

LEADING THE WAY IN ROLLING STOCK RELIABILITY

COT&S EXTENSION & COST REDUCTIONS: WE CAN HELP

For decades the Federal Railroad Administration (FRA) has enforced a Clean, Oil, Test, and Stencil (COT&S) overhaul regulation (Title 49 CFR) for air brake systems throughout the railroad industry. These overhauls are performed at specific intervals and represent a very costly element of rolling stock maintenance. In recent years, transit agencies have worked with the FRA to seek and receive extensions to the COT&S intervals for electronic air brake systems subject to improved monitoring of system functions and operating conditions.

The GBS Group and partners supporting Amtrak have developed an alternative, Reliability Centered Maintenance (RCM) approach that replaces COT&S overhauls. The application of this approach was developed for Amtrak's Acela high-speed train sets and electronic air brake systems. The FRA has

approved this alternative maintenance approach for "age-exploration" on two of 20 train sets operating along the Northeast Corridor. This plan replaces the time-based COT&S overhauls with a comprehensive Condition Based Maintenance solution that eliminates unnecessary overhauls, prevents intrusion into clean systems unnecessarily, and provides an increased assurance that brake systems are functioning properly in real time using embedded sensor systems in combination with specific functional tests and performance demonstrations.



This new approach, when fully implemented, will result in several million dollars in cost savings and will increase in the availability of Acela train sets for passenger revenue service. In addition, the condition-based maintenance approach improves system reliability by assuring critical functions exist through improved performance monitoring, dynamic testing, and continuous monitoring.

THE COT&S LEGACY: WASTED TIME, WASTED MONEY

The COT&S legacy overhaul involves the widespread removal and replacement of the majority of the air brake components, regardless of component or system condition. In between these overhauls, the systems still suffer from routine failures which require corrective maintenance, parts changes, equipment downtime, etc. Studies have shown that complex systems fail randomly over



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time and do not “wear out” conveniently and predictably every five years just in time for overhaul. Only about 3% of complex systems and equipment actually wear out and “fail” due to age. Therefore trying to time an overhaul without regard to actual condition is virtually impossible to do without introducing waste and error. Amtrak recognized that this situation represented a perfect candidate for application of RCM methodology. **The COT&S process is potentially wasteful for electronic air brake systems for a number of reasons:**



■ **Components are being replaced** and

overhauled prematurely, as the intent of age-limited overhaul is to replace each component prior to a wear-related failure. Wear-related failures rarely occur despite widespread belief otherwise.

■ **Comprehensive overhauls** disrupt clean, stable systems and introduce failures due to faulty components, imperfect maintenance environments, human error, etc.

■ **Some components fail more frequently than the COT&S** time interval and are replaced as part of corrective maintenance and then replaced again during the COT&S overhaul. In these cases, COT&S does not prevent failure and results in the replacement of operational components.

THE CUSTOMIZED RCM APPROACH

The GBS Group and Amtrak performed a system-wide evaluation of electronic air brake components using historical failure reports, Failure Mode, Effects, and Criticality Analysis (FMECA), and a full functional failure analysis in accordance with established RCM principles and methodology. The result was a comprehensive in service condition monitoring plan for two test train sets that replaced the COT&S overhauls for these train sets. The added monitoring includes review of embedded sensor data to spot faults, trends of consequence, etc.

In addition, dynamic brake stopping distance tests are performed using specialized instrumentation and standards to measure the actual braking condition of the entire train set and its components. These monitoring and performance actions are performed at a fraction of the cost of age-limit based overhauls and give operators and regulators far better insight into critical brake system performance and condition. Amtrak engineers utilize the revised maintenance approach and brief the FRA approximately quarterly to ensure all stakeholders have visibility into this important process change.

As a result of the revised maintenance approach, the maintenance staff is now able to gauge the health of critical components using standardized tests. They are able to identify faulty systems and components and adjust, renew, or repair equipment prior to functional failure of the systems.

RESULTS AND RECOMMENDATIONS FOR THE FUTURE

The FRA approved Amtrak’s request for extension of the COT&S interval following approximately five months of analysis and effort. The extension authorizes Amtrak to extend the interval on two train sets from 1,840 to 2,546 days during the age-exploration project. The intent is to continue demonstrating success of this process and extend the intervals further, for all train sets, using carefully engineered performance monitoring that assures critical brake systems function as required, at all times.

The GBS Group provides engineering consulting and technical services to the transportation and maritime industries. The COT&S age-exploration executed on Amtrak’s Acela high-speed train set represents the application of our RCM expertise tailored to a specific problem and client need. Our RCM methodology helps owners, operators, maintenance managers and regulators to carefully move from a time-based to condition based maintenance program for high value equipment while building in enhancements to reliability and safety.