| SBIR 06.2 PHASE I - AWARD DETAILS | |
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| **ORGANIZATION** | TARDEC |
| **TOPIC NUMBER** | A06-224 |
| **CONTRACT NUMBER** | |
| **YEAR OF AWARD** | |
| **AWARD START DATE** | |
| **AWARD COMPLETION DATE** | |
| **PROPOSAL NUMBER** | A062-224-3244 |
| **TITLE** | Multi-Physics, Multi-scale Ground Vehicle Reliability Prediction |
| **PROJECT MANAGER** | Galib Abumeri<br>(562) 985-1100<br>GABUMERI@ALPHASTARCORP.COM |
| **COMPANY** | ALPHA STAR<br>5199 E. Pacific Coast Hwy<br>Suite # 410<br>Long Beach CA 90804-3382<br><br>Minority Owned: No<br>Veteran Owned: No<br>Number of Employees: 18 |
| **KEYWORDS** | Ground Vehicle Reliability Progressive Failure Analysis Multi-physics Component/vehicle analysis Multi-scale Environmental degradation Parallel processing Fatigue |
| **ABSTRACT** | Design of US Army ground vehicles, especially those that operate in combat environments, faces increasingly challenging requirements. The vehicles should be capable of operating in contrasting rough terrains and must support a wide range of optional equipment and payloads. Component and system durability /reliability are critical to mission success. Ground vehicle systems reliability is a function of the reliability of its sub-assemblies and their individual components. A multi-scale, multi-physics computational system is needed to address the complexity of the overall vehicle design. The proposed computational tool will evaluate component reliability, and eventually an entire Army vehicle. A multi-physics approach will evaluate the reliability of different components to various factors: mechanical fatigue, thermal stress, erosion, corrosion and other degradation effects, usage history, maintenance history, and manufacturing processes, including defects. The computational capability will be inclusive of: component modeling, finite element analysis, material degradation modeling, damage progression and damage tracking, and reliability evaluation. To dramatically increase computational efficiency, a parallel computing capability will be incorporated to concurrently assess reliability of multiple components prior to determining the overall system reliability. This capability will enable engineers to assess the reliability of a whole vehicle system and to eventually optimize the design for desired reliability. |
| **BENEFITS** | Development of a parallel processing, physics-based integrated computational system for predicting the reliability of US Army ground vehicles on a multi-phase |

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| | level is of great benefit to the Army, other military branches as well as the commercial sector. The proposed software tool and methodologies will allow engineers, managers, and suppliers to analyze ground vehicle reliability in multiple physics modes and at multiple scales from component through vehicle. Component, vehicle and system designers will the be able to calculate the reliability of individual components, sub-assemblies, and ultimately the whole vehicle in the presence of failure loads from fatigue, material degradation caused by corrosion and erosion, thermo-mechanical stresses, and uncertainty in manufacturing, material properties, and usage history. The developed tool will enable engineers to concurrently evaluate the reliability of multiple components using parallel processing technology. This technology can be also used by the US Navy and US Air Force as well as companies that design and fabricate ground, air, or sea vehicles. The proposed technology need not be limited to vehicles. As a by-product, a practical and computationally rapid approach, that correlates reliability of individual components, sub-assemblies, and whole systems, can be applied to any manufactured product whether large or small. |