# ESA & ESF planetary protection study

Silvio Sinibaldi

Planetary Protection Officer
European Space Agency
Independent Safety Office

Jonas L'Haridon

Science Officer
European Science Foundation

# Earth's Moon

ESA Planetary Protection Office has been actively working in the past year in assessing contamination aspects for the Earth's Moon

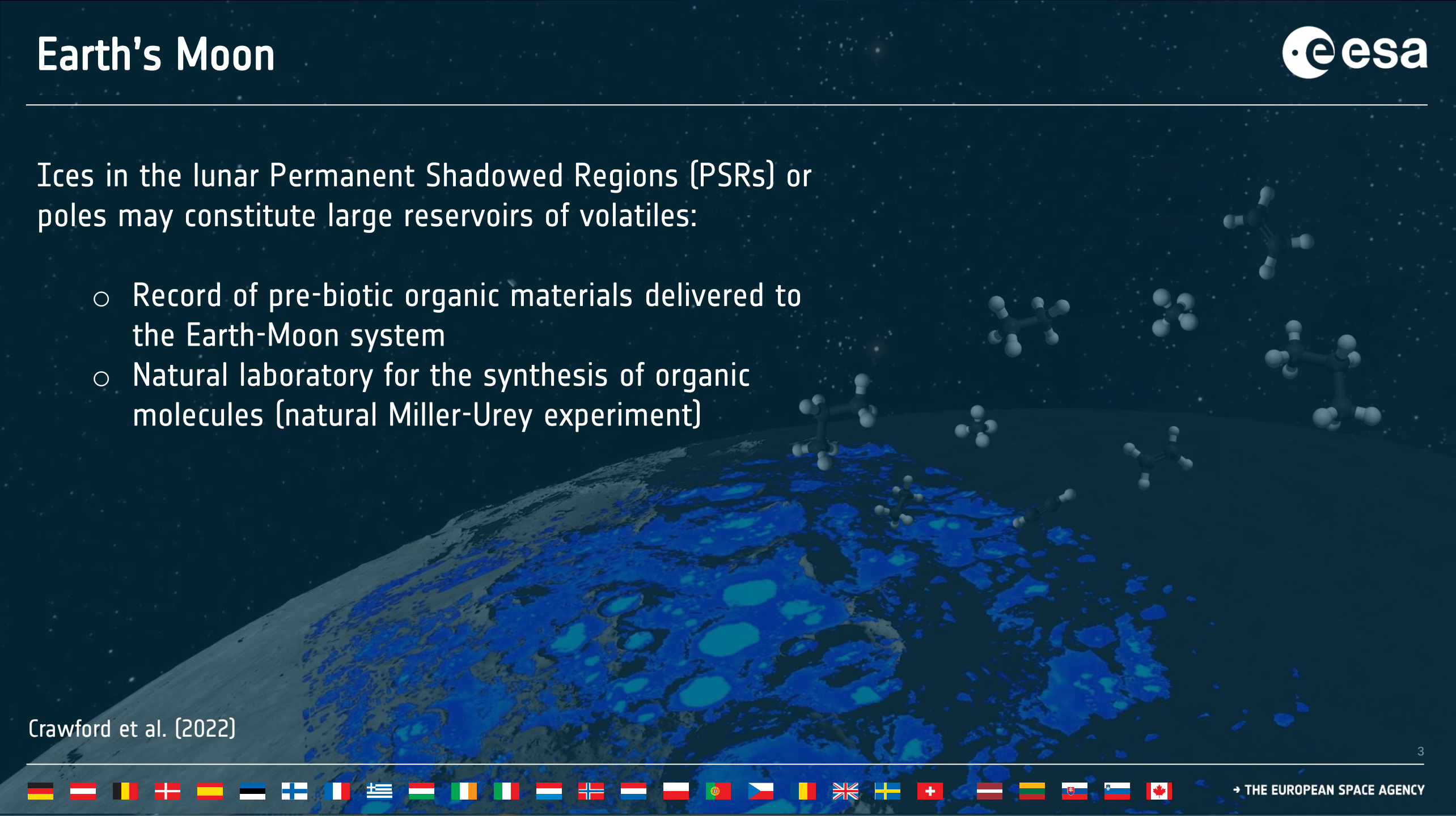
Preserving lunar polar environments from disturbance by extraneous volatiles (e.g. from rocket exhausts), organic materials from spacecrafts, and the generation and widespread dispersal of lunar dust is of great importance for scientific interests

Potential conflict between the scientific goals and commercial infrastructures at the lunar poles - for example, lunar polar ices may be a valuable source of water for in situ resource utilization (ISRU)

# Earth's Moon

Ices in the lunar Permanent Shadowed Regions (PSRs) or poles may constitute large reservoirs of volatiles:

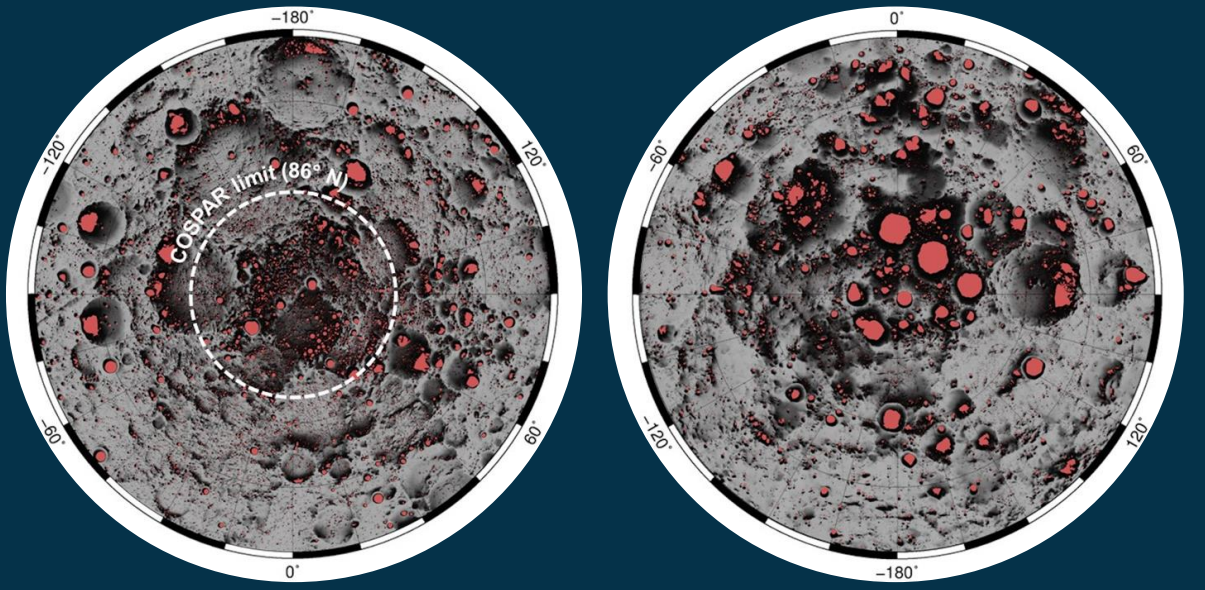
- Record of pre-biotic organic materials delivered to the Earth-Moon system
- Natural laboratory for the synthesis of organic molecules (natural Miller-Urey experiment)



Crawford et al. (2022)

# BACKGROUND AND MOTIVATION

Two sub-categories (IIa and IIb): depending on whether the landing is planned on PSRs / polar regions, an **organic materials inventory** (which includes **outgassing** products coming from propulsions systems) shall be provided




Locations of permanent shadow (marked in red) overlaid on average solar illumination (grayscale) within 10° latitude of the lunar North Pole (left) and South Pole (right). The northern latitude limit for COSPAR PPP Category II(b), 86°N, is indicated; the corresponding southern limit, 79°S, lies outside the area shown. Data from https://pgda.gsfc.nasa.gov/products/69 (Mazarico et al.).

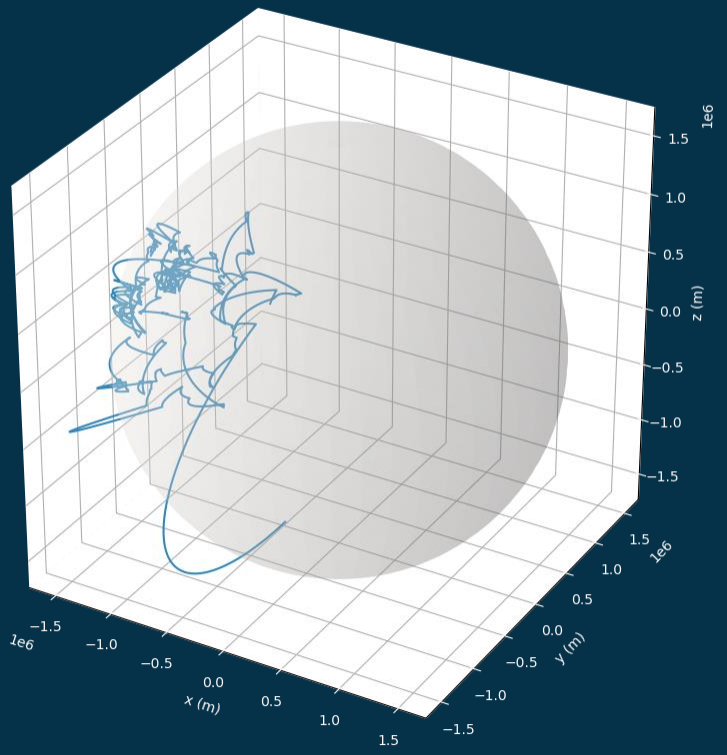
COSPAR (2024)

# TRANSPORT OF ORGANIC VOLATILES ON THE MOON

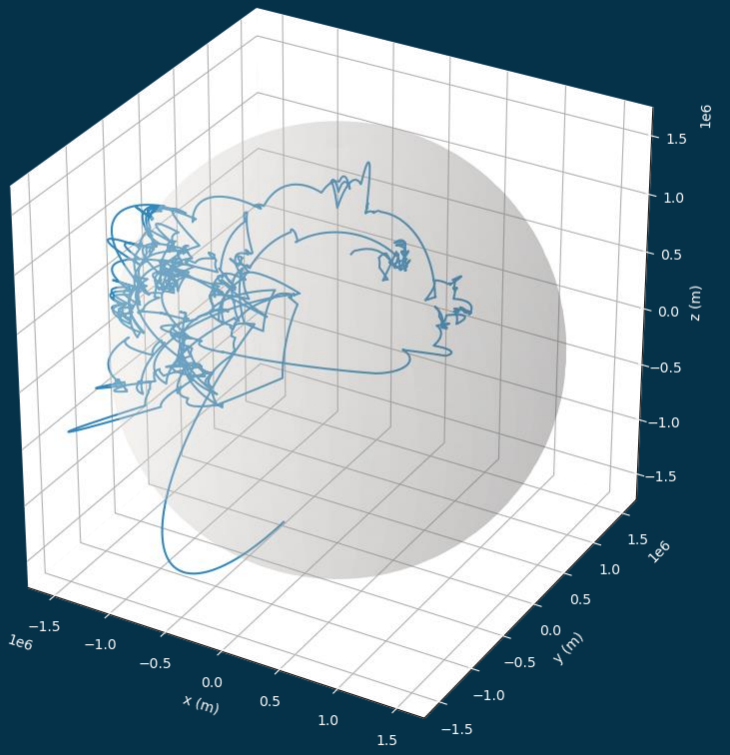
## ESA MODEL BASED ON ARGONAUTS

## MOLECULE TRAJECTORY OVER 5, 10 AND 30 (EARTH) DAYS

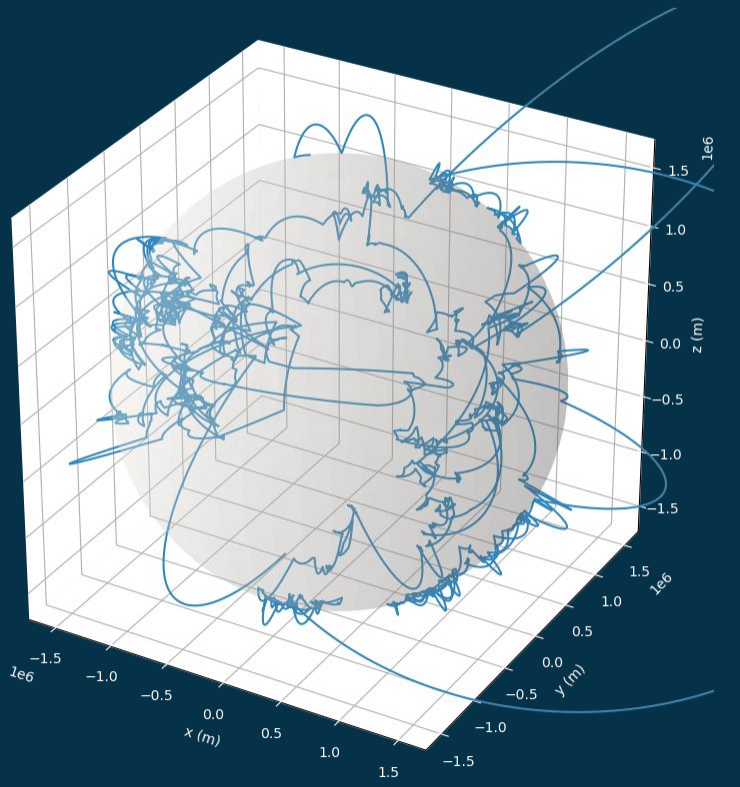
5 days




10 days




30 days



# ESA & ESF Study: Earth's Moon

Build on previous work done in the last year by ESA PP office. Study will focus on:

- Assess the organic materials and propulsion products carried by spacecrafts, orbiters and lander (with target the Earth's Moon)
- Determine the risk for scientific experiments or investigations caused by organic materials introduction
- What do we do with an organic lists, and what experiments framework can be created?
- Is there something else we can do from an implementation perspective rather than an organic material list?
- Assess any other type of contamination (i.e. inorganic, dust, nuclear, etc.) that could have ramifications / cross overs with planetary protection and potentially affect scientific goals.

COSPAR PP panel leadership with different sub-committees as applicable

- ESA PP office will use the advice of ESF study to contribute to the overall discussion led by COSPAR PPP

# ESA & ESF Study

On-going studies:

- Earth's Moon (see previous slide)
- Particle size for ESA ERO (Earth Return Orbiter) and backward planetary protection – update of 2012 ESF report
- Icy Moons – Assess implementation of proposed changes by Doran et al


NO work in silos! ESA contribution to scientific knowledge advancement, as inputs for consideration to the overall discussion led by COSPAR PPP

# ESA & ESF Earth's Moon Study framework

ESF identified 8 European experts to participate in the study, which will be structured around two workshops.

Experts will bring expertise in:

- Lunar geology, volatiles and samples
- Lunar exploration technologies and ISRU
- Nuclear propulsion systems
- Radiation and Organic Biology
- Polar Microbiology and Microbial Ecology

The outcome of the study will be a report, which will be presented to the ESA PPAA (planetary protection approval authority)

# Earth's Moon workshoks

## Workshop #1: Scoping Workshop

- Presentation of the study, ESA's expectations and requirements, workplan
- Identification of the issues to be address in the report
- Identification of potential knowledge gaps within the group of experts

## Workshop #2: Main Workshop

- review, and build up on the progress made since the scoping meeting
- discuss and agree on conclusions and/or recommendations on the final report

# Planetary Protection Studies conducted by ESF