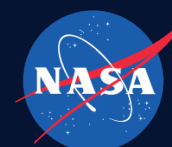


Active Project (2012 - 2016)

Advanced Ground Systems Maintenance Enterprise Architecture Project

Ground Systems Development And Operations Program | Human Exploration And Operations Mission Directorate (HEOMD)



ABSTRACT

The project implements an architecture for delivery of integrated health management capabilities for the 21st Century launch complex. The delivered capabilities include anomaly detection, fault isolation, prognostics and physics-based diagnostics.

ANTICIPATED BENEFITS

To NASA funded missions:

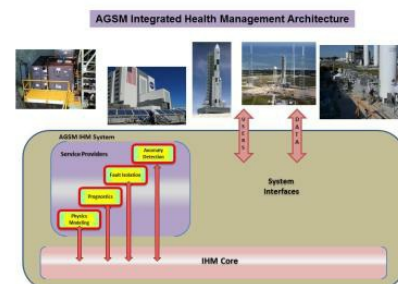
The architecture enables health management capabilities to exchange information among themselves and analyze and respond to complex problems within the system or systems being monitored in an integrated manner. The architecture is also developed to support scalability to accommodate to different level of complexity in the systems/implementations.

To NASA unfunded & planned missions:

The platform-independent design utilizes reusable components; this approach will minimize software development and verification testing for subsequent deployments, which enables low system life-cycle costs of health management deployments.

To the commercial space industry:

The concept of "reusable components" supports the incorporation of this approach to other projects/systems/applications with minimized software development and verification testing. The goal is to create an approach where the majority of the implementation is generic and only a small part of the implementation is tailored to the specific application. This concept will support industrial based applications with reduced effort.

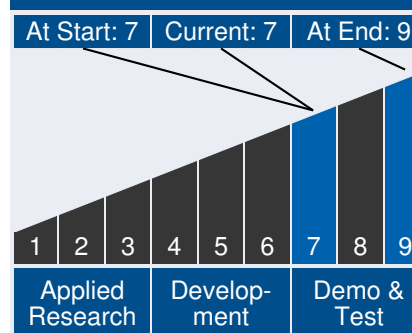


Integrated Health Management Architecture enables delivery of anomaly detection, fault isolation, prognostics and diagnostic capabilities to 21st Century launch complex users

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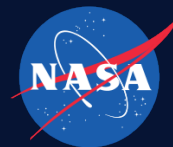
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Technology Maturity



Advanced Ground Systems Maintenance Enterprise Architecture Project

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DETAILED DESCRIPTION

This project will develop a flexible, scalable enterprise architecture required to support the implementation and delivery of Health Management (HM) capabilities under the 21st Century launch complex program. HM Capabilities include anomaly detection, components' prognostics, fault isolation, and physics-based diagnostics. The architecture enables the required information exchange between the HM capabilities, the Spaceport Command and Control System (SCCS) and other diverse multi-users. The architecture flexibility, scalability and modularity will allow for the incorporation of new HM capabilities as required or when they become available, the execution of several instances of the same HM capability, and the use of several information sources (real-time data, simulation, video, etc.) without the need for major rework/redesign.

Management Team

Program Executive:

- Michael Bolger

Program Manager:

- Kirk Lougheed

Project Manager:

- Barbara Brown

Principal Investigator:

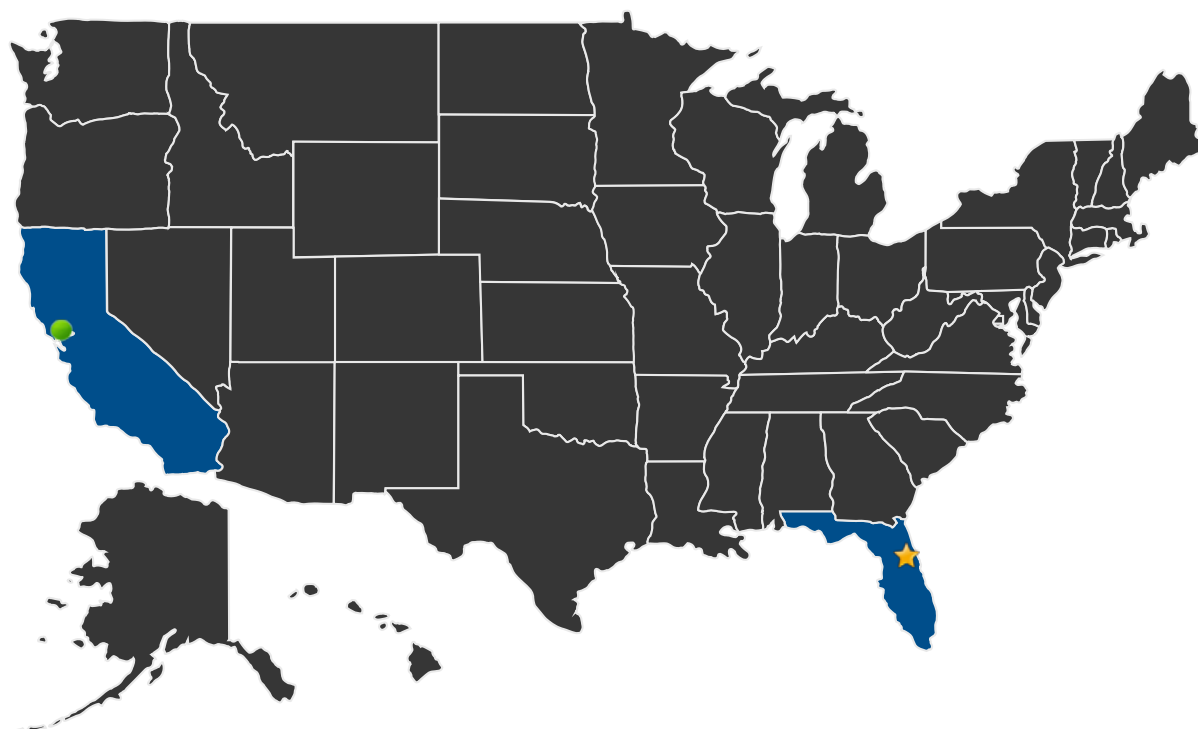
- Barbara Brown

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U.S. LOCATIONS WORKING ON THIS PROJECT



■ U.S. States With Work

★ **Lead Center:**
Kennedy Space Center

● **Supporting Centers:**

- Ames Research Center

Other Organizations Performing Work:

- Abacus / IMCS (Baltimore, MD)
- QinetiQ North America
- Stinger Ghaffarian Technologies (SGT)

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DETAILS FOR TECHNOLOGY 1

Technology Title

Advanced Ground Systems Maintenance Enterprise Architecture

Technology Description

This technology is categorized as an operating system for engineering, design, modeling, or analysis

AGSM Integrated Health Management architecture consists of external interfaces, internal services, and a core capability that is reusable. The core capability will facilitate the exchange of information using a platform-independent messaging format.

Capabilities Provided

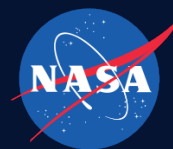
The project implements the infrastructure and connectivity between internal health management services and external systems for which advisory applications provide health and status. The architecture includes core configuration for the integration of models, simulations, and application software to deliver anomaly detection, fault isolation, prognostics, and physics-based diagnostics and simulations of systems being monitored.

Potential Applications

The architecture flexibility allows for a diverse set of applications. It is presently developed to support the GSDO Command and Control (C&C) system being deployed at Kennedy Space Center (KSC), but it can be adapted to any information exchange application with minor changes. The Advanced Ground Systems Maintenance project has implemented a version of the architecture in the Simulated Propellant Loading System at the Cryogenics Laboratory in support of cryogenics loading operation, and will be demonstrating this architecture in the Universal Propellant Loading System pathfinder and the Exploration Flight Test-1 at KSC. The architecture's reusable, scalable platform can be used to provide systems health management to diverse applications such as cryogenics, power, Heating Ventilatin and Air Conditioning (HVAC), etc.

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Performance Metrics

Metric	Unit	Quantity
Internal Response Time	Milliseconds	IHM bus point to point
Throughput	Messages per second	Message traffic on IHM Bus
CPU Usage	% of available CPU time	$\text{Exec. time} \div \text{avail time} \times 100\%$
End-to-End Response Time	Milliseconds	Internal component to external