

# Vehicle-Level Reasoning Systems

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## OVERVIEW

- IVHM is developing Vehicle-Level Reasoning Systems (VLRs) for integrating large, heterogeneous, synchronous and asynchronous data streams from multiple subsystems in order to detect a potential adverse event, diagnose its cause, predict the effect of that event on the remaining useful life of the vehicle, and then take appropriate steps to mitigate the event if warranted. The VLRs will provide aircraft with at least two significant capabilities: improvement of aircraft safety due to enhanced monitoring and reasoning about the aircraft's health state, and also potential cost savings by enabling Condition Based Maintenance (CBM).

## APPROACH

- Develop a Vehicle-Level Reasoning System (VLRs) that
  - Provides for the active interrogation of specific systems and subsystems to determine their health status; the VLRs will generate and test internal hypotheses about the root-cause of a particular adverse event by selecting subsystems and issuing queries designed to verify the generated hypothesis
  - Supports Condition Based Maintenance whereby maintenance is performed when needed (as opposed to scheduled) using data and information derived from in-situ sensors and external test and measurement equipment and maintenance logs
  - Manages uncertainty through mathematically motivated and justifiable tools and techniques that ascribe a probabilistic confidence to each root-cause hypothesis
  - Incorporates component, subsystem, and vehicle level models which would represent connectivity and potential causal chains of failure as well as damage propagation for certain subsystems (such as aircraft systems, airframe, propulsion, or software)
  - Includes data-driven methods to characterize interactions between components, subsystems, and systems

## Notional Vehicle-Level Reasoning System Concept

