PART 7. SENSOR WEB/TESTBED INITIATIVES

4. EO-1 ON-BOARD DIAGNOSTIC TOOLS

The objective of this technology is to develop model-based on-board software that will automatically detect and diagnose failures in satellite's instruments and systems (e.g. Livingstone 2). That is, the diagnostic software tool works by comparing a computerized model of how the spacecraft's systems and software should perform against actual performance. If the spacecraft's behavior differs from the model, then the tool's "reasoner" looks for the root cause of this difference. The diagnostic tool then gives several suggestions of what might have gone wrong.
Such a diagnostic system would typically consist of two main parts, a generalized inference engine and a domain-specific model. When such a software tool is deployed on different spacecraft the inference engine does not change, only a new model needs to be developed for the target system. The target system may be physical, such as the spacecraft hardware, or logical, such as the spacecraft software. The model is used to predict the states of the system components given their initial state, commands which affect the system, and possible changes in components states. If there is a discrepancy between observed and predicted behavior, conflicts are generated in the model's internal belief state. These conflicts are then used to focus a search for component failure modes.

This kind of technology is also needed by NASA to provide the ability to troubleshoot the robotic systems required to handle increasingly complex tasks of exploration while they are millions of miles away from Earth.

Documentation of efforts to create an above described model-based on-board diagnostic software tool, using EO-1 as a testbed, can be obtained from the links in the Table of Contents for Part 7, Section 4.