

Communication Summary

5/8/2015

Information From: Mr. Jon-Adam Michael, Rolls Royce



Summary & Factual Information: Mr. Michael was requested to research if conditions to include an early closing bleed valve could affect surging. He, in part, replied:

- a) An early closing bleed valve could, in theory, contribute to surging in the Ng range where it would normally be open
- b) Engine power at -2% below fully deteriorated (power assurance chart) levels could contribute to engine surging.
- c) A faulty ECU or T1 sensor could contribute to engine surging
- d) Low pressure readings on the P1 sensor will not contribute to engine surging. (Lower acceleration schedule would have more, not less, surge margin).

It should be noted, that though a), b) and c) may affect engine surging; based on the information available, it cannot be concluded that they had an effect on the subject engine during the event.

... The bleed valve provides additional surge margin. Having it close early (or completely), would only reduce surge margin in the Ng (N1) speed range where it would normally be open. The incident recorder data from this event depicts Ng initially at 95% and decelerating to 91% by record 10, at which time the main rotor has drooped enough to trigger the incident recorder (<92% Nr). Based on the bleed valve closure chart, the bleed valve would be closed at 95% and would not open until just below 88% for the given T1 (80°F). So the bleed valve would normally have been closed per specification during the sequence of events leading up to the rotor droop. Furthermore, since the engine is decelerating at this point, it is not a surge-inducing condition even with a prematurely closed bleed valve. The potential concern for a bleed valve that is stuck closed to contribute to engine surging is during engine acceleration.

I can attest that the above summary is correct to the best of my knowledge:

Edward F. Malinowski
National Transportation Safety Board
Air Safety Investigator