Update to SAE HM-1 on HRCS Consortium Progress

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October 2021
HRCS UPDATE: COLLABORATION WITH TMC

• Engaged with American Trucking Associations (ATA) Technology & Maintenance Council (TMC)

• Launched two pilot studies (January 2021- ongoing):
  • Volvo- Garrett- ABF Freight Lines
  • SEFL- DG Technologies- Saferide Technologies

• HRCS has signed an MOU with TMC to collaborate on developing and advancing Integrated Vehicle Health Management (“IVHM”) techniques in the commercial trucking industry

• HRCS has signed a VMRS (Vehicle Maintenance Reporting Standards) License Agreement with TMC to incorporate VMRS coding within commercial trucking standard templates layered on top of SAE standards such as J1939, J2012, and J1972. This will accelerate development and acceptance within the sector.

• Joint Press Release issued week of October 18, 2021. Social Media, SAE Periodicals announcements to follow.
HRCS UPDATE: COLLABORATION WITH TMC

TMC Future Truck IVHM Sub Committee: 5-year horizon and beyond
“The Future Truck Committee mission shall be: To improve transport equipment, its maintenance and maintenance management by efforts to influence future equipment design.”

- Education
- Position Papers
- Policy Positions
- Pilot Programs: Volvo- Garrett- ABF Freight Lines  SEFL- DG Technologies- Saferide Technologies
- Identify topics for Study Group Task Forces
- Next Steps for Health Maintenance within ATA/TMC as an Industry Group

Study Groups are ongoing committees that identify industry challenges with respect to equipment and maintenance.

Task Forces are short-term subcommittees of Study Groups that solve problems, usually through the development of a TMC recommended Practices.
HRCS UPDATE: COLLABORATION WITH TMC

Study Group S5 (Fleet Maintenance) has taken over the JA6268 HRCS work from Future Truck with the start of the S5 HRCS Task force.

- Define ATA/TMC process to maintain VMRS mapping to JA6268
- Define data exchanges required within an asset system and beyond the asset from a fleet perspective
- Publish a Recommend Practice for the use of JA6268 within ATA/TMC Study Groups and Task Forces from a Fleet Perspective

Areas of focus for Study Groups, and Task Forces to be influenced by JA6268 and HRCS:

- Server to server communications compliant to JA6268
- JA6268 HRCS compliant data provided by assets
- Smart Trailer
- Future Propulsion
- Electromechanical Braking
- ADAS
- Autonomy
CODING AND TAXONOMY

• We realized that a focused approach is needed for different industrial sectors (Auto, Commercial Truck, Off-Highway, Aerospace, Marine, etc.). We concluded that we should use SAE source data for HRCS codes from SAE J1939, J1979, & J2012.

• This approach will support a mechanism to develop and manage standard mapping between HRCS and existing sector specific codes (such as VMRS in trucking, ATA codes in aviation, or OBD codes in automotive).

• Sector specific codes will be incorporated to accelerate acceptance and improve granularity where feasible.
HRCS MULTI SECTOR STRATEGY

- HRCS is promoting the application of IVHM in industry
- Targeting mobility- seven sectors
- Developing content relevant across all mobility sectors
- Actions:
  - organizing pilot studies
  - developing standards, best practices, and policies
  - creating standard templates and worksheets to standardize communications
• HRCS Consortium™ intends to periodically issue broad policy recommendations.
  • These statements represent the collective wisdom of our consortium membership and are
    intended to encourage thoughtful discussion on topics of strategic importance to industry which
    may impact the successful implementation of Integrated Vehicle Health Management (IVHM)
    technology solutions. The current set of position statements include:

• Operating Data Ownership (May 2021):
  • Sophisticated components installed in modern vehicles can store and transmit large volumes of
    data regarding the operating condition of individual components, systems or the entire vehicle.
    This data is valuable for predictive and comparative purposes in a variety of contexts. This
    statement is intended to clarify the rightful owner of that operating data as well as elucidate
    some of the key issues relevant to this question.

• Right to Repair (pending release):
  • This is a special case of the “Operating Data Ownership” policy. This policy is focused on
    maintenance-related information and does not apply to clearly proprietary design content such
    as control logic. It is intended to ensure that all repair organizations have access to all
    necessary info.
POLICY STATEMENTS: DATA OWNERSHIP & RIGHT TO REPAIR

- **Data Ownership** addresses:
  - Operating data produced by an asset (vehicle, aircraft, …)
  - Rightful owner of the data
  - Sharing of data among those with different perspectives
  - Safety & legal implications
  - Design IP, maintenance and servicing of the asset

- **Right to Repair** addresses:
  - Owners and repair shops’ right to maintenance-related info to safely service and maintain assets in both automotive & aerospace
  - Existing and proposed legislation as well as governmental regulations
  - Customer support services incl. VHM & Proactive Alerts
  - Design IP of OEMs and Suppliers
  - Vehicle owner and operator privacy rights

The objective of the program is to demonstrate how JA6268 can improve results and reduce cost of IVHM implementations.
THERMAL MANAGEMENT PIPING – TYPICAL SCHEMATIC
THERMAL MANAGEMENT PIPING – DATA EXTRACTION

Inherits From: Assembly Name Assembly Code Assembly Abbreviation
- Generic Heat Exchanger Battery Heat Exchanger HE114 CSBattHE
- Generic Heat Exchanger HVAC (Cabin Heat) Heat Exchanger HE080 CSHVACHE
- Generic Heat Exchanger Main Motor Heat Exchanger HE061 CSHVMotHE
- Generic Heat Exchanger Other System Heat Exchanger HE132 CSOSHE
- Generic Heat Exchanger PDU Heat Exchanger HE112 CSPDUHE
- Generic Manifold Coolant Cold Side Manifold HM008 CSMnfld
- Generic Manifold w Chk Valves Coolant Hot Side Manifold HM009 CSMnfld
- Generic Pipe Battery Packs Cold Side (Inlet) Pipe CS_P_10 CSBattHExDscgPp
- Generic Pipe Battery Packs Return Hot Side (Dscg) Pipe CS_P_13 CSBattHExInltPp
- Generic Pipe Cabin Bypass Valve Cold Side (Inlet) Pipe CS_P_06 CSCabBPVlvInPp
- Generic Pipe Cabin Bypass Valve Cold Side Outlet (Dscg) Pipe CS_P_07 CSCabBPVlvDscgPp
- Generic Pipe Coolant Pump Inlet Pipe CS_P_32 CSPumpInPp
- Generic Pipe Coolant Pump Manifold Cold Side (Inlet) Pipe CS_P_01 CSPumpMFldInPp
- Generic Pipe Coolant Pump Manifold Return Hot Side Pipe CS_P_30 CSPumpDscgPp
- Generic Pipe Coolant Reservoir Clod Side (Inlet) Pipe CS_P_31 CSRsvrInPp
- Generic Pipe Coolant Reservoir Output (Dscg) Pipe CS_P_32 CSRsvrDscgPp
- Generic Pipe Main Motor Cold Side (Inlet) Pipe CS_P_18 CSHVMotInPp
- Generic Pipe Main Motor Hot Side (Dscg) Pipe CS_P_21 CSHVMotDscgPp
- Generic Pipe OS Outlet Valve Input Cold Side (Dscg) Pipe CS_P_02 CSOSOutVlvInPp
- Generic Pipe OS Outlet Valve Output Cold Side (Inlet) Pipe CS_P_03 CSOSOutVlvDscgPp
- Generic Pipe OS Return Valve Input Cold Side (Inlet) Pipe CS_P_04 CSOSRtnVlvInPip
- Generic Pipe OS Return Valve Output Hot Side (Dscg) Pipe CS_P_05 CSOSRtnVlvDscgPip
- Generic Pipe Power Distribution Module Cold Side (Inlet) Pipe CS_P_14 CSPDUInPp
- Generic Pipe Power Distribution Module Return Hot Side (Dscg) Pipe CS_P_17 CSPDUDscgPp
- Generic Pipe Radiator Cool Side (Inlet) Pipe CS_P_30 CSRadInPp
- Generic Pipe Radiator Hot Side Pipe (Dscg) CS_P_31 CSRadOutPp
- Generic Reservoir Coolant Reservoir HRES014 CSRsvr
- Generic Rotational Valve Cabin Bypass Valve VLV117 CSCabBPVlv
- Generic Rotational Valve Other System Outlet Valve VLV095 CSOSOutVlv
- Generic Rotational Valve Other System Return Valve VLV099 CSOSRtnVlv
- Standard Radiator STHC012 Standard Radiator
- Standard Coolant Pump SVTH001 Standard Coolant Pump

Schematic NetList

Assembly List / OEM Standard Data

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<tr>
<th>Assembly Name</th>
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TEMPLATES PROVIDE VALUABLE DATA FOR EACH COMPONENT

- **Fault Model:** Specifies Failure Modes, Symptoms, Corrective Actions, Vehicle Functions and Fault Consequences
- **Advisory Model:** Specifies Corrective Actions, Test Procedures, Component Identifiers, Labor Codes, Alert Codes, Soft Part Codes, Effectivity Tags
- **Processing Model:** Specifies Signals, Data Recording Files, Algorithms and Indicators
- **Nomenclature:** Identifies Subset Of Industry Nomenclature (Std Signals, Std Components, Std Failure Modes, Std DTCs, Std Capabilities) relevant to this Assembly.
Generic Templates: Include Failure Modes, Symptoms Interfaces, Signals, Data Recordings, Algorithms and Symptoms.

Standard Templates: Add DTC’s, Standard Signals, Operational Effects, Operator Indicators
BUILDING FAULT MODELS

HRCS Templates

Generic
- Generic Heat Exchanger
- Generic Manifold
- Generic Pipe
- Generic Reservoir
- Generic Rotational Valve

Commercial Truck
- Industry Standard Cooling Fan
- Industry Standard Radiator
- Industry Standard Cooling Pump

OEM Specifications
- OEM Standard Nomenclature
- OEM Thermal Mgt Piping
Algorithm Processing

- Data Recording Files:
  - Pump Start Fluid Dynamics
  - Pump Start Electrical Dynamics
  - Valve Actuation Fluid Dynamics
  - Solid State Relay Transient Recording

- Regimes:
  - Pump Start
  - Valve Actuation
  - Breaker Closing

- Algorithms:
  - Time to Prime
  - Pump Motor Start Torque and Speed
  - Pump Motor Winding Health

- Indicators (Condition, Health, Predictive, Usage):
  - Time to Prime
  - Pump Start Fluid Dynamics
  - Pump Start Electrical Dynamic
  - Valve Actuation Performance
  - Valve Electrical Performance
ENABLED CAPABILITIES

Templates provide substantial details regarding component failure modes, symptoms, signals, operation impact, data recordings, algorithms, indicators and reported DTCs / Fault Codes.

Method allows templates to be linked to other design artifacts:
- Schematics
- Topology Diagrams
- Message Routing Tables
- Signal Flow Diagrams
- FMEAs
- Fault Trees

Once templates and design data are linked, info can be used by:
- Vehicle Analytics
- Prognostics
- Diagnostics
- Quality / Fleet Analytics
- Machine Learning

Note: Project Includes:
- Serial Communications
- Comm Topology
- Power and Ground
- Signal Flow
- Functional Dependency

Resulting in appx 20 Generic and Std Templates and 10 Project Specific Datasheets.
HEALTH-READY COMPONENTS AND SYSTEMS

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