



National Transportation Safety Board Aviation Incident Data Summary

Location:	Ugolny Airport, Unknown	Incident Number:	ENG13IA033
Date & Time:	07/02/2013, 1026	Registration:	HL8275
Aircraft:	BOEING 777	Injuries:	N/A
Flight Conducted Under:	Part 129: Foreign		

Analysis

On July 2, 2013, a Korean Air Lines (KAL) Boeing 777-300ER, registration number HL8275, powered by two General Electric (GE) GE90-115B turbofan engines, experienced a No. 1 engine (left) in-flight shutdown (IFSD) while crossing the Bering Sea. The pilots diverted the airplane to Ugolny Airport (DYR), in Siberia, Russia where an uneventful single engine landing was made. The Korean ARAIB requested delegation of the investigation and the NTSB accepted responsibility for investigating this incident. Post landing examination of the No. 1 engine revealed that the radial gearshaft within the transfer gearbox housing was fractured. Metallurgical examination of the radial gearshaft found an 0.049-inch axial crack with striation features indicative of fatigue propagation and a morphology consistent with initial fatigue initiation occurring under a torsional and/or biaxial stress condition. This axial crack was considered the primary crack and the fracture origin area. Microhardness tests near the fracture origin revealed a reduction in near surface hardness (lower hardness values than required). GE concluded that the near surface low hardness was attributable to decarburization due to marginal (thin or detached) copper plating existing on the gearshaft surface during the hardening process. Through computer modeling and testing of the radial gearshaft, GE concluded that the initiation of the axial crack was likely the result of a combination of high residual tensile stresses produced by local decarburization coupled with the operating stresses experienced at the outer diameter surface. To address the manufacturing process deficiency, GE issued seven service bulletins to remove, inspect, and repair the suspect radial gearshafts. To expedite the removal of the suspect radial gearshafts, the Federal Aviation Administration issued three separate Airworthiness Directives (AD). According to GE, all affected radial gearshafts addressed by the various FAA ADs have been removed from service.

Flight Events

Enroute-cruise - Loss of engine power (total)
Enroute-cruise - Engine shutdown
Enroute-cruise - Powerplant sys/comp malf/fail

Probable Cause

The National Transportation Safety Board determines the probable cause(s) of this incident to be:
The failure of the transfer gearbox resulting from the fracture and separation of the radial gearshaft from fatigue cracking as a result of a combination of high residual tensile stresses produced by local decarburization during the manufacturing process coupled with the normal operating stresses.

Findings

Aircraft-Aircraft power plant-Engine (turbine/turboprop)-Accessory drives-Failure - C
Aircraft-Aircraft power plant-Engine (turbine/turboprop)-Accessory drives-Design - F

Aircraft and Owner/Operator Information

Aircraft Manufacturer:	BOEING	Registration:	HL8275
Model/Series:	777 300ER	Engines:	2 Turbo Fan
Operator:	KOREAN AIR LINES COMPANY LTD	Engine Manufacturer:	General Electric
Air Carrier Operating Certificate:	Foreign Air Carrier (129)	Engine Model/Series:	GE90-115B
Flight Conducted Under:	Part 129: Foreign		

Meteorological Information and Flight Plan

Observation Facility, Elevation:		Weather Information Source:	Unknown
Conditions at Accident Site:		Lowest Ceiling:	
Condition of Light:	Not Reported	Wind Speed/Gusts, Direction:	
Temperature:		Visibility:	
Precipitation and Obscuration:			
Departure Point:	Chicago, IL (ORD)	Destination:	Seoul, FN (ICN)

Wreckage and Impact Information

Crew Injuries:	N/A	Aircraft Damage:	None
Passenger Injuries:	N/A	Aircraft Fire:	None
Ground Injuries:	N/A	Aircraft Explosion:	None

Administrative Information

Investigator In Charge (IIC):	Jean-Pierre M Scarfo	Adopted Date:	05/14/2014
Investigation Docket:	http://dms.nts.gov/pubdms/search/dockList.cfm?mKey=87474		

The National Transportation Safety Board (NTSB), established in 1967, is an independent federal agency mandated by Congress through the Independent Safety Board Act of 1974 to investigate transportation accidents, determine the probable causes of the accidents, issue safety recommendations, study transportation safety issues, and evaluate the safety effectiveness of government agencies involved in transportation. The NTSB makes public its actions and decisions through accident reports, safety studies, special investigation reports, safety recommendations, and statistical reviews.

The Independent Safety Board Act, as codified at 49 U.S.C. Section 1154(b), precludes the admission into evidence or use of any part of an NTSB report related to an incident or accident in a civil action for damages resulting from a matter mentioned in the report.