A1.05 Data Mining for Integrated Vehicle Health Management

Lead Center: ARC

Participating Center(s): AFRC, GRC, LaRC

Innovative data mining technologies are being solicited to incorporate within systems and continuous risk management processes covering the life cycles of aircraft and their related ground support systems as well as spacecraft, in particular the Orion Crew Exploration Vehicle and the Aries launch vehicle and their related ground support systems. The life cycle includes design, development, integration, testing, operation (nominal and off-nominal), maintenance, enhancement (upgrades), and failure analysis.

Relevant technologies include those that:

- Detect anomalies and faults;
- Detect trends;
- Discover similarities;
- Infer models from data;
- Detect topics from text;
- Classify instances or events;
- Fuse data from multiple sources;
- Display data mining results in an intuitive manner.

To achieve the above capabilities, relevant technologies are expected to meet a subset of the following criteria:
• Perform automated learning, both supervised and unsupervised;
• Permit the user to define the search criteria and heuristics;
• Support a mixed-initiative approach combing automated learning and user search control;
• Perform real-time analyses on continuous streams of data;
• Perform off-line analyses on static databases;
• Process one or more data types including numeric sequences, character sequences, English free-form text, image sequences, and combinations of these forms;
• Perform real-time analyses on continuous streams of data;
• Perform on-demand, scheduled, or triggered analyses on periodic and/or aperiodic data streams;
• Perform off-line analyses on static databases.

NASA has a broad range of potential applications for these technologies. The following list provides a few examples:

• Enhance diagnostic and prognostic capabilities of an onboard integrated health management system;
• Perform clustering and topic identification on reports from a Problem Reporting and Corrective Action system;
• Detect faults from image sequences;
• Enhance acceptance tests to reduce false positive and false negative classifications;
• Enhance information-based security systems by detecting anomalies;
• Improve the design process by discovering similar applicable designs given requirements;
• Support analyses that assess risk of component or system failure.

Proposals are expected to identify commercial state-of-the-art technology that will be extended as well as the relevant research that will be implemented as the result of an award.