Space insurer – current view on SSA

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July 2021

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Space Insurance overview

Need for Insurance in Space

Concentration of value and risk

- Typ 150M$-500M$/sat in GEO
- Typ 5M$-150M$/sat in LEO
- Probability of Failure “Launch + full lifecycle operation” = 10-25% in GEO (~15 years), 5-50% in LEO (~1-10 years)

Recurring innovation

- Prototypes
- New designs and missions
- Technological innovations

Financing needs

- Mandatory for investment
- Protect profitability of operators
- Allows quick restart of big institutional projects

Insurance is essential for private investment and an incentive for systems quality and robustness

Space Insurance overview

Asset cover

- All damages to the Satellites
  - → Cover internal and external events
- Products :
  - → Launch vehicle flight or launch + 1 year: From intentional ignition / lift-off until separation or few days/months after
  - → In-orbit : typ. 12 months of commercial operation, renewed annually
- Sum Insured pre agreed by contract
  - → Corresponds to rebuild cost / loss of revenue / accounting value
- Customized Definition of Partial and Total Loss
  - → As a function of the mission and business criteria
- Waiver of recovery against the manufacturer and launch service provider as waived by satellite owner

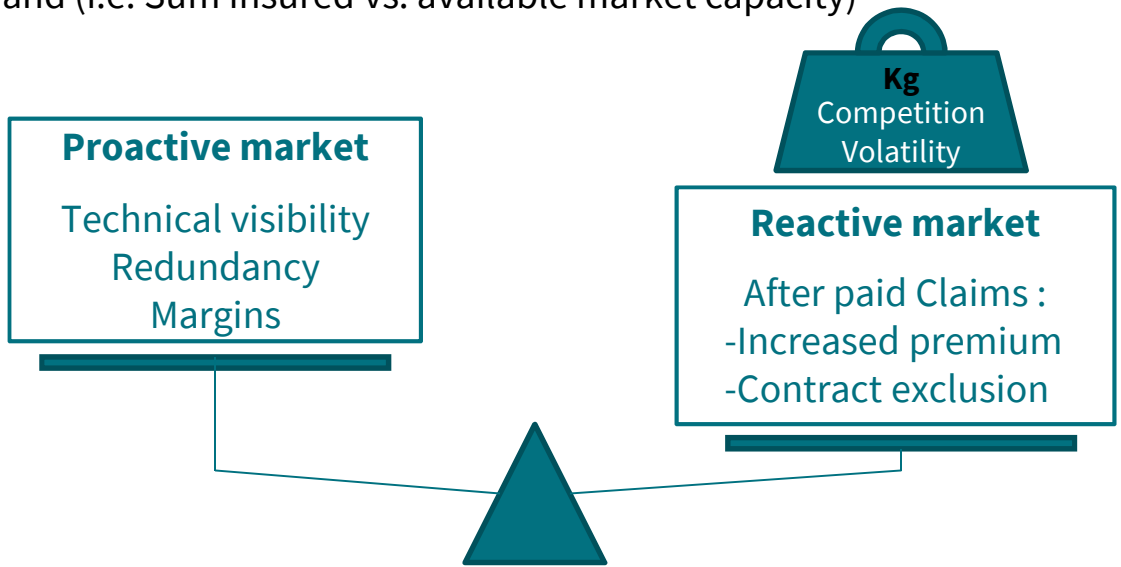
Liability cover

- Requirement (limit, duration) depends on each state
- Useful even if not required

Available for all type of missions, orbits, clients

Space Insurance Market

- Insurance Premium rate is based on
  - Technical merit (design, heritage)
  - Supply & Demand (i.e. Sum Insured vs. available market capacity)



An insured Collision or a serial impact due to Space Weather will have an immediate and dramatic impact on the space industry

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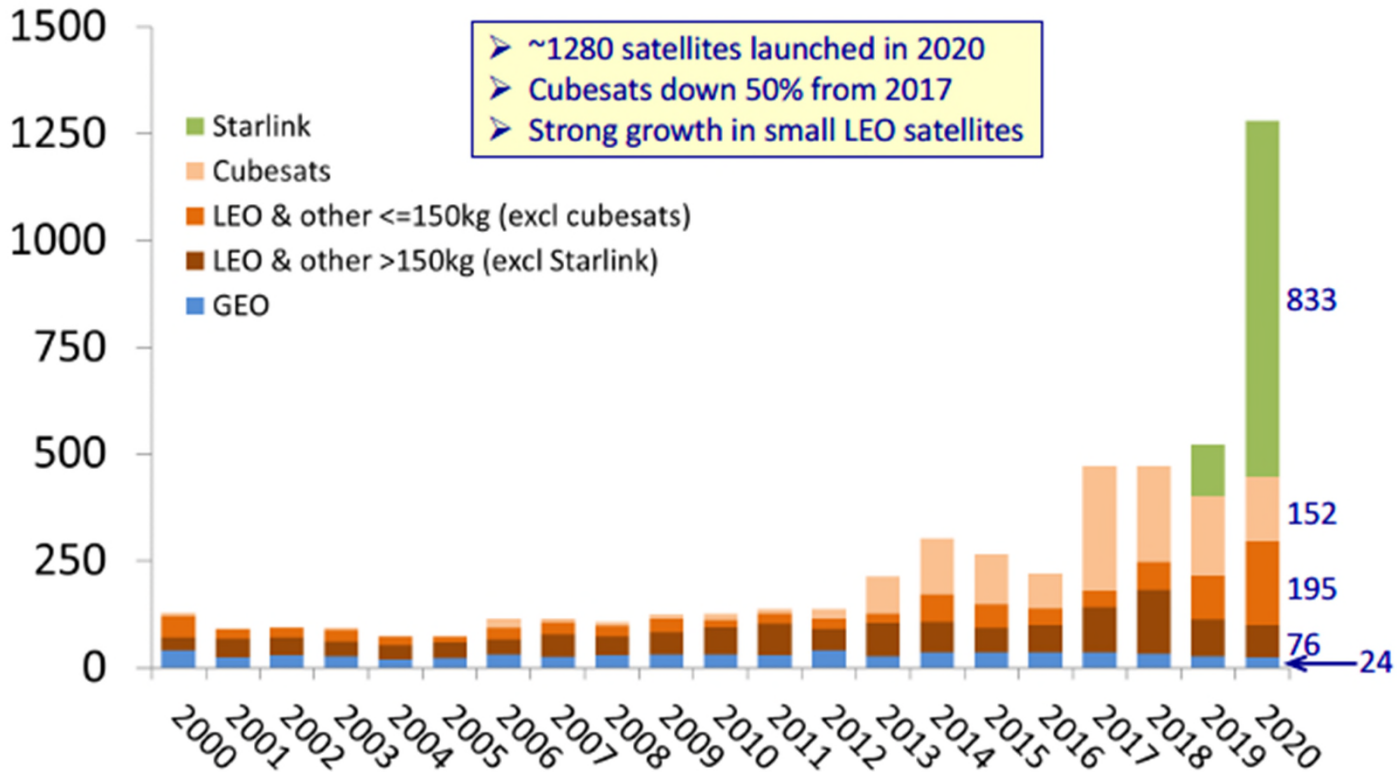
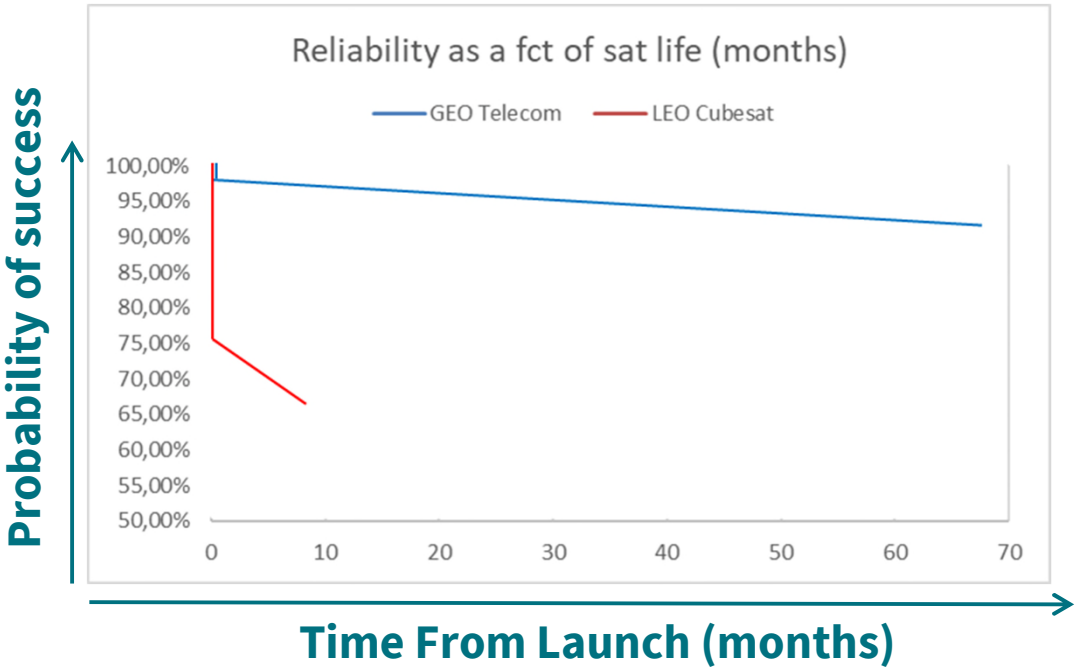
Some statistics

Launched Satellites – by orbit and size



Some statistics

Failure data



- The first subsystem contributing to failure is :
  - In GEO : high power units
  - In LEO : low power electronic
- Deployment mechanism are in both orbits a concern during the first days

Reliability is very dependent on design, heritage, redundancy, testing

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Space Weather

Today

- Several in-orbit failure
  - → Loss of Solar Array Power
  - → Failure of electronic components (Payload amplifier, Processor)

- Resulting from :
  - → Electrostatic Discharge
  - → Single Event Effect

- In some identified failure cases, clear correlation of a space weather event and an in-orbit anomaly or failure

Need to improve monitoring and understand phenomena to prevent in-orbit failure

Space Weather

Tomorrow

- New design are more susceptible
  - On-board processor, active antenna
  - Usage of COTS (Commercial Off The Shelf)
  - Constellations (impact of serial losses)
  - Nanosat
- New missions are coming
  - Human spaceflight
  - Life extension

- New design might be more susceptible to Space Weather
- New mission must properly integrate Space Weather in the design
- As science is progressing, Space Weather will be more commonly used

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Collision Risk

Today

- Density of debris has increased
- Probability of collision has increased
- But :
  - → Probability of intrinsic failure still higher than probability of collision, even in LEO
  - → Conjunction probabilities are not accurate enough

Ex : Iridium constellation conjunction probabilities
during week of Feb 7, 2009
From The Aerospace Corporation

Need data with demonstrated reliability

Collision Risk

Tomorrow

- Population of space objects will dramatically increase

- Need for reliable data
  - → To ensure the maneuver is needed and going in the right direction
  - → Accuracy of data shall be demonstrated

- In case of a collision with two insured satellites or with one high-value satellite
  - → Awareness of the space community
  - → Insurance premium increase
  - → Some orbits might be more difficult to operate and to insure

We should make sure to protect space, now

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SSA and Space Insurance

Risk Management

- Risk management shall be integrated since the start of the project
  - → Shall include end-of-life disposal
- System design depends on the mission and business plan
  - → Sensitivity of design vs space environment shall be studied :
    - *Density of objects in desired orbit*
    - *Conjunction alert accuracy and timeliness*
    - *Ability to perform avoidance maneuvers and end-of-life disposal*
    - *Shielding against radiations*
    - *Redundancy*
  - → Space environment at the time of deployment shall be considered
- Risk transfer to insurance:
  - → Insurance cover vs price

As for any company, risk management is key for a long term business

SSA and Space Insurance

Partners?

- SSA as a tool for Insurance
  - → Collision risk is there but, as of today, lower than probability of intrinsic failure
  - → Space weather is damaging components but correlation and prediction are not ready (yet)
  - → Only one insured event will be sufficient to change the insurance market
  - → Tomorrow, SSA might be mandatory to insure Low Earth Orbit
  - → Insurance may need better data and new services

- SSA as a partner with insurance
  - → Impact of failure can be well in excess of the value of the project
    - *We spread risk of failure among various operators*
  - → Insurance may help the market to better use SSA services
  - → We have some data (failure type, in-orbit experience return) useful for SSA
  - → We want to push for more responsible behavior

SSA will be part of the future of Space Insurance
Space Insurance will be part of the future of SSA

SSA and Space Insurance

Ensuring Space Business on the long term

- Identification
  - → Multi-sat launches
  - → Any technology
- Being able to move
  - → Propulsion for collision avoidance
  - → With passivation
- Cleaning after use
  - → Regulation must come
  - → Be ready to do it now
- Being ready to be serviced
  - → Standardized mechanical interface for grasping
  - → Markers, with well known relative position, to help navigation
  - → Documentation, including external Interface Control Drawing to be stored and easily available after End Of Life for Active Debris Removal
- Space Sustainability Rating is coming
  - → A key step to encourage responsible behavior

As done on ground, AXA XL is committed to encourage responsible behavior, using SSA

Thank you