A Run-time Test System for Maturing Intelligent System/Vehicle Capabilities - SIDAL

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Abstract – Equipment health management (EHM) or vehicle health management (VHM) often involves on-board, real-time monitoring of operating conditions as well as providing control, operational, and maintenance decisions based on assumed conditions. For an off-board health management system, a "copy" of the on-board system functionality is desirable, because it provides a "simulated" environment to recreate on-board operating conditions for the purpose of verification/validation of health management related decisions. The off-board system, for lack of computational timing constraints, is usually equipped with more sophisticated modeling, analysis, and verification capabilities; hence it provides an *environment to improve/mature on-board system capabilities*.

Although a system integration laboratory (SIL) is an essential environment for maturing on-board EHM/VHM capabilities, the SIL is typically available late in the design and verification process when developmental hardware becomes available to support hardware-in-the-loop simulation; furthermore, a full-featured SIL is expensive, and it is not available for subsystem suppliers and integrators to engage in incremental design and development testing. Hence, *a low-cost, easily accessible run-time environment to simulate on-board operating conditions with control and health management algorithms is highly beneficial and desirable.*

This paper presents a solution to improving the design maturation process by reducing the dependency on the full-featured SIL. The solution is a System Interaction and Design Assurance Laboratory (SIDAL). It is a run-time integrated test system to facilitate the development and implementation of diagnostic, prognostic, and decision support algorithms, including models. It can be configured with, or without, actual subsystem hardware (or components). SIDAL is an essential design and development environment for maturing health management capabilities, especially when increasing emphasis is being put on decision assurance and accountability, which needs to be evaluated in a *run-time, closed-loop environment*. We believe that SIDAL can speed up development processes and mitigate implementation risks, especially under the requirement of maximizing software reusability for multiple vehicle configurations as in the U. S. Army's Future Combat Systems (FCS).