

In February of 2008; NASA Stennis Space Center (SSC), NASA Kennedy Space Center (KSC), and The Applied Research Laboratory at Penn State University demonstrated a pilot implementation of an Integrated System Health Management (ISHM) capability at the Launch Complex 20 of KSC. The following significant accomplishments are associated with this development: (1) implementation of an architecture for ground operations ISHM, based on networked intelligent elements; (2) Use of standards for management of data, information, and knowledge (DIAK) leading to modular ISHM implementation with interoperable elements communicating according to standards (three standards were used: IEEE 1451 family of standards for smart sensors and actuators, Open Systems Architecture for Condition Based Maintenance (OSA-CBM) standard for communicating DIAK describing the condition of elements of a system, and the OPC standard for communicating data); (3) ISHM implementation using interoperable modules addressing health management of subsystems; and (4) use of a physical intelligent sensor node (smart network element or SNE capable of providing data and health) along with classic sensors originally installed in the facility. An operational demonstration included detection of anomalies (sensor failures, leaks, etc.), determination of causes and effects, communication among health nodes, and user interfaces.

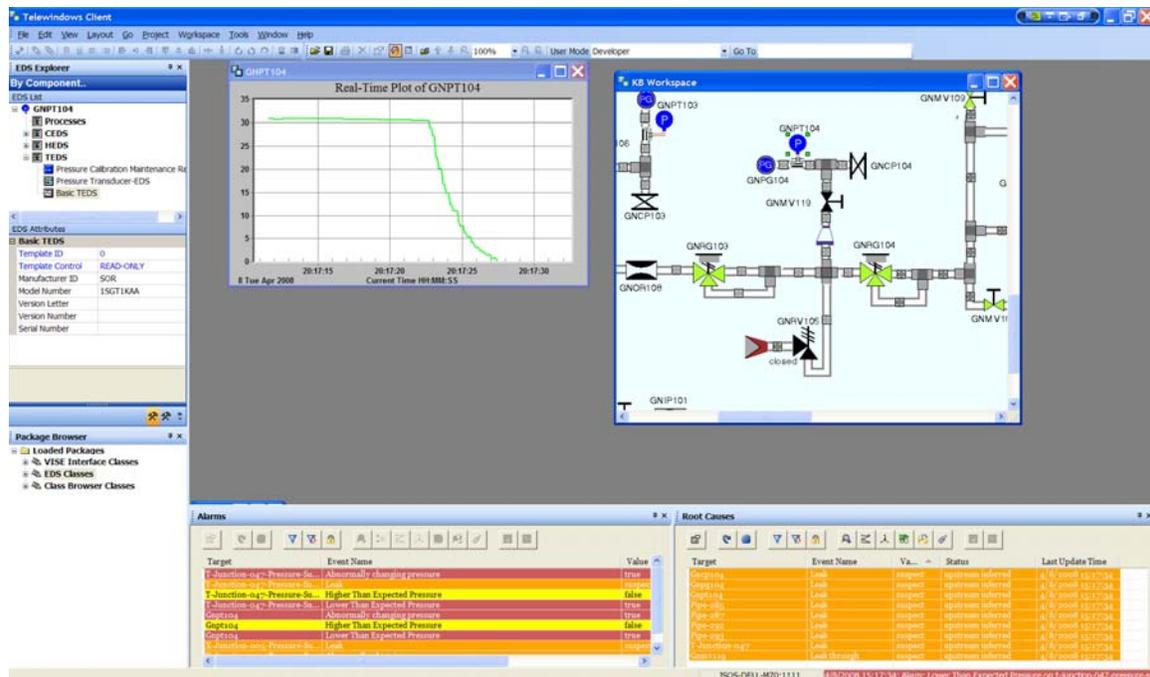


Figure 1. Detection of leak created by opening a manual valve in the Nitrogen Purge circuit. The time plot shows the pressure signature, the schematic shows the subsystem involved in the leak, and related alarms and root causes are shown in the lower panels. The left panels are used to navigate the ISHM model.

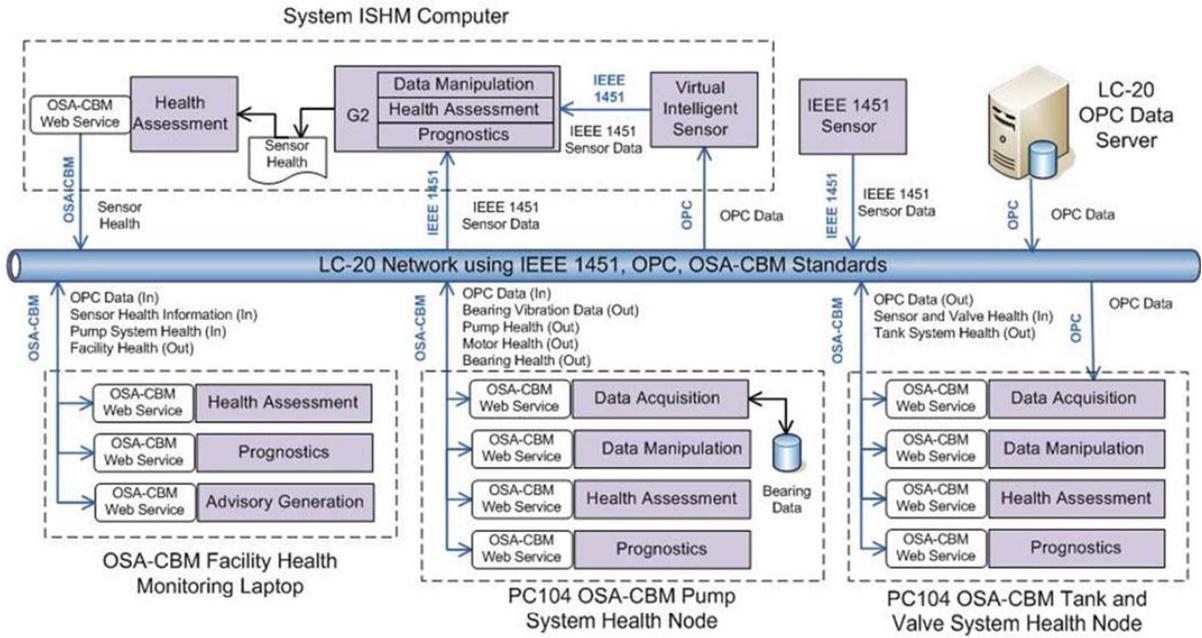


Figure 2. Ground Operations Health Management Architecture Implementation for the Launch Complex-20 Demonstration at NASA Kennedy Space Center.