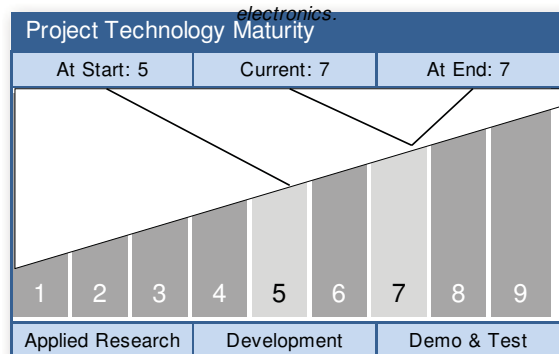# Advanced Ground Systems Maintenance Prognostics Project

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

National Aeronautics and
Space Administration

Researcher Dr. José Celaya readying an aging experiment for electronics.

Project Technology Maturity

At Start: 5	Current: 7	At End: 7

1	2	3	4	5	6	7	8	9

Applied Research	Development	Demo & Test

ABSTRACT

The project implements prognostics capabilities to predict when a component, system or subsystem will no longer meet desired functional or performance criteria, called the "end of life." The capability also provides an assessment of the "remaining useful life" of a hardware component. The project enables the delivery of system health advisories to ground system operators.

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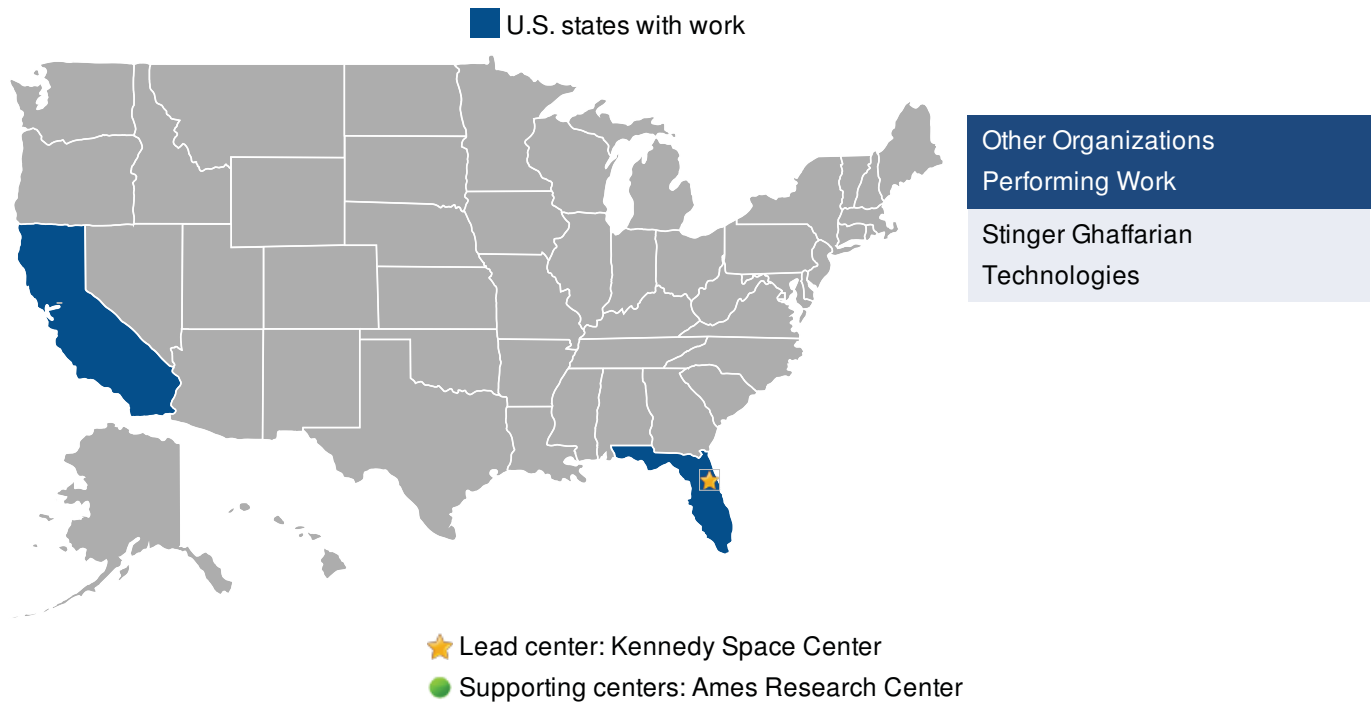Robotics, Tele-Robotics & Autonomous Systems TA04 (Secondary)

ANTICIPATED BENEFITS

To NASA funded missions:

Prognostics provides information about the health status of components and predictions about their remaining useful life. The degree of wear or damage can be tracked and visualized to help support human-in-the-loop decision-making. Prognostics can also be used as part of decision-making processes in autonomous systems. Launch operations can be supported with prognostics-informed go/no-go decisions. Avoiding unscheduled maintenance and supporting condition-based maintenance will lead to reduced costs and ...

Read more on the last page.

U.S. states with work

Other Organizations Performing Work

Stinger Ghaffarian Technologies

⭐ Lead center: Kennedy Space Center
🟢 Supporting centers: Ames Research Center

DETAILED DESCRIPTION

The project implements prognostics capabilities to predict when a component, system or subsystem will no longer meet desired functional or performance criteria, called the "end of life." The capability also provides an assessment of the "remaining useful life" of a hardware component. The project enables the delivery of system health advisories to ground system operators.
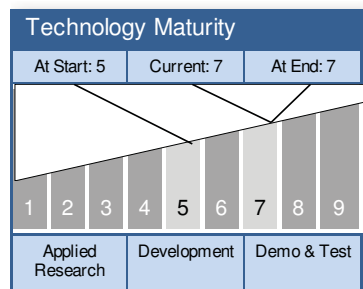
MANAGEMENT

Program Executive:
Michael Bolger
Program Manager:
Kirk Lougheed
Project Manager:
Barbara Brown
Principal Investigator:
Barbara Brown

TECHNOLOGY DETAILS

Advanced Ground
Systems Maintenance
Prognostics Project

Technology Maturity

At Start: 5	Current: 7	At End: 7

| Applied Research | Development | Demo & Test |

TECHNOLOGY DESCRIPTION

Prognostics is performed through an analysis of available sensor data. Signs of aging, or damage, are correlated with mathematical models of how components wear and degrade over time in order to identify the damage progression model and the rate of wear or degradation. Identification of the rate of damage progression enables predictions to be made as to the remaining life and time at which aging or damage will cause the component or system to fail. The prognostics capability can be used during the design stage, to help define maintenance and logistics plans, to monitor real-time changes in component health, and to assess the impact on operations.

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

Prognostics enables informed decisions to be made about whether, and how, to continue to operate a system given anticipated usage profiles. In addition, unscheduled maintenance can be avoided, predictable catastrophic events can be prevented, and component life can be extended. The prognostics capability can be used during the design stage, to help define maintenance and logistics plans, to monitor real-time changes in component health, and to assess the impact on operations. Operations personnel can use prognostics software to improve the safety of operations and to reduce life cycle cost of operations.

Enables condition-based maintenance of hardware components instead of schedule-based maintenance, leading to extended component lifetimes and reduced costs.

IMAGE GALLERY
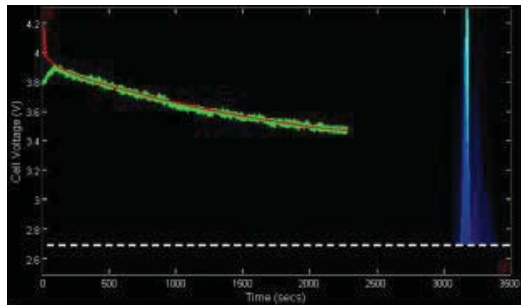
End of charge estimation (blue curve) for battery. Green curve shows estimated voltage during discharge.

Researcher Dr. José Celaya readying an aging experiment for electronics.

ANTICIPATED BENEFITS

To NASA funded missions: (CONT'D)

risk.

To NASA unfunded & planned missions:

Prognostics provides information about the health status of components and predictions about their remaining useful life. The degree of wear or damage can be tracked and visualized to help support human-in-the-loop decision-making. Prognostics can also be used as part of decision-making processes in autonomous systems. Launch operations can be supported with prognostics-informed go/no-go decisions. Avoiding unscheduled maintenance and supporting condition-based maintenance will lead to reduced costs and risk.

To the commercial space industry:

Prognostics provides information about the health status of components and predictions about their remaining useful life. The degree of wear or damage can be tracked and visualized to help support human-in-the-loop decision-making. Prognostics can also be used as part of decision-making processes in autonomous systems. Launch operations can be supported with prognostics-informed go/no-go decisions. Avoiding unscheduled maintenance and supporting condition-based maintenance will lead to reduced costs and risk.