# NASA SBIR 2011 Phase I Solicitation

## O3.04 Vehicle Integration and Ground Processing

**Lead Center: KSC**

**Participating Center(s): SSC**

This subtopic seeks to create new and innovative technology solutions to improve safety and lower the life cycle costs of assembly, test, integration and processing of the ground and flight assets at our nation's spaceports and propulsion test facilities. The following areas are of particular interest:

### Control of Material Degradation

Technologies are needed to reduce costs due to material degradation of materials in spaceport and propulsion test facility infrastructure and ground support equipment, Material solutions must meet current and emerging environmental restrictions and endure today's corrosive and highly acidic launch environments. These needs include:

- New environmentally friendly technologies for paint removal and surface preparation that can be applied to large structures. New technologies must achieve better performance than conventional abrasive blasting techniques by reducing the cost of collecting and/or processing waste while keeping blasting rates the same or better than conventional technologies. These technologies must work for inorganic zinc coating.
- New environmentally friendly technologies for prevention/reduction of microbial corrosion in steel piping systems utilizing brackish or untreated water.
- Sub-scale or laboratory tests that can be used to evaluate the suitability of refractory concrete for use in launch pad and rocket test facilities flame deflectors. Proposed tests must show that they are relevant to full scale blast effects.
- Innovative refractory material application methods to ensure field applications have the same properties (strength, density, performance, etc...) as small scale test coupons.

### Spaceport Processing Evaluation/Inspection Tools

Innovative solutions are desired that reduce inspection times, provide higher confidence in system reliability, increase safety and lower life cycle costs. Technologies must support identifying composite material defects, evaluating material integrity, damage inspection and/or acceptance testing of composite systems. These include:

- Technologies in support of defect detection in composite materials.
- Methods for determining structural integrity of composite materials and bonded assemblies.
- Non-intrusive inspection of Composite Overwrapped Pressure Vessels (COPV), Orion heat shield and other composite systems.
- In-situ evaluation of refractory concrete as installed in the flame trenches associated with propulsion test and launch pad infrastructure.

**Hypergolic Propellant Sensing Technologies**

Technologies for leak detection and leak visualization for hypergolic propellants, such as:

- Novel, cost effective technology solutions to provide leak detection of hypergolic propellants at concentrations of 10ppb with minimal environmental sensitivity (i.e., humidity). Sensors and leak detection systems should provide quantitative data with minimum interferences, drift, and exposure and recovery time.
- Novel, cost effective technology solutions to provide leak detection of hypergolic propellants at concentrations of 1ppm with minimal environmental sensitivity (i.e., humidity). Sensors and leak detection systems should provide quantitative data with minimum interferences, drift, and exposure and recovery time.
- Technology to provide leak visualization of hypergolic propellants to support operations (propellant loading, pressurization, leak check).

**Cold Gas Storage and Servicing of Launch Vehicle Systems**

Storing high-pressure pneumatic gases in a chilled state increases the on board density of gasses used for pressurization during flight. Traditional solutions embed these 3000 - 6000 psig metallic tanks into the flight vehicles' main cryogenic propellant tanks. To achieve the lightest weight tanks, final pressurization takes place after the tanks are immersed to maximize strength gained by the lower temperatures. Under these conditions, it takes several hours to achieve thermal equilibrium with the host tank and maximize mass density of the compressed gas. Solutions are sought to reduce this time to less than 60 minutes to achieve thermal equilibrium of the compressed gas with the host liquid cryogen tank and maximize pneumatic gas mass on board the flight vehicle.

For all above technologies, research should be conducted to demonstrate technical feasibility during Phase I and show a path toward Phase II hardware or software demonstration and delivering a demonstration unit or package for NASA testing at the completion of the Phase II contract.

Phase I Deliverables: Demonstration of technical feasibility (TRL 2-4).

Phase II Deliverables: Demonstration of technology (TRL 4-6)