Space Robotics Society

Astrobiology League

Registration: 26 September 2025 Onwards
Submission: 30 November 2025

Astrobiology League — Challenge 1: Life in the Deep Subsurface

1. Problem Description

In this challenge, participants are invited to design a mission scenario for exploring the deep subsurface of a planetary crust — several kilometres below the surface — where life may survive under extreme conditions. Analogous environments on Earth, such as deep mines, geothermal boreholes, or oceanic basaltic rocks, provide valuable insights into potential habitats on Mars, Europa, Enceladus, or Ganymede.

The challenge is to develop a robotic subsurface exploration mission (either as an Earth-based analogue experiment or as a future space concept) with the goal of detecting evidence of life — active or dormant. Particular emphasis should be placed on safe and effective drilling methods, strict contamination control, and reliable sample analysis in extreme, lightless, and energy-limited environments subjected to high pressure.

2. Assumptions

- The mission may be Earth-based (e.g., South African gold mines, Siberian boreholes, Icelandic volcanic terrains) or set within an extraterrestrial environment.
- Conditions include scarce nutrients, absence of light, extreme temperature gradients, high pressures, and drilling through rock or ice.
- Permitted technologies: deep drilling systems, sterile sampling methods, in-situ microscopy, spectrometry, biosensors, and molecular biology techniques.
- Submissions must outline biological and chemical analysis strategies, detailing which biosignatures will be targeted, how life can be detected without harm, and how contamination will be ruled out.

3. Format

All submissions must take the form of a written report, not exceeding 10 A4 pages in total. This page count includes text, images, diagrams, and tables. No appendices or additional documents are permitted. Visuals must be integrated directly into the report and clearly explained.

4. Eligibility

- Open to all undergraduate students aged 18 or over.
- Teams of up to 10 members may participate.
- No restrictions on nationality or professional background apply.
- Contributions are welcomed from a wide range of disciplines, including engineering, geology, architecture, psychology, safety science, and general space enthusiasts.

5. Requirements

A complete submission must include:

- **Exploration site selection** (Earth-based or extraterrestrial) with justification.
- **Geological environment description**, including anticipated biological and chemical conditions.
- **Drilling and sampling system design**, with measures to prevent contamination and ensure safety.
- **Life detection methods**, outlining indicators (e.g., ATP, metabolites, DNA/RNA, biomarkers) and relevant technologies.
- **Mission workflow**, detailing planned duration, as well as energy and communication limitations.
- **Visualisations**, including drilling system schematics, analysis chamber designs, geological cross-sections, and operational flow diagrams.

6. Evaluation Criteria

- **Originality and Innovation (30%)** — Novelty and creativity of the approach.
- **Technical Feasibility (25%)** — Realism and practicality of implementation.
- **Biological Approach Quality (20%)** — Appropriateness and scientific validity of life-detection techniques.
- **Environmental and Ethical Considerations (15%)** — Biosecurity measures and adherence to planetary protection ethics.
- **Clarity and Presentation Quality (10%)** — Consistency, readability, and visual effectiveness of the report.

7. Timeline

- Challenge registration opens on 26 September 2025.
- Challenge duration: 1 October to 30 November 2025.
- All submissions must be finalised and submitted by 30 November 2025.

8. Submission and Contact

A submission form link will be activated on the website ahead of the submission deadline. For queries or clarifications, participants may contact the organising team via the official competition email address listed on the website: www.SprosTech.com

9. Awards

All participants will receive certificates of participation. Winners will receive certificates of achievement for each individual challenge, as well as for the overall league performance. Points earned in each challenge will contribute to a participant's or team's cumulative league

score, with final awards and certificates presented to the top-ranking individuals and teams at the end of the season.

10. Rules

All participants must adhere to the general competition rules and ethical standards of the Astrobiology League, and are expected to read the problem statement thoroughly.

11. FAQ

A detailed FAQ will be hosted on the official competition website to address common concerns relating to submissions, judging, eligibility, and other procedural matters.