NATIONAL TRANSPORTATION SAFETY BOARD
OFFICE OF AVIATION SAFETY
WASHINGTON, D.C. 20594

June 22, 2000

POWERPLANTS GROUP CHAIRMAN'S FACTUAL REPORT

NTSB ID No.: DCA00MA026

A. ACCIDENT

Location:	Rancho Cordova, California
Date:	February 16, 2000
Time:	1951 Pacific standard time (PST)
Aircraft:	McDonnell Douglas DC-8-71, N8079U, Emery Worldwide Airlines flight EB 017

B. POWERPLANTS GROUP

Group Chairman:	Gordon J. Hookey National Transportation Safety Board Washington, D.C.
Member:	Peter Wilhelmson Federal Aviation Administration Sacramento, California
Member:	Tom S. Pagnard Emery Worldwide Airlines Vandalia, Ohio
Member:	Ben Jui General Electric Aircraft Engines Cincinnati, Ohio
Member:	Pat Botte Air Line Pilots Association Eagle, Idaho

C. SUMMARY

On February 16, 2000, at 1951 PST, Emery Worldwide Airlines flight EB 017, a McDonnell Douglas DC-8-71F airplane, N8079U, crashed in Rancho Cordova, California, while maneuvering for an attempted return to Mather Field for an emergency landing. The airplane had just taken off from Mather Field when the flightcrew reported that they needed to return. The airplane was operating on an instrument flight rules flight plan under the provisions of 14 Code of Federal Regulations Part 121 as a scheduled cargo flight from Mather Field to Dayton, Ohio. The airplane was destroyed by impact forces and fire and the three flight crewmembers were killed.

The Powerplants Group convened on February 17, 2000. The examination of the four CFM International (CFMI)[1] CFM56-2-C1 engines showed the fan blades and booster and low pressure turbine (LPT) blades and high pressure compressor (HPC) blades were bent opposite the direction of engine rotor rotation. The variable stator vane (VSV) actuators' rig pin holes on all four engines were aligned within a maximum of ½ diameter of the pin hole consistent with a high power setting. There was no indication of any uncontainments, preimpact damage, or fire. The Powerplants Group did not remove any of the engines, engine components, or engine accessories for disassembly and/or testing. The Powerplants Group completed its activities on February 21, 2000.

D. DETAILS OF INVESTIGATION

1.0 Engine information

1.1 Engine description

The airplane was equipped with four CFMI CFM56-2-C1 turbofan engines. The CFM56-2-C1 engine is a dual-spool, high bypass, axial-flow turbofan that features a 1-stage fan, 3-stage booster, 9-stage HPC, annular combustor with 20 fuel nozzles, 1-stage high pressure turbine (HPT), and 4-stage LPT. The fan and booster, which are mechanically joined, are connected to the LPT by the LPT shaft and they rotate concurrently. The HPC is connected to the HPT by the front shaft and they rotate concurrently, but independent of the fan, booster, and LPT. The CFM56-2-C1 engine has a normal takeoff thrust rating of 22,000 pounds, flat-rated to 86°F.[2]

[1] CFMI is a company jointly owned by General Electric Aircraft Engines of the United States and Societe Nationale d'Etude et do Construction de Moteurs d'Aviation of France

[2] Flat-rated to a specific temperature indicates the engine will be capable of attaining the rated thrust level up to the specified temperature.

1.2 Engine history

The engines' operating history, which was provided by Emery Worldwide Airlines (Appendix 2), is as follows:

Position	1	2	3	4
Serial No. (SN)	692476	693130	692541	692440
Time since new	35,171 hours	25,966 hours	30,552 hours	35,533 hours
Cycles since new	11,192 cycles	9,099 cycles	11,258 cycles	13,917 cycles
Time since shop visit[3]	1,635 hours	3,891 hours	3,670 hours	10,185 hours
Cycles since shop visit	868 cycles	1,888 cycles	1,786 cycles	4,308 cycles
Date of installation	12/07/98	09/04/97	11/07/97	03/17/94

For further details regarding the engines' maintenance and operating history, refer to the Maintenance Records Group Chairman's Factual Report.

2. Engine No. 1 SN 692476

The No. 1 engine's fan and booster stage was separated from the rest of the engine and was located in beginning of the debris field on the left side.[4] The fan and booster stage was identified with the fan disk SN that was marked on the fan disk's front flange inner diameter (ID). The fan disk and booster spool were intact. There were no penetrations through the booster shrouds. All 44 of the fan blade roots remained in the fan disk's blade slots. There was a 150° continuous sector of fan blades that were fractured transversely across the airfoil adjacent to the blade root platform. The fracture surfaces on the fan blades were consistent with rapid tensile overload. There were 18 fan blades that had the airfoil remain 44 that varied in length from 8 ½- to 20-inches above the blade root platform. All of the fan blade airfoils were bent opposite the direction of rotation except for three airfoils that were bent rearward. The stage 2 booster blades had a 180° continuous sector of blades that were bent opposite the direction of rotation. The stage 1 booster vane trailing edges were all bent towards the direction of rotation.

The remainder of the No. 1 engine was intact from the stage 3 HPC disk to the turbine frame assembly and was located towards the rear of the debris field on the left side. This portion of the engine was identified through the process of elimination after all of the other engines' modules were identified. The HPC front stator case upper and lower halves were separated and were located near the No. 1 engine's core. The stage 1 to 2 HPC spool was broken at the integral spacer and the individual disks were also located near the No. 1 engine's core. The upper and lower HPC front stator cases did not have any penetrations. The variable stator vane actuator on the upper case half had the actuator rig pin holes aligned that is consistent with

[3] The times and cycles since installation are identical to the times and cycles since last shop visit.
[4] All locations in the debris field are referenced as viewed from the beginning to the end of the debris field. Refer to the Powerplants Group wreckage distribution diagram (Section 10) for further details.

maximum engine power. The stage 1 and 2 HPC disks were both intact and all of the blade roots were in their respective blade slots. The stage 1 HPC blades, which were fractured about 1 inch above the blade root platform, were all bent opposite the direction of rotation. The stage 2 HPC blades were all fractured transversely across the airfoil adjacent to the blade root platform. The stage 3 HPC disk and stage 4 through 9 spool were intact. The stage 3 and 4 compressor blades were fractured about ¾ inch above the blade root platform and were bent opposite the direction of rotation. The stage 5 compressor blades were all fractured transversely across the airfoil adjacent to the blade root platform. The stage 6 compressor blades were full length and bent opposite the direction of rotation. The stage 3 and 4 LPT blades had the tip shrouds broken off and the airfoils were bent opposite the direction of rotation. The LPT blades and vanes did not have any metal spatter on the airfoil surfaces. There were no penetrations or indications of an in-flight fire on the cases.

3. Engine No. 2 SN 693130

The No. 2 engine was intact from the fan disk to the turbine frame and was located in the center of the debris field on the right side. The engine was identified from the fan disk SN. The fan disk was intact and all 44 of the fan blade roots were still in the disk. All of the fan blades except six were fractured transversely across the airfoil adjacent to the blade root platform. The remaining airfoils on the six blades varied in length from 6 ½- to 20-inches above the blade root platform of which four were bent opposite the direction of rotation and two that were both about 20-inches long that were bent in an "S" shape. The fracture surfaces on the fan blades were all consistent with rapid tensile overload. The stage 2 booster blade tips were bent opposite the direction of rotation. The right VSV actuator rig pin holes were aligned within ½ the diameter of the hole that is consistent with a high power setting. The stage 3 and 4 LPT disks were intact, but the disk rims were bent forward about ½ inch along a 3-inch long arc and 1 inch along an 8-inch long arc, respectively. All of the stage 3 and 4 LPT blades were fractured transversely across the airfoil adjacent to the blade root platform. The stage 3 and 4 LPT vanes did not have any metal spatter on the airfoil surfaces. The compressor rear case had an irregular shaped crack around the entire circumference between flanges N and P.[5] There were no penetrations or indications of an in-flight fire on the cases.

4. Engine No. 3 SN 692541

The No. 3 engine was intact from the fan disk to the turbine frame and was located in the center of the debris field on the right side. The No. 3 engine was identified from the HPT clearance control valve SN. The fan disk was intact and all 44 of the fan blade roots remained in the disk. The fan blades varied in length from being fractured transversely across the airfoil adjacent to the blade root platform to 12 ½-inches above the platform. The fracture surfaces on the fan blades were all consistent with rapid tensile overload. All of the fan blade airfoils were bent opposite the direction of rotation. The stage 2 booster blade tips were rubbed and bent opposite the direction of rotation. The VSV actuator rig pin holes were aligned within ½ diameter of the pin hole consistent with a high power setting. The stage 3 and LPT 4 disks were

[5] Gas turbine engine convention is to identify case flanges alphabetically from the front of the engine going rearward. A cross section of the CFM56 engine identifying the case flanges is attached (Appendix 3).

intact. All of the stage 3 and 4 LPT blades remained in the disk and were fractured transversely across the airfoil adjacent to the blade root platform except for approximately a 45° sector of stage 3 blades that were missing from the disk blade slots. There was no metal spatter on the stage 3 and 4 LPT vane airfoil surfaces. There were no penetrations or indications of an in-flight fire on the cases.

5. Engine No. 4 SN 692440

The No. 4 engine's fan disk was separated from the rest of the engine and was located in the beginning of the debris field on the right side. The fan disk was identified by the engine's SN that was marked on the front face of the disk and the disk SN that was marked on the fan disk's front flange ID. The fan disk was intact and all 44 of the fan blade roots remained in the disk blade slots. All of the fan blades were fractured transversely across the airfoil adjacent to the blade root platform except for eight blades that were randomly located in a 150° arc and that varied in length from 2 ½- to 17-inches above the blade root platform. Of the eight blades, five were bent opposite the direction of rotation and three were bent towards the direction of rotation. All of the fracture surfaces on the fan blades were consistent with rapid tensile overload.

The No. 4 engine's booster was separated from the rest of the engine and was located in the beginning of the debris field on the right side. The booster was identified by the stage 2 booster vane assembly SN. The booster spool was intact. The stage 2 and stage 4 booster blades were in place, but were bent opposite the direction of rotation. The stage 1 and stage 4 booster vanes remained attached to the outer shroud, but were separated from the inner shroud and bent towards the direction of rotation. There were no penetrations through the booster shrouds.

The remainder of the No. 4 engine was intact from the HPC to the turbine frame and was located in the center of the debris field on the left side. The remainder of the No. 4 engine was identified from the left VSV actuator SN. The stage 1 HPC blade tips were bent opposite the direction of rotation. The VSV actuator rig pin holes were aligned within ½ the diameter of the pin hole that is consistent with a high power setting. The stage 4 LPT blades were fractured transversely across the airfoil adjacent to the blade root platform. There was no metal spatter on the stage 4 LPT vane airfoil surfaces. There were no penetrations or indications of an in-flight fire on the cases.

6. Fan cases

The fan cases were separated from their respective engines. All of the cases were ovalized and had axial crushing damage along the bottom of the cases. The fan blade rub strips all had circumferential scoring that matched the shape of the fan blade tip shroud. There were no penetrations through any of the fan cases.

8. Fan blades

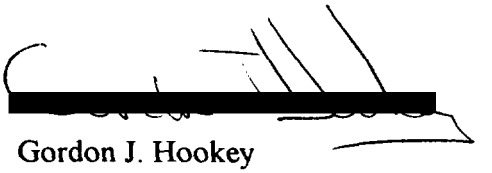
Numerous broken fan blades were located around the debris field. All of the fan blades were either straight or were bent opposite the direction of rotation. The fan blades' tips shrouds had rub marks on the outer diameter.

9. Thrust reversers

All of the thrust reverser actuators except one were in the fully retracted position consistent with the thrust reversers being stowed. One actuator had the rod extended about 7 ½ inches in comparison to the actuator total stroke length of 22.16 inches.

10. Wreckage distribution

The aircraft debris was along a compass heading of 306°. The positions of the engines and engine module pieces are detailed on the wreckage distribution diagram (Appendix 4).



Gordon J. Hookey
Powerplants Group Chairman
6/22/00

APPENDIX

1. Photographs
2. Emery's engine limit report
3. Cross-section of CFM56 engine identifying the case flanges
4. Engine wreckage distribution diagram