



## Delta TechOps Reduces Engine Inspection Costs by Nearly \$2M Annually

**Customer**  
Delta TechOps

**Industry**  
Airline

**Challenge**

- JT8D engines have historically been plagued by turbine blade failures.
- Traditional testing methods only inspected for half of defects known to cause failure.
- Destructive testing methods were costly while non-destructive methods were not sufficient.

**Solution**

- After extensive testing, Delta TechOps implemented PCRT as a supplemental inspection method.
- PCRT tests for all four defects known to affect engine integrity.
- PCRT won FAA approval and completely replaced destructive testing at Delta TechOps.

**Results**

- Delta TechOps reduced T1 failures from three per year to zero and unscheduled engine removals from five annually to zero.
- PCRT reduces cost by \$900,000 annually by eliminating the need to test blades destructively.
- Testing and passing surplus blades allows blades to return to service, saving \$1 million annually.
- By returning blades to service, Delta TechOps saved \$5.1 million.
- Delta TechOps and Vibrant jointly won the FAA-ATA Non-Destructive Testing “Better Way” award.
- Delta TechOps now utilizes PCRT on other engine/component parts, with more planned.

*T1 failures reduced to zero after implementing PCRT*

Delta TechOps is the largest airline maintenance, repair and overhaul provider in North America. In addition to providing maintenance and engineering support for Delta’s own worldwide fleet of more than 750 aircraft, Delta TechOps serves more than 150 other aviation and airline customers around the world.

The engine shop at Delta TechOps provides ISO 9000 Certified maintenance and propulsion engineering following Lean and Six Sigma processes. Engineers put every engine through rigorous testing before it goes into service.



For the JT8D-219 commercial engines – standard on MD-80 aircrafts – Delta TechOps follows all the manufacturer’s recommended testing procedures. Until recently, destructive testing was the standard method of performing JT8D HPT1 over-temperature inspections. When engines received an over-temperature indication, the standard procedure was to cut up one randomly selected blade and inspect the micro-structure for evidence of heat damage. If the test blade passed, then all blades were assumed to be flight worthy. However, if that blade showed signs of heat damage, all 64 blades were removed from service – costing hundreds of thousands of dollars.

“Throwing out all blades and replacing them with brand new ones wasn’t ideal financially or logistically,” said David Piotrowski, Principal Engineer, Delta TechOps.

Beyond cost, existing inspections were insufficient. Recommended inspections only test for half of the defects known to cause engine failure. Even more challenging, these engines have traditionally been plagued by failures.

“We had a host of inspections but blades were still failing in the field,” said George Teeuwen, Manager of Propulsion Engineering.

**PCRT Replaces Destructive Testing**

In 2008, the engine shop was given six months to come up with a better way of inspecting engine blades. Among the methods Delta TechOps evaluated was Process Compensated Resonance Testing (PCRT), a non-destructive inspection method from Vibrant Corporation. Vibrant provides testing services for major aerospace manufacturers and MRO firms under AS9100 Rev. C and ISO 9001:2000 certificate 07-0992.

PCRT is a revolutionary non-destructive testing technology that can determine if a component is structurally sound and fit for service. For Delta TechOps, PCRT offers increased sensitivity to defects, less engine down time and reduced waste – and cost – from blades that test negative for multiple failure modes.

“After extensive testing, we decided that PCRT was the best option technically and financially,” Piotrowski said. “The method simultaneously improves reliability and reduces cost. Usually those are mutually exclusive; to improve reliability you’re going to have to put money into it, or you save money but take a hit on reliability. In this case, we achieved both.”



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Delta TechOps added PCRT as a supplemental inspection in 2009. The following year, the company obtained FAA approval of JT8D-219 T1 over-temperature testing, opening the door for Delta TechOps to replace destructive sampling completely with PCRT.

### PCRT Services Onsite at Delta TechOps

Delta tests its global fleet at its engine shop in Atlanta, Ga. Vibrant Corporation created a custom test process for JT8D-219 T1 testing and provides the service on site. Vibrant trains TechOps team members to run the testing on their own components, but closely monitors the process. Each month, Vibrant collects and analyzes all test results.

As a service provided on site by Vibrant, PCRT did not fall within the typical business arrangement for Delta TechOps. Recognizing the value of the non-destructive testing, both parties worked together to create a teaming arrangement that has proven productive and rewarding.

"It takes time for new practices to become accepted and ingrained in the business and Vibrant has stayed the course with us," said Jeff Peiter, Manager, Enabling Technologies, Operations Support Engineering. "Vibrant has been very open to working with us to find the right business arrangement and we have shared the growing pains of bringing a new technology on board."

### \$5.1M to the Bottom Line

At Delta TechOps, PCRT's non-destructive testing has dramatically changed JT8D T1 inspection, adding millions to the company's bottom line:

- PCRT reduces cost by \$900,000 annually by eliminating the need to destructively test blades.
- Delta now uses PCRT to test surplus-market blades. With greater confidence in these blades, Delta returns those that pass into service, saving \$1 million annually.

"Before we had PCRT in place, our policy was not to consider any used blades on the aftermarket. Now, we have changed our policy to buy blades if they pass our test," Peiter said.

With PCRT testing, Delta has been able to return a large number of blades to service that otherwise would not have been used, saving an estimated \$5.1 million to date. Additionally, the company now saves nearly \$2 million annually.

### Zero Failures on PCRT-Tested Blades

It's now economically and logistically feasible to test every blade. Additionally, PCRT tests for all defects known to affect engine integrity: over-temperature, thin wall thickness, inter-granular attack and cracking.

The comprehensive inspection method contributes to more reliable performance in the field. Since implementing the non-destructive inspection method, Delta TechOps has reduced T1 failures from three per year to zero and unscheduled engine removals from five annually to zero.

"Our previous testing method for over-temperature indications was a major cost driver; if overtemped blades were missed it would destroy the most expensive parts of the engine and result in in-flight shut downs and/or flight diversions. PCRT testing on T1 blades has completely eliminated that problem," Teeuwen said.

For their joint efforts, Delta and Vibrant won the FAA-ATA Non-Destructive Testing "Better Way" award. The Better Way Award annually recognizes a government - industry team that has developed and applied a technology, technique, process or policy resulting in a more sensitive, reliable or cost-effective process for inspecting and testing of aircraft, aircraft components or aircraft systems.

Now PCRT is a major component of Delta TechOps' NDT facility. Delta TechOps now utilizes PCRT on other fleets, including the popular CFM56-7B, with plans for more applications on engines and components.

"PCRT gives us a unique tool in our MRO toolbox as we support our own and customer fleets," Piotrowski said.