

NASA SBIR/STTR Technologies

Numerical Simulation of Rocket Exhaust Interaction with Lunar Soil

STTR CFDR/Univ. of Florida

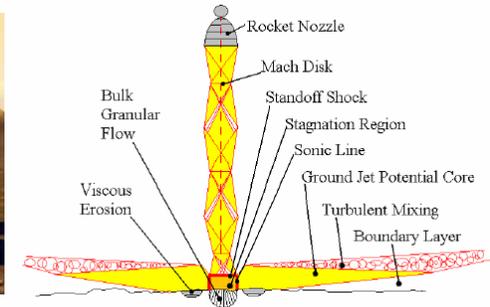
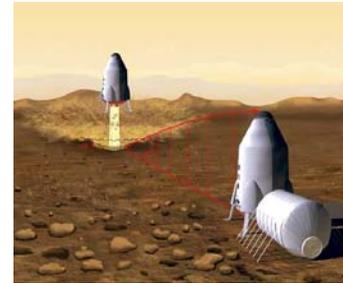
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Identification and Significance of Innovation

- Lunar soil erosion, sandblasting and dust clouds generated by lunar lander rocket plume impingement
- Sandblast damage to lander itself, multiple landing spacecraft, surrounding hardware and habitats
- Dust contamination to sensors, solar arrays, EVA suits, habitats
- Simulation tool needed to predict environment, quantify effects and develop countermeasures
- No tool exists; first-principle based model development required



Technical Objectives

Address complex multi-physics:

- Mixed continuum/rarefied plume impingement in lunar vacuum
- Solid-gas interaction soil erosion mechanisms (flow through porous granular soil, fluidization, particle lofting)

Leverage CFDR and U. Florida tools and expertise:

- Unified Flow Solver (UFS) for continuum/rarefied plume flow
- Soil solid-fluid interaction and particle activation modeling tools
- Debris particle transport and interaction modules

Work Plan

- Simulate plume stagnation layer flow on soil surface with UFS
- Characterize soil layer solid-fluid interaction physics under surface flow environment
- Formulate soil erosion model providing debris mass and initial conditions for debris tracking module embedded in flow solver.
- Demo proposed integrated tool suite for near-field/far-field tracking of dust particles in lunar landing scenario
- Develop roadmap for integrated tool in Phase II

NASA and Non-NASA Applications

- Robotic and manned Moon landing
- Robotic and manned Mars landing
- Dust generation environment during ISRU operations (rovers, excavation, mining, etc.)
- Brown-out during desert helicopter and aircraft take-off

Firm Contacts

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NON-PROPRIETARY DATA