Aviation Safety Investigation Report 199300970

Boeing Co B737

14 February 1993

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Occurrence Number:	199300970	Occurrence Type:	Incident
Location:	Melbourne		
State:	VIC	Inv Category:	3
Date:	Sunday 14 February 1993		
Time:	0750 hours	Time Zone	ESuT
Highest Injury Level:	None		
Aircraft Manufacturer: Boeing Co			
Aircraft Model:	737-376		
Aircraft Registration:	VH-TAK		Serial Number: 23485
Type of Operation:	Air Transport Domest	ic High Capacity Pas	ssenger
Damage to Aircraft:	Nil		-
Departure Point:	Melbourne		
Departure Time:			
Destination:	Various		

Approved for Release: Wednesday, November 9, 1994

FACTUAL INFORMATION

Circumstances

At the completion of flying on 8 February 1993, the aircraft underwent scheduled maintenance at Melbourne. Included in the maintenance was an Engineering Instruction which required that both the left outer and the right inner engine fan cowls be removed for inspection and rectification.

In order to return VH-TAK promptly to service, the right engine inboard fan cowl was borrowed from VH-TAI which was undergoing heavy maintenance.

On 13 February, the borrowed cowl was returned to VH-TAI and the cowl which had been removed from the VH-TAK left engine outer position on 8 February was returned from maintenance. This cowl was then fitted to the right engine inner position on VH-TAK.

The aircraft was released for service on 14 February, and through to the end of flying on 16 February it operated 19 sectors. At 0600 on 17 February, during a pre-flight inspection in Hobart, it was noticed that the Vortex control device (VCD) was not fitted to the right engine inboard cowl.

The VCD, which is a large blade-shaped nacelle chine, is required to be fitted to the engine inner fan cowls on Boeing 737-376 series aircraft. At large angles of attack in the landing configuration, the engine nacelle causes an airflow vortex spill which disrupts the boundary layer flow from the upper wing surface downstream to the extended flaps behind the engine. The chine produces a vortex which mixes with the nacelle vortex to increase wing lift by improving the boundary layer flow over the flaps.

Following advice that the VCD was not fitted, Maintenance Control in Melbourne issued an authorisation for the aircraft to be operated for one revenue sector back to Melbourne where the VCD was to be fitted.

Maintenance Aspects

The cowl was fitted to the aircraft in accordance with Boeing 737 maintenance manual (MM) section 71-11-02. That section defines the procedures to be used for removal and fitment of the cowl by either the manual method or the sling method. The operator of the aircraft utilises the manual method.

Section 71-11-02 page 401 Paragraph 2 is headed 'Remove the Fan Cowl Panel (Manually)' and at sub para (2) states 'If you replace the inboard fan cowl panel, first remove the VCD'. It is by this procedure that all fan cowls, irrespective of position on the aircraft, are received into store with the VCD removed.

In Paragraph 3, on page 404, headed 'Remove the Fan Cowl Panel (Sling Method)', the sub para (2) is not included.

On page 407, Paragraph 4 is headed 'Install the Fan Cowl Panel (Manually)'. This paragraph does not include a requirement to fit the VCD.

On page 410, Paragraph 5 is headed 'Install the Fan Cowl Panel (Sling Arrangement)' and at page 412, sub para E is headed 'Put airplane back in its usual condition'. At E(1) is the requirement 'If you replaced the inboard fan cowl panel, install the VCD on the replacement panel'. Sub para E is not listed as a requirement when the panel is replaced manually per Paragraph 4. Accordingly there was no trigger to alert the maintenance crew to fit a VCD.

The effect of non-fitment of the VCD was not advised in either the Maintenance Planning Document, the MM or the Operations manuals.

The only specification under which the cowl is held in store is P/N 314A1110. To provide for fitment to either engine nacelle, this specification does not include a VCD. The cowls were not labelled to indicate that the VCD was required to be fitted to cowls placed on the nacelle inner position.

There was no requirement on the daily or preflight inspection procedures to specifically check for the presence of a VCD on the inboard cowls. During the time that the aircraft had operated without the VCD, 22 maintenance and 19 pilot inspections had been conducted.

A 'Permit to Operate' document was used by the airline to authorise the operation of an aircraft with damage or unservicabilities outside the scope of the appropriate Minimum Equipment List, Schedule of Permissible Unserviceabilities or Configuration Deviation List. The permit was issued by the Aircraft Maintenance Manager as a Delegate under Civil Aviation Regulations 37(1) and 37(2).

The Aircraft Maintenance Manager discussed the issue with the Engine Type Specialist and with the pilot, but did not consult the manufacturer or an aerodynamics specialist, nor did the operator's procedures require this. The operator's procedures required that the Delegate seek the agreement of the Flight Standards Manager prior to signing the permit. However, this agreement was not obtained.

The manufacturer advised that flight with a VCD missing had not been assessed, and therefore was not approved.

ANALYSIS

The aircraft industry operates under a system of checks and balances designed to ensure safety through accountability and traceability in maintenance and operations. That accountability and traceability is effected through detailed procedures which have been written, assessed, and approved, and is introduced to the user through a series of manuals. Check sheets are used to call up those procedures and a certification is required to indicate that a given procedure has been accomplished. However, when errors or omissions in procedural documentation occur, as in this incident, quality assurance becomes dependent upon the depth of systems knowledge of the personnel involved.

The lack of specific check item requirements alone does not explain why maintenance and flight crews, during the course of numerous inspection procedures, did not recognise the absence of the VCD. The circumstances of this occurrence suggest that there is a need for operators to ensure that training programs promote appropriate systems appreciation, in order that inspection procedures provide the intended system safety.

The procedures laid down for issue of a Permit to Operate did not ensure that the signatory must refer to relevant, qualified persons before signing the Permit. Consequently, the decision to authorise the flight to Melbourne was based on information which was insufficient to ensure that the signatory was fully aware of the implications of his decision.

FINDINGS

1. The maintenance personnel who fitted the cowl did not realise that a VCD was required to be fitted.

2. Pilots and engineers conducting the daily and pre flight inspections did not recognise that the VCD was not fitted.

3. The operator's procedures for the issue of a Permit to Operate did not require that the permit signatory consult either the aircraft manufacturer or an engineer relevant to the discipline in question, prior to issuing the permit.

SIGNIFICANT FACTORS

1. Cowlings, when released from stores, were not required to have the VCD fitted.

2. Those sections of the B737 Maintenance Manual applicable to the manual installation of the cowl did not call for the VCD to be fitted.

3. The daily and pre-flight inspection procedures did not call for the VCD to be inspected.

4. No warnings were contained in the Maintenance Planning Document, the Maintenance Manual or the Operations Manual as to the effect of non-fitment of the VCD.

5. An apparent lack of awareness by both maintenance and operational personnel concerning the function of the VCD.

SAFETY ACTION

As the result of problems identified during this investigation the following changes to maintenance and operational documentation have been made:

i) The Aircraft Maintenance Manual has been amended to highlight the requirement to install the VCD (71-11-02 pages 411 & 414).

ii) The operator's Operations Manual has been revised to include an additional check for VCD condition during crew 'walk round' inspections.

iii) Ancillary maintenance check lists have been amended to include a check for fitment of fan cowl vortex control devices.

iv) Changes have been made to the operator's procedures to ensure that appropriate persons are consulted prior to the granting or issue of permits to operate.