

**EXECUTIVE SUMMARY**  
**AIRCRAFT ACCIDENT INVESTIGATION**  
**KC-135E, S/N 58-0108**  
**PATRICK AIR FORCE BASE, FLORIDA**  
**9 OCTOBER 2003**

On 9 October 2003, at 1943 hours (L), a KC-135E, S/N 58-0108, experienced engine failure to include turbine disintegration and debris shrapnel damage to various parts of the right wing, shortly after take-off from Patrick Air Force Base (AFB), Florida. The KC-135E and its crew were assigned to the 940<sup>th</sup> Air Refueling Wing, Beale AFB, California. The crew had just taken off from Patrick AFB to fly an air refueling mission with two C-17s from Charleston AFB, South Carolina, and return to Patrick AFB for one full stop landing.

At approximately 1500 feet above the ground on departure leg, the crew heard a bang and felt a shudder, observed flames and sparks trailing from the #3 engine (S/N 668218), and applied appropriate emergency procedures to shutdown that engine which stopped the fire. The crew orbited over the ocean, jettisoned 57,000 pounds of fuel, and made an uneventful landing at 2030 hours (L), 47 minutes after takeoff. The crew egressed without injury.

Engineer analyses at Pratt & Whitney (manufacturer of the engine) and Headquarters, Oklahoma City Air Logistics Center (OC-ALC), determined that the low pressure turbine shaft had failed (broken) which resulted in destruction of the turbine section. The low pressure turbine shaft failed because it had been exposed to high temperatures from hot combustion gases due to a large crack (21 inches long and up to 0.25 inches wide) in the 1<sup>st</sup> stage turbine nozzle support front flange weld area.

Further analysis of the 1<sup>st</sup> stage turbine nozzle support revealed that the front flange weld area had been exposed to prolonged and/or improper heat at some time in its history, which degraded the hardness properties of the weld. The failure cause was long-term low cycle fatigue, and engineers determined that it had taken approximately 2800 cycles for the weld to fail (for the TF33 engine, engineers assume 1 cycle = 1 sortie). Because the 1<sup>st</sup> stage turbine nozzle support is not tracked in an engine component database, it could not be determined when, where, or by whom the front flange weld area had become exposed to prolonged/improper heat, other than the fact that it occurred some time in its past and prior to the last major engine overhaul in 1997 at the OC-ALC. It is worth noting that the engine was owned and used by the commercial sector prior to being acquired by the USAF in the mid-1980's.

The primary cause of the engine failure, then, was the complete failure of the 1<sup>st</sup> stage turbine nozzle support front flange weld area, which allowed hot combustion gases to come in contact with the low pressure turbine area, causing the low pressure turbine shaft to fail resulting in #3 engine failure.

Under 10 U.S.C. 2254(d) any opinion of the accident investigators as to the cause of, or the factors contributing to, the accident set forth in the accident investigation report may not be considered as evidence in any civil or criminal proceeding arising from the accident, nor may such information be considered an admission of liability of the United States or by any person referred to in those conclusions or statements.