

Boeing 747-236B, G-BDXO, 14 October 1996

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Aircraft Type and Registration:	Boeing 747-236B, G-BDXO
No & Type of Engines:	4 Rolls-Royce RB211-524D4-19 turbofan engines
Year of Manufacture:	1987
Date & Time (UTC):	14 October 1996 at 2119 hrs
Location:	London Gatwick Airport
Type of Flight:	Public Transport
Persons on Board:	Crew - 19 - Passengers - 340
Injuries:	Crew - None - Passengers - None
Nature of Damage:	Damage to High Pressure Compressor of No 1 engine
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	50 years
Commander's Flying Experience:	14,000 hours (of which 9,600 were on type) Last 90 days - 115 hours Last 28 days - 21 hours
Information Source:	Aircraft Accident Report Form and engine strip report from the operator

The aircraft had begun its take-off roll on a flight to Harare, Zimbabwe. The Flight Data Recorder subsequently showed that take-off power was set by 80 kt, but Turbine Gas Temperature (TGT) on the No 1 engine increased slightly, accompanied by small fluctuations in Engine Pressure Ratio (EPR). As the aircraft reached V₁ at 144 kt there was a bang followed by audible surging, the TGT started to rise sharply and there was a step increase in the vibration indication. Flame and sparks were seen coming from the jet pipe by some passengers and ground observers. Power was reduced as the TGT passed 784°C and momentarily peaked at 804°. Take off was continued and the No 1 engine was shut-down at about 300 ft AGL. The aircraft jettisoned fuel and returned to Gatwick without further incident.

Borescope inspection revealed considerable High Pressure Compressor(HPC) damage and a subsequent strip examination showed severe secondary damage to stages 4, 5 and 6 of the HPC caused by release of a stage 3 stator vane airfoil which had apparently cracked away from its inner and outer shrouds. In this particular model of the RB211 engine, the HPC3 stators are of fabricated design, with the airfoil being brazed to the inner and outer shrouds and are assembled as single vanes to form the complete stage. The remaining stages are of forged construction, separate vanes being brazed together in groups of six.

The operator reports that they have not experienced problems before on the HPC3 stator vanes on the RB211-D4 engine but had encountered problems with the HPC4 vanes on their RB211-535C engines which were also of fabricated construction and were addressed by a change to a forged standard. With this experience in mind, they report that they are giving serious consideration to embodying Rolls-Royce modification 72-7342 on refurbishment of the HPC of their fleet of engines. This modification changes the construction of the HPC3 stator vanes on the 524D4 engines from fabricated to forged. The engine in question had flown 61,288 hours/9,980 cycles since new and 3,821 hours/570 cycles since last workshop visit.