NAVAL AIR PROPULSION TEST CENTER

TRENTON, NEW JERSEY 08628

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ROTOR BURST PROTECTION PROGRAM: STATISTICS ON AIRCRAFT GAS TURBINE ENGINE ROTOR FAILURES THAT OCCURRED IN U.S. COMMERCIAL AVIATION DURING 1975

By R. A. DeLUCIA & G. J. MANGANO

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ROTOR BURST PROTECTION PROGRAM: STATISTICS ON AIRCRAFT GAS TURBINE ENGINE ROTOR FAILURES THAT OCCURRED IN U. S. COMMERCIAL AVIATION DURING 1975

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TABLE OF CONTENTS

LIST OF FIGURES

INTRODUCTION

This report has been prepared as part of the Rotor Burst Protection Program (RBPP), which is sponsored by the National Aeronautics and Space Administration (NASA)[1] and conducted by the Naval Air Propulsion Test Center (NAPTC). The objective of the RBPP is to develop criteria for the design of devices that will be used on aircraft to protect passengers and the aircraft structure from the lethal and devastating fragments that are generated by gas turbine engine rotor bursts.

Presented in this report are statistics on gas turbine rotor failures that have occurred in U. S. commercial aviation during 1975. These statistics are based on data compiled from the Flight Standards Service Difficulty Reports (SDR) that were published by the Department of Transportation, Federal Aviation Administration (FAA). The compiled data were analyzed to establish:

1. The incidence of rotor failures and the number of contained and uncontained[2] rotor bursts.

2. The distribution of rotor bursts with respect to engine rotor component; i.e., fan, compressor or turbine.

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

4. The cause of failure.

5. The type of engines involved.

6. The flight condition at the time of failure.

RESULTS

1. The data used for analysis are contained in APPENDIX A. The results of these analyses are shown in Figures 1 through 6.

a. Figure 1 shows that 193 rotor failures occurred in 1975. These rotor failures accounted for approximately 8.4% of the 2305 shutdowns experienced by the gas turbine powered U. S. commercial aircraft fleet during 1975. Rotor fragments were generated in 104

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[1] NASA DPR C-41581-B, Mod. 6

[2] An uncontained rotor burst is defined as a rotor failure that produces fragments which penetrate and escape the confines of the engine casing.

of the failures experienced and, of these, 14 (13.5% of the rotor bursts) were uncontained. This represents an uncontained rotor burst rate of 2.4 per million gas turbine engine powered aircraft flight hours, or 0.73 per million engine operation hours. Approximately 6.0 million and 19.2 million aircraft flight and engine operating hours, respectively, were logged by the U. S. commercial aviation fleet in 1975. Because of the potentially catastrophic consequence of such bursts, these rates are considered to be significantly high.

b. Figure 2 shows the distribution of rotor bursts (rotor failures that produced fragments) according to the engine component involved -- fan, compressor, turbine; the types of fragments that were generated; and the percentage of uncontained failures according to the type fragment generated. These data indicate that:

(1) The incidence of turbine rotor burst was slightly more than twice that of compressor rotor burst; these corresponded to 65.4% and 30.8%, respectively, of the total number of rotor bursts. Fan rotor bursts accounted for 3.8% of the bursts experienced.

(2) Blade fragments were generated in 90.4% of the rotor bursts; 7.4% of these were uncontained. The remaining rotor bursts (9.6%) produced disk, rim and seal fragments, of which 70% were uncontained.

c. Figure 3 shows the rotor burst distribution among the types of engines that were affected, and the total number of engines in use of the type that experienced rotor failures. It appears that the more recently introduced, larger turbofan engines have experienced the highest rate of rotor burst.

d. Figure 4 shows what caused the rotor failures to occur. Of the known causes of failure*, the dominant causal factors were: (1) Foreign Object Damage (42.6%); (2) Secondary Causes (36.4%); and (3) Design and Life Prediction Problems (18.6%).

e. Figure 5 shows the flight conditions that existed when the various rotor failures or bursts occurred. Approximately 81% of the 193 rotor failures occurred during the takeoff, climb, and cruise stages of flight. Eighty-seven percent of the rotor bursts, and approximately 79% of the uncontained rotor bursts, occurred during these same stages of flight. The highest percentage of uncontained rotor bursts (43%) were experienced during climb.

f. Figure 6 shows the annual incidence of uncontained rotor bursts in commercial aviation for the years 1962 through 1975. There appears to be a decreasing trend in the incidence of uncontained rotor failures

*Because of the high percentage of unknown causes of rotor failure/burst, the analysis was based on the total number of known causes.

during the past three years. The rate of uncontainment with respect to engine operating hours has also decreased during this same period (1.2, 1.1 and 0.73 uncontained bursts per million engine operating hours for the years 1973, 1974 and 1975).

CONCLUSIONS

1. The incidence of rotor failure and uncontained burst is still significantly high enough to warrant continuation of the experimental and analytical efforts that constitute the Rotor Burst Protection Program.

2. Of all the types of fragments generated at rotor burst, disk and fan blade fragments, because of their size, high energy content and high rate of uncontainment, continue to be the major threat that must be addressed in the RBPP.

3. The number of uncontained blade failures has diminished during 1975 but is still surprisingly high considering that, under FAA regulations, rotor blade containment is required for engine certification.

4. It appears that causes beyond the control or scope of present technology such as FOD, structural life and integrity prediction, and secondary effects, are still primarily responsible for most of the rotor failures that occur.

FIGURE 1

INCIDENCE OF ROTOR FAILURE/BURST IN U. S. COMMERCIAL AVIATION 1975

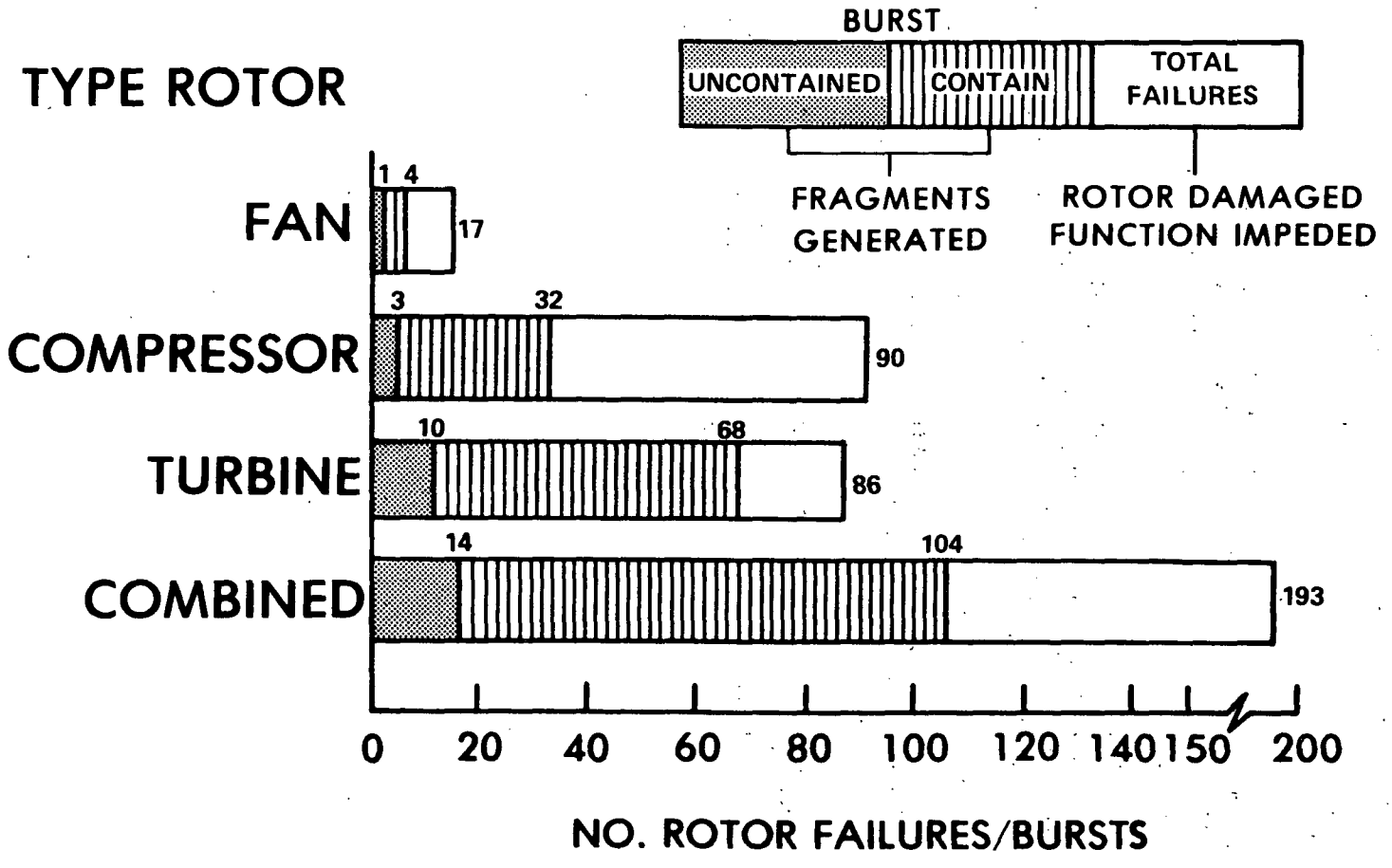


FIGURE 2

COMPONENT AND FRAGMENT TYPE DISTRIBUTIONS FOR CONTAINED AND UNCONTAINED ROTOR BURSTS[1]—1975

ENGINE ROTOR COMPONENT	TYPE OF FRAGMENT GENERATED								TOTALS	
	DISK		RIM		BLADE		SEAL			
	TF	UCF	TF	UCF	TF	UCF	TF	UCF	TF	UCF
FAN	0	0	0	0	4	1	0	0	4	1
COMPRESSOR	1	1	1	0	30	2	0	0	32	3
TURBINE	5	5	1	0	60	4	2	1	68	10
TOTALS	6	6	2	0	94	7	2	1	104	14

(1) FAILURES THAT PRODUCED FRAGMENTS

TF -- TOTAL FAILURES

UCF -- UNCONTAINED FAILURES

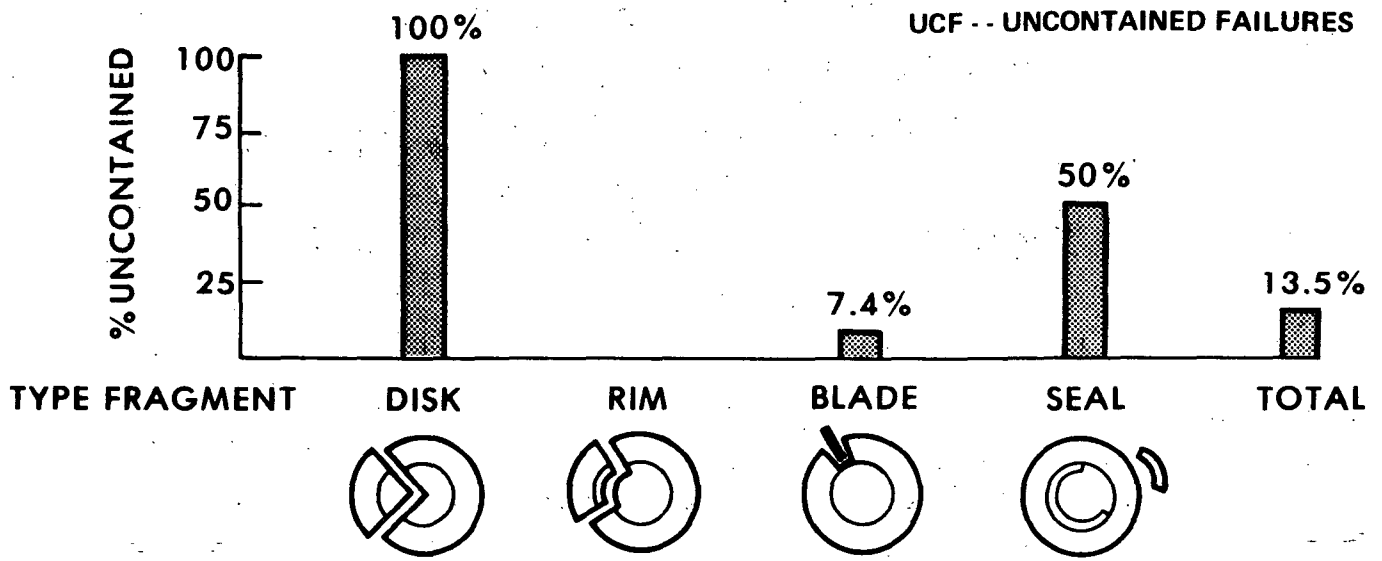
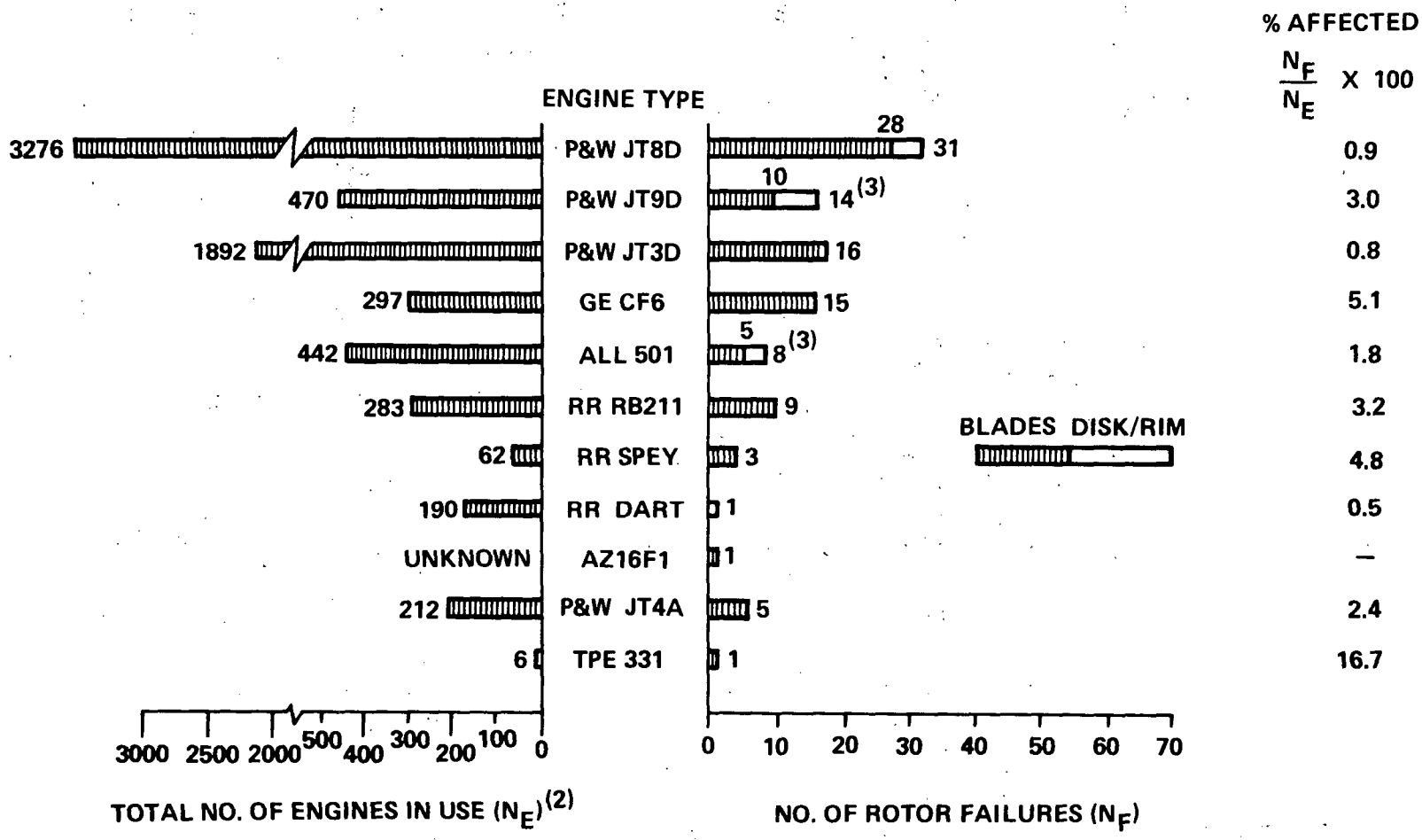


FIGURE 3

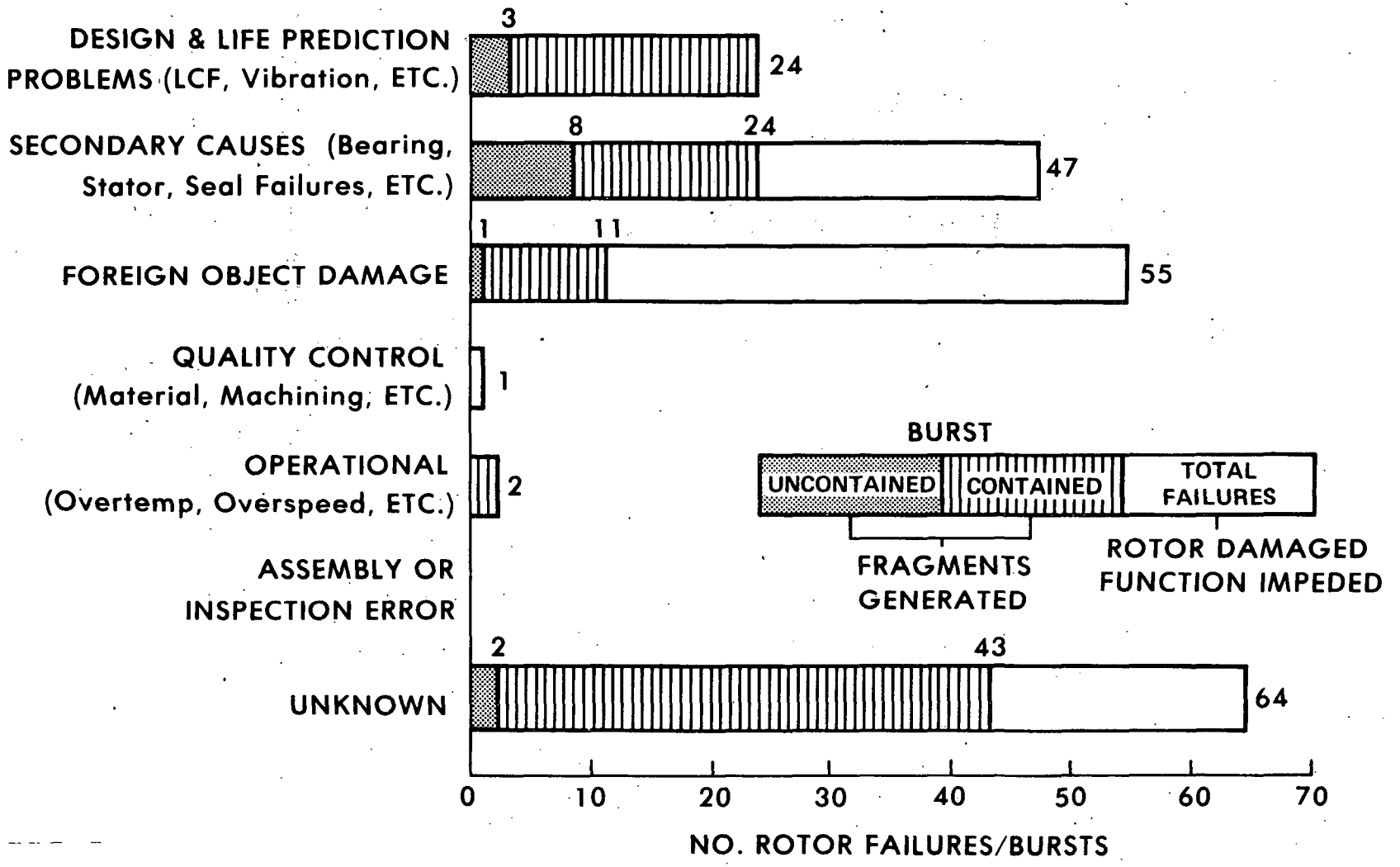
THE INCIDENCE OF ROTOR BURST[1] IN U.S. COMMERCIAL AVIATION ACCORDING TO ENGINE TYPE AFFECTED - 1975



(1) Failures that produced fragments
(2) Yearly avg. of aircraft in use at end of each month
(3) 1 Seal Burst Included in Disk/Rim Compilation

FIGURE 4

ROTOR FAILURE/BURST CAUSE CATEGORIES — 1975



NAPTC-PE-106

FIGURE 5

FLIGHT CONDITION AT ROTOR FAILURE/BURST — 1975

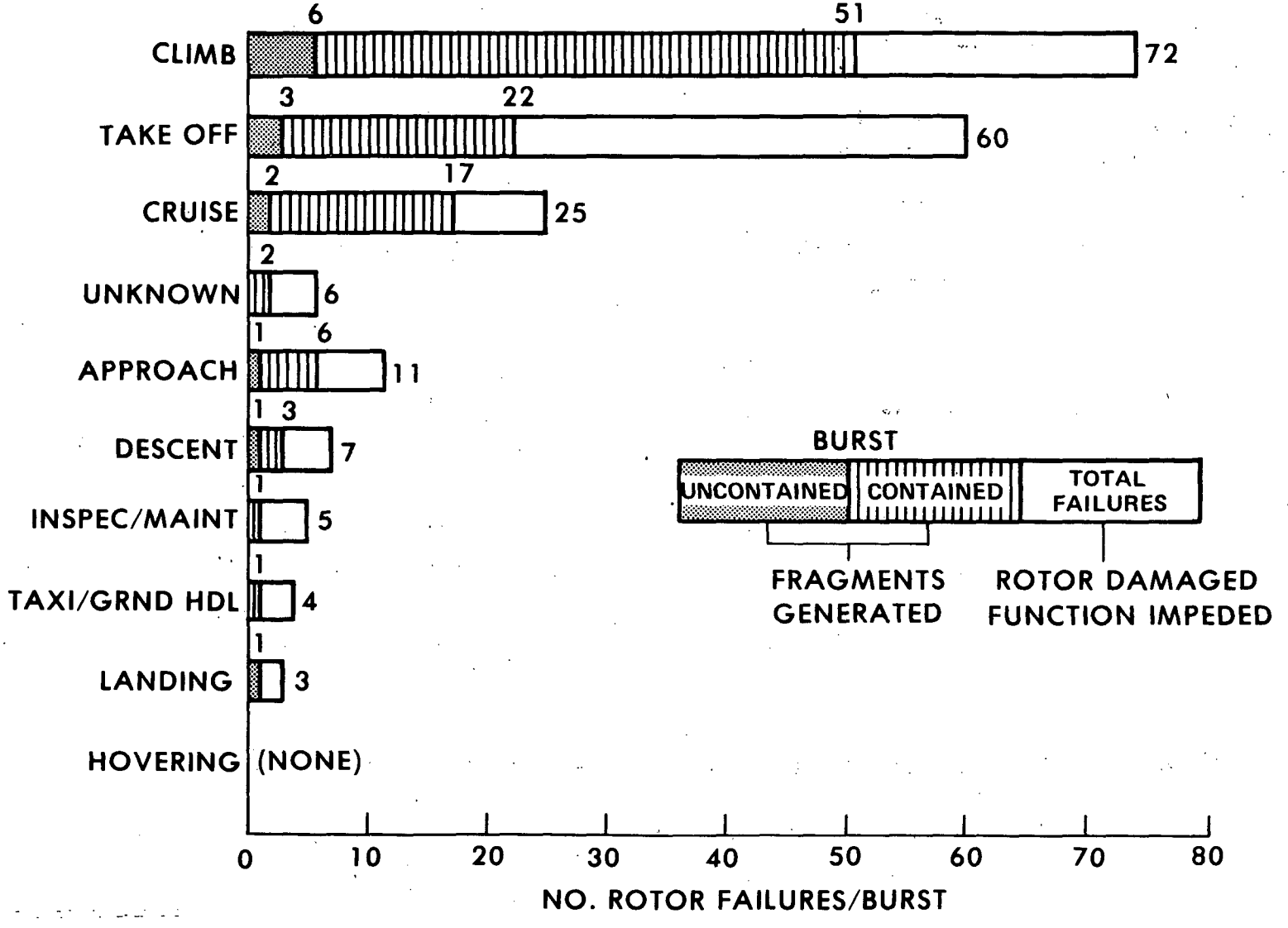
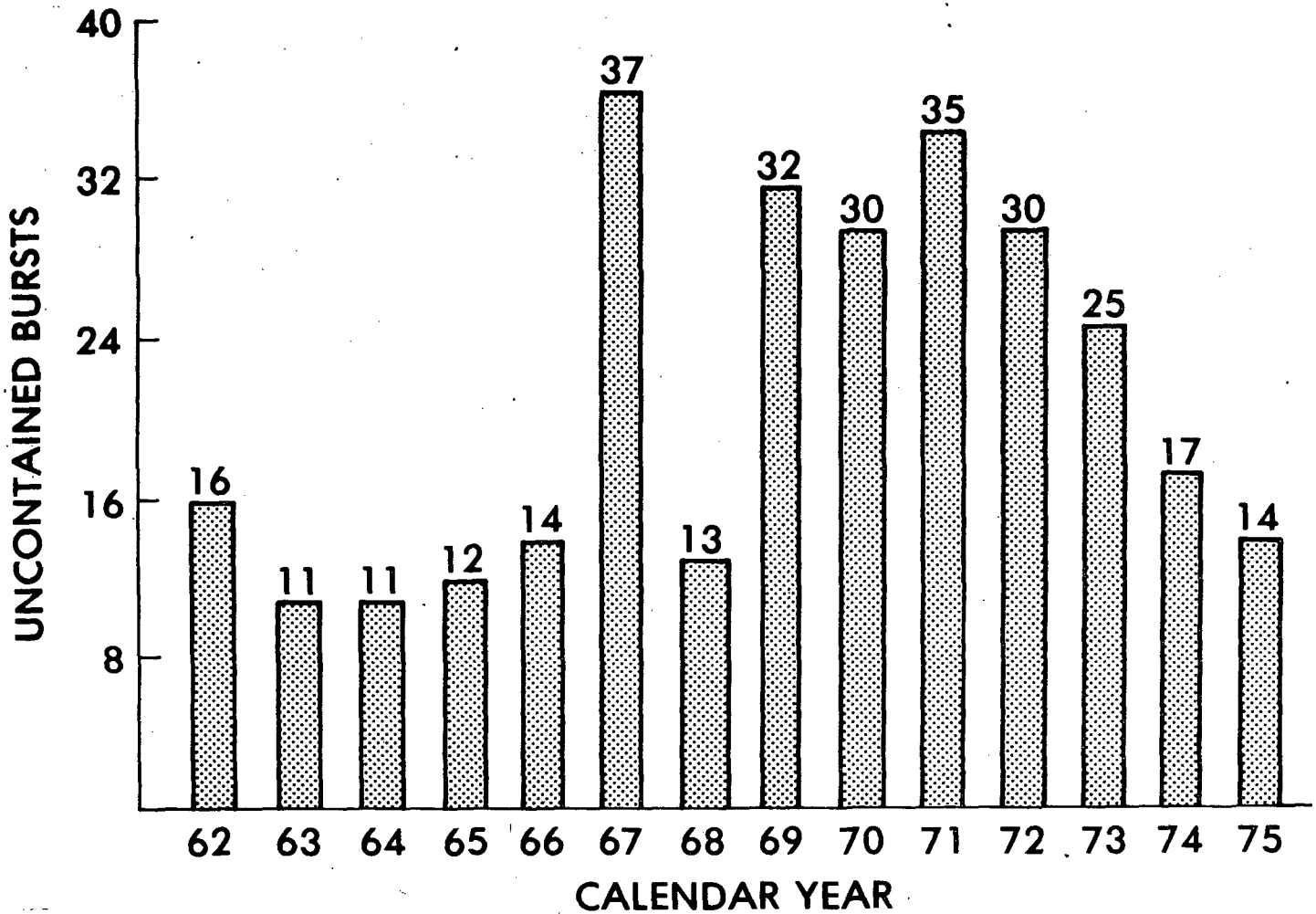


FIGURE 6

THE INCIDENCE OF UNCONTAINED ROTOR BURSTS IN U. S. COMMERCIAL AVIATION 1962 – 1975



NAPTC-PE-106

APPENDIX A

Data on Rotor Failures in U. S. Commercial Aviation for 1975. Compiled from the Federal Aviation Administration Service Difficulty Reports.

DATA COMPILATION KEY:

Submitter Code (single letters only):

A - Air Carrier Operator

B - Certificated Repair Station

C - Operator

D - Mechanic

E - Air Taxi Operator

F - Manufacturer

G - FAA Inspector

H - Other

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

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

FRAGMENTS GENERATED - 1975

SDR NO.	DATE	SUBMITTER	AIRCRAFT	ENGINE	COMPONENT	FRAGMENT TYPE	CAUSE	CONTAINMENT CONDITION	FLIGHT CONDITION
01155023	1/15	TWA	B-727	JT8D	C	B	7	C	4
01205024	1/2	UAL	B-747	JT8D	T	B	3	C	5
01225029	1/4	TWA	B-707	JT3D	C	B	3	C	4
01235021	1/6	TWA	B-707	JT3D	T	B	7	C	4
01295034	1/20	TWA	B-707	JT3D	C	B	7	C	4
01315034	1/15	AAA	CV-580	501	C	B	7	C	5
01085018	1/8	SOU	DC-9	JT8D	F	B	7	C	3
02065035	1/31	AIAX	L-382	501	T	B	7	NC	8
02075098	2/7	EAL	L-1011	RB 211	T	B	7	C	5
02105079	2/10	EAL	L-1011	RB 211	T	B	7	C	3
02115035	1/25	NAL	DC-10	CF 6	C	B	7	C	4
02105084	2/10	EAL	L-1011	RB 211	T	B	7	C	5
02125030	2/4	CAL	DC-10	CF6	C	B	3	C	7
02255161	2/25	TWA	L-1011	RB 211	C	B	7	C	5
02265030	2/15	AAL	B-727	JT8D	T	B	7	C	4
02265031	2/16	TWA	B-727	JT8D	C	B	7	C	3

SDR NO.	DATE	SUBMITTER	AIRCRAFT	ENGINE	COMPONENT	FRAGMENT TYPE	CAUSE	CONTAINMENT CONDITION	FLIGHT CONDITION
02255159	2/25	AAL	DC-10	CF6	T	B	7	C	5
02185030	2/1	UAL	B-747	JT9D	T	B	1	C	3
03055036	2/22	AAL	DC-10	CF6	T	B	1	C	3
03055037	2/14	UAL	B-747	JT9D	T	B	7	C	10
03065033	2/23	AAL	DC-10	CF6	C	B	3	C	4
03065034	2/19	AWI	DC-9	JT8D	F	B	3	C	4
03065035	2/20	NWA	B-747	JT9D	C	R	7	C	3
03075036	2/23	TWA	L-1011	RB-211	C	B	2	C	4
02105034	1/23	UAL	B-747	JT9D	T	S	2	C	3
03285029	3/15	TWA	B-727	JT8D	C	B	3	C	3
04015026	3/20	ACAX	B-737	JT8D	T	B	1	C	5
04115030	4/5	BNF	B-727	JT8D	C	B	2	C	3
04145024	4/3	SAAX	L-382	501	T	B	2	C	5
04175026	4/5	PSAX	B-727	JT8D	T	B	7	C	4
04295026	4/18	AAL	DC-10	CF6	T	B	2	NC	3
04295027	4/20	AAL	B-727	JT8D	T	R	1	C	5
05095030	4/26	CAL	DC-10	CF6	C	B	3	C	3
04215027	5/6	FAL	B-737	JT8D	C	B	2	C	4
05295030	5/20	TWA	B-747	JT9D	T	B	2	C	5

SDR NO.	DATE	SUBMITTER	AIRCRAFT	ENGINE	COMPONENT	FRAGMENT TYPE	CAUSE	CONTAINMENT CONDITION	FLIGHT CONDITION
06025063	5/26	WAL	DC-10	CF6	T	B	7	C	4
06055026	5/27	SOU	DC-9	JT8D	T	B	1	C	7
07175025	7/5	TWA	B-707	JT3D	T	B	1	C	4
06305029	6/18	TWA	B-727	JT8D	T	B	7	C	10
07185029	7/4	CAL	DC-10	CF6	T	B	2	C	4
07185031	7/7	TWA	B-707	JT3D	C	B	1	C	5
07215030	7/9	NCA	CV-580	501	T	D	1	NC	4
06115039	5/29	TWA	B-707	JT4A	C	B	1	C	4
06135027	5/27	NAL	DC-10	CF6	T	B	7	C	4
06135030	5/31	HAL	DC-9	JT8D	T	B	5	C	4
06045028	5/24	NCA	CV-580	501	T	B	7	C	4
06165023	6/5	AAL	B-707	JT3D	C	B	2	NC	5
06175028	6/1	TWA	B-707	JT3D	T	B	1	C	4
06305029	6/18	TWA	B-727	JT8D	T	B	7	C	4
07015030	6/18	AAL	DC-10	CF6	T	B	1	NC	3
07075418	6/19	AAA	DC-9	JT8D	T	B	5	C	3
06255030	6/13	WAL	B-720	JT3D	C	B	1	C	5
07095022	6/24	NAL	DC-10	CF6	T	B	7	C	4
07145020	7/1	AAL	B-747	JT9D	T	B	3	C	5

SDR NO.	DATE	SUBMITTER	AIRCRAFT	ENGINE	COMPONENT	FRAGMENT TYPE	CAUSE	CONTAINMENT CONDITION	FLIGHT CONDITION
07145023	7/1	TWA	B-747	JT9D	C	B	7	C	5
08045031	7/22	TWA	B-707	JT3D	C	B	1	C	4
08085034	7/20	CAPX	DC-8	JT4A	T	B	7	C	4
08135039	7/30	UAL	B-747	JT9D	T	B	2	C	4
08145034	8/2	EAL	DC-9	JT8D	T	D	2	NC	4
08155035	8/5	TWA	B-747	JT9D	T	B	2	C	4
08255031	7/30	UAL	B-747	JT9D	T	B	7	C	4
08265034	8/11	TWA	B-747	JT9D	T	S	2	NC	4
08275034	8/8	AAA	BA-111	SPEY	T	B	7	C	6
08295030	8/12	FAL	CV-340	501	T	D	1	NC	7
08275033	8/27	SWAX	B-737	JT8D	T	B	7	C	7
09025029	8/20	PAI	B-737	JT8D	F	B	3	C	4
09055028	7/30	CAPX	DC-8	JT4A	T	B	1	C	4
09055031	8/16	TWA	L-1011	RB211	T	B	1	C	4
09155023	8/28	WAA	SC-7	TPE331	T	B	1	C	7
09085032	8/14	TWA	B-707	JT3D	C	B	7	C	4
09095029	8/25	UAL	B-747	JT9D	T	D	2	NC	5
09115025	7/31	BNF	B-727	JT8D	C	B	2	NC	4
09125022	8/27	UAL	DC-10	CF6	C	B	1	C	4

SDR NO.	DATE	SUBMITTER	AIRCRAFT	ENGINE	COMPONENT	FRAGMENT TYPE	CAUSE	CONTAINMENT CONDITION	FLIGHT CONDITION
09155025	8/21	CAPX	DC-8	JT4A	T	B	7	C	4
09165028	7/27	NWA	B-747	JT9D	T	B	1	C	4
09165029	9/4	TWA	L-1011	RB211	T	B	1	C	4
09185029	9/3	OZA	DC-9	JT8D	C	B	2	C	4
09255027	9/16	AAA	BA-111	SPEY	T	B	7	C	7
10215020	10/8	AAL	B-707	JT3D	T	B	1	C	4
09185032	8/25	SPAT	HP-137	AZ16F1	T	B	7	C	3
10165021	10/7	NWA	B-727	JT8D	C	B	2	C	4
10305018	10/19	AAL	DC-10	CF6	F	B	3	NC	4
10305019	10/13	AAL	DC-9	JT8D	T	B	7	NC	3
11035025	10/19	TWA	B-707	JT3D	C	B	3	C	3
11035026	10/19	TWA	L-1011	RB211	C	B	2	C	3
11105025	10/23	TWA	B-707	JT4A	T	B	7	C	4
11105026	10/29	WAA	F-27A	DART	T	D	2	NC	6
11145025	10/30	TX1	DC-9	JT8D	T	B	1	C	4
11185027	11/6	PAA	B-747	JT9D	C	D	2	NC	4
11215027	11/7	AAL	B-707	JT3D	T	B	2	C	4
12015026	11/13	AAA	BA-111	SPEY	T	B	7	C	3
12035031	11/19	SBWX	DC-8	JT3D	T	B	2	C	4

SDR NO.	DATE	SUBMITTER	AIRCRAFT	ENGINE	COMPONENT	FRAGMENT TYPE	CAUSE	CONTAINMENT CONDITION	FLIGHT CONDITION
12045030	11/17	SAAX	L-188	501	T	B	7	C	1
12095029	11/21	TWA	B-707	JT3D	C	B	7	C	4
12115028	12/2	WAL	DC-10	CF6	T	B	7	C	4
12165029	12/2	SAAX	L-382	501	T	B	7	C	2
12165030	12/2	TWA	B-727	JT8D	T	B	2	C	3
12165031	11/25	DAL	L-1011	RB211	T	B	1	C	5
12175023	12/7	TWA	DC-9	JT8D	T	B	7	C	3
01076032	12/21	WRLX	B-747	JT9D	T	B	7	C	4
01096030	12/28	TWA	B-707	JT3D	C	B	7	C	3
01096032	12/25	TWA	B-747	JT9D	T	B	2	C	4
01136030	12/31	TXI	DC-9	JT8D	T	B	7	C	3
01026028	12/17	AAL	B-727	JT8D	T	B	1	C	6
02035023	2/3	NCA	DC-9	JT8D	C	-	3	-	3
07115007	7/11	TWA	B-727	JT8D	C	-	3	-	3
10145024	10/5	TXI	DC-9	JT8D	C	-	3	-	5
07115023	7/11	FECT	MD-20	CF7	F	-	3	-	3
09105005	8/27	AAA	BAC111	SPEY	C	-	3	-	5
09265014	9/12	HAL	DC-9	JT8D	F	-	3	-	3
10305018	10/30	AAL	DC-10	CF6	C	-	3	-	5

SDR NO.	DATE	SUBMITTER	AIRCRAFT	ENGINE	COMPONENT	FRAGMENT TYPE	CAUSE	CONTAINMENT CONDITION	FLIGHT CONDITION
09035021	9/3	FECT	MD-20	CF7	F	-	3	-	3
10205027	9/23	FECT	MD-20	CF7	C	-	3	-	4
10085029	10/8	FECT	MD-20	CF7	C	-	3	-	4
10085030	9/23	AAA	DC-9	JT8D	C	-	3	-	5
11195026	11/2	AAA	BAC111	SPEY	C	-	3	-	3
11105022	10/27	FAL	CV-580	501	C	-	3	-	6
10225028	10/13	SAAS	L-382	501	C	-	3	-	3
05065026	5/6	SRAX	L-382	501	C	-	3	-	3
04085028	4/8	SAAS	L-382	501	C	-	3	-	4
01215021	1/21	ATAX	L-382	501	C	-	3	-	4
06055024	6/5	AIAX	L-382	501	C	-	3	-	5
01205021	1/20	FECT	MD-20	CF7	F	-	3	-	3
02215043	2/6	UAL	B-737	JT8D	C	-	3	-	1
12195026	12/8	PAI	B-737	JT8D	C	-	3	-	3
04175025	4/9	ACAX	B-737	JT8D	F	-	3	-	3
11075025	10/25	AAL	B-747	JT9D	F	-	3	-	3
11195025	11/19	PAA	B-747	JT9D	C	-	3	-	4
02105035	1/27	AAL	B-747	JT9D	F	-	3	-	3
01295032	1/19	TWA	B-707	JT3D	F	-	2	-	3

SDR NO.	DATE	SUBMITTER	AIRCRAFT	ENGINE	COMPONENT	FRAGMENT TYPE	CAUSE	CONTAINMENT CONDITION	FLIGHT CONDITION
02135040	2/4	AAL	B-707	JT3D	C	-	3	-	10
02185033	1/31	AAL	BA-111	SPEY	C	-	2	-	2
01295031	1/16	NAL	DC-10	CF6	F	-	3	-	3
02275036	2/12	UAL	DC-10	CF6	F	-	3	-	3
04095029	3/25	SRAX	L-382	501	C	-	3	-	4
04215019	4/8	FAL	CV-580	501	C	-	3	-	4
04285027	4/16	BNF	B-727	JT8D	C	-	3	-	3
05075037	4/28	TWA	L-1011	RB211	C	-	2	-	3
05085030	4/20	SRAX	L-382	501	C	-	3	-	4
05095007	4/29	AAL	B-727	JT8D	F	-	3	-	3
05165023	5/6	FAL	CV-580	501	T	-	2	-	7
07075018	6/16	CAL	B-727	JT8D	T	-	7	-	4
07095021	6/24	SRAX	L-382	501	C	-	3	-	3
07115011	6/24	AAL	BA-111	SPEY	C	-	3	-	7
07145027	6/30	TWA	L-1011	RB211	C	-	2	-	3
07155023	6/26	AAA	DC-9	JT8D	F	-	3	-	3
07245032	7/7	CAL	B-727	JT8D	C	-	4	-	4
08285034	8/13	SFO	S61-N	CT58	C	-	2	-	10
08055032	6/29	AIAX	L-382	501	T	-	2	-	8

SDR NO.	DATE	SUBMITTER	AIRCRAFT	ENGINE	COMPONENT	FRAGMENT TYPE	CAUSE	CONTAINMENT CONDITION	FLIGHT CONDITION
09025028	8/14	FAL	CV-580	501	T	-	2	-	7
08145035	8/2	NAL	B-727	JT8D	T	-	7	-	4
10155026	10/2	BNF	B-727	JT8D	T	-	2	-	8
10215019	9/18	FECT	MD-20	CF7	F	-	3	-	1
10225030	9/24	SFO	S61-N	CT58	C	-	2	-	5
11115025	10/20	SOU	DC-9	JT8D	T	-	2	-	3
11195025	10/30	PAA	B-747	JT9D	C	-	3	-	4
11055024	10/20	TWA	B-747	JT9D	T	-	2	-	4
12235024	11/28	SOU	DC-9	JT8D	C	-	3	-	4
01086033	12/27	TWA	L-1011	RB211	C	-	7	-	4
01126029	12/30	BNF	DC-8	JT3D	C	-	2	-	3
02255168	2/25	DAL	DC-10	CF6	T	-	2	-	3
01135023	1/13	NAL	DC-10	CF6	T	-	7	-	4
08215033	8/21	NAL	DC-10	CF6	T	-	7	-	4
03045037	2/17	TWA	L-1011	RB211	C	-	2	-	3
01025020	1/2	DKOT	MD-20	CF7	C	-	3	-	2
08285034	8/28	SFO	S61-N	CT58	C	-	2	-	3
01145033	1/14	DAL	B-727	JT8D	C	-	2	-	7
04115030	4/11	BNF	B-727	JT8D	C	-	2	-	4

SDR NO.	DATE	SUBMITTER	AIRCRAFT	ENGINE	COMPONENT	FRAGMENT TYPE	CAUSE	CONTAINMENT CONDITION	FLIGHT CONDITION
10015031	10/1	TWA	B-727	JT8D	T	-	2	-	1
02105034	2/10	UAL	B-747	JT9D	T	-	2	-	3
08265035	8/11	TWA	B-747	JT9D	T	-	2	-	3
08115031	7/26	TWA	B-747	JT9D	T	-	2	-	3
05095096	5/9	EAL	L-1011	RB211	C	-	7	-	6
05225079	5/22	EAL	L-1011	RB211	C	-	7	-	3
02105082	2/10	EAL	L-1011	RB211	C	-	7	-	3
02105078	2/10	EAL	L-1011	RB211	C	-	7	-	3
01165058	1/16	EAL	L-1011	RB211	C	-	7	-	3
01165057	1/16	EAL	L-1011	RB211	C	-	7	-	10
01165054	1/16	TWA	L-1011	RB211	C	-	7	-	5
01165056	1/16	EAL	L-1011	RB211	C	-	7	-	3
03075047	3/7	TWA	L-1011	RB211	C	-	7	-	3
03065075	3/6	TWA	L-1011	RB211	C	-	7	-	10
03045131	3/4	TWA	L-1011	RB211	C	-	7	-	6
01175055	1/17	EAL	L-1011	RB211	C	-	7	-	3
02255180	2/25	EAL	L-1011	RB211	C	-	7	-	2
07035028	7/3	TWA	L-1011	RB211	C	-	7	-	4
02255114	2/25	EAL	L-1011	RB211	C	-	7	-	6

SDR NO.	DATE	SUBMITTER	AIRCRAFT	ENGINE	COMPONENT	FRAGMENT TYPE	CAUSE	CONTAINMENT CONDITION	FLIGHT CONDITION
04215066	4/21	PSAX	L-1011	RB211	T	-	3	-	1
02255113	2/25	EAL	L-1011	RB211	T	-	7	-	4
04085021	3/28	EAL	L-1011	RB211	C	-	3	-	4
09025007	8/14	UAL	B-727	JT8D	C	-	3	-	5
11135020	10/27	TWA	L-1011	RB211	C	-	3	-	3

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