National Aeronautics and
Space Administration

technology solution

Information Technology and Software

A system for fault management and consequences analysis

An Algorithm for Failure Consequences Analysis Based on Diagnostic Modeling

Called Failure Consequences Assessment System (SysEffects), this innovation adds to the capabilities of the ACAWS (Advanced Caution and Warning System) fault management used in Deep Space Habitat and Orion Capsule (EFT-1) tests. The diagnostic element of ACAWS is based on Testability, Engineering, and Maintenance System (TEAMS) an off-the-shelf diagnostic system widely used at NASA and in industry. The power of TEAMS is in the identification of the component or components that caused or are suspected to have caused a particular failure. This innovation adds the capability to identify which components will be impacted by any failed components, which in turn enables the end-user to develop risk mitigation strategies based on hypothetical failures. This also allows for what-if reasoning where one can ask what the consequences (impacts) will be should a particular component fails.

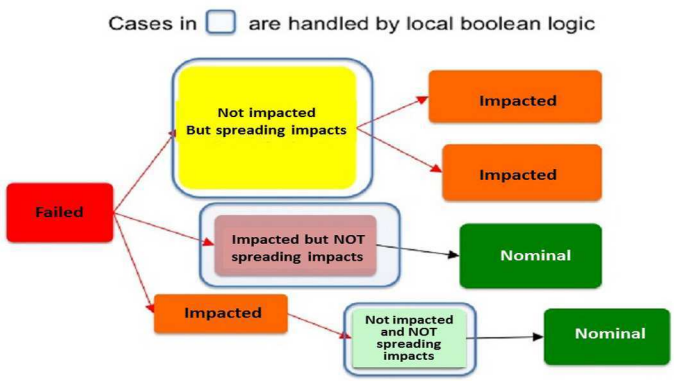
BENEFITS

- Allows for failure consequences analysis
- Allows for the use of an existing diagnostic modeling tools

THE TECHNOLOGY

SysEffects software consists of three main components: TEAMS diagnostic model parser, SysEffects reasoner, and communication mechanism. The front-end parser reads and converts the TEAM model into an SysEffects graph representation. The SysEffects reasoner is a depth-first graph search mechanism that starts its traversal from the graph node corresponding to the failure mode whose impact needs to be determined. The reasoner maintains an internal stack to hold the components being processed as well as a separate impact list that will be populated with the components that have been determined to be impacted. The reasoner publishes the final impact list when all affected nodes in the graph have been traversed. The communication mechanism enables the SysEffects application to service requests for impact analysis from either the Advanced Caution and Warning System (ACAWS) diagnosis engine, as will be the case during live operation, or from the ACAWS Graphics User Interface (GUI) during a user-fail mode system analysis. After performing a graph search as described in the previous section, the results are broadcast into the communication layer and are picked up by the ACAWS GUI.

Diagnosis starts from effects or failed tests and attempts to find the causes. This innovation starts from a known cause or causes and proceeds in the opposite directions to find all derived effects (impacts). This is not a trivial tasks because diagnostic strategies are based on test locations and not necessarily on cause-effect analysis.



TEAMS model needs to be extended to enable SysEffects

APPLICATIONS

The technology has several potential applications:

- Aerospace
- Automotive industry
- Oil and gas industry
- Chemical process plants

PUBLICATIONS

Patent Pending

More Information

National Aeronautics and Space Administration

Technology Partnerships Office

Ames Research Center

MS 202A-3
Moffett Field, CA 94035
855-627-2249
ARC-TechTransfer@mail.nasa.gov

http://technology.nasa.gov/

www.nasa.gov

NP-2015-05-1841-HQ

NASA's Technology Transfer Program pursues the widest possible applications of agency technology to benefit US citizens. Through partnerships and licensing agreements with industry, the program ensures that NASA's investments in pioneering research find secondary uses that benefit the economy, create jobs, and improve quality of life.

ARC-17194-1