DOT/FAA/CT-91/28

FAA Technical Center
Atlantic City International Airport
N.J. 08405

Statistics on Aircraft Gas Turbine Engine Rotor Failures that Occurred in U.S. Commercial Aviation during 1988

R. A. Delucia — Naval Air Propulsion Center

B. C. Fenton — FAA Technical Center
E. R. Chapdelaine

March 1992

Final Report

U.S. Department of Transportation
Federal Aviation Administration

NOTICE

Technical Report Documentation Page

1. Report No. DOT/FAA/CT-91/28	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle STATISTICS ON AIRCRAFT GAS TURBINE ENGINE ROTOR FAILURES THAT OCCURRED IN U.S. COMMERCIAL AVIATION DURING 1988		5. Report Date March 1992
		6. Performing Organization Code
7. Author(s) R. A. Delucia NAPC E. R. Chapdelaine, B. C. Fenton, FAA Technical Center		8. Performing Organization Report No. DOT/FAA/CT-91/28
9. Performing Organization Name and Address Commanding Officer Naval Air Propulsion Center P.O. Box 7176 Trenton, NJ 08628-0176		10. Work Unit No. (TRAIS)
		11. Contract or Grant No. DOD/FA7INA AP
12. Sponsoring Agency Name and Address Department of Transportation Federal Aviation Administration Technical Center Atlantic City International Airport, NJ 08405		13. Type of Report and Period Covered Final Report
		14. Sponsoring Agency Code ACD-210

15. Supplementary Notes

Previous reports (1981-1987) DOT/FAA/CT-86/42, 88/23, 89/5, 89/6, 89/7, 89/30, 90/19.

16. Abstract

This report presents statistical information relating to gas turbine engine rotor failures which occurred during 1988 in U.S. commercial aviation service use. Four hundred and thirteen failures occurred in 1988. Rotor fragments were generated in 175 of the failures, and of these 14 were uncontained. The predominant failure involved blade fragments, 95 percent of which were contained. Five disk failures occurred and all were uncontained. Forty-two percent of the 413 failures occurred during the takeoff and climb stages of flight.

This service data analysis is prepared on a calendar year basis and published yearly. The data are useful in support of flight safety analyses, proposed regulatory actions, certification standards, and cost benefit analyses.

17. Key Words Air Transportation Aircraft Hazards Aircraft Safety Gas Turbine Engine Rotor Failures Containment	18. Distribution Statement This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	25	

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

EXECUTIVE SUMMARY

This service data analysis is prepared on a calendar-year basis and published annually. The data support flight safety analyses, proposed regulatory actions, certification standards, and cost benefit analyses. The following statistics are based on gas turbine engine rotor failures that have occurred in United States commercial aviation during 1988.

Four hundred thirteen rotor failures occurred in 1988. Rotor fragments were generated in 175 of the failures and, of these, 14 were uncontained. This represents an uncontained failure rate of 1.0 per million gas turbine engine powered aircraft flight hours, or 0.3 per million engine operating hours. Approximately 14.4 million and 45.6 million aircraft flight and engine operating hours, respectively, were logged in 1988.

Turbine rotor fragment-producing failures were approximately 1.7 times greater than that of the compressor rotor fragment-producing failures; 107 and 64 respectively, of the total. Fan rotor failures accounted for 4 of the fragment-producing failures experienced.

Blade fragments were generated in 165 of the rotor failures; 9 of these were uncontained. The remaining 5 of the 14 uncontained failures were produced by disk fragments.

Of the 278 failures with known causes (because of the high percentage of unknown causes of rotor failures, the percentages were based on the total number of known causes), the causal factors were (1) foreign object damage--114 (41.0 percent); (2) secondary causes--73 (26.3 percent); and (3) design and life prediction problems--78 (28.1 percent). One hundred and seventy-five (42.4 percent) of the 413 rotor failures occurred during the takeoff and climb stages of flight. One hundred and one (101) (57.7 percent) of the 175 rotor fragment-producing failures and 7 (50.0 percent) of the 14 uncontained rotor failures occurred during these same stages of flight.

The incidence of engine rotor failures producing fragments has increased when compared to 1987 (170 in 1987 and 175 in 1988). The number of uncontained engine rotor failures reported has increased 17 percent in 1988 (12 in 1987 and 14 in 1988). This is due to the introduction of the Accident/Incident Data System (AIDS) as a source of uncontained failures. Without the introduction of this new source there would have only been 10 reported uncontained failures, a decrease of 17 percent when compared to 1987. The 13-year (1976 through 1988) average of uncontained engine rotor failures is 14.9.

INTRODUCTION

This report is sponsored and co-authored by the Federal Aviation Administration (FAA) Technical Center, located at the Atlantic City International Airport, New Jersey. The FAA's Propulsion/Fuel Safety Program sponsors raw data reduction support from the Naval Air Propulsion Center.

This service data analysis is published yearly. The data support flight safety analyses, proposed regulatory actions, certification standards, and cost benefit analyses.

The intent of this report is to present data as objectively as possible on gas turbine rotor failure occurrences in U.S. commercial aviation. Presented in this report are statistics on gas turbine engine utilization and failures that have occurred in U.S. commercial aviation during 1988. These statistics are based on service data compiled by the FAA Flight Standards District Office. The National Safety Data Branch of the FAA Aviation Standards National Field Office disseminated this information in the Service Difficulty Reports (SDR) data base, the Accident/Incident Data System (AIDS), and the Air Carrier Aircraft Utilization and Propulsion Reliability Reports. The aircraft count was supplemented by the International Aircraft Operator Information System, a registry data system located out of Wichita State University. The FAA service data base contains only a fraction of the actual commercial helicopter fleet operating statistics. The number of turboshaft engines in use with the corresponding engine flight hours given herein are estimates derived primarily from statistics published by the Helicopter Association International in their helicopter annuals. The compiled data were analyzed to establish:

1. The incidence of rotor failures and the incidence of contained and uncontained rotor fragments (an uncontained rotor failure is defined as a rotor failure that produces fragments which penetrate and escape the confines of the engine casing).

2. The distribution of rotor failures with respect to engine rotor components, i.e., fan, compressor or turbine rotors and their rotating attachments or appendages such as spacers and seals.

3. The number of rotor failures according to engine model and engine fleet hours.

4. The type of rotor fragment (disk, rim, or blade) typically generated at failure.

5. The cause of failure.

6. The flight conditions at the time of failure.

7. Engine failure rate according to engine fleet hours.

RESULTS

The raw data used in this report are contained in appendix A. The results of an analysis of the data are shown in figures 1 through 6 and tables 1 through 3.

Figure 1 shows that 413 rotor failures occurred in 1988. Rotor fragments were generated in 175 of the failures experienced and, of these, 14 (8.0 percent of the fragment-producing failures) were uncontained. This represents an uncontained failure rate of 1.0 per million gas turbine engine powered aircraft flight hours, or 0.3 per million engine operating hours.

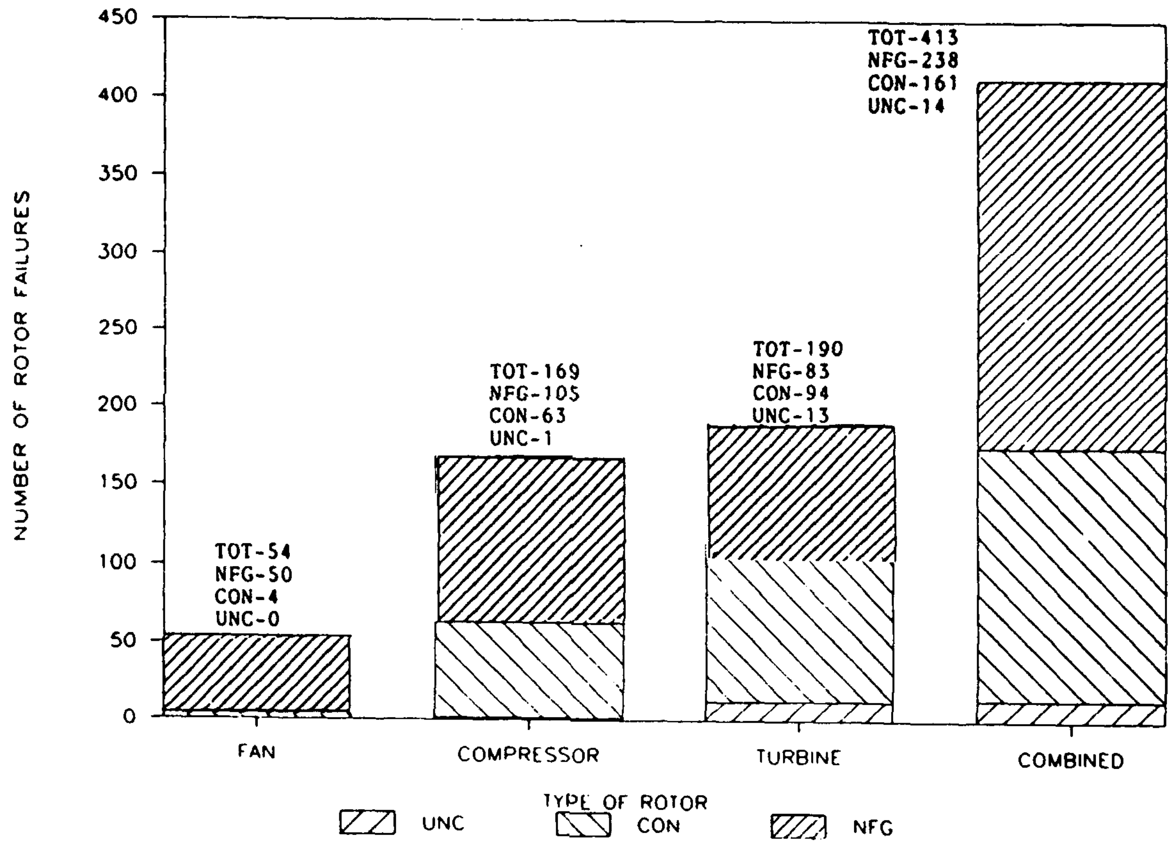

FIGURE 1. INCIDENCE OF ENGINE ROTOR FAILURES IN U.S COMMERCIAL AVIATION - 1988

Approximately 14.4 million and 45.6 million aircraft flight and engine operating hours, respectively, were logged by the U.S. commercial aviation fleet in 1988. Gas turbine engine fleet operating hours relative to the number of rotor failures and type of engines in use are shown in figure 2.

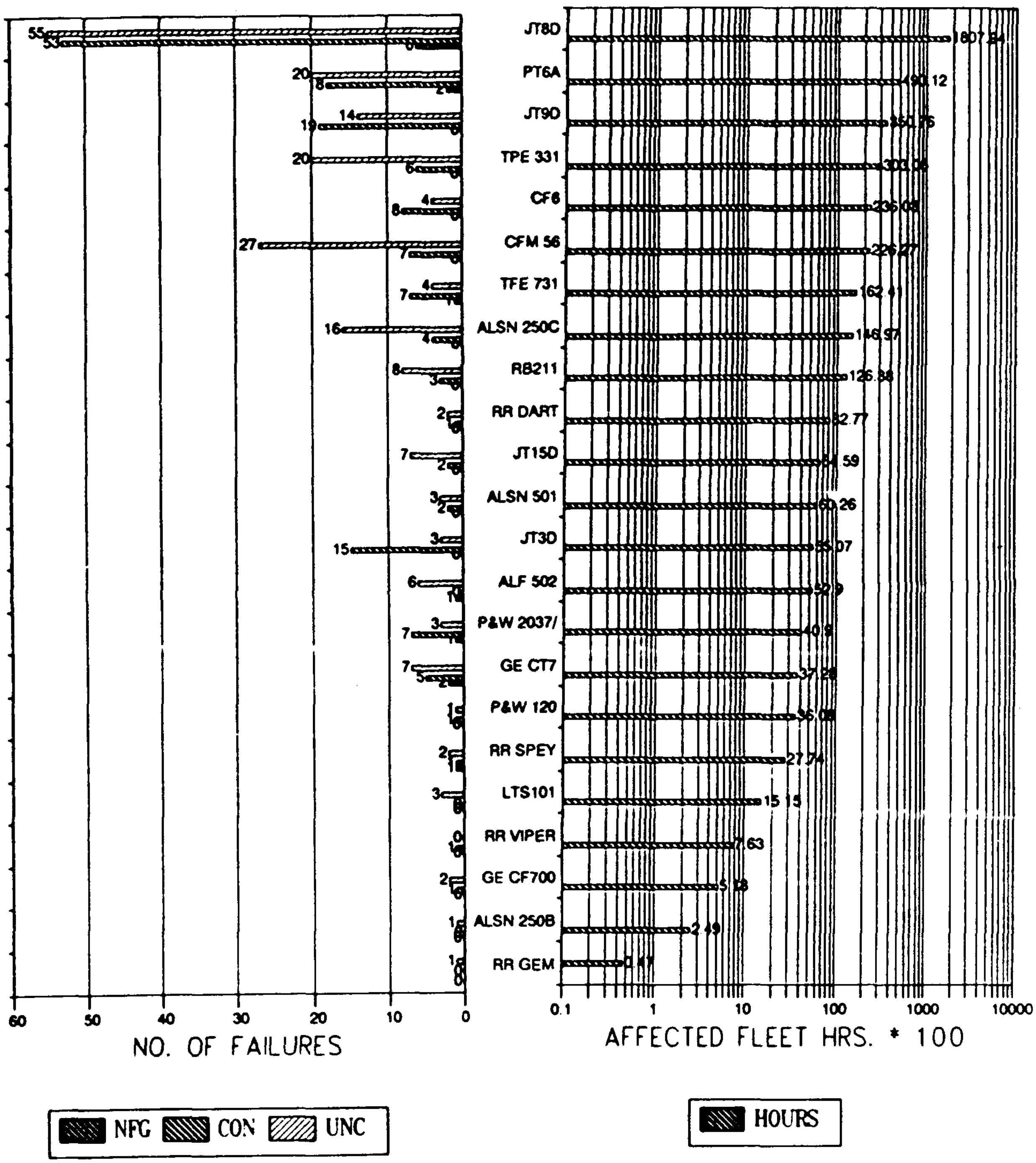

FIGURE 2. TYPE AND NUMBER OF ENGINE ROTOR FAILURES IN U.S. COMMERCIAL AVIATION ACCORDING TO AFFECTED ENGINE MODEL AND ENGINE FLEET HOURS - 1988

Table 1 shows the distribution of rotor failures that produced fragments according to the engine component involved (fan, compressor, turbine), the type of fragments that were generated, and the percentage of uncontained failures according to the type of fragment generated. These data indicate that:

1. The incidence of turbine rotor failures generating fragments was approximately 1.7 times greater than that of the compressor rotor failures; these corresponded to 107 (61.1 percent) and 64 (36.6 percent), respectively, of the total number of fragment-generating failures. Fan rotor failures accounted for 4 (2.3 percent) of the failures experienced.

2. Of the 175 fragment-producing failures, blade fragments were generated in 165 (94.3 percent); 9 (5.5 percent) of these were uncontained. The remaining 10 (5.7 percent) failures were produced by the disk, rim, and seal. All 5 of the disk failures were uncontained. There were no uncontained rim or seal failures.

TABLE 1. COMPONENT AND FRAGMENT TYPE DISTRIBUTIONS FOR CONTAINED AND UNCONTAINED ENGINE ROTOR FAILURES (FAILURES THAT PRODUCED FRAGMENTS) - 1988

TYPE OF FRAGMENT GENERATED

ENGINE ROTOR COMPONENTS	DISK		RIM		BLADE		SEAL		TOTAL	
	TOTAL	UNC	TOTAL	UNC	TOTAL	UNC	TOTAL	UNC	TOTAL	UNC
FAN	0	0	0	0	4	0	0	0	4	0
COMPRESSOR	0	0	0	0	63	1	1	0	64	1
TURBINE	5	5	2	0	98	8	2	0	107	13
TOTAL	5	5	2	0	165	9	3	0	175	14

Figure 3 shows the rotor failure distribution among the engine models that were affected and the total number of models in use.

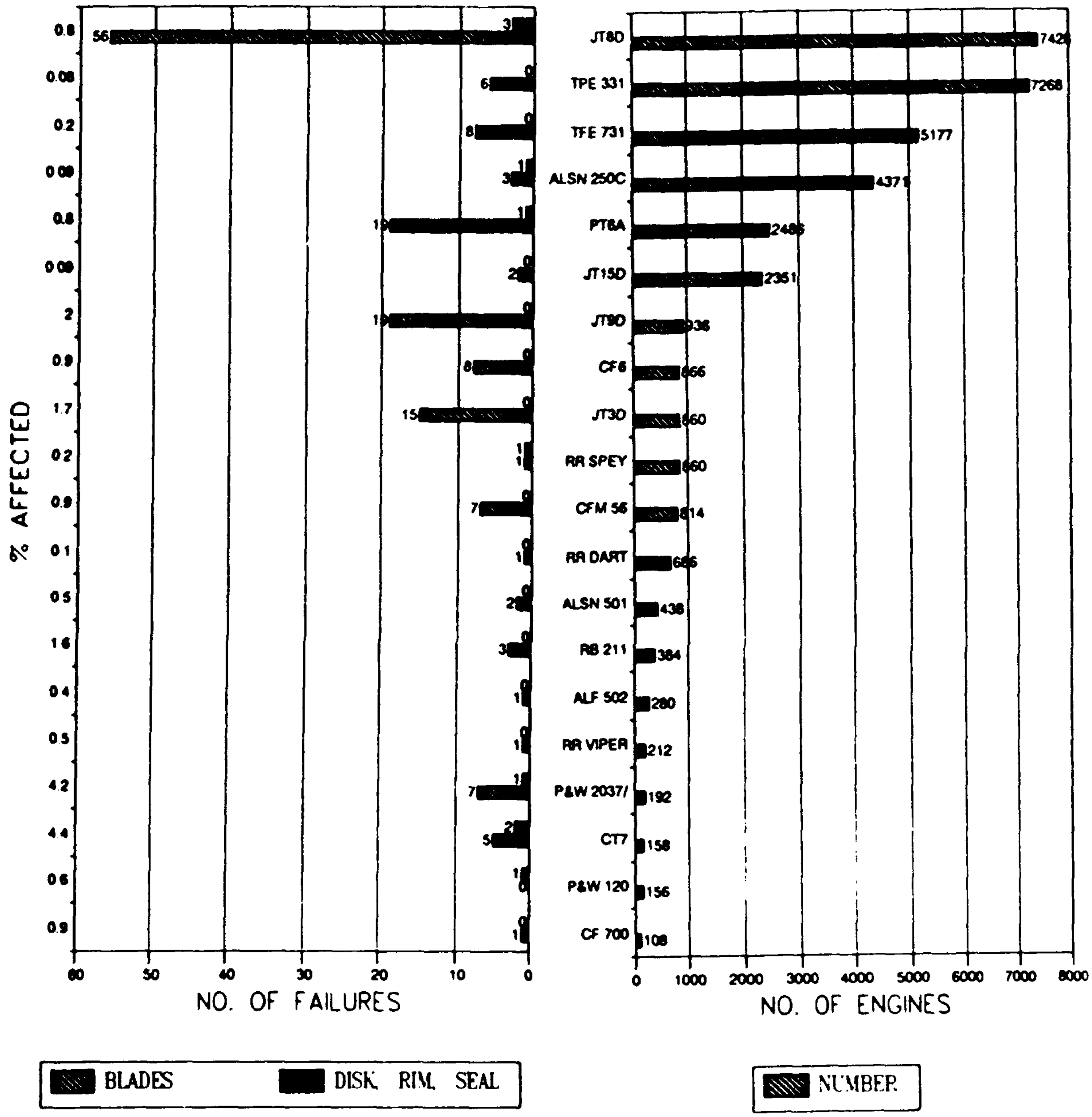

FIGURE 3. THE INCIDENCE OF ENGINE ROTOR FAILURES IN U.S. COMMERCIAL AVIATION ACCORDING TO ENGINE MODEL AND COMPONENT AFFECTED - 1988

Figure 4 shows what caused the rotor failures to occur. Of the 278 failures with known causes (because of the high percentage of unknown causes of rotor failure, the percentages were based on the total number of known causes), the causal factors were (1) foreign object damage--114 (41.0 percent); (2) secondary causes--73 (26.3 percent); and (3) design and life prediction problems--78 (28.1 percent).

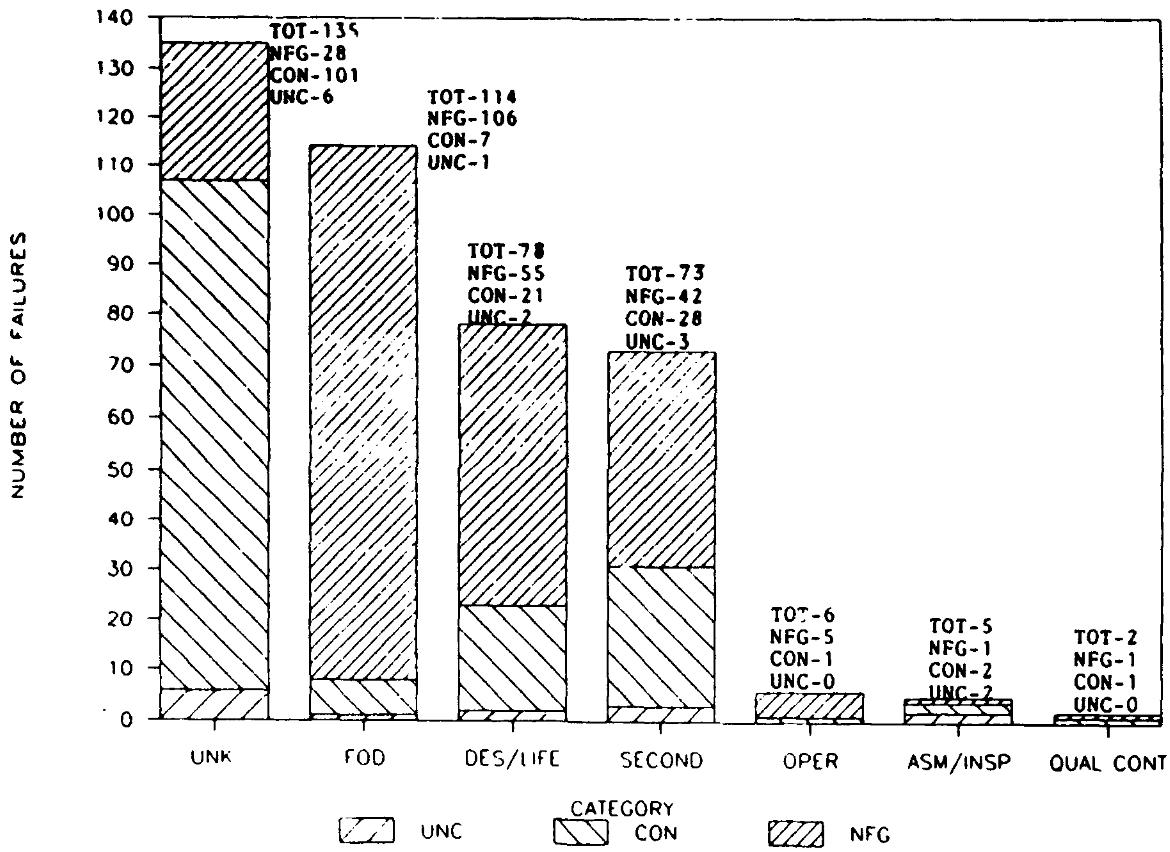

FIGURE 4. ENGINE ROTOR FAILURE CAUSE CATEGORIES - 1988

Figure 5 indicates the flight conditions that existed when the various rotor failures occurred. One hundred and seventy-five (42.4 percent) of the 413 rotor failures occurred during the takeoff and climb stages of flight. Ninety-eight (56.0 percent) of the rotor fragment-producing failures and 7 (50.0 percent) of the uncontained rotor failures occurred during these same stages of flight. The highest number of uncontained rotor failures, 4 (28.6 percent), happened during both the takeoff and cruising portions of the flight.

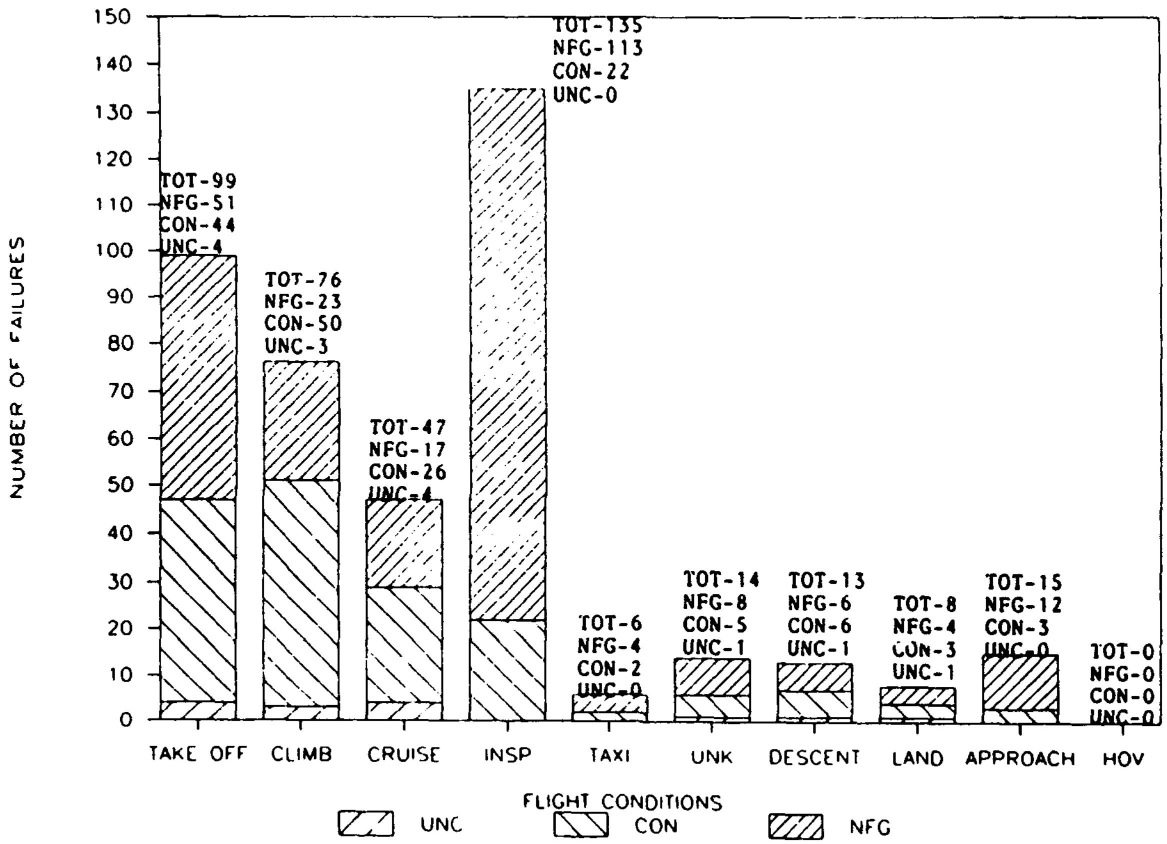

FIGURE 5. FLIGHT CONDITION AT ENGINE ROTOR FAILURE - 1988

Table 2 contains a compilation of engine failure rates per million engine flight hours according to engine model, engine type, and containment conditions. The engine failure rates per million flight hours by engine type are turbofan--8.4, turboprop--8.3, and turboshaft--26.3. Uncontained engine failure rates per million flight hours by engine type were turbofan--0.3, turboprop--0.4, and turboshaft--0.0.

Table 3 is a cumulative tabulation that describes the distribution of uncontained rotor failures according to fragment type, engine component involved, cause category, and flight condition (takeoff and climb are defined as "high power," all other conditions are defined as "low power") for the years 1976 through 1988. This figure is expanded yearly to include all subsequent uncontained rotor failures. These data indicate that for "secondary causes" the number of uncontained failures was approximately four and one-half times greater at high power than low power (namely 35 and 8). For "design and life prediction problems," the number of high power uncontained failures was approximately three times greater than low power (namely 32 and 9); and for "foreign object damage," the number of uncontained failures was approximately four times greater at high power than low power (namely 9 and 2). This tabulation also indicates that of the 194 total uncontained incidences, blade failures accounted for 66.5 percent; disk failures 23.2 percent; rim failures 4.1 percent; and seal/spacer failures 6.2 percent.

TABLE 2. GAS TURBINE ENGINE FAILURE RATES ACCORDING TO ENGINE MODEL AND TYPE - 1988

TYPE/ MODEL	AVERAGE NUMBER IN USE**	ENGINE FLIGHT HRS.x10^{6}	NUMBER OF FAILURES C*	NC	N*	TOTAL	FAILURE RATES / 10^{6} ENGINE FLIGHT HOURS C	NC	N	TOTAL
TURBOFAN/ TURBOJET										
JT8D	7428	18.0794	53	6	55	114	2.9	0.3	3.0	6.2
JT3D	660	0.5507	15	0	3	18	27.2	0.0	5.4	32.6
JT9D	936	3.5076	19	0	14	33	5.4	0.0	4.0	9.4
CF6	866	2.3603	8	0	4	12	3.4	0.0	1.7	5.1
RB211	384	1.2638	3	0	8	11	2.4	0.0	6.3	8.7
PW2037/2040	192	0.4090	7	1	3	11	17.1	2.4	7.3	26.8
SPEY	860	0.2774	1	1	2	4	63.6	3.6	7.2	14.4
TFE731	5177	1.6241	7	1	4	12	4.3	0.6	2.5	7.4
CFM56	814	2.2627	7	0	27	34	3.1	0.0	11.9	15.0
ALF502	280	0.5290	0	1	6	7	0.0	1.9	11.3	13.2
JT15D	2351	0.6459	2	0	7	9	3.1	0.0	10.8	13.9
CF700	108	0.0518	1	0	2	3	19.3	0.0	38.6	57.9
OTHERS	2358	0.4244	0	0	0	0	0.0	0.0	0.0	0.0
TOTAL	22626	32.0624	124	10	135	269	3.9	0.3	4.2	8.4
TURBOPROP										
PT6A	2486	4.9012	18	2	20	40	3.7	0.4	4.1	8.2
A501	438	0.6026	2	0	3	5	3.3	0.0	5.0	8.3
TPE331	7268	3.0305	6	0	20	26	2.0	0.0	6.6	8.6
DART	686	0.8277	1	0	2	3	1.2	0.0	2.4	3.6
PW120	156	0.3608	1	0	1	2	2.8	0.0	2.8	5.6
CT7	158	0.3728	5	2	7	14	13.4	5.4	18.8	37.6
A250B	74	0.0249	0	0	1	1	0.0	0.0	15.0	15.0
OTHERS	460	0.8501	0	0	0	0	0.0	0.0	0.0	0.0
TOTAL	11726	10.9778	33	4	54	91	3.0	0.4	4.9	8.3
TURBOSHAFT										
A250C	4300	1.4448	4	0	16	20	2.8	0.0	11.1	13.8
LTS 101	669	0.2248	0	0	32	32	0.0	0.0	142.3	142.3
GEM	14	0.0047	0	0	1	1	0.0	0.0	212.8	212.8
OTHERS	1012	0.3400	0	0	0	0	0.0	0.0	0.0	0.0
TOTAL	5995	2.0143	4	0	49	53	2.0	0.0	24.3	26.3

C = CONTAINED NC = NOT CONTAINED
N = FUNCTION IMPEDED, NO FRAGMENTS GENERATED

*As reported by service difficulty reports only.
**Estimated total number in use and engine flight hours for entire U.S. commercial fleet.

TABLE 3. UNCONTAINED ENGINE ROTOR FAILURE DISTRIBUTIONS ACCORDING TO CAUSE AND FLIGHT CONDITIONS - 1976 THROUGH 1988

TYPE OF FRAGMENT GENERATED		DISK			RIM			BLADE			SEAL				
ENGINE ROTOR COMPONENT		FAN	COMP	TURB	FAN	COMP	TURB	FAN	COMP	TURB	FAN	COMP	TURB	SUB TOT	TOTAL
CAUSE	FLIGHT COND.														
DESIGN/LIFE PREDICTION PROBLEMS	HI	1	5	0	0	3	0	9	10	3	0	1	0	32	
	LOW	0	1	3	0	0	0	1	0	4	0	0	0	9	41
	UNK	0	0	0	0	0	0	0	0	0	0	0	0	0	
SECONDARY CAUSES	HI	0	1	1	0	0	0	5	4	21	0	0	3	35	
	LOW	0	0	1	0	0	0	0	2	5	0	0	0	8	46
	UNK	0	0	0	0	0	0	1	0	2	0	0	0	3	
FOREIGN OBJECT DAMAGE	HI	1	0	1	0	0	0	6	0	1	0	0	0	9	
	LOW	0	0	0	0	0	0	2	0	0	0	0	0	2	13
	UNK	0	0	0	0	0	0	2	0	0	0	0	0	2	
QUALITY CONTROL	HI	0	1	0	0	0	1	2	0	0	0	0	0	4	
	LOW	0	0	0	0	0	0	0	0	0	0	0	0	0	4
	UNK	0	0	0	0	0	0	0	0	0	0	0	0	0	
OPERATIONAL	HI	0	0	0	0	0	0	0	0	0	0	0	0	0	
	LOW	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	UNK	0	0	0	0	0	0	0	0	0	0	0	0	0	
ASSEMBLY/ INSP. REPORTS	HI	0	0	1	0	0	0	0	0	1	0	0	0	2	
	LOW	0	0	1	0	0	0	0	0	0	0	0	0	1	3
	UNK	0	0	0	0	0	0	0	0	0	0	0	0	0	
UNKNOWN	HI	1	2	11	0	3	0	6	10	14	1	2	3	53	
	LOW	1	0	11	0	1	0	0	2	12	0	1	1	29	87
	UNK	0	0	1	0	0	0	1	0	3	0	0	0	5	
SUBTOTAL	HI	3	9	14	0	6	1	28	24	40	1	3	6	135	
	LOW	1	1	16	0	1	0	3	4	21	0	1	1	49	194
	UNK	0	0	1	0	0	0	4	0	5	0	0	0	10	
TOTAL			45			8			129			12		194	

* Takeoff and climb are defined as "High Power" and all other conditions are defined as "Low Power".

Figure 6 shows the annual incidence of uncontained rotor failures in commercial aviation for the years 1963 through 1988. During 1988, the incidence of uncontained rotor failures increased by two over the previous year (This is due to the fact that the FAA's Accident/Incident Data System was used as a data source. Otherwise a decrease of two uncontained failures would have been noted.). Over the past 13 years, 1976 through 1988, an average of 14.9 uncontained rotor failures per year have occurred. During the same time period, the rate of uncontained rotor failures has remained relatively constant at an average of approximately one per million operating hours.

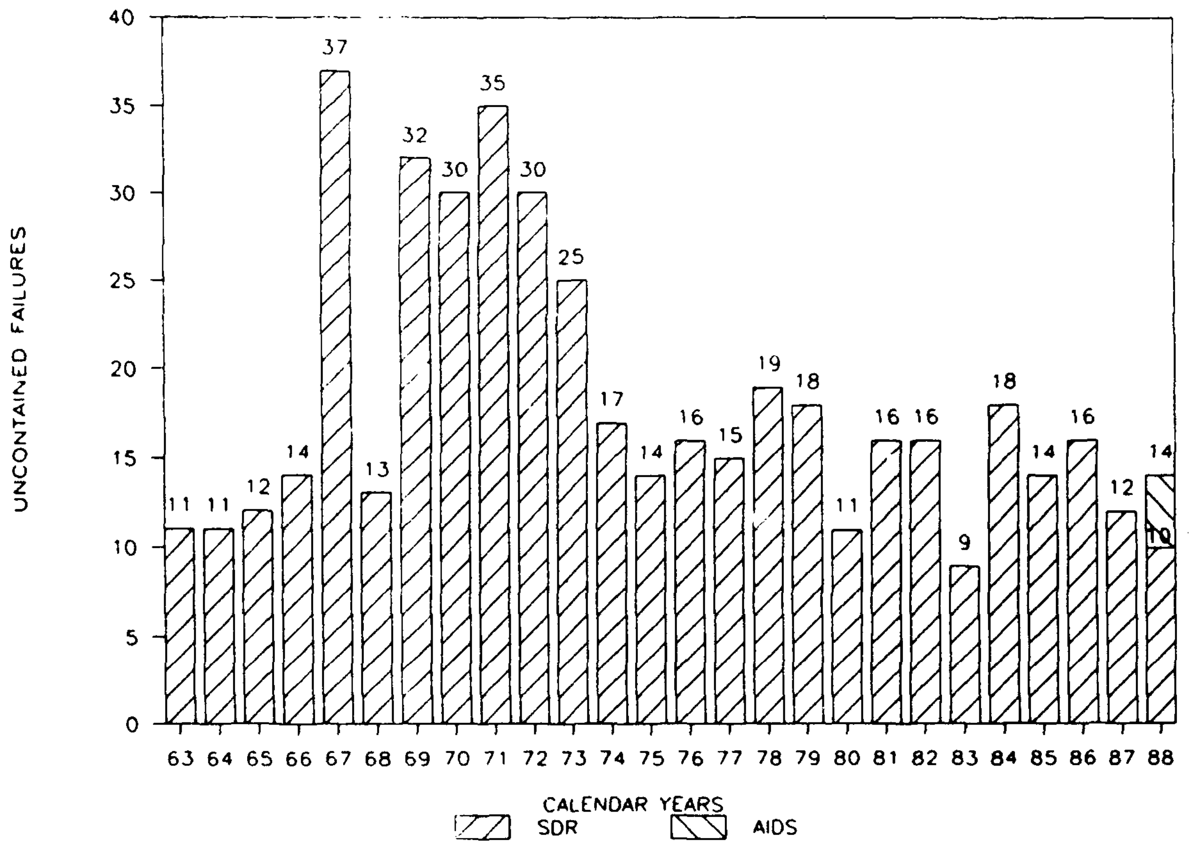

FIGURE 6. THE INCIDENCE OF UNCONTAINED ENGINE ROTOR FAILURES IN U.S. COMMERCIAL AVIATION, 1963 through 1988

DISCUSSION AND CONCLUSIONS

The incidence of engine rotor fragment-producing failures has remained relatively constant when comparing 1988 to 1987 (170 in 1987 and 175 in 1988). The uncontained engine rotor failures has increased 17 percent (14 in 1988 and 12 in 1987), due, in part, to the introduction of the AIDS as a data source. The 13-year (1976 through 1988) average of uncontained engine rotor failures is 14.9.

Of the 14 uncontained events that occurred during 1988, 13 (92.9 percent) involved turbine rotors, and 1 (7.1 percent) involved compressor rotors. There were no uncontained fan rotor failures reported.

The predominant cause of failure was attributed to foreign object damage (41.0 percent of the known failures). One uncontained failure occurred in this category. Secondary causes (26.3 percent of the known failures) had three uncontained failures and design and life prediction problems (28.1 percent of the known causes) had two uncontained failures. Assembly and inspection error had two uncontained failures. The causes of the remaining six uncontained failures (42.9 percent) are unknown.

Uncontained failures occurred in 6 of the 10 flight modes; i.e., 4 during takeoff (28.6 percent); 3 during climb (21.4 percent); 4 in cruise (28.6 percent); 1 in landing (7.1 percent); 1 in descent (7.1 percent), and 1 was unknown (7.1 percent).

The higher incidences of uncontained rotor failures in calendar years 1967 through 1973 (except for 1968) were probably due to the introduction of newly developed engines entering the commercial aviation fleet, such as the JT9D and CF6 engines.

Structural life predictions and verification are being improved by the increased use of spin chamber testing by government and industry as a means of obtaining failure data for statistically significant samples. In addition, increased development and application of high sensitivity, nondestructive inspection methods should increase the probability of cracks being detected prior to failure. The capability to reduce the causes of failures from secondary effects is also being addressed through technology development programs. However, causes due to foreign object damage still appear to be beyond the control or scope of present technology.

APPENDIX A

Data of Engine Rotor Failures in U.S. Commercial Aviation for 1988. Compiled from the Federal Aviation Administration Service Difficulty Reports and the Accident Incident Data System.

Data Compilation Key

Component Code:
- F - Fan
- C - Compressor
- T - Turbine

Fragment Type Code:
- D - Disk
- R - Rim
- B - Blade
- S - Seal
- N - None

Cause Code:
- 1 - Design and Life Prediction Problems
- 2 - Secondary Causes
- 3 - Foreign Object Damage
- 4 - Quality Control
- 5 - Operational
- 6 - Assembly and Inspection Error
- 7 - Unknown

Containment Condition Code:
- C - Contained
- NC - Not Contained
- N - No Fragments Generated

Flight Condition Code:
- 1 - Insp/Maint
- 2 - Taxi/Grnd Hdl
- 3 - Takeoff
- 4 - Climb
- 5 - Cruise
- 6 - Descent
- 7 - Approach
- 8 - Landing
- 9 - Hovering
- 10 - Unknown

Report Source - Number
- S - SDR
- A - AIDS
- X - Other

CHARACTERISTICS OF ROTOR FAILURES - 1988

REPORT NO.	SUBMIT.	AIRCRAFT.	ENGINE/ POSITION	COMPNT	FRAG. TYPE	CAUSE	CONTN. COND.	FLT. COND.
S-880205022	NWAA	B747	JT9D	T	B	1	C	4
S-880205162	PAAA	B747	JT9D	F	B	3	C	8
S-880129008	NWAA	DC10	JT9D	T	B	7	C	4
S-880226114	FTLA	B747	JT9D	T	B	7	C	4
S-880308031	TWAA	B747	JT9D	T	B	1	C	5
S-880311020	TWAA	B747	JT9D	C	B	7	C	4
S-880419008	TWAA	B747	JT9D	T	B	7	C	4
S-880429153	PAAA	B747	JT9D	C	B	7	C	3
S-880509047	PAAA	B747	JT9D	C	B	7	C	5
S-880708156	PAAA	B747	JT9D	T	B	7	C	4
S-880822075	NWAA	B747	JT9D	C	B	7	C	3
S-881014020	PAAA	A310	JT9D	T	B	7	C	3
S-881209023	PAAA	B747	JT9D	T	B	7	C	4
S-881209025	PAAA	B747	JT9D	C	B	7	C	3
S-881216026	TWAA	B747	JT9D	C	B	7	C	4
S-890106001	PAAA	A310	JT9D	C	B	1	C	5
S-890113118	NWAA	DC10	JT9D	T	B	1	C	3
S-890327257	PAAA	B747	JT9D	C	B	7	C	4
S-890327259	PAAA	B747	JT9D	C	B	7	C	3
S-880401059	PAAA	B747	JT9D	C	N	7	N	4
S-880419010	TWAA	B747	JT9D	C	N	2	N	10
S-880418095	TWAA	B767	JT9D	T	N	3	N	6
S-880425070	PAAA	B747	JT9D	F	N	1	N	1
S-880624021	NWAA	B747	JT9D	T	N	2	N	6
S-880729043	NWAA	DC10	JT9D	C	N	2	N	6
S-880826061	PAAA	A310	JT9D	F	N	2	N	5
S-881028024	NWAA	DC10	JT9D	C	N	2	N	5
S-881104018	UALA	B747	JT9D	F	N	3	N	3
S-881115101	PAAA	B747	JT9D	F	N	3	N	4
S-881207002	GL25	UNKNOWN	JT9D	F	N	7	N	1
S-881216027	UALA	B747	JT9D	F	N	3	N	3
S-890127042	TWAA	B767	JT9D	F	N	3	N	5
S-880701179	NWAA	B747	JT9D	F	N	7	N	1
S-880129004	SWAA	B737	CFM56	C	B	2	C	5
S-880603012	UALA	DC8	CFM56	C	B	1	C	4
S-880816039	PAIA	B737	CFM56	T	B	7	C	1
S-880816056	PAIA	B737	CFM56	T	B	7	C	1
S-880830023	CALA	B737	CFM56	T	B	2	C	4
S-880930013	PAIA	B737	CFM56	T	B	7	C	1
S-881107108	DALA	DC8	CFM56	C	B	1	C	4
S-880520003	RAXA	DC8	CFM56	C	N	1	N	1
S-880520005	RAXA	DC8	CFM56	C	N	1	N	1
S-880520007	RAXA	DC8	CFM56	C	N	1	N	1
S-880627072	PAIA	B737	CFM56	T	N	7	N	1
S-880712015	SW07	DC8	CFM56	C	N	1	N	1
S-880712014	SW07	DC8	CFM56	C	N	7	N	1
S-880811033	SW07	DC8	CFM56	C	N	1	N	1

CHARACTERISTICS OF ROTOR FAILURES - 1988

REPORT NO.	SUBMIT.	AIRCRAFT	ENGINE/ POSITION	COMPNT	FRAG. TYPE	CAUSE	CONTN. COND.	FLT. COND.
S-880811036	SW07	DC8	CFM56	C	N	3	N	1
S-880811037	SW07	DC8	CFM56	C	N	1	N	1
S-880902037	RAXA	DC8	CFM56	C	N	1	N	1
S-880913062	SW07	DC8	CFM56	C	N	7	N	1
S-880916017	SWAA	B737	CFM56	T	N	5	N	3
S-881004128	SW05	DC8	CFM56	C	N	1	N	1
S-881004129	SW05	DC8	CFM56	C	N	1	N	1
S-881004090	SW05	DC8	CFM56	C	N	1	N	1
S-881028029	RAXA	DC8	CFM56	C	N	1	N	1
S-881109061	SW07	DC8	CFM56	C	N	7	N	1
S-881014021	USAA	B737	CFM56	T	N	2	N	4
S-881021068	AWXA	B737	CFM56	T	N	3	N	1
S-881021069	AWXA	B737	CFM56	T	N	3	N	1
S-881121136	IPXA	DC8	CFM56	C	N	3	N	7
S-881205123	FTLA	DC8	CFM56	C	N	3	N	4
S-881212136	AWXA	B737	CFM56	F	N	3	N	3
S-881216045	IPXA	DC8	CFM56	C	N	3	N	1
S-881216047	IPXA	DC8	CFM56	C	N	3	N	1
S-890113175	PAIA	B737	CFM56	F	N	3	N	3
S-890123067	SWAA	B737	CFM56	C	N	3	N	3
S-880129036	PAYA	DHC7102	PT6A	T	B	5	C	5
S-880211037	SJSA	DHC6300	PT6A	C	B	7	C	3
S-880325176	PCAA	STC262	PT6A	C	B	7	C	2
S-880329142	SWO3	PA31T	PT6A	T	B	7	C	3
S-880415159	HNAA	DHC7102	PT6A	C	B	7	C	3
S-880426002	GLBA	BEECH99	PT6A	T	B	7	C	10
S-880706016	RAYA	EMB110	PT6A	T	B	7	C	3
S-880816002	SALA	SD360	PT6A	T	B	1	C	3
S-880822083	PAYA	DHC7102	PT6A	T	R	1	C	5
S-880831099	RAYA	EMB110	PT6A	T	B	7	C	3
S-880902168	PCAA	SD330	PT6A	T	B	7	C	2
S-881028043	PAYA	DHC7102	PT6A/2	T	B	7	NC	5
S-881104002	PLGA	1900C	PT6A	F	B	7	C	3
S-881109017	NM08	212	PT6A	F	B	1	C	5
S-881007002	HNAA	DHC7102	PT6A	C	B	2	C	4
S-881027003	S003	E90	PT6A	C	B	7	C	4
S-881118004	CR0A	SD330	PT6A	C	B	7	C	4
S-881207003	EA11	B200	PT6A	T	B	7	C	4
S-890123048	PCAA	SD330	PT6A	T	B	7	C	1
S-880125012	SWJA	SD360	PT6A	T	N	2	N	1
S-880125011	SWJA	SD360	PT6A	T	N	2	N	1
S-880212029	HALA	DHC7102	PT6A	C	N	7	N	2
S-880304011	SIMI	SD360	PT6A	C	N	2	N	7
S-880309003	EA03	C99	PT6A	C	N	2	N	1
S-880525070	COMA	EMB110	PT6A	T	N	7	N	8
S-880608003	SO11	B200	PT6A	T	N	1	N	1
S-880617088	PCAA	SD330	PT6A	C	N	3	N	5

CHARACTERISTICS OF ROTOR FAILURES - 1988

REPORT NO.	SUBMIT.	AIRCRAFT	ENGINE/ POSITION	COMPNT	FRAG. TYPE	CAUSE	CONTN. COND.	FLT. COND.
S-880715115	PCAA	SD330	PT6A	C	N	3	N	5
S-880729269	WTAA	SD360	PT6A	C	N	3	N	3
S-880801017	WTAA	SD360	PT6A	T	N	2	N	3
S-880824067	SW01	C99	PT6A	C	N	2	N	3
S-880919150	SO19	UNKNOWN	PT6A	T	N	1	N	1
S-881003037	WTAA	SD360	PT6A	C	N	5	N	3
S-881025013	SW01	C99	PT6A	C	N	7	N	3
S-881103019	WTAA	EMB110	PT6A	C	N	3	N	7
S-881007003	CAIA	SD360	PT6A	C	N	2	N	5
S-881017296	NMO1	212	PT6A	F	N	3	N	3
S-881220029	BHAA	1900C	PT6A	T	N	2	N	2
S-880119045	SO11	UNKNOWN	PT6A	F	N	1	N	1
S-880115019	AALA	B727	JT8D	C	B	3	C	4
S-880119096	SW05	DC9	JT8D	C	B	7	C	1
S-880129010	NWAA	B727	JT8D	T	B	2	C	3
S-880128029	DALA	B727	JT8D	T	B	7	C	4
S-880205247	TWAA	B727	JT8D	T	B	2	C	10
S-880209054	SU19	UNKNOWN	JT8D	T	B	2	C	1
S-880212003	UALA	B727	JT8D	T	B	1	C	3
S-880219011	USAA	DC9	JT8D	T	B	7	C	4
S-880224048	WP09	UNKNOWN	JT8D	C	B	7	C	1
S-880304012	USAA	B737	JT8D	T	B	7	C	5
S-880325025	AALA	DC9	JT8D	T	B	7	C	4
S-880401006	NWAA	DC9	JT8D	T	B	1	C	3
S-880401019	USAA	UNKNOWN	JT8D	T	B	7	C	3
S-880412010	WP09	UNKNOWN	JT8D	C	B	7	C	1
S-880412014	WP09	UNKNOWN	JT8D	C	B	7	C	1
S-880422007	NWAA	DC9	JT8D	T	B	1	C	3
S-880422003	UALA	B737	JT8D/2	T	B	1	NC	3
S-880415005	AWXA	B737	JT8D	C	B	2	C	4
S-880429002	DALA	B727	JT8D	T	B	2	C	3
S-880429053	HALA	DC9	JT8D	C	B	7	C	4
S-880520044	TWAA	DC9	JT8D	T	B	1	C	4
S-880523110	EALA	B727	JT8D	T	B	7	C	4
S-880527349	MRKA	B737	JT8D	T	B	7	C	3
S-880603014	AALA	B727	JT8D	T	B	7	C	3
S-880603023	USAA	DC9	JT8D	C	B	7	C	4
S-880606080	EALA	B727	JT8D	T	B	7	C	4
S-880624028	NWAA	DC9	JT8D	T	B	1	C	3
S-880624031	NWAA	DC9	JT8D	T	B	2	C	4
S-880708007	FTLA	B727	JT8D/3	T	B	2	NC	10
S-880715035	USAA	DC9	JT8D	C	B	3	C	4
S-880715045	EMAA	DC9	JT8D	T	B	7	C	3
S-880808082	HALA	DC9	JT8D	T	B	7	C	4
S-880822117	NWAA	B727	JT8D	C	B	3	C	6
S-880816013	DALA	B727	JT8D	F	B	1	C	3

CHARACTERISTICS OF ROTOR FAILURES - 1988

REPORT NO.	SUBMIT.	AIRCRAFT	ENGINE/ POSITION	COMPNT	FRAG. TYPE	CAUSE	CONTN. COND.	FLT. COND.
S-880830031	CALA	B727	JT8D	C	B	3	C	3
S-880830020	TAGA	B727	JT8D	T	B	7	C	4
S-880902040	NWAA	DC9	JT8D/2	C	B	1	NC	3
S-880902018	NWAA	DC9	JT8D	T	B	1	C	4
S-880909107	CALA	B727	JT8D	T	B	2	C	5
S-880916018	SWAA	B737	JT8D	T	B	7	C	5
S-881011015	EIAA	B727	JT8D	T	B	7	C	3
S-881014024	IPXA	B727	JT8D	T	B	2	C	3
S-881028012	USAA	DC9	JT8D	T	B	7	C	3
S-881028094	UALA	B737	JT8D	T	B	7	C	3
S-881114033	FDEA	B727	JT8D/3	T	D	2	NC	3
S-881114006	CALA	B727	JT8D	T	B	7	C	4
S-881007018	SWAA	B737	JT8D	C	B	7	C	4
S-881021118	CALA	B727	JT8D	T	B	7	C	4
S-881202051	BNFA	B737	JT8D	T	B	7	C	3
S-881216057	MIDA	B737	JT8D	T	B	7	C	4
S-881216022	AALA	DC9	JT8D	T	B	7	C	3
S-881223033	MIDA	B737	JT8D	T	B	7	C	6
S-881230023	UALA	B727	JT8D	C	B	2	C	10
S-881230005	ASAA	DC9	JT8D	T	B	1	C	4
S-890127124	MRKA	B737	JT8D	T	B	7	C	6
S-890113142	NWAA	B727	JT8D	C	B	2	C	3
S-890118010	PAAA	B727	JT8D	T	B	7	C	7
S-880129099	DALA	B727	JT8D	F	N	1	N	1
S-880129070	AWXA	B737	JT8D	F	N	3	N	3
S-880205240	TWAA	DC9	JT8D	F	N	3	N	4
S-880219145	PAAA	B727	JT8D	F	N	3	N	5
S-880219159	EIAA	B727	JT8D	C	N	3	N	3
S-880317113	SW07	B727	JT8D	F	N	3	N	1
S-880401114	MIDA	DC9	JT8D	C	N	3	N	6
S-880421038	SO19	UNKNOWN	JT8D	F	N	1	N	1
S-880523054	FDEA	B727	JT8D	F	N	3	N	1
S-880602074	SW07	UNKNOWN	JT8D	F	N	3	N	1
S-880602047	SW07	B727	JT8D	F	N	3	N	1
S-880603024	AALA	DC9	JT8D	F	N	3	N	3
S-880603041	EALA	B727	JT8D	T	N	2	N	3
S-880603133	BNFA	B727	JT8D	C	N	3	N	1
S-880718003	RJEF	B737	JT8D	F	N	3	N	3
S-880802049	EALA	DC9	JT8D	C	N	3	N	3
S-880729055	TWAA	DC9	JT8D	C	N	3	N	3
S-880801097	EALA	DC9	JT8D	F	N	3	N	3
S-880825176	USAA	B737	JT8D	F	N	3	N	3
S-880826005	CALA	B727	JT8D	C	N	3	N	3
S-880826080	CALA	DC9	JT8D	C	N	3	N	3
S-880830130	CALA	B727	JT8D	C	N	3	N	5
S-880902106	SWAA	B737	JT8D	F	N	3	N	3
S-880906078	PAIA	B737	JT8D	F	N	3	N	5

CHARACTERISTICS OF ROTOR FAILURES - 1988

REPORT NO.	SUBMIT.	AIRCRAFT	ENGINE/ POSITION	COMPNT	FRAG. TYPE	CAUSE	CONTN. COND.	FLT. COND.
S-880926155	HALA	DC9	JT8D	C	N	3	N	3
S-881003139	PAIA	B727	JT8D	F	N	3	N	3
S-881005019	SW05	B727	JT8D	F	N	3	N	1
S-881021013	PAIA	B727	JT8D	T	N	7	N	3
S-881028102	SWAA	B737	JT8D	T	N	2	N	1
S-881028101	SWAA	B737	JT8D	T	N	2	N	1
S-881028104	SWAA	B737	JT8D	T	N	2	N	1
S-881028105	SWAA	B737	JT8D	T	N	2	N	1
S-881028103	SWAA	B737	JT8D	T	N	2	N	1
S-881107138	SWXA	DC9	JT8D	F	N	3	N	3
S-881109007	BNFA	B727	JT8D	F	N	3	N	3
S-881007198	NWAA	DC9	JT8D	F	N	3	N	3
S-881017222	SWAA	B737	JT8D	T	N	2	N	1
S-881017224	SWAA	B737	JT8D	T	N	2	N	1
S-881017220	SWAA	B737	JT8D	T	N	2	N	1
S-881017228	SWAA	B737	JT8D	T	N	2	N	1
S-881017226	SWAA	B737	JT8D	T	N	2	N	1
S-881021073	PAIA	B737	JT8D	C	N	3	N	3
S-881121005	MIDA	B737	JT8D	F	N	3	N	3
S-881205025	MIDA	B737	JT8D	F	N	3	N	1
S-881205021	MIDA	DC9	JT8D	F	N	3	N	4
S-881205115	SWAA	B737	JT8D	T	N	2	N	1
S-881209003	AALA	B737	JT8D	F	N	3	N	3
S-881209009	UALA	B737	JT8D	C	N	3	N	5
S-881223037	MIDA	B737	JT8D	F	N	3	N	1
S-881230065	HALA	DC9	JT8D	T	N	7	N	10
S-890127192	EALA	DC9	JT8D	T	N	7	N	4
S-890130039	MIDA	DC9	JT8D	F	N	3	N	1
S-890120165	MRKA	B737	JT8D	C	N	3	N	10
S-890213003	USAA	DC9	JT8D	C	N	3	N	4
S-890425070	MWEA	DC9	JT8D	F	N	3	N	4
S-880506028	ASPA	STCAP	501D13	T	B	7	C	3
S-880722012	SPAA	STCAP	501D13	C	B	7	C	3
S-880226137	SRAA	L382	501D22	T	N	3	N	4
S-881017278	MRKA	L382	501D22	C	N	3	N	3
S-890207092	MRKA	L382	501D22	C	N	3	N	10
S-880112116	WP15	HS1257	TFE731	T	B	7	C	4
S-880211030	EA21	LEAR35	TFE731	T	B	7	C	5
S-880411043	EA21	LEAR36	TFE731	T	B	7	C	1
S-880628013	EA17	BAE128	TFE731	T	B	7	C	4
S-880906154	GL23	FALCON50	TFE731	T	B	7	C	1
S-881206032	SO17	LEAR35	TFE731	T	B	7	C	1
S-881026077	GL03	HS1257	TFE731	T	B	7	C	4
S-881025004	SW03	HS1257	TFE731	T	N	7	N	4
S-880927004*	BAQA	LEAR35A	TFE731	C	N	3	N	3
S-880927004*	BAQA	LEAR35A	TFE731	C	N	3	N	3

* 2 Engines Affected, Same Aircraft

CHARACTERISTICS OF ROTOR FAILURES - 1988

REPORT NO.	SUBMIT.	AIRCRAFT	ENGINE/ POSITION	COMPNT	FRAG. TYPE	CAUSE	CONTN. COND.	FLT. COND.
S-881206033	SO17	LEAR35	TFE731	T	N	1	N	1
S-880112068	NM01	AS350D	LTS101	T	N	1	N	1
S-880121083	GL13	BK117A3	LTS101	T	N	1	N	1
S-880204095	EA27	BK117A1	LTS101	T	N	1	N	1
S-880204090	EA27	BK117A1	LTS101	T	N	1	N	1
S-880310104	GL13	UNKNOWN	LTS101	T	N	1	N	1
S-880322159	EA27	BK117A3	LTS101	T	N	1	N	1
S-880328041	EA25	Bell222	LTS101	T	N	1	N	1
S-880329051	EA25	AS350D	LTS101	T	N	1	N	1
S-880427054	NM07	BK117A3	LTS101	T	N	5	N	1
S-880426032	WP15	AS350D	LTS101	T	N	1	N	1
S-880608039	EA11	Bell222U	LTS101	T	N	1	N	1
S-880705134	SO17	Bell222	LTS101	T	N	1	N	1
S-880720026	NM07	BK117A3	LTS101	T	N	1	N	1
S-880728075	NM07	BK117A3	LTS101	C	N	3	N	1
S-880728077	NM07	BK117A3	LTS101	T	N	1	N	1
S-880728094	NM07	BK117A3	LTS101	T	N	1	N	1
S-880802086	NM07	BK117A3	LTS101	C	N	3	N	1
S-880811005	NM07	BK117A3	LTS101	T	N	1	N	1
S-880818047	CZYA	BK117A3	LTS101	T	N	1	N	1
S-880818048	CZYA	BK117A3	LTS101	T	N	1	N	1
S-880824096	NE01	AS350D	LTS101	T	N	1	N	1
S-880824052	WP01	Bell222	LTS101	T	N	1	N	1
S-880823117	SW03	Bell222	LTS101	T	N	1	N	1
S-880809018	NM07	BK117A3	LTS101	T	N	1	N	1
S-881004072	SW99	Bell222	LTS101	T	N	1	N	1
S-881025045	EA25	AS350D	LTS101	T	N	1	N	1
S-881109016	EA17	Bell222U	LTS101	T	N	1	N	1
S-881110063	CE01	Bell222U	LTS101	T	N	1	N	1
S-881026072	GL13	BK117A3	LTS101	T	N	1	N	1
S-881026073	GL13	BK117A3	LTS101	T	N	1	N	1
S-881206066	NM01	AS350D	LTS101	T	N	1	N	1
S-881222040	EA25	AS350D	LTS101	T	N	1	N	1
S-880112112	SW99	CL600	ALF502/2	T	B	7	NC	5
S-880129051	AALA	BAC1462	ALF502	C	N	3	N	4
S-880511006	EA11	CL600	ALF502	C	N	2	N	4
S-881121129	WTAA	BAC1462	ALF502	F	N	3	N	1
S-881223014	WTAA	BAC1462	ALF502	C	N	3	N	7
S-890127005	ASPA	BAC1462	ALF502	T	N	2	N	3
S-890123070	WTAA	BAC1462	ALF502	C	N	3	N	10
S-880225039	REXA	SF340A	CT75A/1	T	D	7	NC	8
S-880226001	ANAA	SF340A	CT75A	T	B	2	C	5
S-880226007	COMA	SF340A	CT75A	T	B	7	C	5
S-880415060	BHAA	SF340A	CT75A	T	S	3	C	5

CHARACTERISTICS OF ROTOR FAILURES - 1988

REPORT NO.	SUBMIT.	AIRCRAFT	ENGINE/ POSITION	COMPNT	FRAG. TYPE	CAUSE	CONTN. COND.	FLT. COND.
S-880624044	PLGA	SF340A	CT75A	T	B	7	C	3
S-880916019	MTRA	SF340A	CT75A/1	T	B	3	NC	4
S-881202028	MTRA	SF340A	CT75A	C	B	6	C	1
S-880115011	NE63	SF340A	CT75A	C	N	4	N	4
S-880422005	ANAA	SF340A	CT75A	C	N	2	N	5
S-880617106	AMWA	SF340A	CT75A	T	N	7	N	4
S-880617097	PLGA	SF340A	CT75A	C	N	3	N	3
S-880624047	PLGA	SF340A	CT75A	T	N	7	N	3
S-880902028	AMWA	SF340A	CT75A	C	N	3	N	3
S-881114037	MTRA	SF340A	CT75A	T	N	2	N	7
S-880412065	NM07	Bell206B	250C20	C	B	3	C	10
S-880823015	WP13	Bell206L	250C20	C	B	7	C	1
S-880927019	SW03	Bell206B	250C20	C	B	7	C	5
S-881220042	SW05	UNKNOWN	250C20	T	R	4	C	1
S-881206070	SW09	Bell206L	250C28	T	N	7	N	8
S-880706045	SW05	AS355F	250C20	C	N	7	N	1
S-880706029	SW05	AS355F	250C20	C	N	3	N	1
S-880706027	SW05	AS355F	250C20	C	N	1	N	1
S-880811038	NM07	AS355F	250C20	C	N	3	N	1
S-880927027	SW03	BO105S	250C20	C	N	3	N	7
S-880928030	NM07	AS335F	250C20	C	N	2	N	1
S-881025047	NM01	Bell206B	250C20	C	N	2	N	1
S-881123067	SW03	Bell206B	250C20	T	N	1	N	1
S-881123076	SW03	Bell206L	250C28	T	N	1	N	1
S-881123069	EU70	Bell206B	250C20	C	N	7	N	1
S-881123077	SW03	Bell206L	250C28	T	N	1	N	1
S-881123066	SW03	Bell206L	250C28	T	N	1	N	1
S-881123056	SW03	Bell206L	250C28	T	N	1	N	1
S-881213043	SW03	Bell206L	250C28	C	N	1	N	1
S-881213038	SW03	Bell206L	250C28	T	N	1	N	1
S-880317148	ORLA	N22B	250B17	C	N	3	N	5
S-880122067	UALA	DC10	CF6	C	B	2	C	5
S-880527142	FDEA	DC10	CF6	T	B	2	C	5
S-880816053	FDEA	DC10	CF6	C	B	7	C	3
S-880902045	UALA	DC10	CF6	C	B	6	C	4
S-880930008	UALA	DC10	CF6	T	B	1	C	4
S-881007011	UALA	DC10	CF6	T	B	2	C	4
S-890113127	UALA	DC10	CF6	C	B	7	C	3
S-880314066	EALA	A300	CF6	T	B	7	C	4
S-880801095	EALA	DC10	CF6	C	N	3	N	4
S-880802044	EALA	DC10	CF6	C	N	3	N	4
S-880816049	FDEA	DC10	CF6	T	N	6	N	3
S-881125058	PAAA	A300	CF6	F	N	3	N	1
S-881110050	SW15	NA265	CF700	C	B	2	C	8
S-880622098	SW15	NA265	CF700	F	N	3	N	1
S-8811100010	SW15	NA265	CF700	C	N	3	N	3
S-880129025	RAXA	DC8	JT3D	T	B	2	C	3

CHARACTERISTICS OF ROTOR FAILURES - 1988

REPORT NO.	SUBMIT.	AIRCRAFT	ENGINE/ POSITION	COMPNT	FRAG. TYPE	CAUSE	CONTN. COND.	FLT. COND.
S-880205030	RAXA	DC8	JT3D	C	B	7	C	4
S-880212004	RAXA	DC8	JT3D	C	B	7	C	8
S-880226020	RAXA	DC8	JT3D	C	B	7	C	5
S-880304006	FWTA	B707	JT3D	T	B	7	C	5
S 880328014	RAXA	DC8	JT3D	T	B	2	C	3
S-880415003	RAXA	DC8	JT3D	C	B	7	C	7
S-880429048	HALA	DC8	JT3D	T	B	7	C	5
S-880205030	RAXA	DC8	JT3D	C	B	7	C	3
S-880816017	RAXA	DC8	JT3D	C	B	7	C	5
S-881007088	RAXA	DC8	JT3D	C	B	7	C	6
S-881007008	RAXA	DC8	JT3D	C	B	7	C	5
S-881202031	RAXA	DC8	JT3D	T	B	7	C	4
S-881223002	ARWA	DC8	JT3D	C	B	7	C	5
S-880617001	RAXA	DC8	JT3D	C	B	7	C	5
S-881021020	TIEA	DC8	JT3D	F	N	3	N	4
S-880129054	RAXA	DC8	JT3D	C	N	7	N	10
S-880212233	SRAA	B707	JT3D	T	N	2	N	4
S-880325011	AMTA	L1011	RB211	C	B	2	C	5
S-880404145	TAEA	L1011	RB211	T	B	7	C	5
S-881003260	TWAA	L1011	RB211	T	B	1	C	1
S-880212163	TWAA	L1011	RB211	F	N	7	N	4
S-880212274	DALA	L1011	RB211	C	N	3	N	3
S-880318052	HALA	L1011	RB211	T	N	7	N	2
S-880401004	TAEA	L1011	RB211	C	N	3	N	2
S-880419001	TWAA	L1011	RB211	C	N	3	N	7
S-880729046	EALA	B757	RB211	C	N	2	N	5
S-881223001	TAEA	L1011	RB211	C	N	7	N	1
S-890206045	AMTA	L1011	RB211	F	N	5	N	3
S-880429032	PAIA	F28MK4	SPEY/2	T	D	7	NC	5
S-880816015	PAIA	F28MK4	SPEY	C	B	1	C	4
S-880205153	FLEA	BAC111	SPEY	C	N	7	N	3
S-881014080	FLEA	BAC111	SPEY	T	N	7	N	3
S-880913123	EA03	DC125	VIP522	T	B	7	C	3
S-880411022	EU51	HS748	DART	T	B	7	C	3
S-880226033	BRIA	FH227C	DART	C	N	3	N	6
S-880415068	BRIA	FH227C	DART	C	N	7	N	5
S-880307060	EA25	WEST30	GEM510	C	N	3	N	1
S-880202106	QXEA	SA227	TPE331	T	B	7	C	3
S-880718119	NAXA	3101	TPE331	T	B	7	C	1
S-880721051	DHLA	SA227	TPE331	C	B	7	C	1
S-880721052	DHLA	SA227	TPE331	C	B	7	C	1
S-880818003	DHLA	SA227	TPE331	C	B	7	C	1
S-880310011	RAIX	SA227	TPE331	T	B	2	C	6
S-880721050	MEJA	SA227	TPE331	T	N	7	N	4
S-880225046	QXEA	SA227	TPE331	C	N	3	N	6
S-8[illegible]0[illegible]31086	WWMX	SA227	TPE331	C	N	3	N	4
S-880622080	BSAA	SA226	TPE331	C	N	3	N	5

CHARACTERISTICS OF ROTOR FAILURES - 1988

REPORT NO.	SUBMIT.	AIRCRAFT	ENGINE/ POSITION	COMPNT	FRAG. TYPE	CAUSE	CONTN. COND.	FLT. COND.
S-880902092	VNAA	3101	TPE331	C	N	3	N	7
S-880909086	VNAA	3101	TPE331	C	N	3	N	8
S-880916078	VNAA	3101	TPE331	C	N	3	N	7
S-881007031	NAXA	3101	TPE331	C	N	3	N	10
S-881031305	VNAA	3101	TPE331	C	N	3	N	1
S-881114249	VNAA	3101	TPE331	C	N	3	N	3
S-881114250	VNAA	3101	TPE331	C	N	3	N	1
S-881017112	VNAA	3101	TPE331	C	N	3	N	1
S-881017053	VNAA	3101	TPE331	C	N	3	N	7
S-881020018	MALA	SA227	TPE331	C	N	3	N	7
S-881020015	MALA	SA227	TPE331	C	N	3	N	8
S-881031305	VNAA	3101	TPE331	C	N	3	N	1
S-890106046	FBAA	2282	TPE331	C	N	3	N	7
S-890113241	CPLA	3101	TPE331	C	N	3	N	3
S-890118038	NAXA	3101	TPE331	T	N	5	N	10
S-890123052	VNAA	3101	TPE331	C	N	3	N	3
S-880129039	DALA	B757	PW2037	T	S	2	C	4
S-880205020	NWAA	B757	PW2037	C	B	1	C	4
S-880205001	NWAA	B757	PW2037	C	B	2	C	6
S-880304014	DALA	B757	PW2037	C	B	2	C	4
S-880624017	NWAA	B757	PW2037	T	B	2	C	4
S-880722010	DALA	B757	PW2037/1	T	B	2	NC	6
S-880822110	NWAA	B757	PW2037	C	B	2	C	7
S-881028001	DALA	B757	PW2037	C	B	2	C	3
S-881202046	NWAA	B757	PW2037	C	N	2	N	4
S-881209020	IPXA	B757	PW2040	F	N	3	N	3
S-890103146	IPXA	B757	PW2040	F	N	3	N	3
S-880823023	GL07	550	JT15D	T	B	7	C	1
S-880426047	GL07	550	JT15D	T	B	7	C	10
S-880818058	S001	550	JT15D	F	N	2	N	1
S-880818059	GL25	550	JT15D	F	N	2	N	1
S-880315042	EA21	500	JT15D	T	N	7	N	5
S-881110023	GL25	550	JT15D	F	N	2	N	1
S-881011043	SW99	552	JT15D	T	N	2	N	1
S-881207014	GL07	550	JT15D	T	N	2	N	1
S-881116021	SW99	550	JT15D	T	N	2	N	1
S-880725088	EMXA	DC8	PW120	C	S	7	C	1
S-880520020	HNAA	DHC8	PW120	C	N	2	N	5
A-880405022179C	NE01	B737	JT8D/2	T	D	6	NC	3
A-880627027329G	SO01	IAI1124	TFE731	T	B	6	NC	4
A-880504019679C	CE03	DC9	JT8D/2	T	D	7	NC	4
A-881024060959C	NE01	BEECH200	PT6/2	T	B	7	NC	5

☆U.S. GOVERNMENT PRINTING OFFICE: 1992 - 604-061/60047