Focus

Design Factors

Sensor Gaps

Enhance Model

Deploy & Test (Field Sample)

Maint / Cost Drivers	FMEA / FMECA	Physics Of Failure	Design / Perform Experiment	Identify Features	Fit Model & Generate Algorithm	Verify / Validate / Test

Data Mining

SME Expertise

Design & Analysis of Experiments

M&S or Physical Test to Improve Sensitivity

Analysis :
- ILAP / OSMIS
- AMSAA SDC
- PEO / PM Data

2009/2010 Targets:
- Powertrain
- Track
- Electrical System

Analysis :
- Identify failure modes
- Derive design factors and sensor strategy

FMEAs Developed :
- Diesel Engine
- Transmission
- Alternators

Analysis :
- Identify data features / fault signature
- Data fusion techniques

Analytical Tools :
- DOE Tools
- Data Analysis Tools

Algorithm Improvement :
- Model fit to only significant factors and interactions
- Additional tests to improve sensitivity

Testing:
- Team with AMSAA for field testing
- M&S and additional physical testing to introduce more noise factors

Increasing knowledge and capability through proper experimental design and analysis!

CBM
CONDITION BASED MAINTENANCE

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

Report Documentation Page

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Schedule	FY09	FY10	FY11
CAT C7 Engine			
Allison 2500 Transmission			
Prestolite 130A Alternator			
Li-ion and PbA Batteries			

Purpose:
- Development of health assessment models and algorithms for common automotive components through seeded fault and durability analysis at the component level
- Identification of sensor strategies that could be implemented in a ground vehicle application to allow for accurate diagnosis of impending faults
- Evaluation of the potential Return on Investment (ROI) for implementing these technologies in a vehicle
- Collaboration with AMSAA to evaluate the developed algorithms in a vehicle environment

Products:
- Prognostic and Diagnostic algorithms for selected failure modes
- Sensor strategy for vehicle implementation
- ROI Analysis

Payoffs:
- Provide critical insight into sensors required for diagnosis of component health and prediction of Remaining Useful Life (RUL)
- Allow for replacement of the component prior to a failure that could potentially damage or dead-line a vehicle
- Provide Government owned knowledge that can be applied across a variety of vehicle platforms

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- # Diagnostics / Prognostics:
  - Tools and techniques for development
    - Software Tools (Glyphworks, LabVIEW, Matlab)
    - Prognostic techniques (Usage Models, Signature Analysis)
    - Development Methodologies (DOEs, Seeded Fault, Durability Test)
  - Outside looking in approach
    - Use of broadcast CAN and external sensor data only
    - Limited access to proprietary parameters
    - No access to internal ECU variables
  - FMEAs for common automotive components
    - Powertrain (Heavy Duty Diesel Engines and Transmissions)
    - Electrical (Batteries, Alternators, Starters)
  - Data Formats
    - Open standard, compressible

HEMTT

FMTV

STRYKER

- # Vehicle Health Aggregation
  - Use of health data to inform intelligent system management
  - Effective user display and alert schemes (colors, fonts, etc)

Maintenance Support Device

PD TMDE

Embedded Smart Displays

Communications System

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