



# Space Sustainability Rating

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on behalf of the SSR Project team

Clean Space Industry Days  
22<sup>nd</sup> September 2021



# Background



The **World Economic Forum's** Global Future Council (GFC) on Space Technologies, during the **2016-2018 term**, initiated a conversation about potential **ratings** for space missions

Goal: promote the importance of space **sustainability**, with a focus on the challenge of **orbital debris**

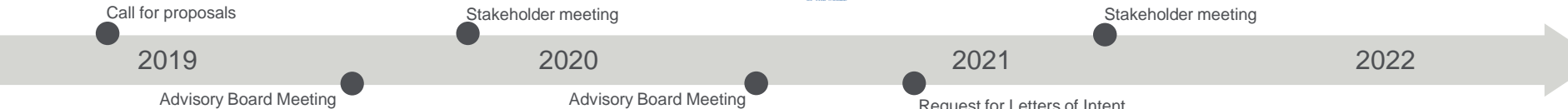
Call for proposals to find partners to develop the Space Sustainability Rating (SSR) was launched at **IAC 2018**.

Winning consortium (post-application):  
**ESA + MIT/UT/Bryce** notified in January 2019

SSR in development since two years



# Space Sustainability Rating



Preliminary concept definition

Host agency selection | Hand-over

Module selection

Modelling refinement

Architecture definition

Architecture finalisation

Alpha-testing | i.e. application to missions from the consortium (ESA, MIT)

Beta-testing | i.e. application to commercial actors



# Concept



Main objective: create an **incentive** to

- **design** missions compatible with sustainable operations
- **operate** missions considering not only mission objectives & service quality, but also the potential harm to the orbital environment and the impact on other operators

Not a new set of guidelines, but a system to recognise **compliance** and **better-than-required** behaviours



Illustrative example inspired by the LEED classification system

# What do we mean by *Space Sustainability*

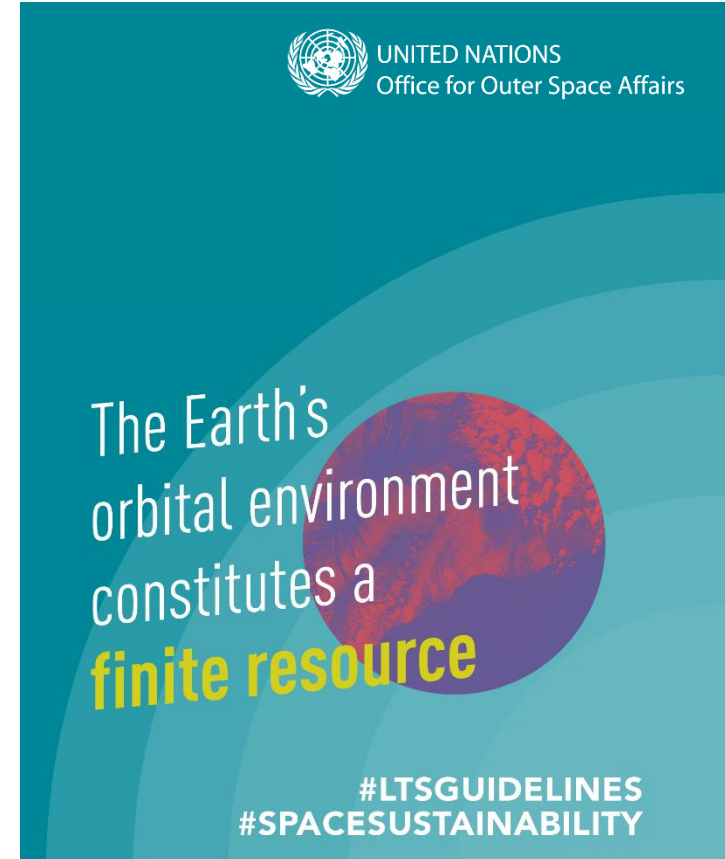


Sustainability in Space will ensure that we can continue to use the **resources** of the Space Environment for generations to come

The Space Sustainability Rating Team builds on the concepts of sustainability developed in the **United Nations** Committee on the Peaceful Uses of Outer Space in the 2019 **Guidelines** for the Long Term Sustainability of Outer Space

Mapping of SSR parameters vs UN Guidelines principles carried out

- ▶ M. Rathnasabapathy et al, Space Sustainability Rating: Towards An Assessment Tool To Assuring The Long-Term Sustainability Of The Space Environment, IAC 2019



# Potential scope



# Selected architecture

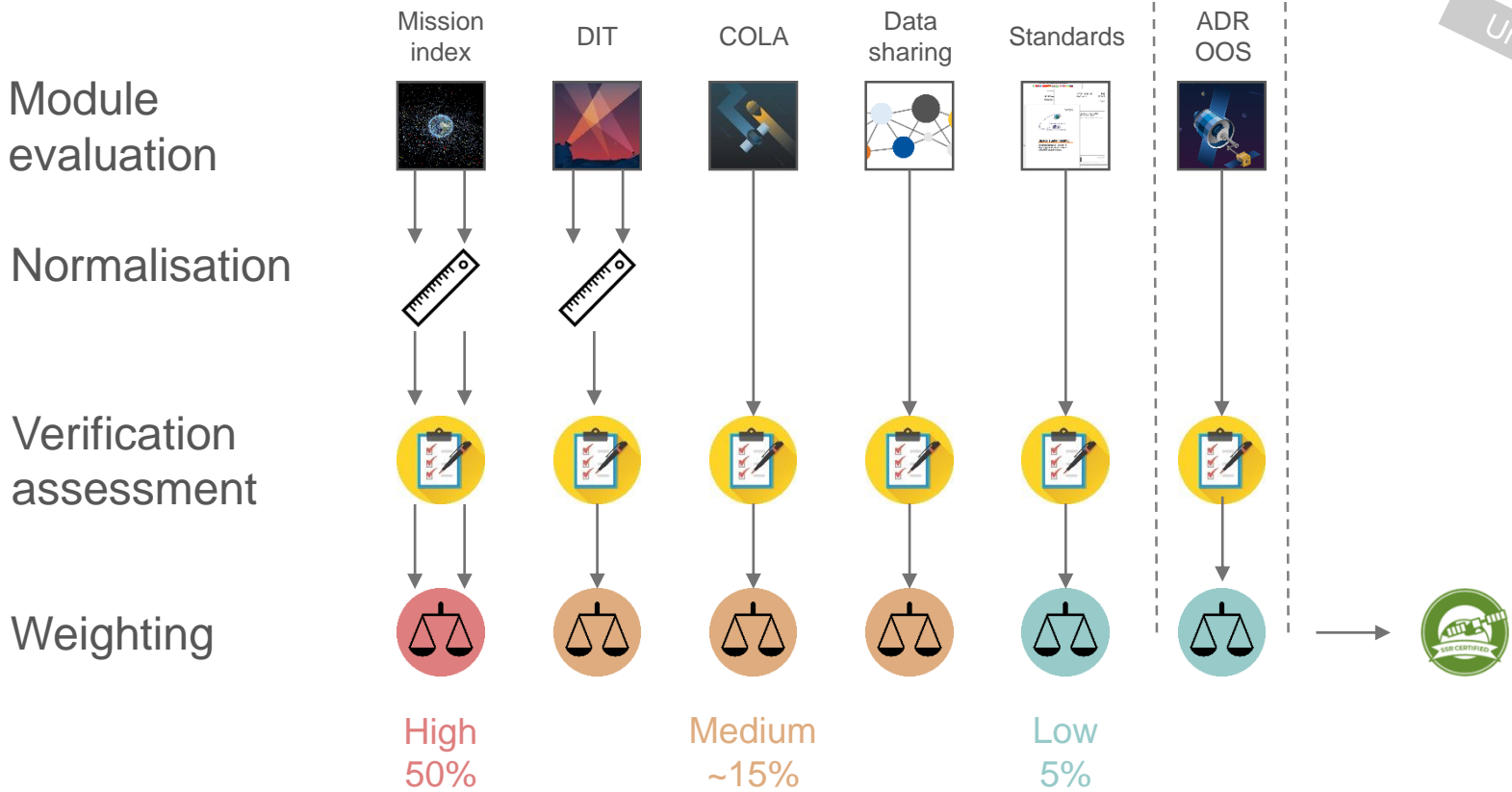
Composite indicator based on 6 + 1 modules



- Cross-parameter evaluation
- Simulation-based parameters
- Questionnaire-based parameters



# Composite indicator



Under review



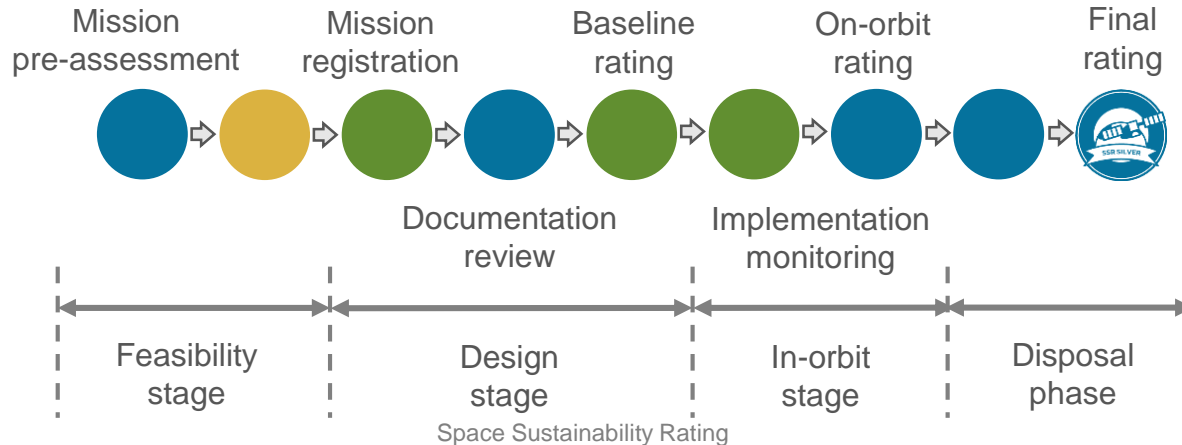
# Scope & process



**Mission:** functional unit of spacecraft, launch vehicle, and mission related objects aimed at providing a specific service



## Timeline



## Tier definition



**Certified:** The mission meets the pre-requisite requirements to apply for an SSR. The Applicant demonstrates willingness to increase mission's sustainability. Current sustainable practices need to be incorporated into the mission.



**Silver:** The mission incorporates current sustainability practices with areas to improve upon. The Applicant demonstrates consideration for the orbital environment in design and operation of mission.



**Gold:** The Applicant demonstrates currently accepted best practices for sustainability in all aspects of the mission. The mission has minimal impacts on the orbital environment beyond the necessary use.



**Platinum:** The mission incorporates innovative methods for improving the orbital environment that go beyond common best practices. The Applicant demonstrates sustainable practices that enhance sustainability outcomes across all aspects of the mission.

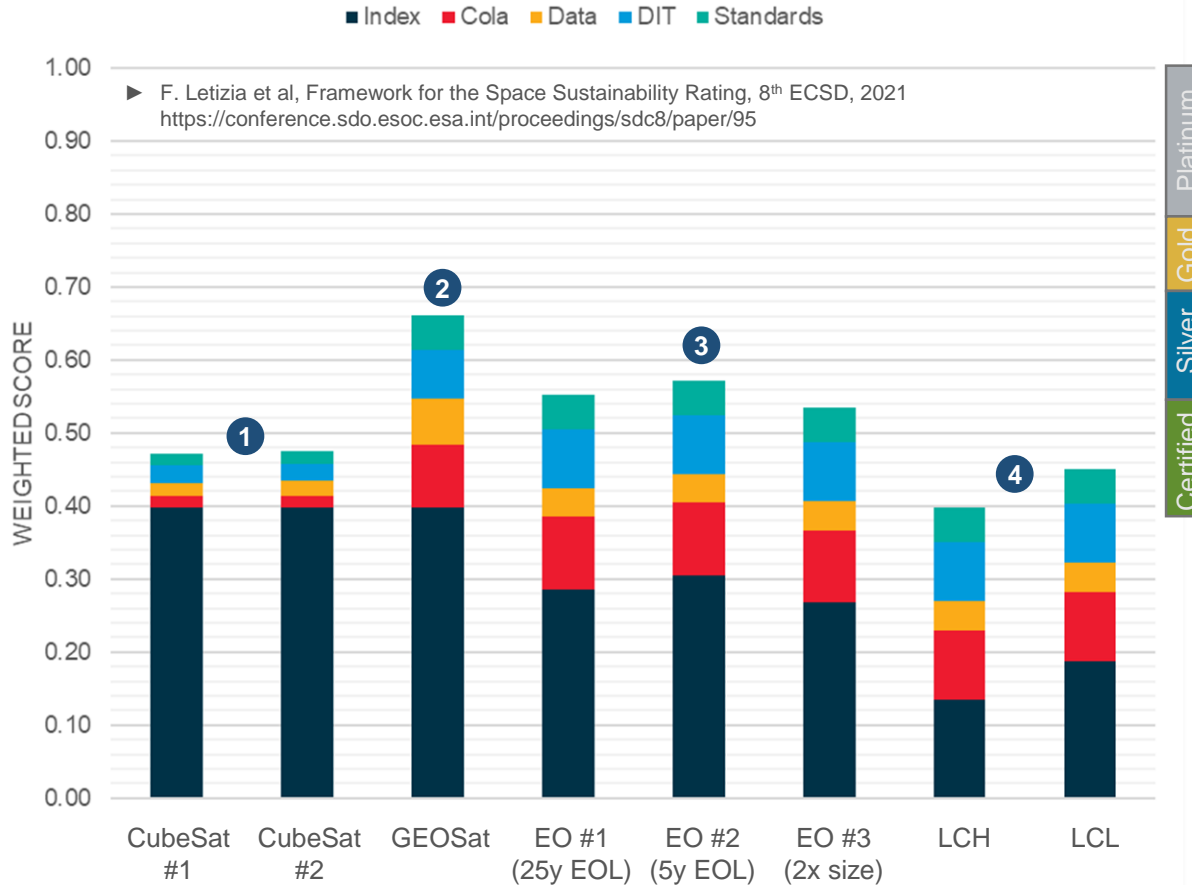
# Alpha test

GEO missions benefit from reduced risk metric with respect to LEO missions

2

CubeSat missions have low associated risk, but are penalised by the lack of collision avoidance capabilities

1



Variations on an Earth Observation mission to assess the sensitivity to operator choices (e.g. disposal) and to design features (e.g. size)

3

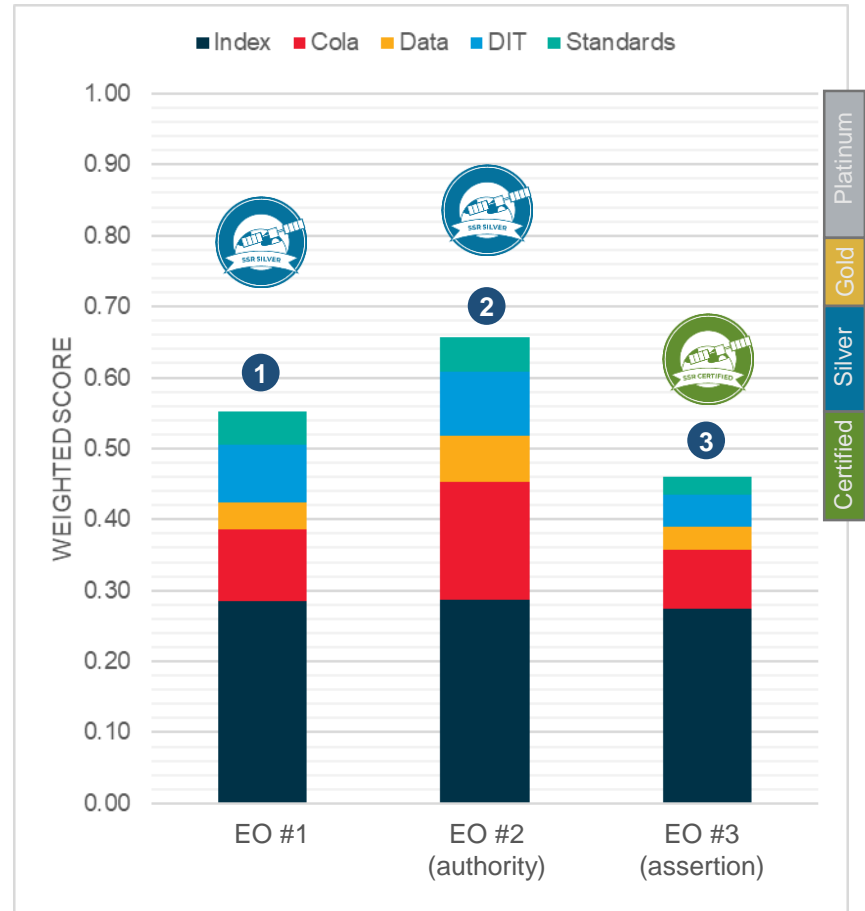
Large LEO Constellations cases at High and Low altitude. Significant risk contribution.

4

# Alpha test – data validation

Same reference Earth Observation mission, but different levels of data verifiability

1. current
2. all inputs verified by an external authority
3. all inputs based on assertion only





Platform for Earth Observation

Mature design

New design

(e.g. improved compliance)



Constellation

Different orbital altitudes

Different generations

+ additional feedback from other operators

## Beta testers – aggregated feedback

Explicit consideration of manoeuvre capabilities

Consideration for a rating for rockets only

Promotion of standard formats for data sharing

Need to align SSR timeline with missions lifecycle (e.g. understand when inputs are frozen)

Effort to provide inputs around 1 working day, but contribution from different experts may be needed

Need for the issuer to highlight handles and possible improvements

Consideration of mission extensions and fleet management (e.g. new platform generation) may suggest the inclusion of LCA elements

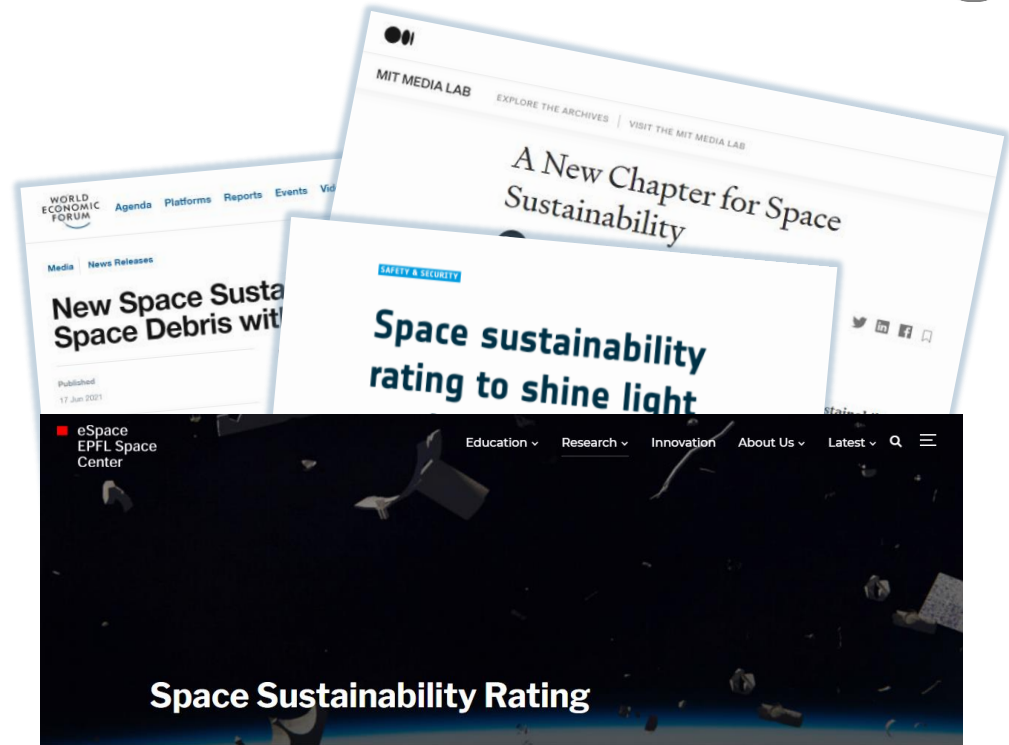
# From project to operational phase

Host agency selected: **EPFL Space Center**

Hand-over phase until end of **2021**

ESA's role in the future:

- Support EPFL with **technical experience** and expertise from technical **international fora**.
- Part of the **Space Sustainability Rating Advisory Board**



eSpace has been selected as the organization taking over and putting in place the Space Sustainability Rating (SSR), a system that will evaluate the grade of sustainability of a space mission, which has been developed in the last two years by a consortium of organizations including WEF, ESA and MIT. The objective of the SSR is to push forward sustainability in the space sector and reward operators whose missions comply with the sustainability norms and guidelines.

# Conclusions

## Space Sustainability Rating goals

- promote the importance of space **sustainability**, with a focus on the problems with **orbital debris**
- incentivise **positive behaviour**

Several possible components analysed:

- proposed formulation based on **6(+1) modules**
- selection based on **relevance, access, verifiability**

Rating design completed and on-going handover to the selected host agency: **EPFL**

Operational phase from **2022**







# Thanks for your attention

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