

ROOT CAUSE ANALYSIS: REPLACING ANECDOTES WITH EVIDENCE

**WANT A 60% IMPROVEMENT IN
YOUR FLEET AVAILABILITY? READ ON.**

The GBS Group has distinguished its consulting practice by getting results through persistent field engineering expertise combined with use of a disciplined Root Cause Analysis (RCA) process methodology. The GBS Group has developed an outstanding reputation implementing Root Cause Analysis with great success to solve complex system and process problems for small and large clients including Amtrak.



In complex machinery systems like Amtrak's HHP8, described below, there are literally thousands of components, electronic controls and sensors that collectively act to perform critical functions. When these functions fail, identifying the cause or causes often involves guessing, anecdotes, and often results in tremendous frustration from the executive suite to the shop floor. Such was the case with the HHP8 for years before Amtrak launched an RCA campaign in 2006.

THE GBS GROUP RESPONDS TO AMTRAK'S CHALLENGES

Amtrak was experiencing an extremely high failure rate within the propulsion systems of its High Horsepower electric locomotive (HHP8). These locomotives operate at a maximum of 8000 horsepower, and 125 MPH, and are responsible for moving passengers up and down the Northeast Corridor from Boston to Washington, DC. The locomotives are all electric power with an overhead catenary and pantograph configuration. The locomotive systems convert very high voltage, single-phase AC power to a constant voltage DC buss then invert to a variable frequency, variable voltage, three-phase power to a synchronous traction motor and reduction gear for each axle. The propulsion failures with HHP8 appeared to be random and unrelated to one another and represented a very costly and labor intensive maintenance burden, keeping approximately 65% of the locomotives out of service typically. Amtrak decided to attack these problems using a disciplined root cause analysis process and software from The Reliability Center, Inc of Hopewell, VA. The



**CONSULTING &
TECHNICAL SERVICES**

397 LITTLE NECK ROAD
BUILDING 3300 SOUTH
SUITE 204
VIRGINIA BEACH, VA 23452
(757) 965-4274
WWW.THEGBSGROUP.US
INFO@THEGBSGROUP.US

GBS Group field engineers led the HHP8 analysis efforts for approximately six months using a cross-functional team representing Amtrak maintenance personnel, OEM reps, purchasing, operations, and other stakeholders affected by the propulsion problems.

The cross-functional team worked closely together to map out the numerous "undesirable events," or failures, in order to align everyone to the exact understanding of what it was the team was trying to fix. The team then spent months investigating specific troubled systems and components identified through hypothesis testing to further pinpoint one-by-one the problems with mechanical and electrical components. After extensive investigation, a grounded power module caused by a series of undetected shorts in the high-voltage sub-components surfaced as the dominant failure mode. If left unresolved, these grounds were shown to be worsening over time leading to eventual, sometimes catastrophic destruction of the power modules and associated components. The team identified over 25 separate causes for grounding, including coolant leaks from fittings; damaged insulators from handling or shipping errors; inadequate attention to ground detection sensors, etc. Each of these root causes was mapped as either physical, human, or latent (system-related) and given single or multiple solutions.

Our engineers managed the extensive action items to methodically eliminate the causes and, therefore, the functional failures themselves. Since this effort began, availability of the HHP8 locomotives increased by more than 60% as measured by Amtrak's Transportation and Mechanical Departments. In addition, the discipline used helped to train maintenance personnel to levels unimaginable prior to the RCA efforts. This training had positive effects in almost every area, leading to a culture change in many ways. Amtrak's maintenance personnel are now talking about "root causes" more than ever before and are no longer satisfied to merely treat symptoms and entertain anecdotes.

"The GBS Group has earned my trust and my business. They figured out the real causes for chronic failures on our most complex electric locomotives. **They blew us away with their persistence and technical discipline** which helped us dispel many myths about why our systems were failing. GBS and its field engineering talent doubled the number of locomotives I could put in service every day.

— *Vince Nesci,*
Chief Mechanical Officer,
Amtrak

YES, TRUTH IS STRANGER THAN FICTION

There are no shortcuts to finding out the truth about your system problems and failures. So, while the truth may indeed be stranger than fiction, knowing the truth will save you time and money. Don't waste both merely fixing problems born of anecdote, rumor, and pure fiction. Contact The GBS Group at (757) 965-4274 or visit www.theGBSgroup.us to help your team find the truth using disciplined root cause analysis techniques, experienced, passionate consultants and engineers. We suspect there is no time for fiction in your business.

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.