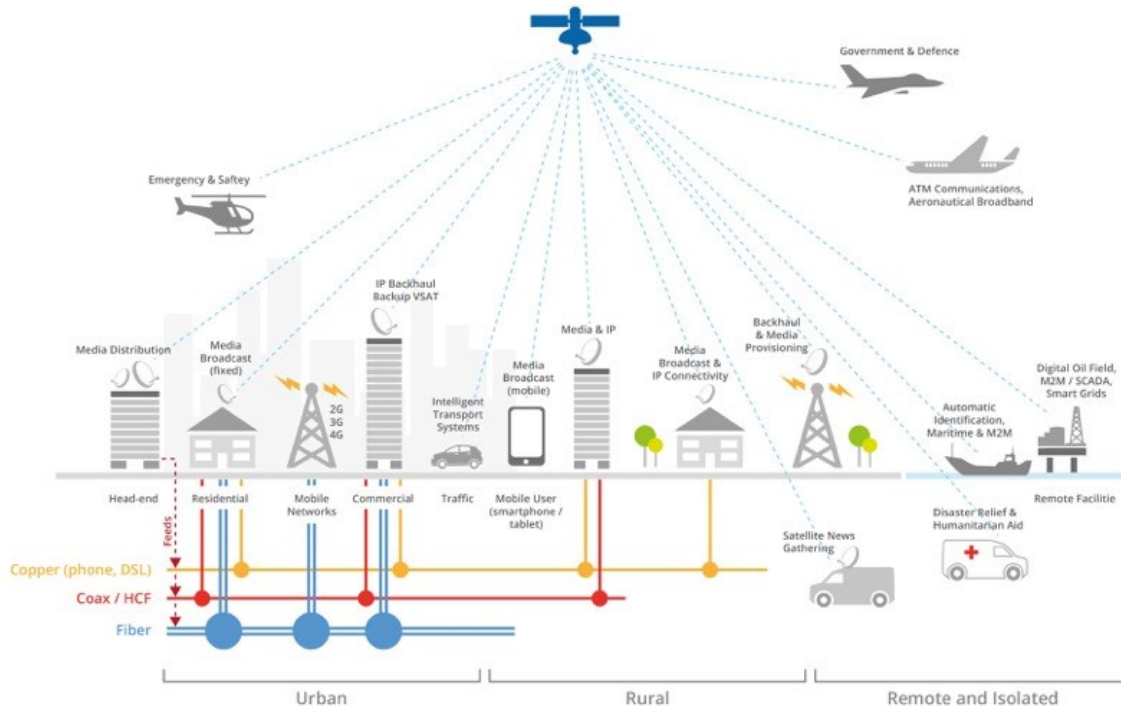


Open
Architecture

- ▲ Multi modal delivery
- ▲ Interoperability

- Flexibility**
- Scalability**
- Technology evolution**
- Improved economics**

Multi modal delivery and interoperability



- ▲ **5G** ubiquitous access
- ▲ **Hybrid** video capabilities
- ▲ **Integrated** GEO/MEO network

Innovation Drives Managed Solutions for Video and Networks

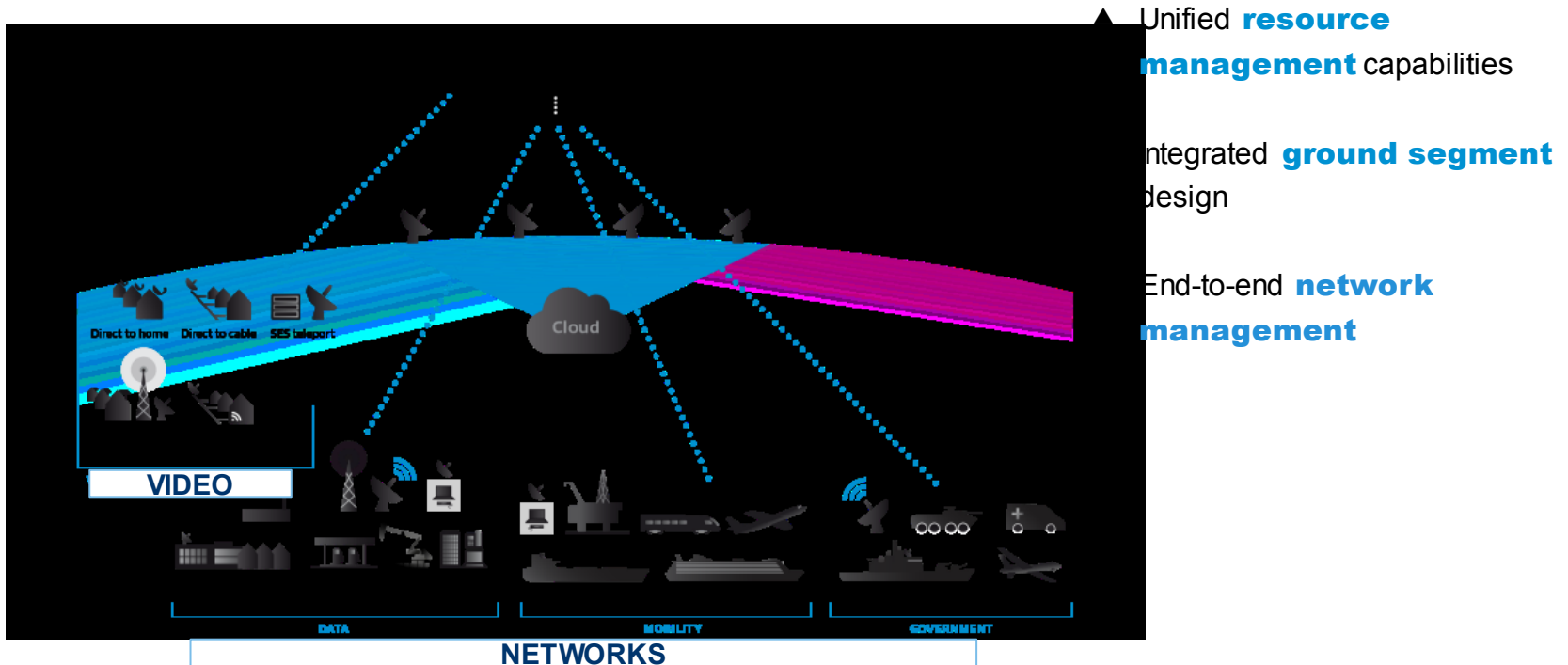


Managed Solutions

- ▲ Video
- ▲ Virtual Networks

- Flexibility** ✔
- Scalability** ✔
- Technology evolution** ✔
- Improved economics** ✔

Multi-layer multi-band satellites to enable managed solutions



Strong Track Record of Enhancing SES's CapEx Efficiency

Cost efficiency

▲

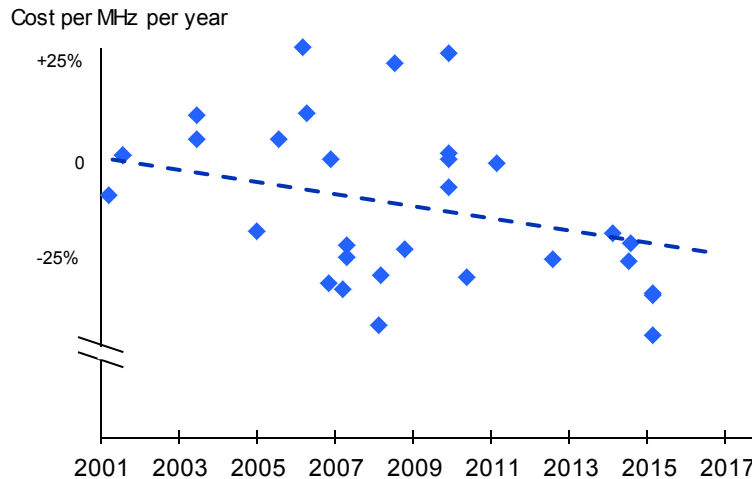
Technological evolution and customised solutions

- Flexibility** ✓
- Scalability** ✓
- Technology evolution** ✓
- Improved economics** ✓

Continuous cost reduction for shaped beams, accelerated for spot beams

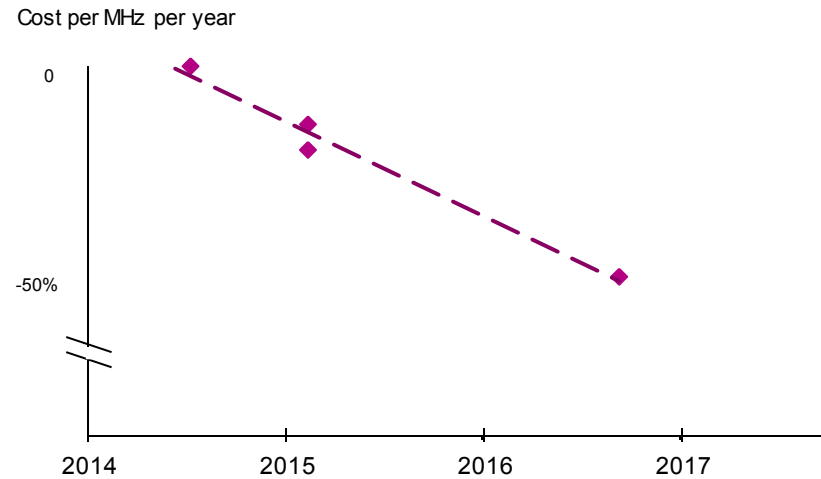
Shaped missions:

Satellite + Launch costs⁽¹⁾ per MHz per Year



HTS missions:

Satellite + Launch costs⁽¹⁾ per MHz per Year



1) Cost refers to the average amounts contracted with the satellite manufacturer and launch services provider i.e. excludes insurance, ground, project management, capitalized interests; Capacity refers to the predicted active MHz at EOL (End Of Life); Years are the date of contract placed with satellite manufacturer

Continued CapEx Efficiency Supporting Competitiveness

2014 - 2017

20% Normalised CapEx reduction

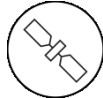


Achieved



Economies of scale

▲ Improved satellite efficiency enables five less primary satellites



Procurement and design

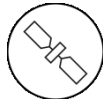
▲ Project control and close partnership with manufacturers

2018 - 2022

Around EUR 100 million of further reduction on a like for like basis



25% already identified



Electrical propulsion

▲ Improved mass efficiency

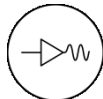
▲ More launcher options



Re-usable rockets

▲ Reduced cost

▲ Shorter time to space



Full digital processing

▲ Improved mass efficiency

▲ Flexibility enhancement



Satellite life extension

▲ Operational expertise

▲ Improved monetisation

Flexibility



Scalability



Technology evolution



Improved economics



Advancing Space Capabilities Through Innovation

▲ **Five GEO** and **eight MEO satellites** under procurement with enhanced capabilities

	H1 2017	H2 2017	2018 /19	2018 /19	2018 /19	2020/+	
	SES-11	SES-12	SES-14	SES- 16/ GovSat ⁽¹⁾	O3b Block-3 ⁽²⁾	SES-17	GEO/MEO- Next
Payload type	Shaped	HTS + Shaped	HTS + Shaped	Steerable spot beams	HTS	HTS	General payload
Digital processing	No	Yes	Yes	No	No	Yes	Yes
Satellite Propulsion	Chemical	Electric	Electric	Chemical	Chemical	Electric	Electric
Launch Vehicle	Falcon 9	Ariane 5	Falcon 9	Falcon 9	Soyuz	TBD	TBD

1) Procured by LuxGovSat

2) Satellites 13-16 scheduled for launch in Q1 2018 and satellites 17-20 in Q4 2019

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