

NTSB Recommendations (Excerpted from NTSB report NTSB/AAR-98/01)

As a result of the investigation of this accident, the National Transportation Safety Board makes the following recommendations to the Federal Aviation Administration:

Form a task force to evaluate the limitations of the blue etch anodize and other post manufacturing etch processes and develop ways to improve the likelihood that abnormal microstructure will be detected. (A-98-09)

Inform all manufacturers of titanium rotating engine components of the potential that current boring and honing specifications may not be sufficient to remove potential defects from holes and ask them to reevaluate their manufacturing specifications and procedures with this in mind. (A-98-10)

Establish and require adherence to a uniform set of standards for materials and procedures used in the cleaning, drying, processing, and handling of parts in the fluorescent penetrant inspection process. In establishing those standards, the FAA should do the following:

- Review the efficacy of drying procedures for aqueously cleaned rotating engine parts being prepared for fluorescent penetrant inspections; (A-98-11)
- Determine whether flash drying alone is a sufficiently reliable method; (A-98-12)
- Address the need to ensure the fullest possible coverage of dry developer powder, particularly along hole walls; (A-98-13)
- Address the need for a formal system to track and control development times; (A-98-14) and
- Address the need for fixtures that minimize manual handling of the part without visually masking large surfaces of the part. (A-98-15)

Require the development of methods for inspectors to note on the part or otherwise document during a nondestructive inspection the portions of a critical rotating part that have already been inspected and received diagnostic follow-up to ensure the complete inspection of the part. (A-98-16)

Conduct research to determine the optimum amount of time an inspector can perform nondestructive testing inspections before human performance decrements can be expected. (A-98-17)

In conjunction with industry and human factors experts, develop test methods that can evaluate inspector skill in visual search and detection across a representative range of test pieces, and ensure proficiency examinations incorporate these methods and are

administered during initial and recurrent training for inspectors working on critical rotating parts. (A-98-18)

Require that all heavy rotating titanium engine components (including the JT8D-200 series fan hubs) receive appropriate nondestructive testing inspections (multiple inspections, if needed) based on probability of detection data at intervals in the component's service life, such that if a crack exists, but is not detected during the first inspection, it will receive a second inspection before it can propagate to failure; assuming that a crack may begin to propagate immediately after being put into service, as it did in the July 6, 1996, accident at Pensacola, Florida, and in the July 19, 1989, United Airlines accident at Sioux City, Iowa. (A-98-19)

Require, as an interim measure, pending implementation of Safety Recommendation A-98-19, that critical rotating titanium engine components that have been in service for at least 2 years receive a fluorescent penetrant inspection, eddy current, and ultrasonic inspection of the high-stress areas at the engine's next shop visit or within 2 years from the date of this recommendation, whichever occurs first. (A-98-20)

Require Delta Air Lines to review its operational procedures, with special emphasis on nonmaintenance stations, to ensure that flightcrews have adequate guidance about what constitutes a maintenance irregularity or discrepancy (including the presence of fluid drops in unusual locations) before departure, and that following this review Delta should, contingent on FAA approval, amend its flight operations manual to clarify under what circumstances flightcrews can, if at all, make independent determinations to depart when maintenance irregularities are noted. Further, the FAA should have its principal operations inspectors review these policies and procedures at their respective operators to clarify, if necessary, these flightcrew responsibilities. (A-98-21)

Require that all newly manufactured passenger-carrying airplanes operated under 14 Code of Federal Regulations Part 121 be equipped with independently powered evacuation alarm systems operable from each crewmember station, and establish procedures and provide training to flight and cabin crews regarding the use of such systems. (A-98-22)

Require that all newly manufactured airplanes be equipped with cockpit indicators showing open exits, including overwing exit hatches, and that these cockpit indicators be connected to emergency power circuits. (A-98-23)