

The background of the slide features a sunset sky with a gradient from deep blue at the top to bright orange and yellow near the horizon. Several saguaro cacti are silhouetted against the sky, with the largest one on the left and several smaller ones scattered across the horizon.

Standards for the Digital Stage (Panel Session #12)

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Steve Holland Background

- Long Career with GM (retired in 2019)
 - A leading proponent of PHM in the auto industry
 - Helped launch OnStar Proactive Alerts which provides prognostics for millions of GM vehicles
 - Led deployment of large-scale machine learning prognostics applications in GM manufacturing
- Now Principal Consultant, VHM Innovations, LLC
- Member of PHM Society Board of Directors & active in the SAE IVHM Standards efforts
- Steve is a Life Fellow of IEEE & Fellow of PHM Society



SAE JA6268™ on Health-Ready Components



SURFACE VEHICLE/AEROSPACE RECOMMENDED PRACTICE	JA6268™	APR2018
	Issued	2018-04
Design & Run-Time Information Exchange for Health-Ready Components		

RATIONALE

This Surface Vehicle & Aerospace Recommended Practice was created to help reduce existing barriers to the successful implementation of Integrated Vehicle Health Management (IVHM) technology into the aerospace and automotive sectors by introducing health-ready components. Health-ready components are augmented either to monitor and report their own health or, alternatively, ones where the supplier provides the integrator sufficient information to accurately assess the component's health via a higher-level system on the vehicle. The principal motivation for health-ready components is to facilitate enhanced IVHM functionality in supplier-provided components that better meet the needs of end users and government regulators in a cost-effective manner. Underlying this motivation is the assumption that market forces will drive the need to achieve IVHM's benefits, which will in turn drive new requirements that suppliers must ultimately meet. This recommended practice has two primary objectives: (1) to encourage the introduction of a much greater degree of IVHM functionality in future vehicles at a much lower cost, and (2) to address legitimate intellectual property concerns by providing recommended IVHM design-time and run-time data specification and information exchange alternatives in an effort to help unlock the potential of IVHM.

Evolution of VHM Capabilities in Auto & Aero

SAE Level	Vehicle Health Capability	Narrative Description	Participation in Repair Actions	Key Data Resources	Availability of Logged &/or Real-Time Data	Use of Supporting Models	IVHM System Characteristics
Manual Diagnosis & Repair Process performed by Technician							
0	Limited On-Vehicle Warning Indicators	Service actions for scheduled maintenance or when Operator notices problems or is alerted by indicator lights or simple gages.	Operator/Driver & Service Tech	On-Vehicle Measurements & Observation	N/A	Paper-based Manuals	Only Manual Diagnostic Tools & No Condition-Based Services
1	Enhanced Diagnostics Using Scan Tools	Service techs gain added diagnostic insight using automated scanners to extract vehicle operating parameters & diagnostic codes.	Operator/Driver & Service Tech	On-Vehicle & Service Bay/ Depot Tools	Logged Diagnostic Codes & Parameters available to Service Tech	Paper-based Manuals	On-Board Diagnostics Available
2	Telematics Providing Real-Time Data	Service techs gain real-time vehicle data via remote monitoring of vehicle to more completely capture issues.	Operator/Driver, Service Tech & Remote Support Center Advisor	On-Vehicle, Service Bay / Depot & Cloud Data	Telematic Data Available to Service Tech with Diagnostics Info	Paper-based Manuals	On-Board & Remote Data Available
Diagnosis & Repair Augmented by Prognosis & Predictive Analytics							
3	Component Level Proactive Alerts	Operator and service techs are provided with component health status (R/Y/G) before problem occurs. Limited condition-based maintenance.	Operator/Driver, Service Tech & Cloud-Based Services	On-Vehicle, Service Bay & Cloud Data	Telematic Data Available to Service Tech with Diagnostics Info	Addition of Component-Level Health Models	Component-Level Health Predictions
4	Integrated Vehicle Health Mgmt.	Operator and service techs are provided with system or vehicle level health indicators before problems occur with remaining useful life estimated. Condition-based maintenance.	Operator/Driver, Service Tech & Cloud-Based Services	On-Vehicle, Service Bay & Cloud Data	Telematic Data Available to Service Tech with Diagnostics Info	Addition of Vehicle-Level Health Models	Vehicle-Level Health Management
5	Self-Adaptive Health Mgmt.	Self-adaptive control and optimization to extend vehicle operation and enhance safety in presence of potential or actual failures.	Operator/Driver, Service Tech & Cloud-Based Services	On-Vehicle, Service Bay & Cloud Data	Telematic Data Available to Service Tech with Diagnostics Info	Addition of Vehicle-Level Health Models	IVHM Capability Integrated into Vehicle Controls

New SAE ITC HRCS Consortium Launching

➔ GOAL: Increase Impact of JA6268 to Deliver Value to Industry

Cross Industry Initiative under SAE ITC

New HRCS Registry



Other initiatives in planning

- Standardized design documents, e.g., ICD
- Standard lexicons, ...

Lessons Learned

- Organizational Barriers & Interdependencies
 - ✓ OBD Evolution in Automotive Analogy
- Digital controls offering new features
 - ✓ Just because you can doesn't mean you should
- Communications Remains a Major Problem
 - ✓ Excel as today's digital napkin → Digital Thread req'd