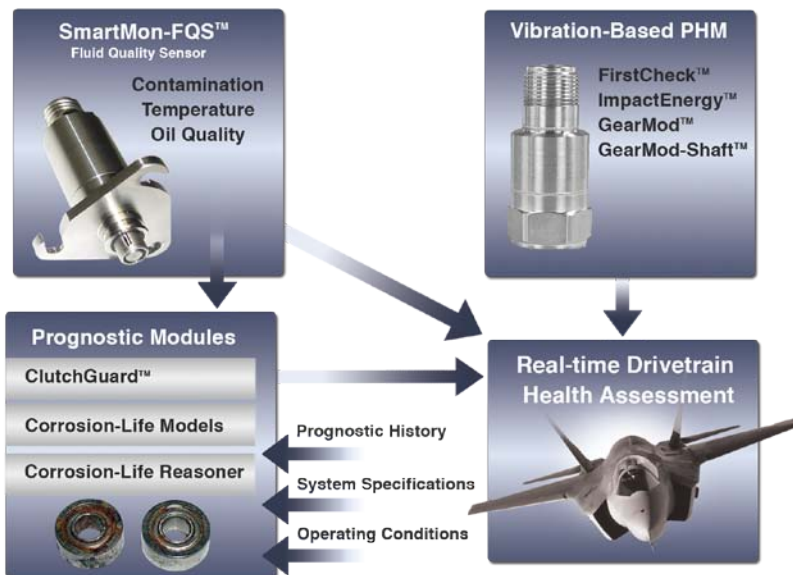


# Comprehensive Drive Train PHM



*Comprehensive, automated health management system for diagnostic/prognostic reasoning of critical drivetrain and propulsion system components.*

Impact Technologies has developed a comprehensive, automated health management system for diagnostic/prognostic reasoning of critical drivetrain and propulsion system components. This system fuses robust vibration-based damage indicators with oil quality measurements and corrosion modeling to provide a real-time assessment of a drivetrain assembly. By providing on-line fluid quality measurements, corrosion fatigue assessments, and vibration analysis, machinery failure mode indicators can be fused to produce fault classification, maintenance action recommendations, and component replacement recommendations. This on-line predictive capability will improve asset readiness and reduce total ownership cost, and can be transferred to a wide range of fixed wing, rotocraft, and ground vehicle systems.



## Benefits:

- Improves fault coverage of drivetrain system
- Safer/More cost effective asset operation through continuous monitoring
- Reduces overall life cycle cost, increases readiness, and improves safety
- Provides longer detection horizons than traditional PHM solutions
- Enables real-time onboard monitoring and event detection

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## Improve asset readiness and reduce total ownership cost.

### Features:

- Autonomous health assessment and prediction in near real-time for drivetrain components including: gears, bearings, shafts, couplings, and lube systems.
- Fluid Quality Sensor technology identifies corrosion precursors within the gearbox lube system and provides real-time on-line oil quality analysis.
- Advanced sensor validation to ensure confident PHM results.
- Robust vibration monitoring accurately detects fault signals, even in noisy machinery environments.
- “Plug and Play” software architecture permits incorporation of new modules or selective implementation of existing modules.
- Corrosion models aggregate operational history to assess corrosion risk and estimate damage size.

### Drivetrain Modules:

**SmartMon™** - The SmartMon is an in-line multi-sensor which provides oil health and contamination tracking. For gearbox corrosion applications, it assesses water content (accurate to 10s of ppm) and tracks temperature.

**FirstCheck™** – Provides signal validation and verification, random anomaly detection, and dynamic reconfiguration of feature threshold values to account for changes in sensing hardware.

**GearMod™** – Uses HUMS vibration feature analysis, physics-based failure modeling, and inspection/operational data to detect tooth bending, web fatigue, and multiple surface fatigue and wear modes in gears.

**GearMod™ Shaft** – Applies GearMod™ techniques to detect and predict faults in shafts and couplings such as misalignment, imbalance, and cracks.

**ImpactEnergy™** – Extracts valuable incipient fault data from vibration analysis results to enhance detection horizon of bearing failures.

**ClutchGuard™** – Uses a wear prediction model and prognostic algorithms to determine current clutch health state and time-to-failure.

**Corrosion Life Models** - Impact's corrosion models aggregate information pertaining to usage, conditions, and material properties to serve as a first line of defense against gearbox corrosion damage. The probabilistic framework tracks corrosion development from pit initiation to critical crack length.

**PHM Reasoner** – Integrates results from each module to determine overall health, Remaining Useful Life (RUL), and confidence level.