### **20-7. Insitu Lunar Launch & Landing Pad Construction w/ Regolith and Thermoset Polymers**

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This CIF project is an extension of materials developed under a previous NASA Innovative Advanced Concepts (NIAC) project titled “Regolith Derived Heat Shield for Planetary Body Entry and Descent Systems with In-Situ Fabrication” by M. Hogue et al. (2012). Launch and landing pads are necessary to mitigate risks to lander/ascent vehicles, surface assets, and orbital assets from rocket plume ejected regolith. At this time, all launching and landing on the lunar surface will be on unprepared surface sites. Though this has been a successful approach for Apollo and other uncrewed missions, significant risks exist for the Artemis Program due to the increased thrust of the vehicles, presence of co-located assets, and potential surface level requirements for tall vehicles. This project developed a thermoset polymer–regolith composite material for use as a launch and landing pad. Test articles were prepared at 20% and 11% polymer mass percent (wt%) and tested under hot fire conditions that simulated large vehicle lunar launch/landing conditions. A minimum polymer wt% of 9% was achieved and both samples successfully mitigated regolith ejecta from plume effects. A concept for emplacing launch/landing pads was successfully tested in laboratory environments using a screw and barrel approach to mixing, conveying and depositing materials. It is recommended that materials and systems be developed to TRL 6 for a small-scale lunar demonstration of emplacement of a launch/landing pad via a Commercial Lunar Payload Services (CLPS) mission to support the Artemis Program.

**NTR:** KSC-14377: Paver system based on in-situ regolith materials for rocket propulsion vehicle Landing/Launch Pad construction