Planetary Robotics & Autonomy
- current and future collaborations with China

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Key Areas for Collaboration

- Rover Technologies
- Drilling & Sampling
- Kinetic Penetrators
- Spacecraft Autonomy
Rover Technologies

Our unique strength:

- Space system miniaturization making micro-rover (10s of kg) feasible for planetary missions based on small-sat heritage, e.g. sample fetch rover, or astronaut assisted rover
- Re-configurable design for onboard GNC & autonomy software – flexible, reusable, yet reliable -> cut down development cost
- Post-processing of bulk data (such as images) - standardized data products & pipeline process
- European leader in these topics, e.g. key members of EU FP7 projects on Planetary Robotic Vision Processing (ProVisG), Forward Acquisition of Soil and Terrain for Exploration Rover (FASTER), etc

Past and current Chinese collaborators:

- Beijing University of Technology (BJUT)— supported by UK Royal Academy of Engineering
- Harbin Institute of Technology (HIT)

The future

- Happy to work with other Chinese universities and organizations, as well as taking part in Chang’E stage 2, stage 3, Mars landing missions, manned missions…
Drilling & Sampling

Our unique strength:

- Bio-inspired DRD drill making low-cost deep drilling possible in low gravity environment e.g. for Moon, Mars, asteroids
- World leader on DRD design & development – patent in application
- Small sampling tool suitable for low mass landers or vehicles.
- Rigorous and systematic regolith simulants preparation techniques
- European leader on planetary drilling, e.g. leading ESA project on low-cost planetary drilling, EU initiative of research training network on planetary drilling

Existing Chinese links:

- Harbin Institute of Technology (HIT)
- China University of Geosciences

Mission opportunities:

- Chang'E Stage 2, Stage 3
- Landing and sample return missions for Mars, asteroids
- Any thoughts from Chinese colleagues?
Kinetic Penetrators

Our *unique* strength:

- Miniaturized subsystem based on micro-sat or nano-sat heritage
- Single thruster attitude control technology for spin-stabilized spacecraft
- Designer of state-of-the-art slew algorithms (namely dual-cone, extended half-con, etc), funded by EADS Astrium

Existing Chinese link:

- SAST

Future mission opportunities:

- Mars or asteroid landing missions
- ??
Spacecraft Autonomy

**Our unique strength:**

- Using **reliable, understandable and consistent** approach as to the ad-hoc and opaque approach that is commonly adopted at the moment
- **Rational and generic software agent architecture or core** that governs autonomous decision-making of multiple spacecrafts in constellation and/or formation, and can be re-usable
- A “plug and play” library of sensors/ actuators/ planning/learning modules so that the core can be reconfigured for distinct platforms in a reliable yet flexible way
- **Enabling new type** of Earth and planetary missions requiring more complex spacecrafts and/or multiple spacecrafts

Existing Chinese collaborator:

- Harbin Institute of Technology (HIT)— supported by Royal Academy of Engineering

**The future:**

- Chinese future missions of satellite constellation or formation for Earth observation, disaster monitoring, etc
- Beihang-led “3+2” mission?
I welcome different views and suggestions

Thank You!