

LONDON INSTITUTE OF SPACE POLICY AND LAW

SPACE POLICY AND LAW COURSE

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RISK, LIABILITY AND INSURANCE

Akiko Hama

Underwriting Manager Space, Global Aerospace

Denis Bensoussan

Head of Space, Beazley

SPACE LIABILITY RISKS & INSURANCE

DENIS BENSOUSSAN

Head of Space, Beazley Syndicate

AKIKO HAMA

Underwriting Manager, Global Aerospace Underwriting Managers Ltd

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International Conventions

- **The 1967 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (the "Outer Space Treaty").**
- The 1968 Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space (the "Rescue Agreement").
- **The 1972 Convention on International Liability for Damage Caused by Space Objects (the "Liability Convention").**
- The 1975 Convention on Registration of Objects Launched into Outer Space (the "Registration Convention").
- The 1979 Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (the "Moon Treaty").

1972 UN Convention on Liability

1. **The Convention imposes liability on the signatory Governments to other Governments for damage caused by a space object for which they are the “Launching State”.** The definition of “Launching State” for any space object imposes joint and several liability on all states party to a launch, who are all regarded as the “Launching State” for that object
2. **Liability for damage caused on the ground or to aircraft in flight is absolute** i.e., the Launching State is liable to other Governments for all such damage caused by its space objects. **A fault has to be established with respect to damage to other spacecraft** and that a Launching State’s liability survives for all time, even for derelict objects
3. **Remedies under the Treaty are available solely between Governments** and stipulate procedures within a diplomatic context
4. **Governments have developed a regime where it is made illegal to conduct space operations without a licence.** The licence is then made subject to provision of a hold harmless in favour of the Government. The Government may also require satisfactory evidence of adequate insurance

National Space Legislation

- Article VI of the Outer Space Treaty of 1967 introduced **the need for appropriate national legislation** in respect of private space activity without defining what that should be.
- To date 20+ States have enacted legislation governing the space activities of their nationals and to license space activities.
- The principal purpose of such legislation is to ensure that the **State Party can implement its own obligations** under the UN International Treaties.
- In 2012 the International Law Association (ILA), an international non-governmental international body, adopted guidelines for a “Model Law for National Space Legislation” (“the Sofia Guidelines”).
- The model law could provide a useful reference for States considering adopting legislation at national level or considering amendments to existing legislation.
- It is only a statement of broad principles and requirements.

How are Treaties performing? (1)

- **The OST and the Liability Convention are the main pillars of international law governing space activities** and most space-faring nations have ratified them. The Treaties provide **public interest protection** and a necessary **reference point for registration and licensing** of space activities
- But Treaties were concluded in the infancy of space activity when only governments were funding and initiating activities and **many developments were not anticipated**
- Initial problems with definitions
 - “Launching State”?
 - What constitutes a “space object” and to what extent can space debris be considered a space object?
 - What is meant by “fault” and “negligence” (both terms being used)?
 - Is indirect damage covered as well as direct damage?

How are Treaties performing? (2)

- **Liability Treaty has seldomly been tested**
- **Only one instance** where the Liability Convention was invoked (under article 2 - strict liability in respect of damage on earth). In 1978 Soviet Spacecraft RORSAT Cosmos 954 survived re-entry and left a scattering of radio-active debris on Canadian territory. Canadian Gov. lodged a \$6M claim to clean up. Was settled for \$3M on diplomatic basis (without recourse to a Commission established for the specific purpose as envisaged in the Convention)
- **Never been a claim under Article 3** of Liability Convention relating to damage in orbit (where proof of fault is required) → was possible with 2009 Iridium-33 collided with COSMOS 2251
- However the emergence of **commercial space activities is likely to increase** the number of incidents where Treaties may be invoked and put to the test, leaving some problematic uncertainties:
 - **Can a form of claims management/dispute resolution be devised in which commercial parties can have confidence?**
 - **Are the provisions appropriate for occurrences in space involving private parties;** will private parties want claims managed by States or will they prefer self control?

Current/future risks & challenges

- Systemic nature and dependencies on space derived data and applications / the commercialisation of space
- Potential for relative physical congestion in the LEO and GEO rings
- **Space debris growth and concentration.** Need for debris mitigation and growing calls for debris removal to avoid a cascade of collisions
- Legacy of near 5000 launches and counting
- Collisions involving space objects
- De-orbiting of space objects without terrestrial damage e.g. MIR space
- Weaponisation of space / use of space for military purposes
- Cyber attacks
- Reliability of legacy and new launch vehicles and satellites
- The rising capital values in space assets
- Managing commercial operator financial default
- Availability of adequate and affordable liability insurance
- Short term nature of insurance / long term nature of the liability exposure
- Major occurrence involving significant damage and how will the parties react?
- How Space sustainability will be best addressed?
- Will States change licensing rules?
- How will the international community deal with the actions of rogue states?
- Will the Liability Convention be amended?
- Will COPUOS and the UN remain as the law makers for space activities?
- How will issues relating to new space-based activities and applications e.g. suborbital space tourism and liabilities from the space exploration or global navigation systems, be addressed?
- Will there be a new assessment of the long tail nature of liability exposure?

Risk Disaster Scenarios

- It is a Lloyd's of London insurance concept, but there is no formal Lloyds RDS for TPL. Reason is the small number of launches and the extremely low number and severity of events so far
- Very difficult to assess catastrophic failures with low probabilities and potentially high losses. Historically the TPL market has relied on the US FAA criteria: the Maximum Probable Loss (MPL) per launch
- The FAA uses a statistical approach to estimate expected losses based on estimated probabilities that a catastrophic event could occur (probability for TPL losses above the MPL has been set at 1 in 10 million) and the estimated costs of a catastrophic event given the details and location of the specific launch
- **The US average MPL is US\$100m**, ranging from about US\$23m to US\$267m
- Other space-faring nations have set MPL/thresholds ranging from US\$79m to US\$300m (**average US\$120m**) which have allowed to set State indemnification schemes including mandatory insurance
- **MPL model has been tested. Globally, never been a TPL claim from a commercial space launch failure beyond the MPL** (19 recorded losses since 1962 incl. 3 non-insured military payloads, majority in last 20 years)

Insurance

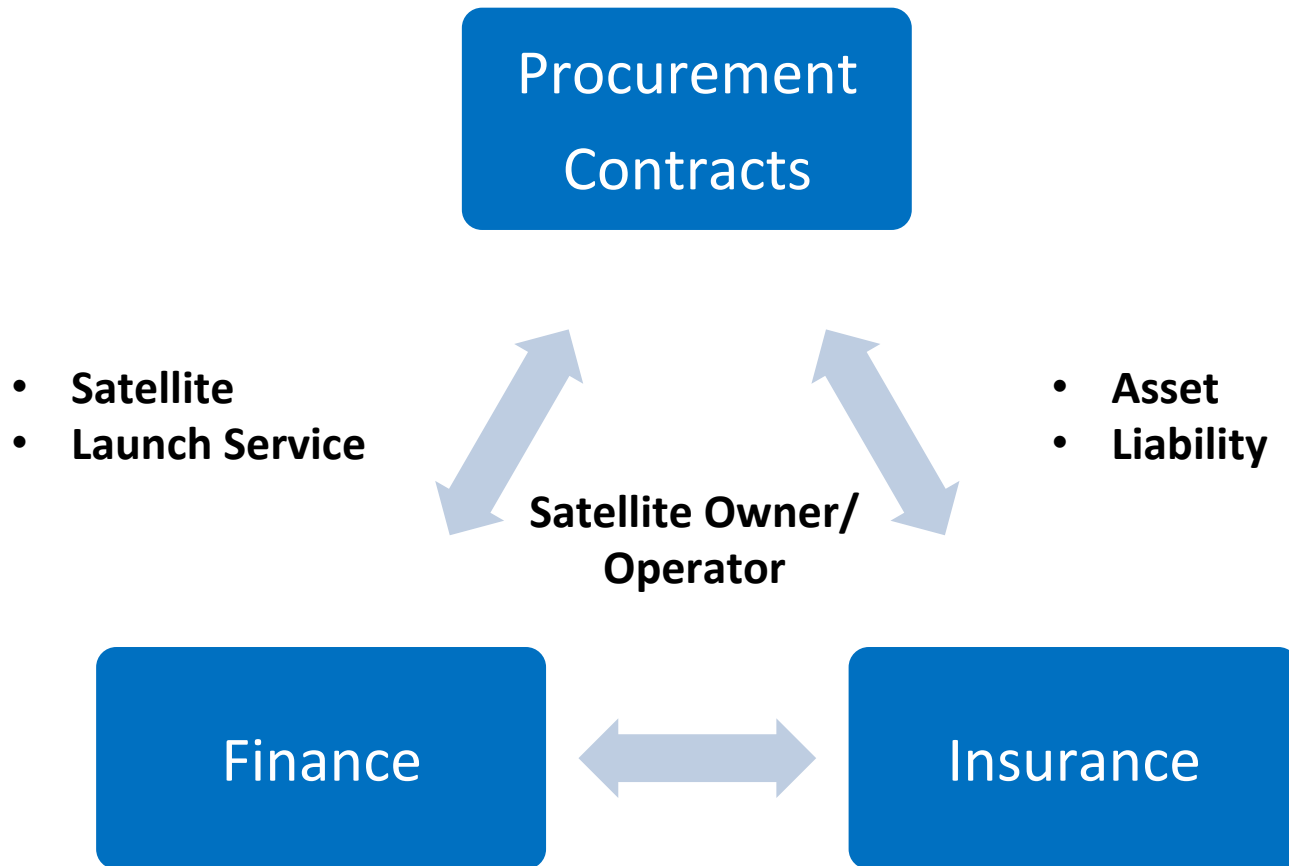
Risk Transfer Mechanism

- Security
 - Encourages business confidence
 - Financing requirement
 - Regulatory requirement

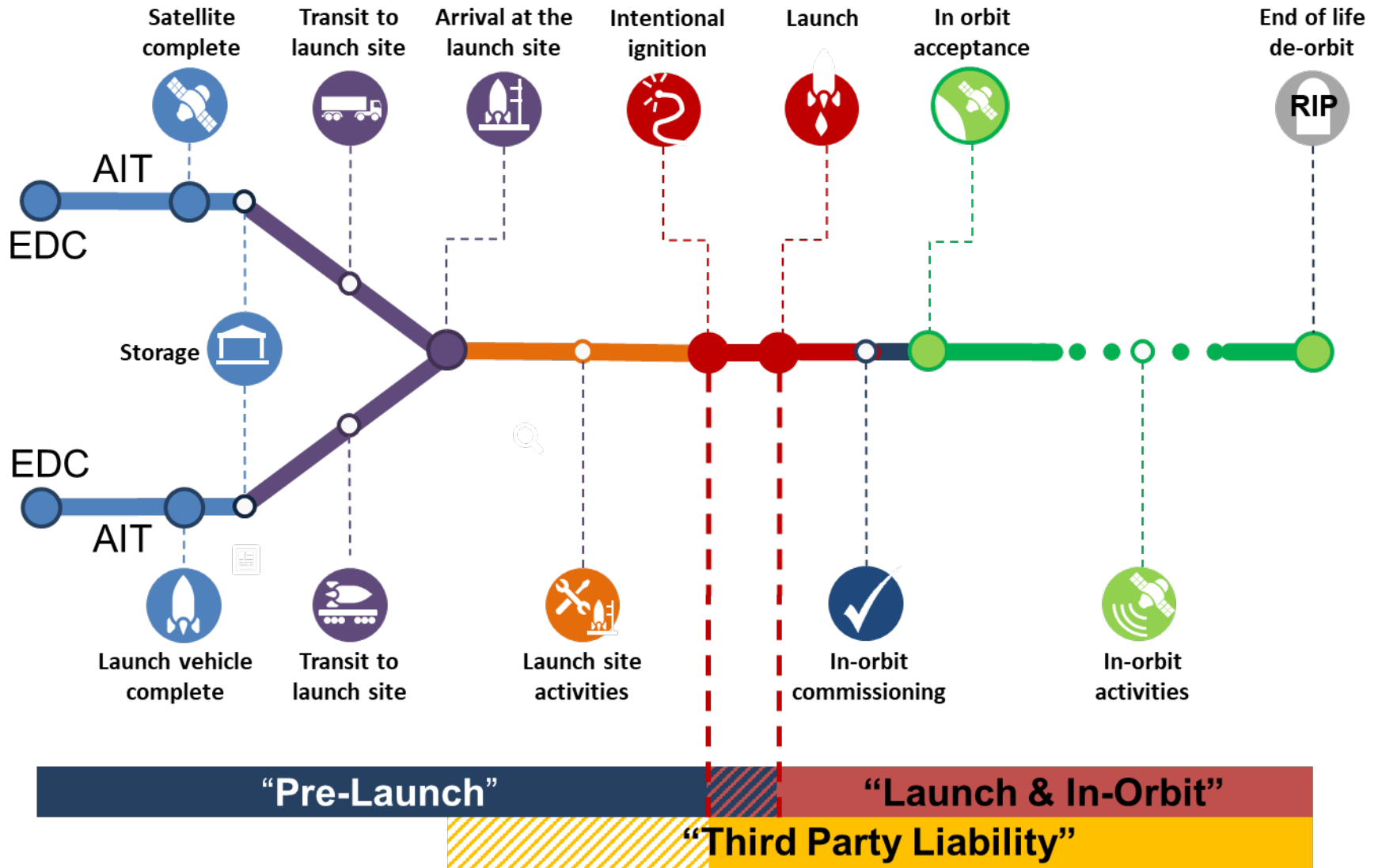
- Risk Sharing
 - The premium of the many should pay for the losses of the few

- Place the insured back into the financial position where it would have been if a loss had not occurred

Where Does Insurance Lie in a Satellite Project?



Satellite Project Lifecycle



Not to scale



PRE-LAUNCH

- What's covered?
 - All risk of physical loss or damage – accidental damage
 - Cover indemnifies for repair/replacement and subsequent re-test/re-qualification of the spacecraft

- What's excluded?
 - Standard exclusions – nuclear, terrorism/war (with limited write-backs), wilful or intentional acts
 - Design/latent defects
 - Wear and tear/gradual deterioration
 - Consequential loss – although certain financial consequences can be bought back



PRE-LAUNCH

- What comprises the Amount of Insurance?
 - Replacement cost of hardware
 - Ground support equipment
 - Containers during transit
 - Fuels (for satellites)
 - For consequential loss – ground station/labour/training/other financial expenses and penalties (with sub-limits)

- Underwriting Considerations
 - Coverage phases bought
 - AIT and pre-launch – infrastructure/processes/experience
 - Transit phase – mode of transport/container/loading and unloading processes and procedures/experience of operators

- Timing of the purchase of insurance
 - Depends on which phases of coverage purchased
 - Coverage terminates at intentional ignition or launch – dependent on the launch vehicle and/or the procurement contracts



LAUNCH

- What's covered?
 - Physical loss or damage to or failure of the satellite due to an event between Attachment of Risk and Termination of Risk
 - Attachment of Risk typically “Intentional Ignition” or “Launch”
 - Termination of Risk typically first anniversary of launch, albeit cover for other periods (longer and shorter) are available
 - Cover is typically for asset value, not revenue

- What's excluded?
 - List of “standard” exclusions including war, terrorism, insurrection, anti-satellite weapons, confiscation, unlawful seizure or wrongful exercise of control, wilful or intentional acts intended to cause loss or failure, third party liability

- What comprises the Amount of Insurance?
 - Replacement cost of satellite, launch service and cost of insurance



LAUNCH

- Underwriting Considerations
 - Satellite and launch vehicle type
 - Satellite application
 - Heritage / first flight items
 - Redundancy / margins
 - Insurance coverage – deductibles / exclusions / CTL point
 - Oversight / experience
 - Amount of insurance
 - Accumulation on launch / environment
 - Competition

- Timing of the purchase of insurance
 - Varies tremendously but often placement activity starts after Critical Design Review of satellite
 - Presentation, Q&A, policy wording all provided as underwriting info
 - Placement usually completed 12 – 18 months prior to launch
 - May be longer when cover is being purchased for fleet of satellites
 - Timing can also be influenced by state of insurance market or pending “high value” launch



IN-ORBIT

- What's covered?
 - Similar to Launch policy, covers physical loss or damage to or failure of the satellite due to an event between Attachment of Risk and Termination of Risk
 - Attachment of Risk typically anniversary of launch date
 - Termination of Risk typically one year thereafter
 - Cover for asset value, not revenue

- What's excluded?
 - Same exclusions as for launch: war; terrorism; insurrection; anti-satellite weapons; confiscation; unlawful seizure or wrongful exercise of control; wilful or intentional acts intended to cause loss or failure; third party liability

- What comprises the Amount of Insurance?
 - Replacement cost of satellite (and launch service) typically depreciating over lifetime of satellite



- Underwriting Considerations
 - As per Launch policy, albeit focused on satellite only: satellite type; satellite application; heritage / first flight items; redundancy / margins; insurance coverage – deductibles / exclusions / CTL point; oversight / experience; amount of insurance; accumulation of fleet; environment; competition

- Timing of the purchase of insurance
 - Renewal activity typically start four – six weeks prior to renewal date
 - Underwriters provided with health report and draft policy wording and given chance to raise questions / wording comments
 - Questions answered and negotiations start
 - Negotiations continue for numerous rounds and are often completed just days before attachment



THIRD PARTY LIABILITY

- What's covered?
 - “To pay on behalf of the Insured all sums which the Insured shall become legally obligated to pay as damages for Bodily Injury and/or Property Damage caused by an Occurrence arising out of the Insured Activities and including liabilities arising under the Convention of International Liabilities for Damage Caused by Space Objects 1972 (TIAS 7762)”
 - Claims handling service
 - Legal costs and expenses for payment or defence of the claim

- What's excluded?
 - Standard exclusions – nuclear, war/terrorism, noise and pollution, asbestos, wilful or intentional acts
 - Property damage to first party property involved in the Insured Activity
 - Bodily injury to those involved in the Insured Activity
 - Electromagnetic interference



THIRD PARTY LIABILITY – Launch Liability

- Limits of Liability – any one Occurrence limits

Typical limits

Ariane	€60m
Atlas V	Up to US\$500m
Proton	\$300m
Soyuz	\$100m
HIIA	JPY 20bn
Space X	Up to US\$500m

- Risk regimes vary
 - France – unlimited government indemnity above €60M
 - US – for commercial launches, government indemnity up to US\$1.5B (inflation adjusted) above the MPL
- Insured parties and contractual considerations
 - Additional Insureds would include the launching state(s) and all contractual parties
 - Cross-waivers and hold harmless between all contractual parties
 - Single launch liability policy covers all contractual parties at every tier
 - Government indemnity



THIRD PARTY LIABILITY – Launch Liability

- Coverage period
 - Attachment of risk
 - Usually includes a pre-launch phase of up to 3 months (‘arrival of the launch vehicle or the payload at the launch site’)
 - Can be at intentional ignition/launch
 - Termination of risk
 - At separation
 - 45 days from launch
 - 1 year from launch
 - Usually maximum 18 months from attachment of risk

- Underwriting Considerations
 - Limit
 - Coverage duration
 - Launch vehicle hardware and insured activities
 - Launching state and authority
 - Location of launch, launch trajectory and profile
 - Range safety – incl. NOTAMs/Note to Mariners, flight termination capabilities
 - Blast zones/impact zones
 - Satellite considerations



THIRD PARTY LIABILITY – In-orbit Liability

- Limits of Liability – any one Occurrence limits
 - Limits bought by operators vary from US\$25M to US\$500M
 - Typically any one Occurrence limits but may be aggregated
 - Some states require operators to buy insurance coverage (the scope varies)

Typical limit requirements

UK	€60m
France	€60m
Singapore	SG\$100m
Hong Kong	US\$100m

- State requirements vary
 - Coverage requirements – in-orbit or de-orbit/relocation only
 - Government indemnity may apply



THIRD PARTY LIABILITY – In-orbit Liability

- Coverage period
 - Typically annual policies
 - De-orbit or relocation could be for a shorter period (duration of operation)

- Underwriting consideration
 - Limit
 - Coverage duration
 - Insured activity
 - Spacecraft hardware and operator experience
 - Type of spacecraft
 - Manoeuvrability
 - TT&C capability
 - Other spacecraft bus information (heritage, redundancies and margins)
 - Operational space situational awareness

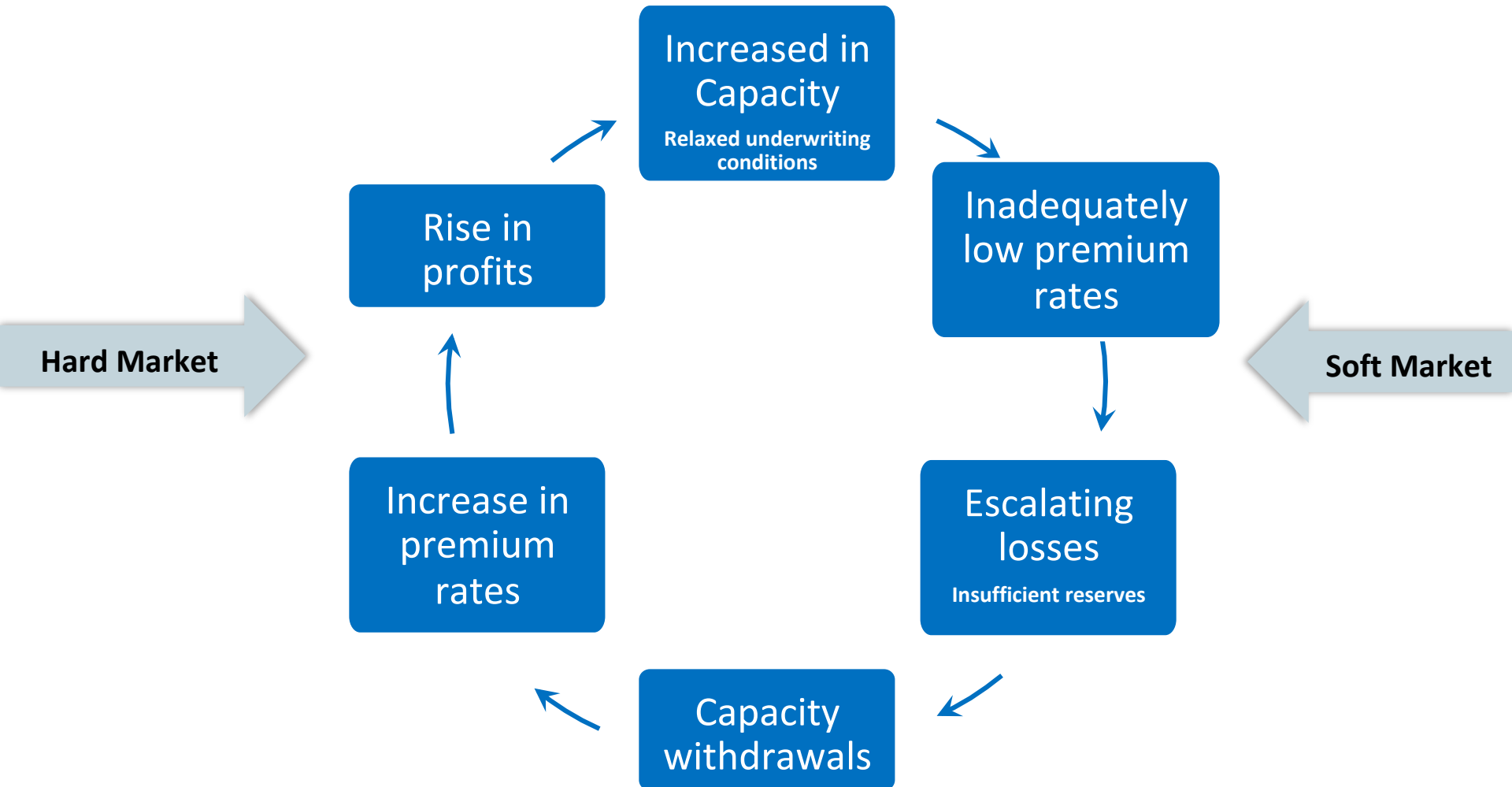
General Notes on Insurance

- Insurance Capacity and Premium
 - Availability and affordability dependent on:
 - Specific risk
 - Market environment
 - Class specific
 - Non-class specific

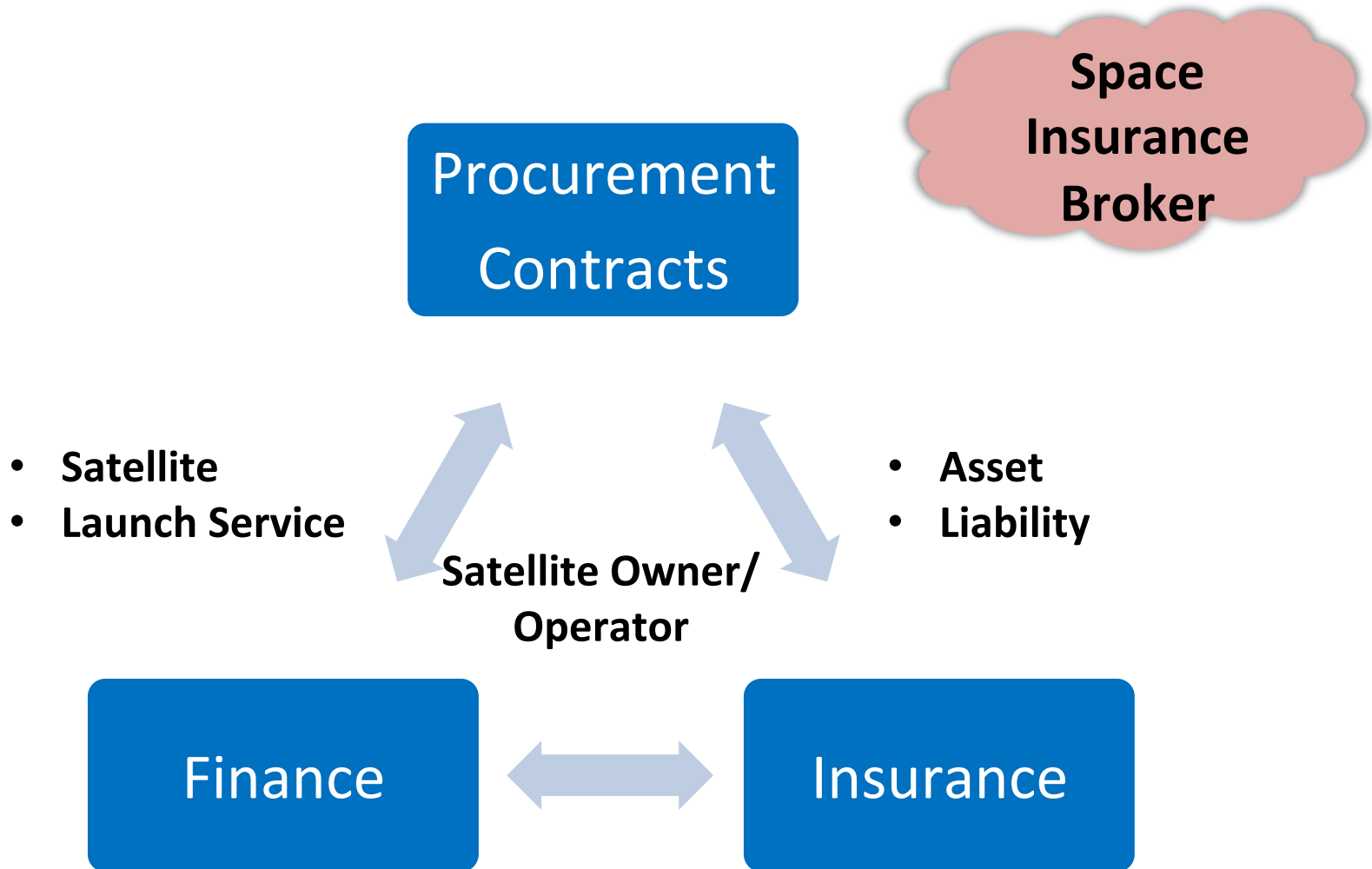
- Insurance Conditions
 - Exclusions
 - Due Diligence

- Contractual cross-waivers/hold harmless agreements

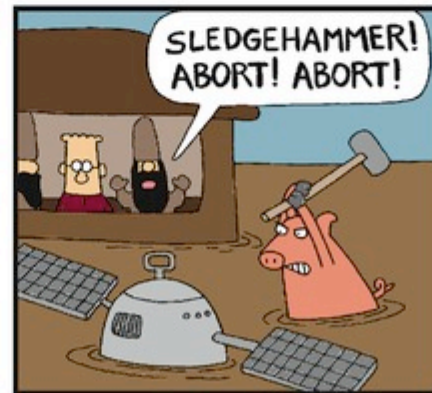
Insurance Market Cycle



Where Does Insurance Lie in a Satellite Project?



Insurance should not be an afterthought!



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Risks scenarios
Practical insurance cases

STARSHIP

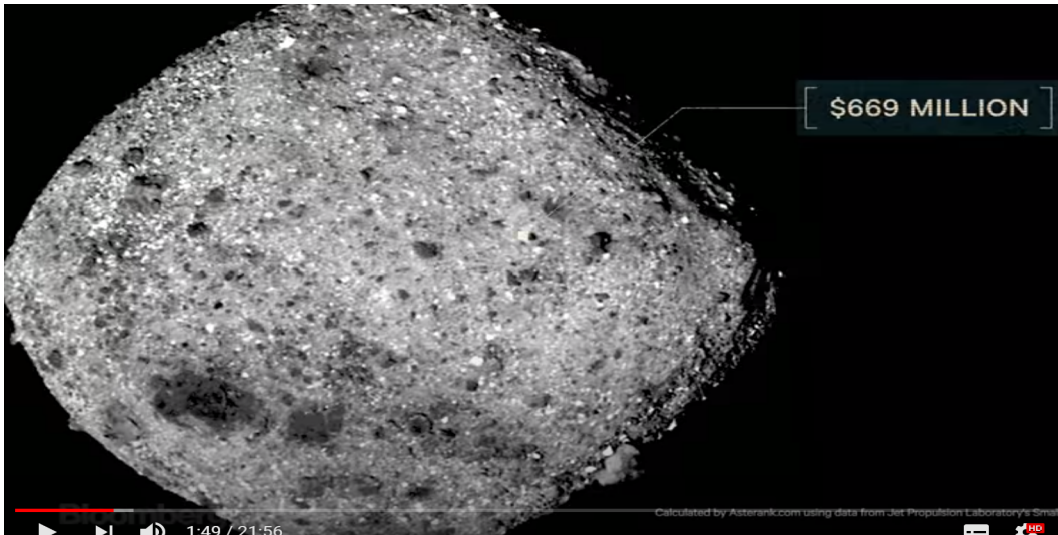
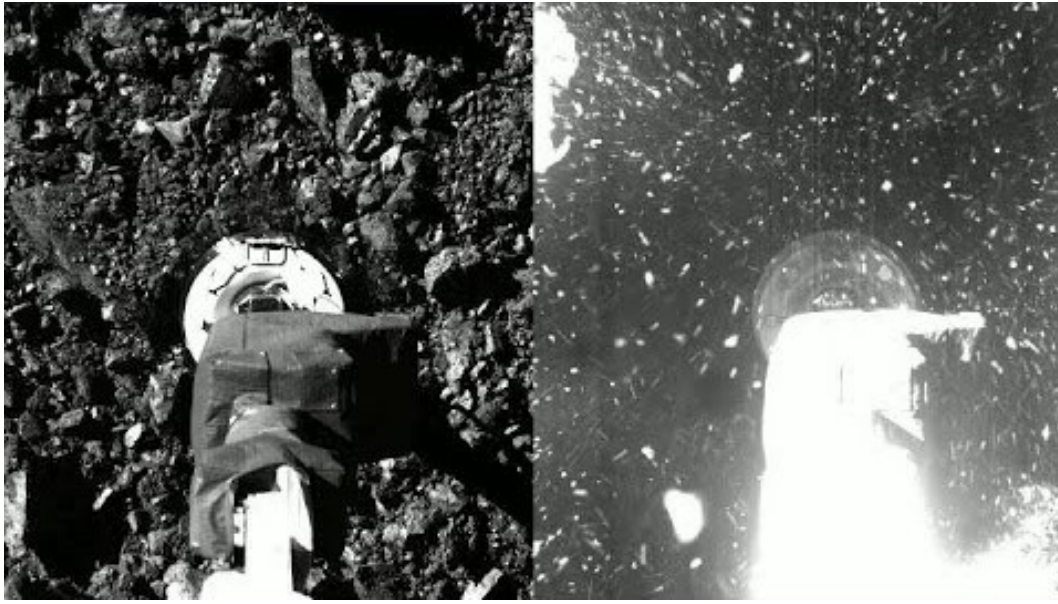


- New paradigm in space activities
- New applications and new concepts of operations
- New risks
 - Design and Manufacturing
 - Testing
 - Missions and performance
 - Landing and reusability
- Loss scenarios
- Space insurers involvement

Starship
Animation.



SPACE RESOURCES EXPLORATION/ PRODUCTION/MINING



- Technologies and experience make such activities possible in the near future
- Private / commercial initiative leading the way
- Space sustainability?
- Legal regime is uncertain
- New risks
 - Liability
 - Economical
 - Political/societal
- Loss scenarios
- Space insurers involvement

CONSTELLATIONS

- GEO vs LEO
- Numerous applications
- Diverse range in the size of constellation and spacecraft
- New risks
 - Design
 - Manufacturing and Testing
 - Launch vehicles
 - Collision risks
 - End of life disposal?
- Loss scenarios
- Space insurers' involvement

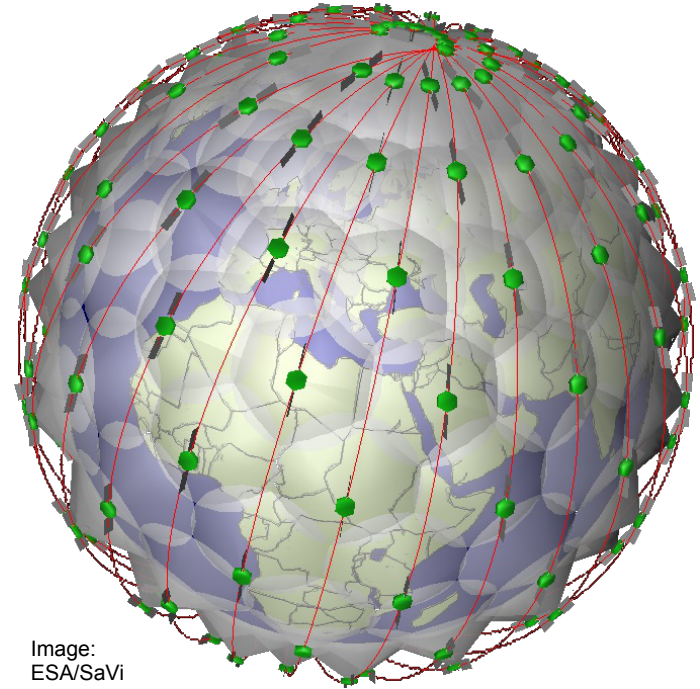
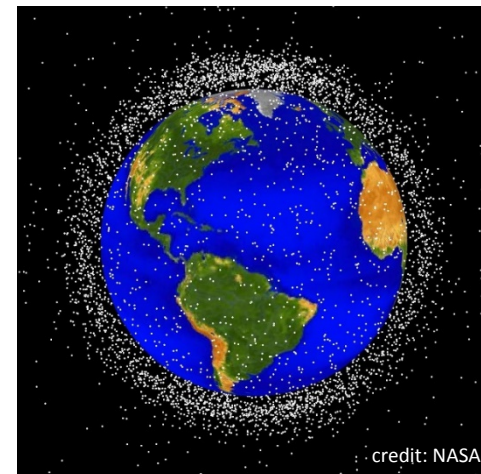


Image:
ESA/SaVi

IN-ORBIT DEBRIS – Debris Mitigation And Removal

- The Problem:
 - Over 9,500 satellites launched to date
 - Only ~2,300 satellites still functioning
 - ~22,300* observable objects in Earth orbit (tracked and catalogued)
 - 65% of these are in LEO
 - Estimated 900,000 objects >1cm
 - With increase in number of satellites being launched into space, the problem will worsen

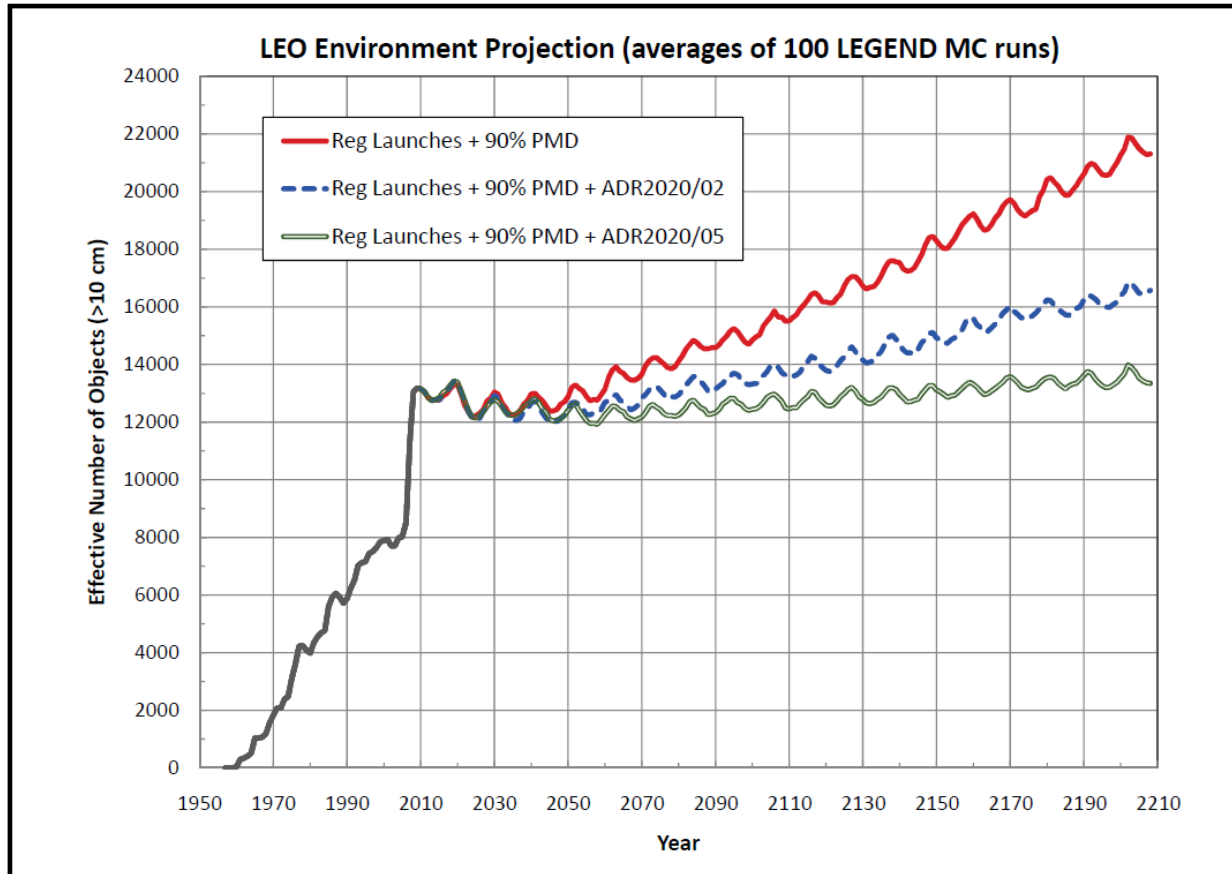
- Potential Solutions:
 - Debris Prevention
 - Active Debris



credit: NASA

*As at February 2020

IN-ORBIT DEBRIS – Debris Mitigation and Removal



credit: NASA (Liou)

ACTIVE DEBRIS REMOVAL

- Challenges

- Technically complex
- Ownership of space objects being removed
- ITAR and other export control
- Liability and responsibility
- Regulation
- Dual-use technology
- Funding

- New risks

- Mission concept
- Hardware
- Space environment
- Collision/re-entry risk

- Loss scenarios

- Space insurers involvement

- Programmes:

- Demo missions
 - RemoveDEBRIS
 - Astroscale
- Actual mission

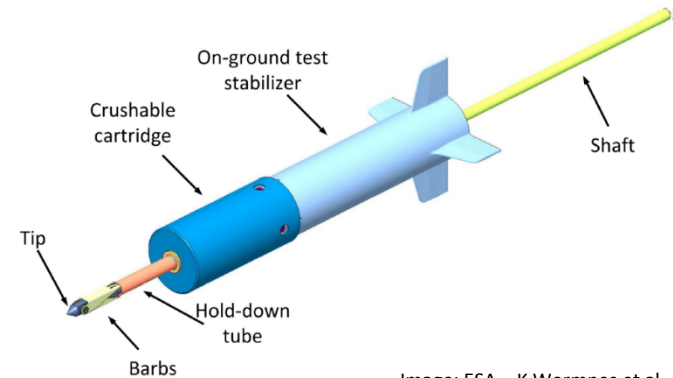


Image: ESA – K Wormnes et al

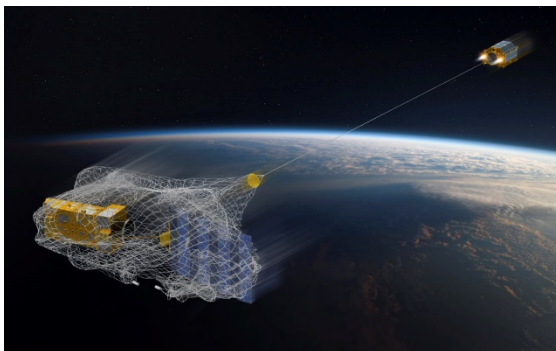


Image: ESA/David Ducros

ACTIVE DEBRIS REMOVAL

Palapa B2 and Westar VI

