

# Commercial Application of Robotics in Space

## PERASPERA Workshop

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PRESENTED BY  
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PRESENTED ON  
03 April 2019

# SES Global Fleet



In Orbit



To be Launched\*

\*SES-17 will be launched in 2020



MEO HTS Satellites

Delivering low latency, high throughput satellites



GEO HTS Satellites (High-throughput satellites)



Geostationary Orbit (36,000km from Earth)



Medium Earth Orbit (8,000km from Earth)

**Additionally, we have nine satellites flying secondary missions:**

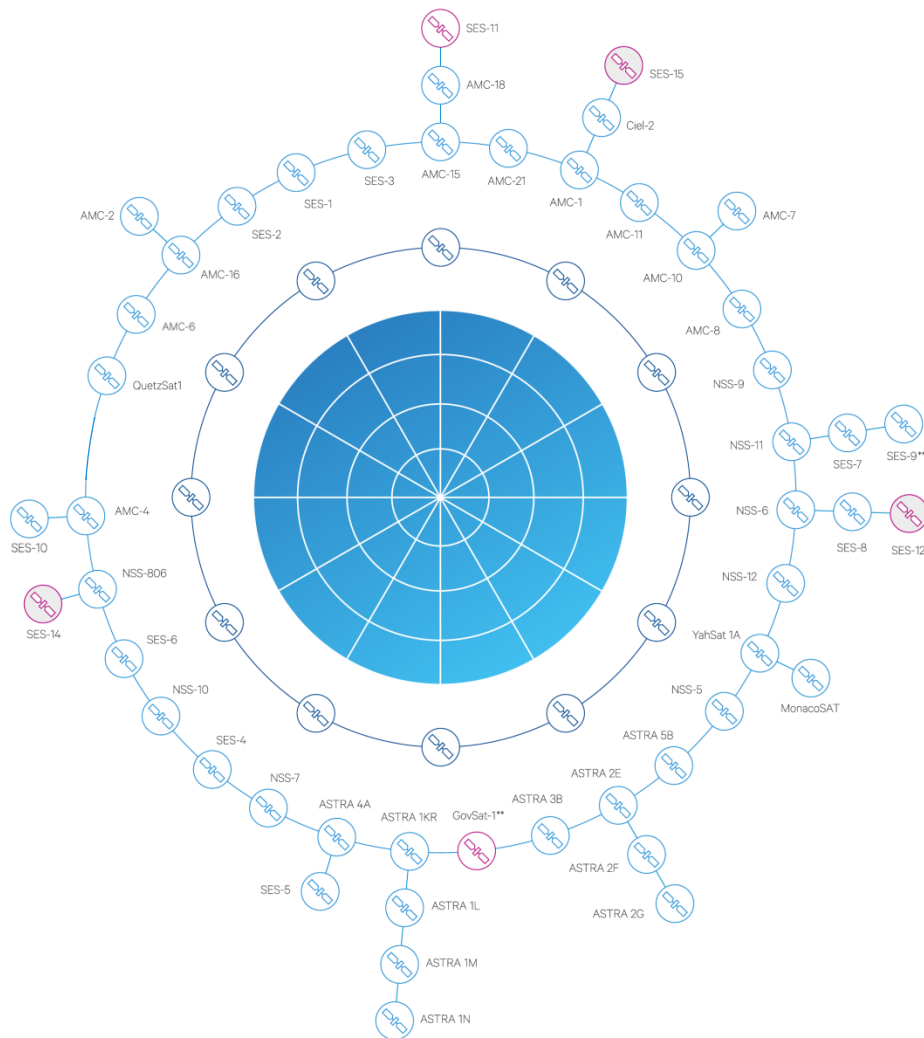
ASTRA 1D, ASTRA 1F, ASTRA 1G, ASTRA 1H, ASTRA 2A, ASTRA 2B, ASTRA 2C, ASTRA 2D, ASTRA 3A.

Fleet configuration is based on current planning and is subject to change.

SES holds a 70% interest in Ciel Satellite Limited Partnership and a 100% ownership interest in QuetzSat. Yahsat 1A's Ku-band payload is owned by YahLive, where SES holds a 35% ownership interest. MonacoSAT is a partner satellite with transponders onboard TurkmenAlem at 52°E.

\*\* Procured by LuxGovSat

\*\*\* SES-9 at 108.2E vicinity



# Commercial Application of Space Robotics

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## CHALLENGES

**Cost of space segment replacement**

**Payload obsolescence**

**Hosting opportunities**

**Technical problems in orbit**

**Robotic tools can assist in reducing economical challenges**

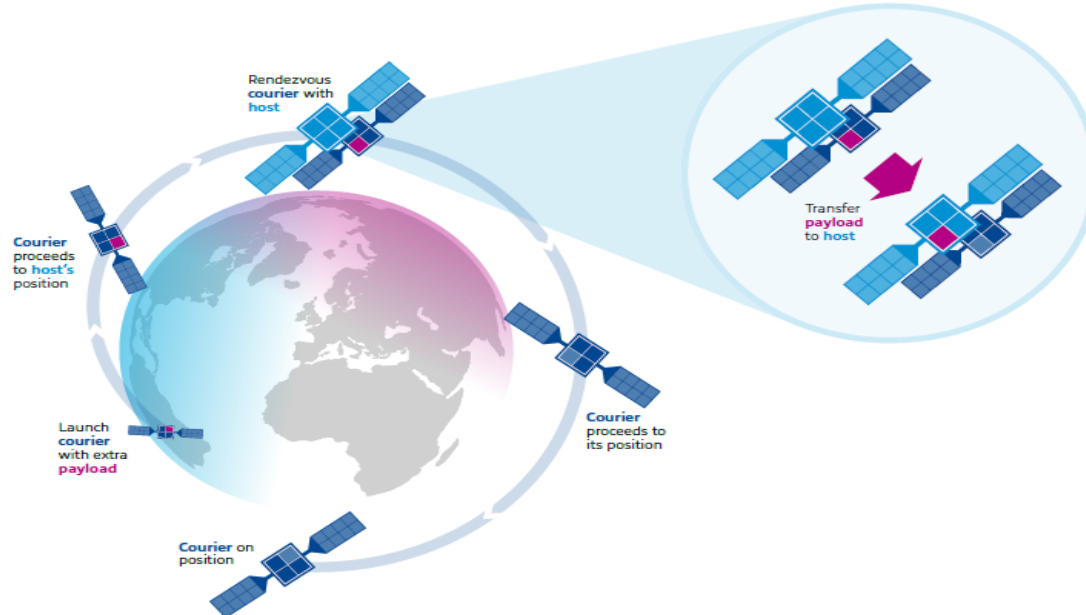
# Extending Satellite Operational Life



**Robotics enables life extension and allows cost reduction of space segment replacement**

# Robotics Payload In-Orbit Replacement

## SATELLITE PAYLOAD TRANSFER



Robotics enables transfer of hosted and/or augmented payloads on operational satellites

# Repairs in Orbit

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- ▲ Robotic arms may be an effective tool to fix some technical problems in orbit, like the examples below
  - Stuck deployable appendages
  - Blockage in field of view due to movement of adjacent hardware during ascent
  - External electrical connector issues
  
- ▲ Commercial benefits:
  - Reduction of risk of total constructive failures and consequent benefit on insurance side
  - Elimination of commercial losses consequent to lengthy in-orbit replacement cycle in case of total loss

# SES's Experience with Robotics

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- ▲ Starting with Smart Olev in the early 2000's, SES has spurred the industry and institutions to develop commercially viable tools based on robotics to enhance competitiveness of commercial space telecommunications satellites
- ▲ SES worked together with DARPA and MDA/SSL in the development of a commercially viable robotics tool, and was the first to sign a service provision agreement with SSL
- ▲ In parallel, SES has had discussions with Northrop (ex-Orbital) and Effective Space, among others, with the goal to help these organizations to understand the specific requirements of commercial operators and steer their development in a commonly beneficial direction
- ▲ SES conducted studies with major satellite manufacturers to design and install standard electromechanical interfaces on commercial satellites (a “space USB”) to allow installation in-orbit of hosted payloads

# The 2019 Scene

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- ▲ Up to now there is no in-orbit demonstration of commercial use of robotics
- ▲ The economical challenges that affect the space industry have slowed down the onset of associated services like life extension
- ▲ Institutional investment is in place in the USA (DARPA, Northrop) and Israel (Effective Space) however the business case of the life extension services is challenged



# Limitations of Commercial Use of Robotics

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## ▲ Life extension of commercial space assets is not a panacea

- Its commercial benefits are limited to satellites that
  - Are in good health
  - Are compatible with the life extension module
  - Their payloads still retain commercial value to the customer base
  - The market they serve does not demand expansion

## ▲ Change and expansion of payloads in space require that

- The host satellite be designed to accommodate such payload in orbit, or alternatively
- The new or augmented payload operates completely independently from the host, with its own power sources, telemetry and command etc

## ▲ Use of robotics for fixing in-orbit problems has limitations:

- Its viability needs to be assessed on a case-by-case basis
- The time to assess, plan and execute the remedy action may be too long commercially
- In-orbit problems are not predictable, making a difficult business case

- Use of robotics for commercial applications is technically viable and technology is mature enough to allow its deployment
- Robotics-based services are valuable for commercial satellite operators
- Viability of robotics-based services on a purely commercial basis is not clear
- Successful exploitation of robotics on commercial undertakings requires contribution of governmental institutions

# Thank You!

# Questions?

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