

Beneficiation of Regolith and Mobile Excavation: Space Resources Challenge and next steps

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Mission Scenario: The 2040s – Lunar South Pole

Mission Context

Long-term human presence
End-to-end ISRU demonstration
O₂ and metals production

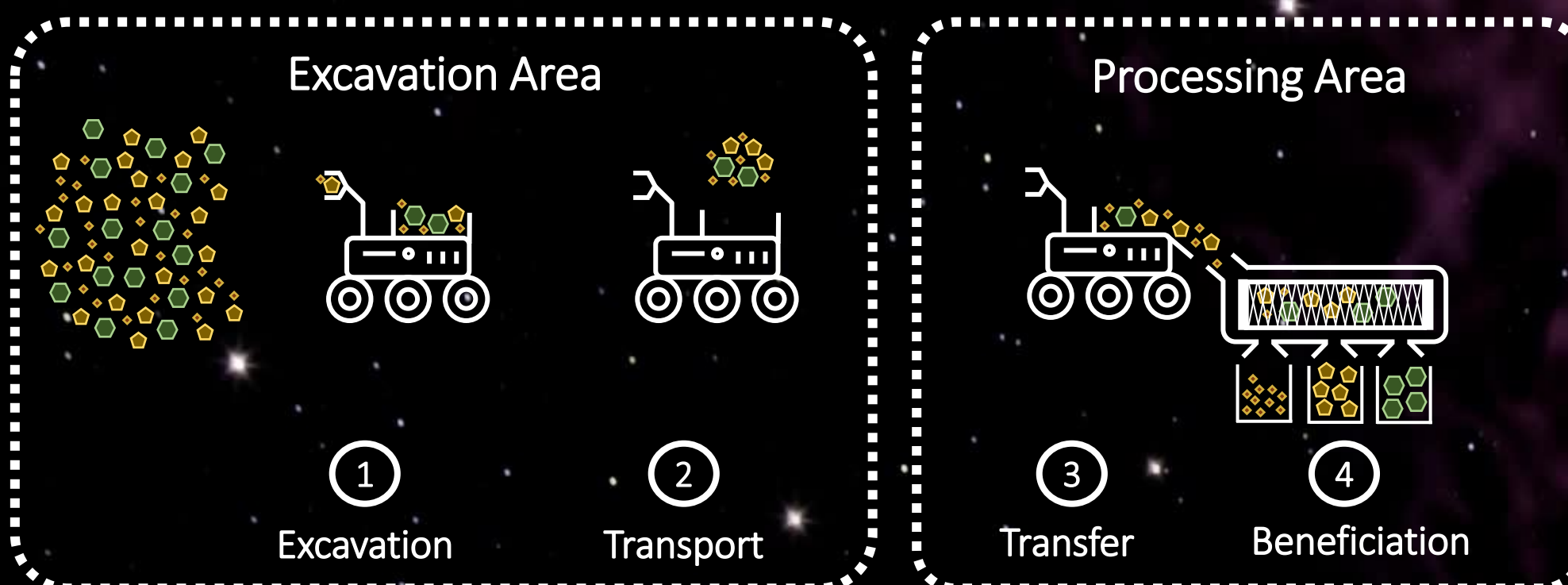
Infrastructure

O₂ refueling capability
Additive Manufacturing
Autonomous ISRU facilities

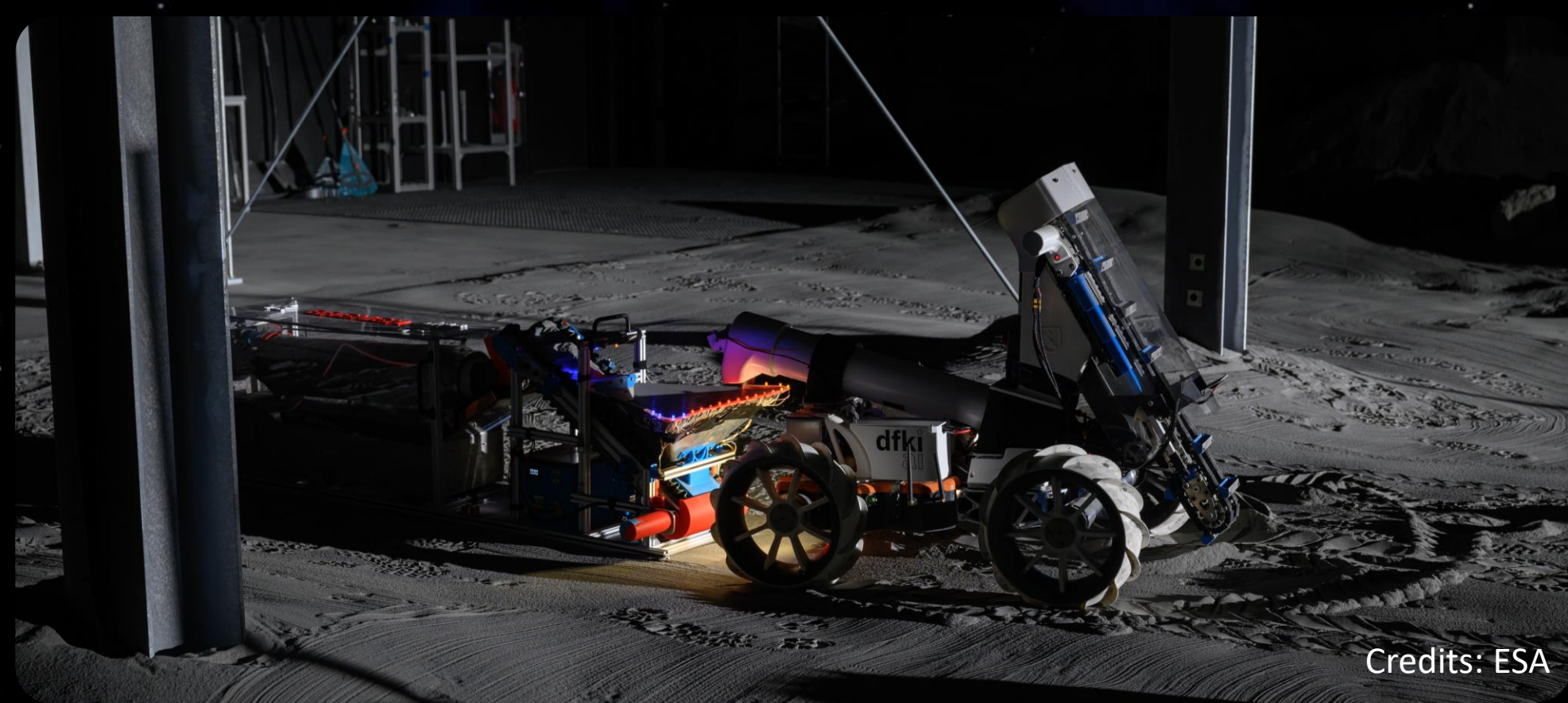
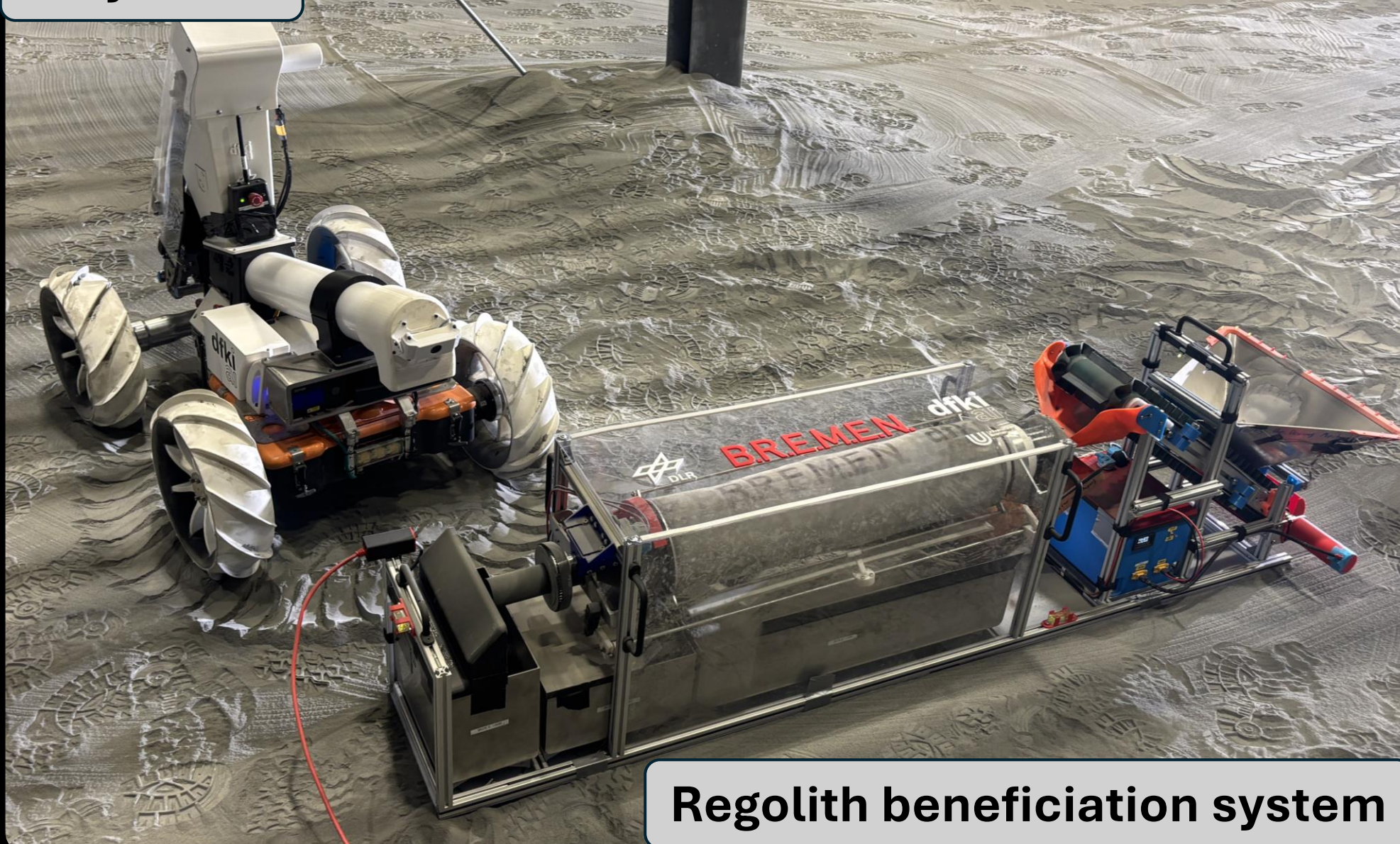
Crew & missions

Frequent crewed missions
Up to 30-day surface stays
Science & ISRU maintenance

Team BREMEN Field Test ConOps



Coyote III



CONCLUSION

- Successful field test demonstration for all targets
- Field test results → Benchmarks for further technology maturation
- Future developments shall focus on improving the system robustness and operational stability across all performance metrics
- Current plan → Field test at LUNA with improved system in Q1 2027

O₂ production process chain

Regolith

~45 wt.% O₂

Excavation

Surface regolith collection

Beneficiation

Particle size classification

Molten salt electrolysis

O₂ production

Scaled Demonstration: LUNA Field Test

Excavation target

≥ 15 kg surface regolith collection

Beneficiation target

≥ 5 kg feedstock
PSD: 500 – 100 μm

Energy target

≤ 300 Wh total energy consumption

Operational targets

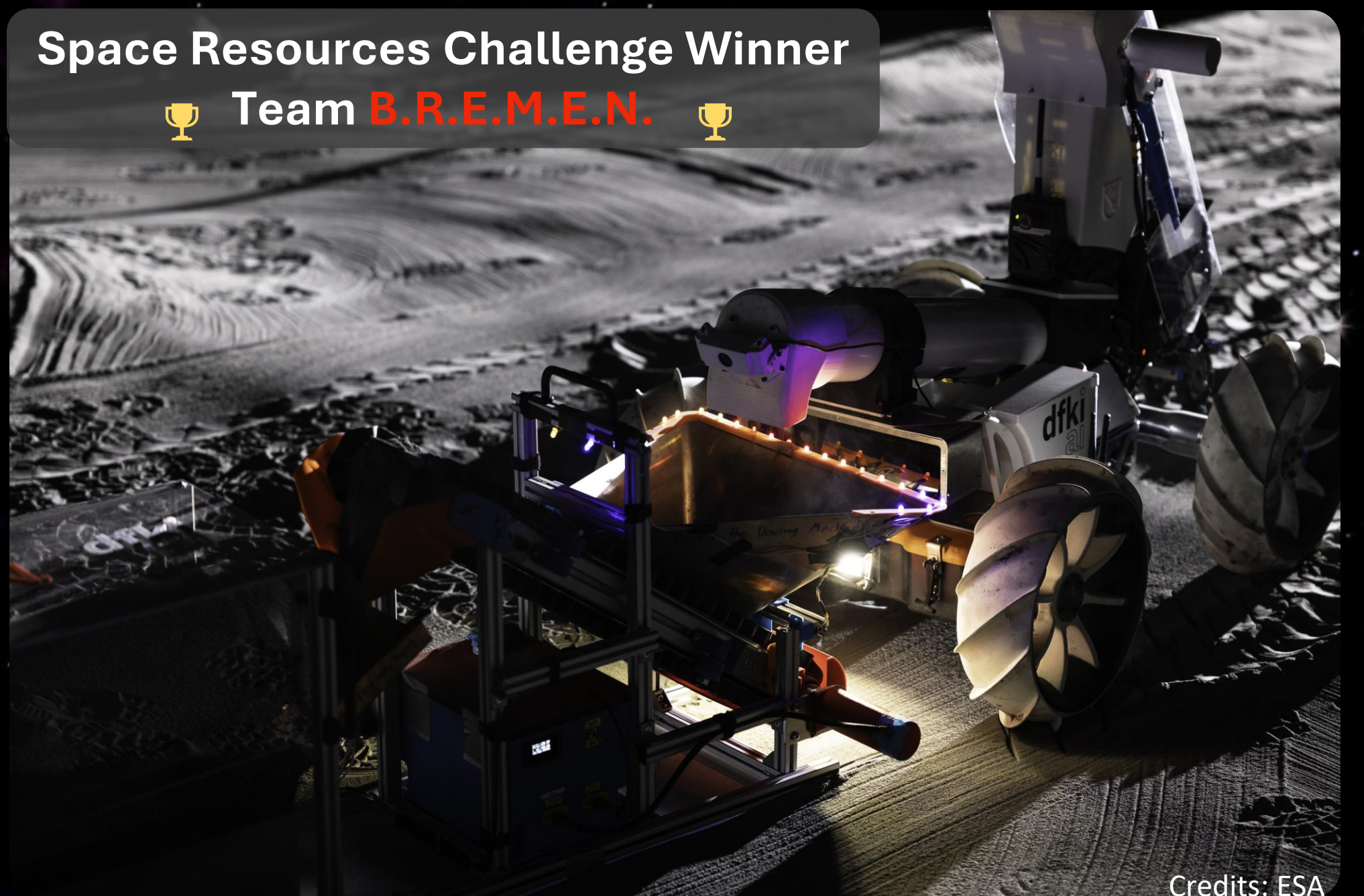
≤ 2.5 h total operational time
Mandatory tele-operations
Lunar south pole-like lighting condition

System mass target

≤ 60 kg total system mass

Space Resources Challenge Winner

🏆 Team **B.R.E.M.E.N.** 🏆



Field Test Results

System Mass	60.34 kg
Energy consumption	245 Wh
Excavated mass	18 kg
Beneficiated mass (500 - 100 μm)	6.2 kg
Total operational time	2 h

