

Advanced Ground Systems Maintenance Functional Fault Models For Fault Isolation Project

Human Exploration And Operations Mission Directorate (HEOMD)

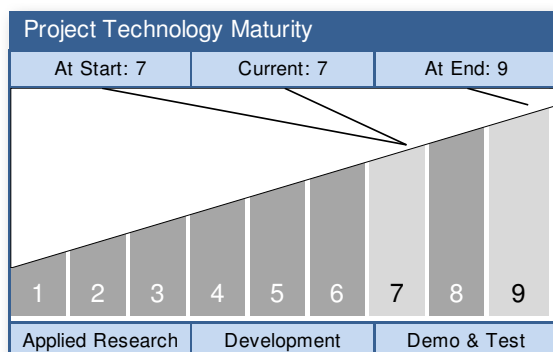
National Aeronautics and
Space Administration



Engineer Building FFM Model

ABSTRACT

This project implements functional fault models (FFM) to automate the isolation of failures during ground systems operations. FFM's will also be used to recommend sensor placement to improve fault isolation capabilities. The project enables the delivery of system health advisories to ground system operators.



Technology Area: Ground & Launch Systems Processing TA13
(Primary)
Robotics, Tele-Robotics & Autonomous Systems
TA04 (Secondary)

ANTICIPATED BENEFITS

To NASA funded missions:

Automates the identification of failed systems components during system operation and can also be used as an engineering analysis tool during the design phase. Provides the capability to conduct subsystem assessment of known, undetectable system failure modes. Provides capability to

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Read more on the last page.

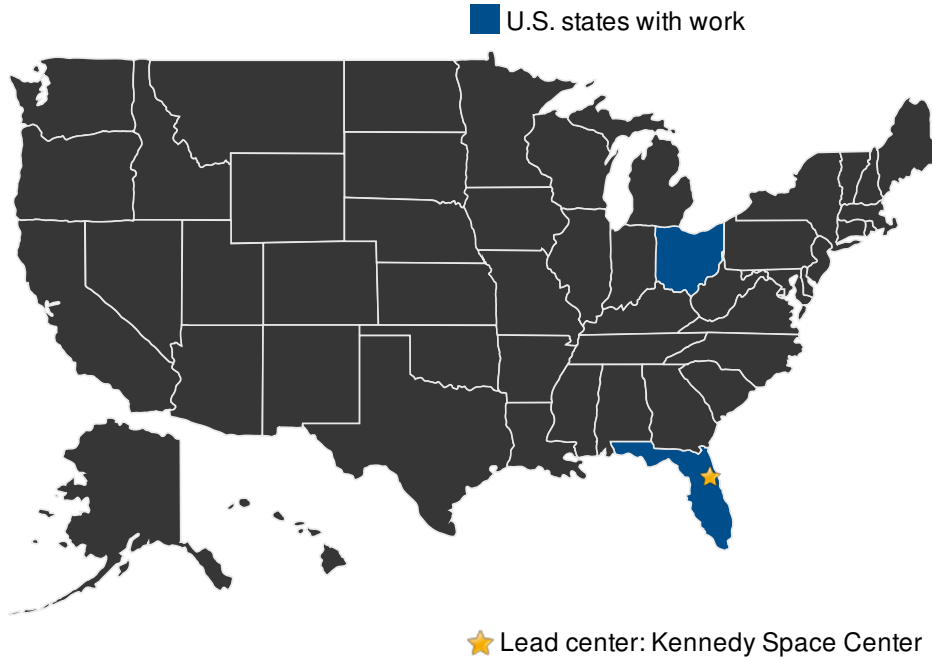
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TechPort

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Printed 8/19/2014

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Other Organizations Performing Work

Abacus / IMCS (Baltimore, MD)
N&R Engineering (Parma Heights, OH)
QinetiQ North America
(read more on the last page)

DETAILED DESCRIPTION

The objective of this project is to automate the isolation/allocation of systems' faults to a component or series of components once the fault in the system has been detected. The Fault Isolation (FI) capability effort will develop and implement functional fault models for specific Ground Subsystems to automate the detection and isolation of faults. The capability will receive data from the system's Command & Control and perform FI analysis returning the results (identified source of fault) to the system operator. It will also identify how the fault propagates across the overall system, allowing for a faster resolution of the problem.

MANAGEMENT

Program Executive:
Michael Bolger

Program Manager:
Kirk Lougheed

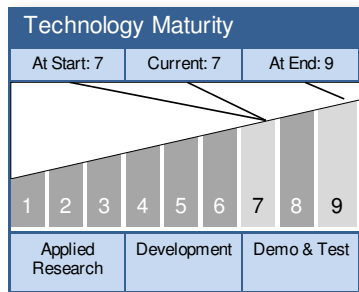
Project Manager:
Barbara Brown

Principal Investigator:
Barbara Brown

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TECHNOLOGY DETAILS

Advanced Ground Systems Maintenance Functional Fault Models for Fault Isolation



TECHNOLOGY DESCRIPTION

The TEAMS tool suite is a commercial product developed by Qualtech Systems Incorporated. TEAMS-Designer is used to create functional fault models from Failure Mode and Effects Analysis reports, fault trees, schematics, instrumentation lists, operational use cases, and other technical documentation. The FFM captures a system's structure, interconnections, tests, procedures, and failure modes and the relationships between various failure modes and system instrumentation. TEAMS-Remote Diagnostic Server (RDS) and TEAMS-RT are used to monitor the system's operation and perform real-time fault isolation, when needed.

This technology is categorized as a software macro for engineering, design, modeling, or analysis

- Technology Area
 - TA13 Ground & Launch Systems Processing (Primary)
 - TA04 Robotics, Tele-Robotics & Autonomous Systems (Secondary)
 - TA06 Human Health, Life Support & Habitation Systems (Additional)

CAPABILITIES PROVIDED

Automates the identification of failed systems components within the system being monitored. Provides the capability to conduct subsystem assessment of known, undetectable system failure modes. Provides capability to assess the system design and identify the optimal placement of sensors to optimize the ability to detect known fault modes. Optimizes troubleshooting actions.

POTENTIAL APPLICATIONS

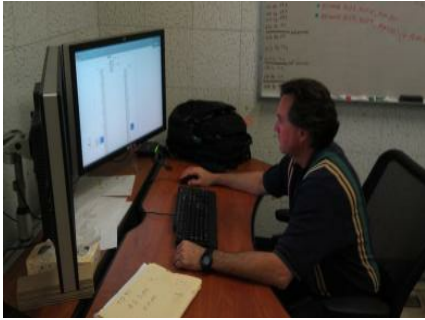
The primary application of this capability will be to aid the system operator quickly identify and isolate the source of faults in their systems in an automated way. This capability will expedite the resolution of problems that could jeopardize the intended mission. Specifically, the project is developing and implementing an application for the ground cryogenics loading system in the launch site. Other ground systems can

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Read more on the last page.

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IMAGE GALLERY

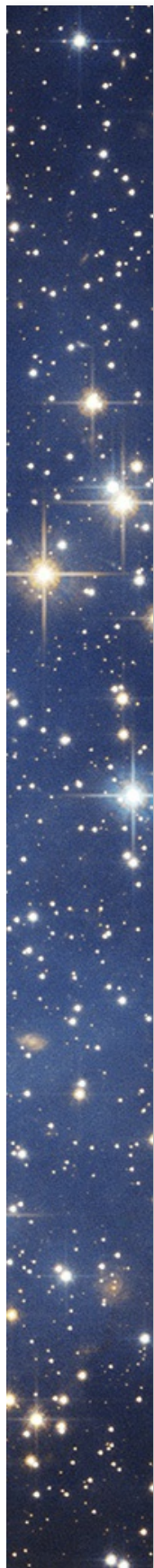


Functional Fault Models for Fault Isolation

PROJECT LIBRARY

Images

- Engineer Building FFM Model
<https://techport.nasa.gov/fetchFile?objectId=2086>
- Functional Fault Models for Fault Isolation
<https://techport.nasa.gov/fetchFile?objectId=1958>



ANTICIPATED BENEFITS

To NASA funded missions: (CONT'D)

assess the system design and identify the optimal placement of sensors to optimize the ability to detect known fault modes. Optimizes troubleshooting actions. Performs time-to-criticality analyses and supports planning of skills/time for repair of a given failure mode. Supports requirements to train personnel on system function in nominal and off-nominal operation.

To the commercial space industry:

Reduces trouble-shooting time during system operation and can also be used as an engineering analysis tool during the design phase. Provides the capability to conduct subsystem assessment of known, undetectable system failure modes. Provides capability to assess the system design and identify the optimal placement of sensors to optimize the ability to detect known fault modes. Optimizes troubleshooting actions. Performs time-to-criticality analyses and supports planning of skills/time for repair of a given failure mode. Supports requirements to train personnel on system function in nominal and off-nominal operation.

TECHNOLOGY DETAILS

POTENTIAL APPLICATIONS (CONT'D)

also benefit from this capability.

Another application for this capability will be the training of ground operations personnel in their assigned systems, to increase their awareness of potential faults, how these faults propagate and what are the indications they produce. FFM can also be used during design for selecting optimal sensors placement and assess sensor coverage of the system. Finally, it can aid Safety and Mission Assurance personnel during the generation of Failure Modes and Effects Analysis (FMEA) for these systems.

OTHER ORGANIZATIONS PERFORMING WORK (CONT'D)

- Sierra Lobo, Inc.

