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A Study of Bird Ingestions Into Large High Bypass Ratio Turbine Aircraft Engines

Gary Frings

US Department of Transportation
Federal Aviation Administration
Technical Center
Atlantic City Airport, N.J. 08405

NOTICE

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16. Abstract

From May 1981 to June 1983, the Federal Aviation Administration (FAA) Technical Center conducted a detailed study of bird ingestions into large high bypass ratio turbine aircraft engines. The worldwide study covered over 2.7 million operations by 1,513 aircraft consisting of the DC8, DC10, B747, B757, B767, A300, A310, and L1011. The objective of this study was to determine the numbers, weights, and species of birds being ingested into these engines and determine what engine damage, if any, resulted. This report presents the findings of this study.

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CF6		

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EXECUTIVE SUMMARY

An investigation was initiated by the Federal Aviation Administration Technical Center in May 1981 and completed in June 1983, to determine the numbers, weight, and species of birds which are ingested into large high bypass ratio (HBPR) turbine aircraft engines during service operation and determine what damage, if any, resulted.

A total of 1513 HBPR engined aircraft conducted 2.74 million operations during the study period. The aircraft studied were the DC8, DC10, A300, B747, B757, B767, L1011, and A310.

Because there were at least 2.7 million bird ingestion opportunities and only 638 aircraft bird ingestion events were observed, an ingestion is considered a rare (2.33×10^{-4}) but probable event. This represents 233 bird ingestion events per million aircraft operations. Approximately 1.25 million HBPR engined aircraft operations are conducted per year. The monthly distribution of the 638 total worldwide bird ingestion events are shown in figure E-1.

The most commonly ingested family of birds are gulls (Laridae). The majority of the 85 bird species identified during this study are flocking birds. The United States (U.S.) and foreign bird weight distributions are different. The United States bird ingestion rate is significantly lower than the foreign rate. Seasonal changes appear to affect the bird ingestion rate. Wing mounted engines experience significantly more ingestions than center aft mounted engines. Twenty-five airports account for 36 percent of all reported worldwide bird ingestions, and it is noted that 76 percent of all bird ingestions occur in the airport environment during landing and takeoff. The majority of bird ingestions, engine damage, and engine failures occur in the bird weight range of 9 to 24 ounces. Five percent (32) of the reported bird ingestions resulted in engine failure. Analysis reveals that the engine failures cannot be predicted based only on the knowledge of the bird weight and bird numbers. To accomplish this, one must consider factors such as damage tolerance assessments, flight dynamics, and others which were not within the scope of this study. The majority of bird ingestions resulted in either minor or no damage to the engine.

Significant findings resulting from this study are presented below. The detailed discussion of these findings are presented in Section 3 of this report.

Aircraft Bird Ingestion (B.I.) events	638
Engines experiencing B.I.	666
Average bird weight, United States	30 ounces
Average bird weight, foreign	25 ounces
Most commonly ingested bird, United States	Gull
Most commonly ingested bird, foreign	Kite, Gull
Engines which experienced damage (minor and/or major damage)	416
Multiple engine ingestion events per aircraft	25
Multiple birds per engine	65
Takeoff and climb phase-of-flight (for known events)	61%
Approach and landing phase-of-flight (for known events)	36%
Airports where B.I. events occurred	137
Airlines reporting B.I. events	83

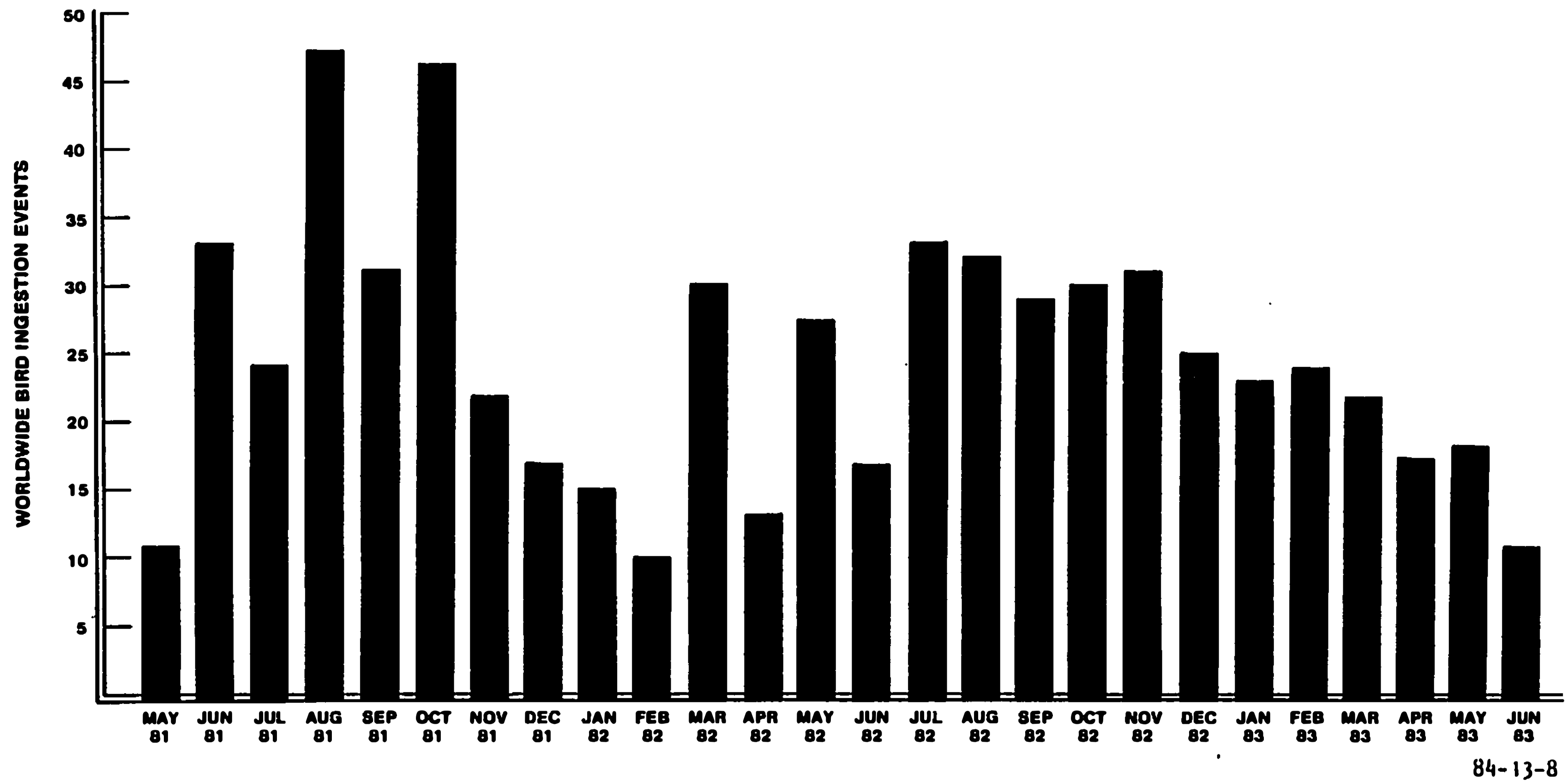


FIGURE E-1. MONTHLY DISTRIBUTION OF WORLDWIDE BIRD INGESTION EVENTS

1. INTRODUCTION.

1.1 BACKGROUND.

National Transportation Safety Board (NTSB) Recommendation A-76-64 was issued April 1, 1976, as a result of an aircraft accident involving a rejected takeoff after "a number of large birds" were ingested into one of the engines. This recommendation stated in part"

> "Amend 14 CFR 33.77 to increase the maximum number of birds in the various size categories required to be ingested into turbine engines with large inlets. These increased numbers and sizes should be consistent with the birds ingested during service experience of these engines." (Class III - Longer Term Follow-up)

In response to the Safety Board's subsequent inquiry of July 30, 1980, the Federal Aviation Administration (FAA) on October 30, 1980, summarized the status of the work addressing the recommendation made by NTSB. The FAA had made several examinations of NTSB, FAA, and industry engine records to determine the numbers and weights of birds being ingested into turbine engines with large inlets. These high bypass ratio (HBPR) engines started to enter airline service early in 1969. A study of available records was also made by an Ad-Hoc Committee of the Aerospace Industries Association of America, Inc., in 1978. All of these industry and Government efforts, relying on available records, did not provide the pertinent information necessary to make a decision concerning possible revision of the weights and numbers of birds required to be ingested for engine type certification.

The FAA acknowledged the need for better data relating to the number and weights of birds being ingested in service operation. Because normal reporting activity was not providing sufficient information of this kind, the FAA initiated a special project by the FAA Technical Center. A worldwide data base will be established. This data base, together with other pertinent information, will be used to determine if amendment to existing engine certification standards is warranted.

1.2 OBJECTIVE.

The objective of this investigation was to determine the numbers, weights, and species of birds which are ingested into large high bypass ratio (HBPR) turbine aircraft engines during worldwide service operation and determine what damage, if any, resulted.

1.3 ORGANIZATION OF THIS REPORT.

This report has been organized into four major sections. Section 1 is the Introduction. Section 2, Plans and Procedures, describes the framework utilized in the conduct of this study. Data Analysis and Results are presented in Section 3. Sections 4 and 5 present the summary and conclusions of this report, respectively.

2. PLANS AND PROCEDURES.

2.1 PLAN DESCRIPTION.

This study was limited to enigne bird ingestions experienced by large high bypass ratio (HBPR) turbine aircraft engines during worldwide service operations. Therefore, the following guidelines were established to structure an overall plan to conduct this study:

- Worldwide consideration of data
- Familiarity with the engine design criteria
- Proven expertise and prior experience on engine foreign object ingestion interpretation
- Standardized reporting
- Minimum impact on the operational fleet
- Proven expertise in bird identification
- Airline cooperation and understanding of need
- Quick response
- Report of all known engine bird ingestions

Based on these guidelines, it was determined that the most effective approach would be to have the engine manufacturers investigate the bird ingestion incidents on their respective engines. Manufacturing of large high bypass ratio turbine aircraft engines is conducted by Pratt and Whitney Aircraft (PWA), General Electric Company (GE), Rolls Royce, Inc., (RR), and CFM International (CFMI), a joint GE/SNECMA corporation. This offered the benefit of the engine manufacturer's expertise in damage tolerance assessment and will allow them to use their worldwide service organizations to investigate engine ingestion events quickly.

The information in this study was obtained by the manufacturers in cooperation with the Air Transport Association of America (ATA) and the International Air Transport Association (IATA) and their member airlines. Whenever possible, the engine manufacturers used the services of a recognized ornithologist to identify the bird species. This study spanned twenty-six (26) months from May 1981 to June 1983.

2.2 ASSUMPTIONS, COVERAGE, AND EXPOSURE DEFINITIONS.

2.2.1 Assumptions. In order to meet FAA information needs as well as data analysis objectives of this study, a framework for the data collection was established. This framework consisted of the following assumptions:

1. This study will be a census of the worldwide bird ingestion events.
2. A bird ingestion event is a rare but probable phenomenon. Few such events are expected.
3. The bird characteristics, i.e., the number, weight, and species must be determined.

2.2.2 Coverage. The aircraft with HBPR engines in service during the study period constituted the total population of this study. The four engine models — JT9D (PWA), CF6 (GE), RB.211 (RR), and CFM 56 (CFMI) — were arbitrarily assigned a coding of one through four for the engine identifier. The eight aircraft types studied were also encoded in the data base but will be identified by name in this report. The aircraft types are McDonnel-Douglas DC8-70 series and DC10; Boeing B747, B757, B767; Airbus A300 and A310; and Lockheed L1011.

A comparison of relative size, shape, and engine position for these HBPR engined aircraft is shown in appendix A. The distribution of these aircraft is shown in figure 2.1. The engine distribution by make and model for these aircraft are shown in table 2.1.

2.2.3 Exposure. During the development of the analysis plan, it became apparent that bird ingestion incidence data by itself will not be useful unless some measure of exposure is defined. In other words, to understand the magnitude of the bird ingestion problem it is essential to determine the level to which the aircraft in table 2.1 was exposed, on a worldwide bases, to potential bird ingestions. To compare and contrast the bird ingestion rates of the various aircraft types, it was necessary to determine the total number of operations conducted during the study period. An "operation," as used in this study, is contrary to normal Federal Aviation Administration (FAA) practice. A flight, for example, from airport "A" to airport "B" is counted as one operation. The main source used in determining numbers of operations was the Official Airline Guide (OAG) computer tapes, which are updated every month. These tapes were used to identify the airline schedules and provide data such as aircraft type, departure and arrival airports, frequency of flight, and domestic/foreign operations. To validate the accuracy of the OAG operational data, engine manufacturers' data were used as a cross-check. Their operational count was 6.3 percent higher (163,000 operations) than the OAG data. Further investigation revealed that 92,000 of these operations involved the B747 aircraft which is extensively used for freighter operations and, therefore, not always included in OAG data. The data reported in this study include freighter operations. Worldwide, approximately 2.7 million operations occurred during the study period. This constituted the total exposure for the bird ingestion phenomenon to occur for the worldwide HBPR engined aircraft fleet. The worldwide operations by aircraft type is shown in figure 2.2.

2.3 DATA ADEQUACY.

In order to determine if sufficient data had been collected to allow conclusions to be formulated, the following guidelines were established:

- Sufficient data to allow a reliable assessment of the bird ingestion phenomenon.
- Sufficient data to conduct a statistical analysis based upon the numbers, weights, and species of birds.
- Sufficient data to conduct a statistical analysis of the engine damage resulting from a bird ingestion — considering the bird number, weight, and species.
- Sufficient data to conduct a statistical analysis of the year-to-year variation (if any) of the bird ingestion phenomena.

Based on these guidelines, it was reported at the end of the first year's data collection effort (reference 1) that the data base at that time appeared to be inadequate, in most instances, to allow conclusions to be formulated. It was not known at the time if the first year's bird ingestion data were representative of the ingested bird population distribution for a typical year. For these reasons, the data collection effort was extended for another fourteen (14) months. A comparison of the first and second year's cummulative distribution of ingestion events is presented in table 2.2 and graphically represented in figure 2.3.

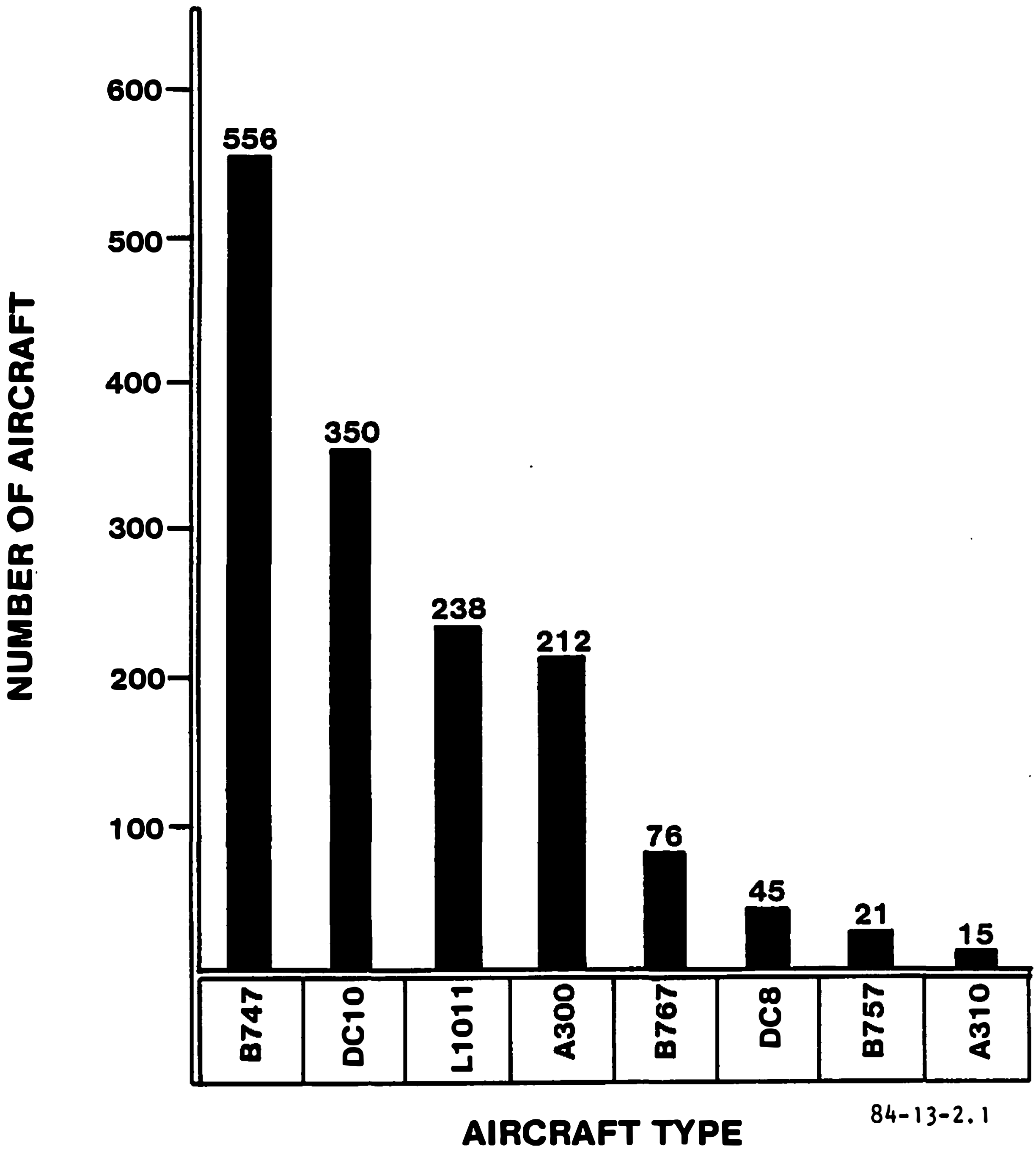


FIGURE 2.1 AIRCRAFT DISTRIBUTION

TABLE 2.1 NUMBERS OF AIRCRAFT AND HBPR ENGINES IN SERVICE AS OF JUNE 30, 1984

			DC8	DC10	A300	B747	B757	B767	L1011	A310
PWA	JT9D	-3,-7				326				
	JT9D	-70,-7Q*				86				
	JT9D	-59		20	23					
	JT9D	-20		22						
	JT9D	-7R4				7		49		6
	Aircraft Sub-Total			42	23	419		49		6
	Engine Sub-Total			126	46	1676		98		12
GE	CF6	-6		127						
	CF6	-50*		181	189	93				
	CF6	-80						27		9
	Aircraft Sub-Total			308	189	93		27		9
	Engine Sub-Total			924	378	372		54		18
RR	RB.211	-22B							160	
	RB.211	-524*				44			78	
	RB.211	-535*					21			
	Aircraft Sub-Total					44	21		238	
	Engine Sub-Total					176	42		714	
CFMI	CFM56	-2*	45							
	Aircraft Sub-Total		45							
	Engine Sub-Total		180							
	Total Aircraft		45	350	212	556	21	76	238	15
	Total Engines		180	1050	424	2224	42	152	714	30

Grand Aircraft Total - 1513, Grand Engine Total - 4816 (PWA - 1958, GE - 1746, RR - 932, CFMI - 180)

* Shown pictorially in appendix B.

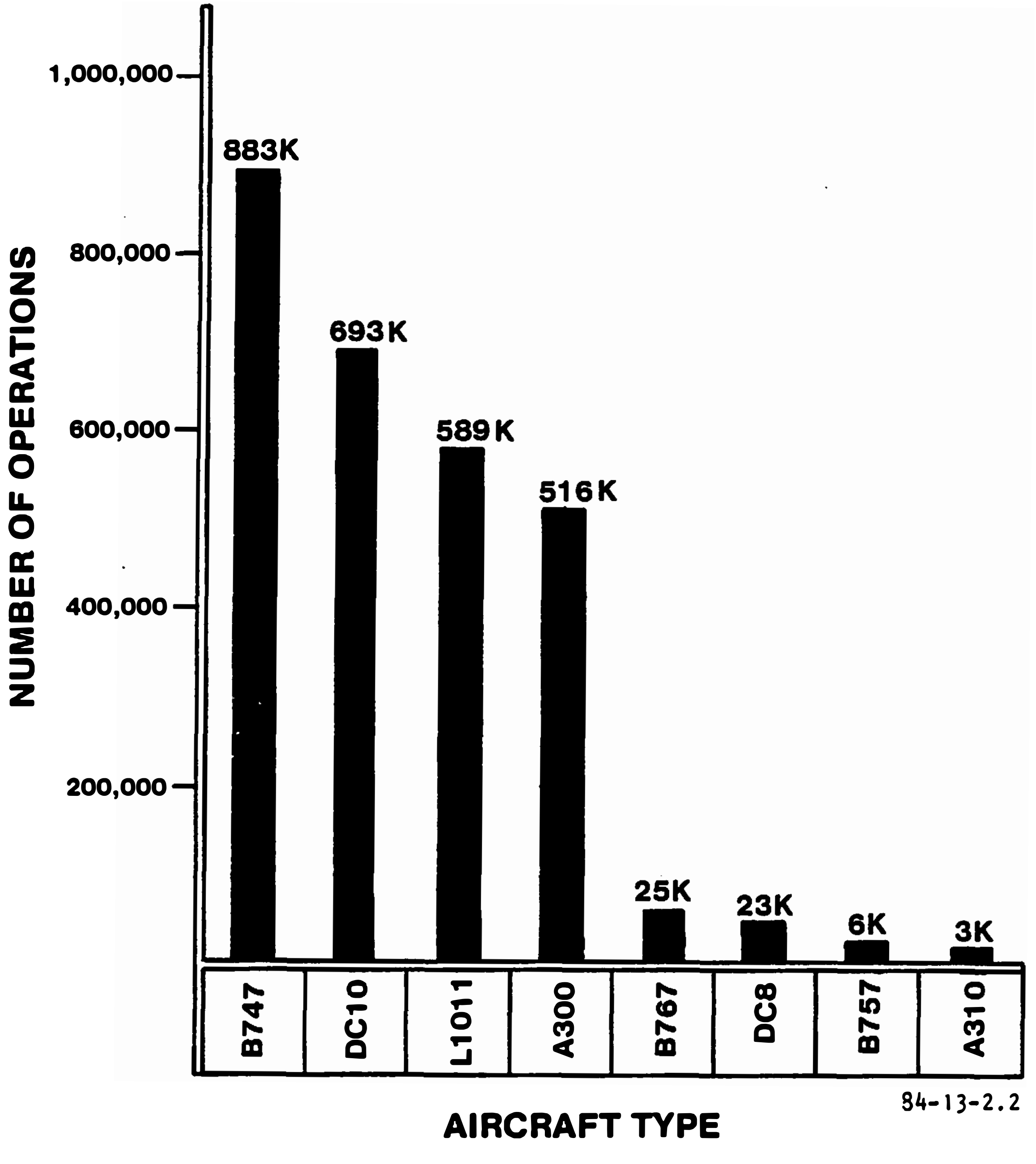


FIGURE 2.2 OPERATIONAL DISTRIBUTION

TABLE 2.2 CUMULATIVE DISTRIBUTION OF INGESTION EVENTS FOR 1ST AND 2ND YEAR

Year 1			Year 2		
Month	Events	Cum. %	Month	Events	Cum. %
May 81	11	3.7	May 82	27	8.7
Jun 81	33	14.7	Jun 82	17	14.2
Jul 81	24	22.7	Jul 82	33	24.8
Aug 81	47	38.5	Aug 82	32	35.2
Sep 81	31	48.8	Sep 82	29	44.5
Oct 81	46	64.2	Oct 82	30	54.2
Nov 81	22	71.6	Nov 82	31	64.2
Dec 81	17	77.3	Dec 82	25	72.3
Jan 82	15	82.3	Jan 83	23	79.7
Feb 82	10	85.6	Feb 83	24	87.4
Mar 82	30	95.7	Mar 83	22	94.5
Apr 82	13	100.0	Apr 83	17	100.0
Total	299			310	

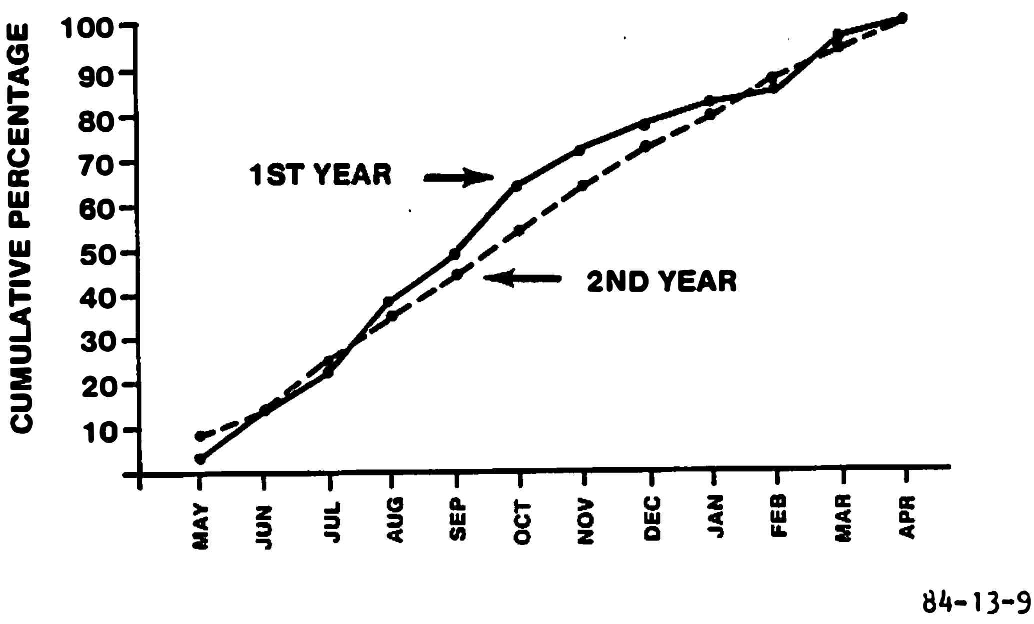


FIGURE 2.3 CUMULATIVE DISTRIBUTION OF 1ST AND 2ND YEAR BIRD INGESTION EVENTS

In order to ascertain whether the bird ingestions event distributions were the same for both year 1 and year 2, the non-parametric test of Kolmogorov-Smirnov was employed. The details of this test are presented in appendix C. The test shows that at a significant level of five (5) percent, we can safely state that there is no difference in the empirical distribution shown in figure 2.3 for year 1 and year 2. Therefore, both of these distributions are drawn from a common parent distribution. Revised (different time span) first and second year cumulative distributions are presented in table 2.3 and in figure 2.4. The statistical test cited above affirms the same conclusion for this revised data as was reached above.

Based upon these results, it was decided not to collect further bird ingestion data because it was apparent that the data which had been collected were representative for both years of the worldwide bird ingestion environment for the aircraft types studied. Had this study been extended one or possible two more years a significant shift in the bird distribution characteristics would not be expected. Additional bird ingestion data collection may be required for the newer aircraft and/or engine models which have recently entered commercial revenue service (DC8-70 series, B757, B767, A310) because of their limited exposure history as evidenced by figures 2.1 and 2.2.

3. DATA ANALYSIS AND RESULTS.

3.1 DESCRIPTION OF ANALYSIS CATEGORIES.

The analysis of the data presented in the following sections is confined to five (5) major categories:

- Characteristics of Ingested Birds
- Ingestion Rates
- Airport Bird Ingestion Experience
- Engine Damage and Failure Description
- Probability Estimate of Bird Ingestion Related Events

Various analytical techniques were employed to manage the more than 15,000 pieces of information collected during the twenty-six (26) months of this bird ingestion study. These analytical techniques are briefly described in appendix C. The use of these techniques required only minimal assumptions of the underlying statistical distributions of these data and only a generalized knowledge of bird habits. Delineating all the factors relating to bird ingestions contained in the 15,000 pieces of information was not attempted.

3.2 CHARACTERISTICS OF INGESTED BIRDS.

3.2.1 Bird Types. The identification of the types and sizes of birds being ingested into high bypass ratio engines was the prime objective of this report. Appendix D was constructed to give engineers, ornithologists, airport managers, aircraft flight personnel, and other interested parties in the aircraft engine bird ingestion phenomenon a standardized description of the order, family, and species of birds encountered, typical estimated weights, and frequency of occurrence. References 2, 3, and 4 were used extensively in structuring appendix D. It was recognized, while constructing this appendix, that considerable weight variations may be found among individual birds of any one species. The weights shown in appendix D represent an assement of the average weights based on

TABLE 2.3 CUMULATIVE DISTRIBUTION OF INGESTION EVENTS FOR REVISED 1ST and 2ND YEAR

Year 1			Year 2		
Month	Events	Cum. %	Month	Events	Cum. %
Jul 81	24	8.0	Jul 82	33	11.2
Aug 81	47	23.8	Aug 82	32	22.0
Sep 81	31	34.1	Sep 82	29	31.9
Oct 81	46	49.5	Oct 82	30	42.0
Nov 81	22	56.9	Nov 82	31	52.5
Dec 81	17	62.5	Dec 82	25	61.0
Jan 82	15	67.5	Jan 83	23	68.8
Feb 82	10	70.9	Feb 83	24	76.9
Mar 82	30	80.9	Mar 83	22	84.4
Apr 82	13	85.3	Apr 83	17	90.2
May 82	27	94.3	May 83	18	96.3
Jun 82	17	100.0	Jun 83	11	100.0
Total	299			295	

*This table excludes first two months of data (namely April 81 and May 81).

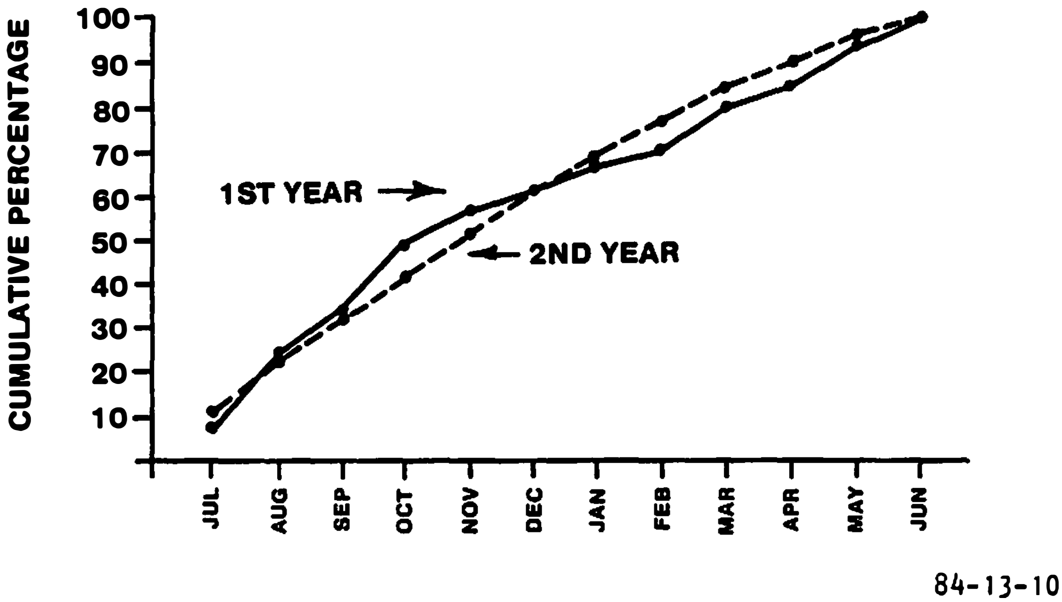


FIGURE 2.4 CUMULATIVE DISTRIBUTION OF REVISED 1ST AND 2ND YEAR BIRD INGESTION EVENTS

the available information from references 3 and 4, and weight information submitted by the engine manufacturers on individual bird ingestion events.

During the course of this study, 85 bird species were identified as having been involved in aircraft engine ingestions. The overwhelming majority of these species (79) are flocking birds or birds which group together on the ground (in this case, the airport) after feeding or while resting. Flocking and grouping birds present the greatest hazard to aircraft. The most hazardous family of birds, in terms of aircraft engine ingestions, is Laridae (gulls, etc.) which alone account for 35 percent of all engine ingestions. The gulls are closely followed by Accipitridae (kites, etc.) which account for 20 percent of all ingestions. Examination of appendix E shows that two- and three-engine bird ingestions are almost all caused by flocking bird species.

Appendix F offers a visual perspective of the morphology of the most commonly ingested birds. The birds depicted in this appendix represent species which have been ingested five or more times. These birds are shown relative to their sizes measured from the tip of the bill to the tip of the tail.

It has been possible to validate the bird weight in over 50 percent of the bird ingestions. Bird remains were collected from the engines by the manufacturers and sent to the Smithsonian Institution for identification and analysis by an ornithologist. From the remains, the ornithologist not only determined species but in many cases also sex and maturity. This information, together with location and time of year, enabled the ornithologist to determine a range of weights for the bird(s). The majority of bird weights reported in this study are the midpoints of the range of weights as reported by the ornithologist.

3.2.2 Bird Weight Distribution. Figure 3.1 shows the worldwide distribution of bird weights and also highlights the average, most likely, and median bird weights. The average bird weight per event was calculated by summing all known bird weights which appeared for each event and dividing this result by the number of events. The most likely weight is that weight which occurs the most frequently. The weight at which an equal number of weights occur, both above and below it, is called the median weight. It should be noted that with the exception of the very heavy, large birds (vultures, eagles, storks, herons, geese, etc.) which are shown in figure 3.1 as weighing more than 64 ounces (>64), the bird weight distribution is very sparse above 40 ounces (2.5 pounds). Figure 3.1 also shows that a disproportionate number of events occur at discrete weights. In many of these cases, the weight is peculiar to certain bird species. For example, 10 and 11 ounces - black-headed gulls, silver gulls; 16 ounces - pigeons, rock doves, ring-billed gulls; 20 ounces - crows, black-tailed gulls; 24 and 28 ounces - black kite; 32 ounces - red kite, pintail duck, lesser black-backed gull, black kite; 36 and 40 ounces - Herring gull, red kite, mallard duck.

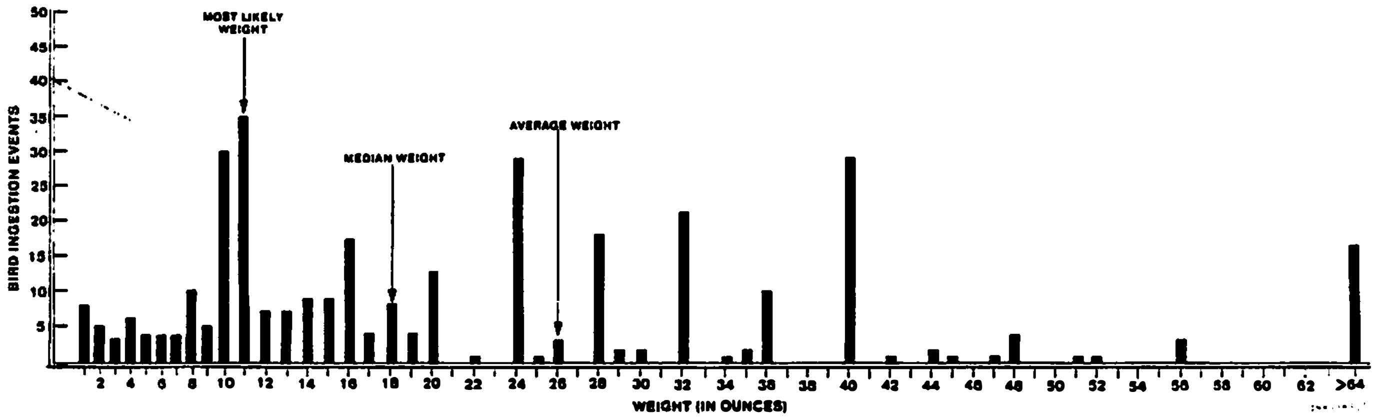


FIGURE 3.1 WORLDWIDE DISTRIBUTION OF BIRD WEIGHTS

A summary of the bird weights, United States versus foreign is presented in table 3.1.

TABLE 3.1 BIRD WEIGHT SUMMARY

	U.S.	Foreign	Unknown	Worldwide
Number of Events	97	494	47	638
Known Weight Events	66	254	19	339
Average Bird Weight Per Event	30 oz.	25 oz.	20 oz.	26 oz.
Most Likely Bird Weight	40 oz.	11 oz.	*	11 oz.
Median Bird Weight	34 oz.	17 oz.	15 oz.	18 oz.

* No single weight can be identified (see figure 3.2), observations are limited.

3.2.3 Bird Distribution, United States Versus Foreign. The weight distribution, by origin of ingestion, is presented in table 3.2 and figure 3.2. The cumulative weight distribution by bird origin is presented in table 3.3 and figure 3.3.

To determine if these two bird weight distributions shown in figure 3.3, United States versus foreign, are similar, an appropriate statistical test the Kolmogorov-Smirnov (K.S.) two-sample test is applied. This test is concerned with the agreement between two sets of sample values. Two weight samples drawn from the same weight population distribution, should show that the cumulative distributions of both weight samples may be expected to be fairly close to each other and should show only random deviations from the weight population distributions. Should the cumulative weight distributions of the two samples diverge too much at any point,

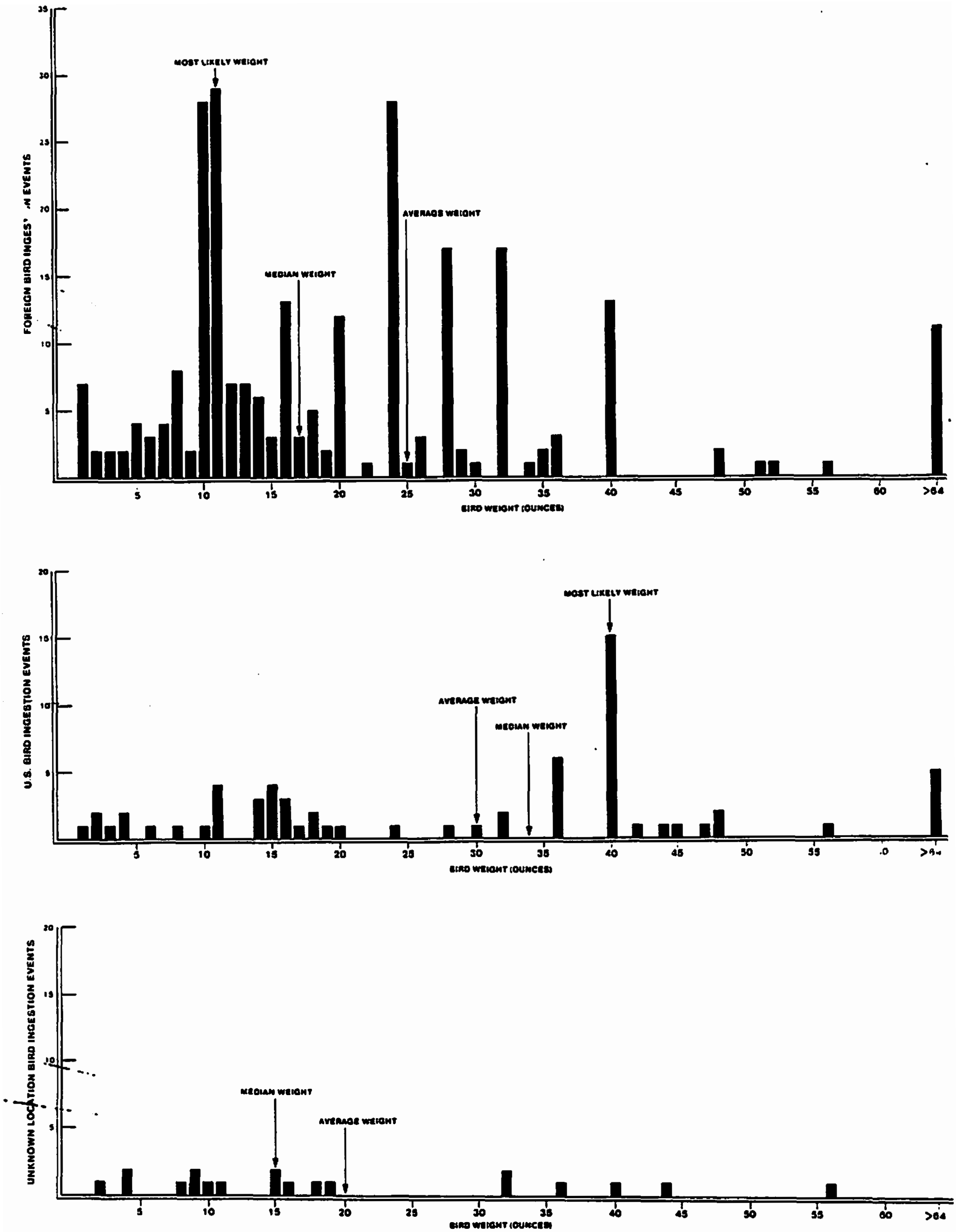


FIGURE 3.2 BIRD WEIGHT DISTRIBUTION BY ORIGIN OF INGESTION

TABLE 3.2 WEIGHT DISTRIBUTION OF BIRD INGESTION EVENTS BY ORIGIN

Weight (oz.)	U.S.	Foreign	Unk.	World
1-4	6	13	3	22
5-8	2	19	1	22
9-12	5	66	4	75
13-16	10	29	3	42
17-20	5	22	2	29
21-24	1	29	0	30
25-28	1	21	0	22
29-32	3	20	2	25
33-36	6	6	1	13
37-40	15	13	1	29
41-44	2	0	1	3
45-48	4	2	0	6
49-52	0	2	0	2
53-56	1	1	1	3
57-60	0	0	0	0
61-64	0	0	0	0
> 64	5	11	0	16
TOTAL	66	254	19	339

TABLE 3.3 CUMULATIVE WEIGHT DISTRIBUTION BY BIRD ORIGIN

Bird Weight	U.S. Cumulative Percentage	Foreign Cumulative Percentage
< 5 oz.	9.1	5.1
< 9 oz.	12.1	12.6
<13 oz.	19.7	38.6
<17 oz.	34.8	50.0
<21 oz.	42.4	58.7
<25 oz.	43.9	70.1
<29 oz.	45.5	78.3
<33 oz.	50.0	86.2
<37 oz.	59.1	88.6
<41 oz.	81.8	93.7
<45 oz.	84.9	93.7
<49 oz.	90.9	94.5
<53 oz.	90.9	95.3
<57 oz.	92.4	95.7
<61 oz.	92.4	95.7
<65 oz.	92.4	95.7
<240	100	100

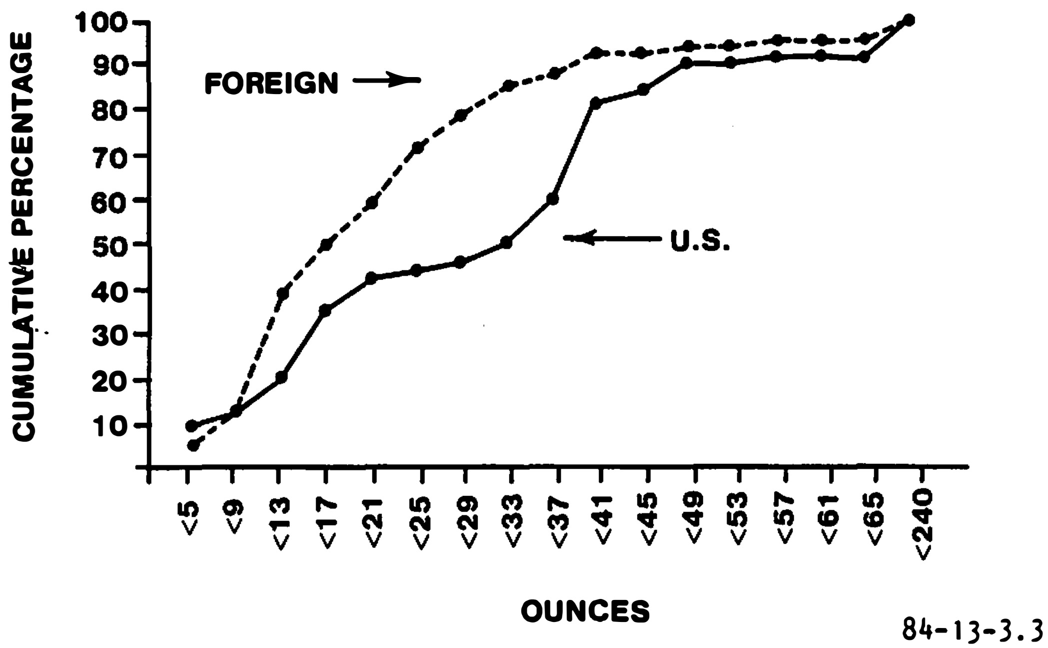


FIGURE 3.3 CUMULATIVE DISTRIBUTIONS OF U.S. AND FOREIGN BIRD WEIGHTS

it would indicate that the observations came from different bird weight distributions. Figure 3.3 clearly shows that large weight deviations exist between the two observed distributions. The largest deviation, 36.2, occurs at cumulative weight interval, <29 ounces. At a significance level of 5 percent, the K.S. test shows that these two distributions are significantly different, that is, the parent distributions (U.S. and foreign) of bird weights are not the same. The weight distributions of foreign, United States, and unknown location bird ingestion events, which were presented in figure 3.2 further enhances this inference.

3.2.4 Seasonal Bird Ingestion Effects. In order to determine seasonal effects on bird ingestion, three factors had to be taken into consideration. First, the northern and southern hemispheres experience opposite seasons. Second, aircraft operational counts increase during the summer months. Third, the operational count steadily increased during the course of this study, due to the lifting of restrictions caused by the air traffic controllers strike of 1981, thereby making it difficult to compare annual seasonal variations.

The seasons were defined for the northern and southern hemisphres as per table 3.4. Inspection of the operational data for this study period revealed that, worldwide, the operational count increased approximately 5 to 10 percent during the summer months when compared to the winter months. Unfortunately, the operational data by season for northern and southern hemispheres were not readily available, but it was determined that the vast majority of aircraft operations for this study were conducted in the northern hemisphere.

TABLE 3.4 SEASONAL DEFINITIONS

Season	Northern Hemisphere	Southern Hemisphere
Spring	March - May	September - November
Summer	June - August	December - February
Fall	September - November	March - May
Winter	December - February	June - August

The ingestion events data were divided into two seasonal cycles. The first cycle contains the ingestion data for the first year of this study (June 1981 - May 1982) and the second cycle contains the ingestion data for the second year of this study (June 1982 - May 1983). These two cycles were compared to each other, first in the northern hemisphere. No seasonal adjustments are necessary for this comparison. The cycles were then compared to each other for both hemispheres combined (worldwide) in conformance with the seasonal definitions set forth in table 3.4. The resulting ingestion events for the northern hemisphere and worldwide (combined hemispheres) are presented in table 3.5 for each of the two cycles.

TABLE 3.5. INGESTION EVENTS BY SEASON

The hypothesis of interest is to determine whether the seasonal ingestion event distributions for the first cycle and the second cycle are the same. For testing this type of hypotheses the chi-square test (appendix C) for homogeniety of two samples was employed. The chi-square values obtained for the northern hemisphere and worldwide are 6.67 and 4.95, respectively, which are not significant at the 95 percent confidence level. Therefore, we can conclude that there are no difference between the two seasonal cycles.

However, this does not imply that there are no differences among the seasons within the cycle itself. In fact, if there were no seasonal effects, the ingestion events should be evenly distributed among the four seasons. An inspection of table 3.5 indicates that during the winter season the ingestion events are significantly less than the summer and fall seasons. The statistical test strongly indicates that ingestion events by season within each of the cycles are heterogeneous and, therefore, seasonal effects on the ingestion phenomenon are not negligible.

3.3 INGESTION RATES.

3.3.1 Bird Ingestion Rates, United States Versus Foreign. Engine bird ingestion rates indicate that the Unted States and foreign bird environments are not the same. A comparison of United States, foreign, and worldwide bird ingestion rates are summarized in figure 3.4. The United States bird ingestion rate is approximately one-third to one-half of the foreign bird ingestion rate, even taking into account those bird ingestions for which locations are unknown (cross-hatched area). The fact that the United States operations count is approximately one-third (35.6 percent - table 3.6) of the total worldwide count, does not explain the difference in the United States versus foreign bird ingestion rates. Examination of table 3.6 shows that the DC10 and L1011 aircraft have approximately equal operations in both the United States and foreign environments, yet both aircraft types display a higher (by a factor greater than 2) foreign ingestion rate than United States ingestion rate. All aircraft types studied exhibited lower ingestion rate while operating in the United States environment than in the foreign environment. The exceptions to this are the B757 and A310 which did not operate extensively in both environments during the course of this study.

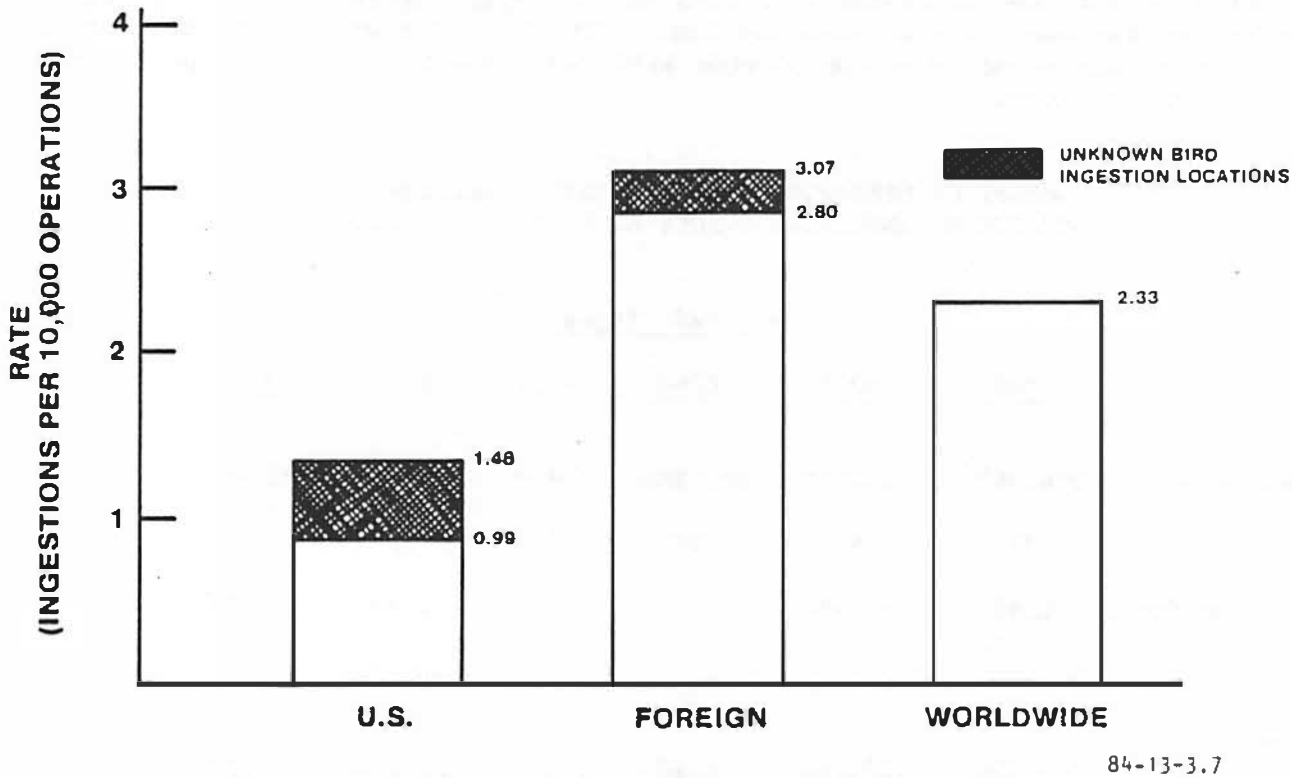


FIGURE 3.4 U.S. FOREIGN AND WORLDWIDE BIRD INGESTION RATES

TABLE 3.6 INGESTION RATES BY AIRCRAFT TYPE

Aircraft Types	Ingestion Events U.S.	Foreign	Unk	World	Operations U.S	Foreign	World	Rates/10K Operations U.S.	Foreign	World
DC8	1	1	0	2	17,047	5,682	22,729	0.59	1.76	0.88
DC10	25	66	6	97	338,475	354,142	692,616	0.74	1.86	1.40
A300	10	133	1	144	78,841	437,405	516,246	1.27	3.04	2.79
B747	34	234	29	297	237,754	645,396	883,150	1.43	3.63	3.36
B757	1	0	0	1	3,079	3,321	6,400	3.25	0.00	1.56
B767	3	1	0	4	22,584	2,554	25,138	1.33	3.92	1.59
L1011	23	57	11	91	277,679	311,321	589,000	0.83	1.83	1.54
A310	0	2	0	2	0	3,040	3,040	0.00	6.58	6.58
Total	97 (15.2%)	494 (77.4%)	47 (7.4%)	638 (100.0%)	975,459 (35.6%)	1,762,861 (64.4%)	2,738,320 (100.0%)	0.99	2.80	2.33

The United States ingestion rate is much lower than the foreign ingestion rate. The statistical test for comparing two Poisson rates (appendix C) indicates that the difference between the United States and foreign rates, under the assumption that these rates are equivalent, is highly unlikely. In other words, the difference noted is not due to random variation but strongly suggests that these rates describe two distinct Poisson distributions. The United States bird environment appears to be different from the foreign bird environment. Table 3.7 presents a summary of these rates.

TABLE 3.7 SUMMARY OF OPERATIONS, EVENTS, AND INGESTION RATES FOR KNOWN LOCATIONS (INGESTION EVENTS BY SELECTED AIRCRAFT TYPES)

	Aircraft Types					
	DC10	A300	B747	B757	B767	L1011
U.S.						
Operations	256,902	86,530	193,580	1,879	11,158	202,802
Events	21	6	27	1	2	15
Rates/10K Ops	0.82	0.69	1.40	5.32	1.79	0.74
Foreign						
Operations	269,354	329,164	511,205	1,505	2,004	175,288
Events	50	97	167	0	1	40
Rates/10K Ops	1.86	2.95	3.37	0.00	4.99	2.28

NOTE: Airport statistics given in this table pertain to only those airports which are identified in appendix E. The airports designated (XUS) Unknown United States, (XFO) Unknown Foreign, and (XXX) Unknown location, are excluded from this table. No airport operations data were available for the DC8 and A310 aircraft.

3.3.2 Comparison Of Bird Ingestion Rates By Aircraft Type.

3.3.2.1 Engine Position. A unique feature of this data gathering effort has been the opportunity to study the bird ingestion phenomenon from the standpoint of aircraft which are engined in three basically different configurations (appendix A). These configurations are: two-wing mounted engines (A300, A310,B757,B767), two wing- and one tail-mounted engine (DC10, L1011), and four wing-mounted engines (B747, DC8). It is of interest to determine whether or not the aircraft engine configuration has an impact on the bird ingestion rate which these aircraft experience. Table 3.6 presented the bird ingestion rates for these aircraft. This analysis is confined to the DC10, A300, B747, and L1011 for which there is sufficent operational and bird ingestion data. The other aircraft have not been in service long enough.

Figure 3.5 presents the bird ingestion location by engine position for the four aircraft types under consideration. The number 2 (center) engine position of the DC10 and L1011 aircraft experienced relatively few bird ingestions when compared to positions 1 and 3. The DC10 experienced 97 ingestion events and only one of these involved the center aft engine (one percent). The L1011 experienced 91 ingestion events and 9 of these involved the center aft engine (10 percent). Figure 3.5 shows the fairly even distribution of bird ingestions among the four aircraft and engine locations under consideration. That the center aft engine location of the DC10 and L1011 aircraft experience relatively few ingestions indicates that this phenomenon is engine position dependent. From the bird ingestion phenomena point of view, these two aircraft types may be considered to have only two engines.

Table 3.6 also showed that the B747 aircraft exhibits the highest bird ingestion rate of all the aircraft types under consideration. Since the B747 is a four-engine (all wing-mounted) aircraft, it should exhibit approximately twice the ingestion rate of the DC10, L1011, or A300. In order to determine the validity of such a hypothesis, the operating environment of the B747 was investigated.

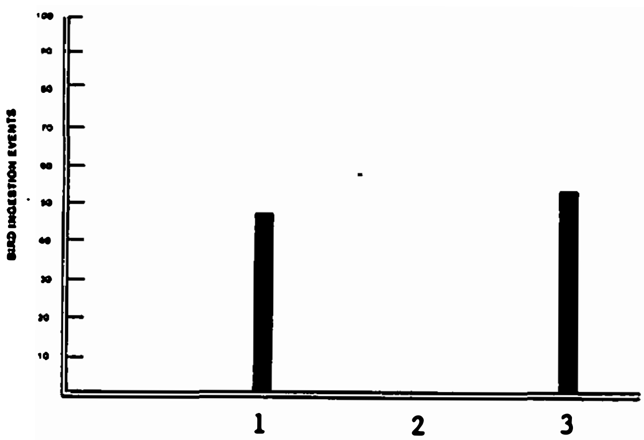
It was determined that the B747 aircraft experienced bird ingestions at 72 known airport locations. The B747 bird ingestion rate at these locations was compared to the bird ingestion rate of the other three aircraft types at the same 72 airports. Table 3.8 presents this data and shows that the B747 ingestion rate, in its exclusive set of 72 airports, is over twice the rate of the DC10 and L1011. The ratio between the A300 and B747 is approximately 1 to 1.7. This suggests that the B747, which has twice the number of wing-mounted engines compared to these other aircraft types, experiences approximately twice the exposure risk. Thus, it is highly probable that four wing-mounted engines will result in greater numbers of bird ingestion events (by a factor of approximately two) than only two wing-mounted engines while operating in a comparable environment.

TABLE 3.8 COMPARISON OF BIRD INGESTION RATES BASED UPON B747 INGESTION LOCATIONS

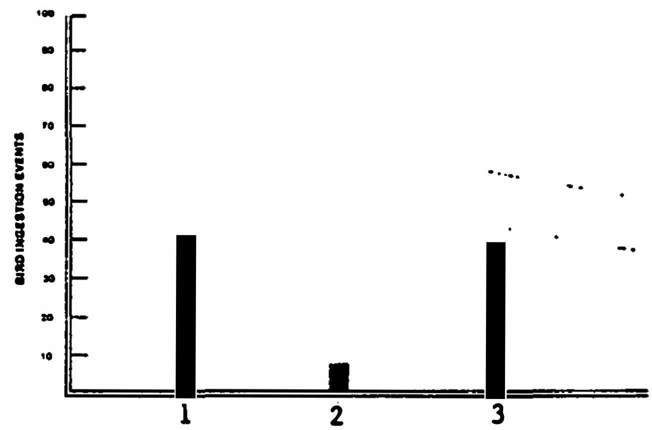
	DC10	A300	B747	L1011
Operations	344,344 (49.7)	269,617 (52.2)	616,954 (69.9)	249,750 (42.4)
Bird Ingestion Events	42	51	194	33
Ingestion Rate/ 10K Ops.	1.22	1.89	3.14	1.32

Note: ( ) denotes percent of total worldwide operations per aircraft type for 26 months.

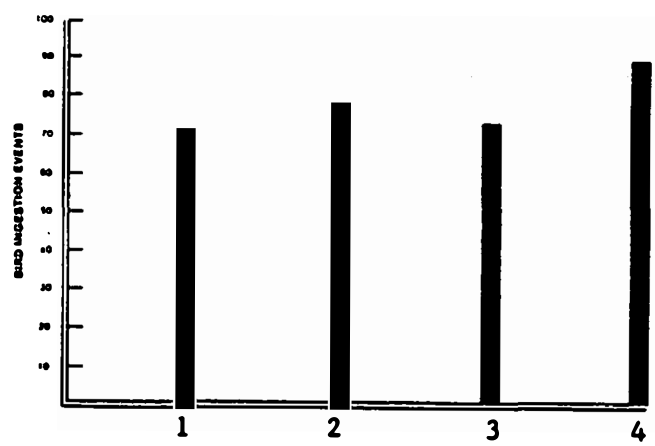
Figure 3.5 presents a summary of the engine positions which experienced bird ingestions by aircraft type.



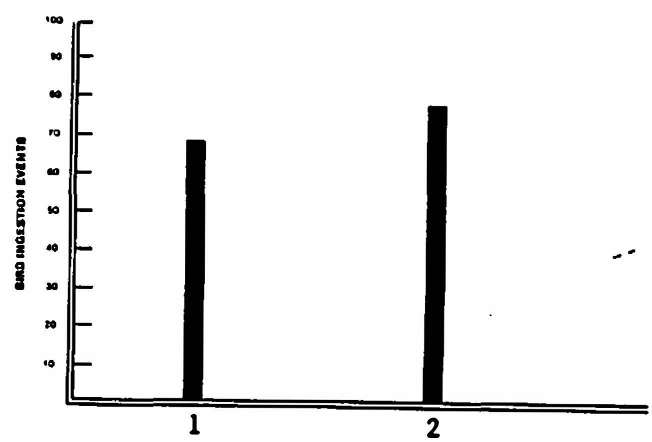
(a) DC10 Aircraft



(b) L1011 Aircraft



(c) B747 Aircraft



(d) A300 Aircraft

FIGURE 3.5 BIRD INGESTION FREQUENCY VERSUS ENGINE POSITION

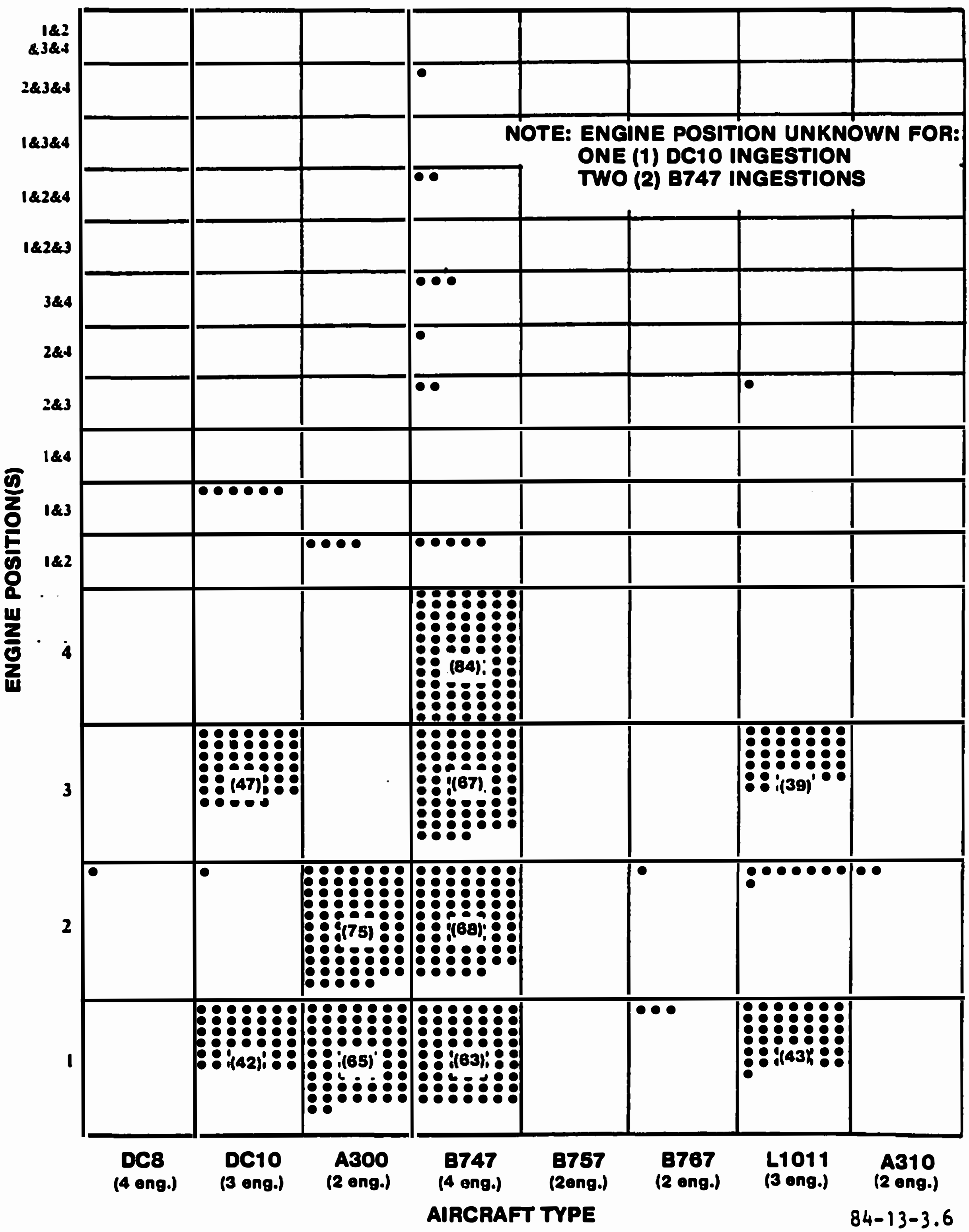


FIGURE 3.6 ENGINE POSITIONS WHICH EXPERIENCED BIRD INGESTIONS

3.3.2.2 Aircraft Operational Environment. In order to assess the effects of the aircraft operational environment on the ingestion rates, tables 3.9 and 3.10 were developed. Table 3.9 addressed only those airport locations where it is known that an ingestion had taken place. Table 3.10 addresses those airports also, however, the ingestions which occurred at unknown locations are also included in this table. For example, it is shown in both tables that the DC10 aircraft served 114 airports with a corresponding operations count of 526,256. Table 3.9 shows that known location ingestions occurred at only 47 of these airports with a corresponding operations count of 338,642. Additionally, 71 ingestions can be attributed to these 47 airports yielding an ingestion rate of 2.10. Continuing this example for the DC10, it can be seen that in table 3.10, 97 ingestions were now attributed to these same 47 airports, yielding an ingestion rate of 2.86. Adding those DC10 ingestions for which the geographic locations are unknown, under the assumption that the unknown location ingestions occurred at these airports, increases the rate.

Tables 3.9 and 3.10 present similar data for the A300, B747, and L1011. The ingestion rates shown in these tables reflect those rates which the aircraft experience in their respective operational environments. Certain airports may or may not be common to all aircraft types under consideration. In general, the ingestion rates vary considerably among the aircraft types studied. In other words, this aircraft operational environmental assessment suggests that there are considerably different rates that could be attributed to routing structure and many other factors which were not explicitly examined during this study.

3.3.3 Multiple Engine Bird Ingestion Rates, United States Versus Foreign. There were a total of 25 multiple engine ingestions, that is, birds were ingested into more than one engine per aircraft. Twenty-two events occurred wherein two engines ingested birds. Three events occurred wherein three engines ingested birds. The geographic ingestion location of two of the multiple engine ingestion events is unknown. Twenty-one of the remaining 23 events occured in the foreign environment, yielding a foreign ingestion rate of 0.119 ingestions per 10,000 operations. The United States rate is 0.021 ingestions per 10,000 operations. The foreign multiple engine ingestion rate is 5.8 times greater than the United States rate.

For comparison, the foreign rate at the end of the first year was 0.116 ingestions per 10,000 operations while the United States rate was 0.047. This indicates that the foreign multiple engine ingestion rate has remained relatively constant over the 2 years of this study. The United States multiple engine ingestion rate has been halved from the first to the second year because no United States multiple engine ingestions have been reported during the second year of this study. This comparison of the United States versus foreign mulitple engine ingestion rates for 26 months, further suggests that the United States and foreign bird environments are not the same.

3.4 AIRPORT BIRD INGESTION EXPERIENCE.

With the exception of those events where the geographic bird ingestion location is unknown, all remaining ingestions occurred in the airport environment. "Environment" in this case may be defined as the airport and the airspace immediately above and adjacent to it. Over 76 percent of all known bird ingestions occur during the combined takeoff and landing phases-of-flight. These phases-of-flight occur mostly within the geographical confines of the airport.

TABLE 3.9 AIRCRAFT BIRD INGESTION RATES UTILIZING ONLY KNOWN BIRD INGESTION LOCATION DATA

	Aircraft Type			
	DC10	A300	B747	L1011
Airports Served	114	101	110	88
Operations	526,256	415,694	704,785	378,090
Ingestions	71	103	194	55
Rate/10K Ops	1.35	2.48	2.75	1.46
Airports Served Where Ingestion Occurred	47	45	72	32
Operations	338,642	237,570	616,954	239,160
Ingestions	71	103	194	55
Rate/10K Ops	2.10	4.34	3.14	2.30

TABLE 3.10 AIRCRAFT BIRD INGESTION RATES UTILIZING COMBINED KNOWN AND UNKNOWN BIRD INGESTION LOCATION DATA

	Aircraft Type			
	DC10	A300	B747	L1011
Airports Served	114	101	110	88
Operations	526,256	415,694	704,785	378,090
Ingestions	97	144	297	91
Rate/10K Ops	1.84	3.46	4.21	2.41
Airports Served Where Ingestion Occurred	47	45	72	32
Operation	338,642	237,570	616,954	239,160
Ingestions	97	144	297	91
Rate/10K Ops	2.86	6.06	4.81	3.81

Over 90 percent of the bird ingestions which occurred during the course of this study, for which the altitudes are known, occurred below 3000 feet. Most engine bird ingestions are encountered when the aircraft is relatively close to, if not on, the ground. Consequently, the bird ingestion phenomenon suggests an airport environment problem, at least for the aircraft types investigated during the course of this study. The phases-of-flight in which the bird ingestion events occurred are graphically depicted in figure 3.7. The phase-of-flight data used to generate this figure are those data reported by the operator of the aircraft. It is recognized that phase-of-flight definitions vary considerably in the industry, however, the data are a compilation from many operators and it is assumed that normal data scatter would tend to mitigate any bias in phase-of-flight definitions.

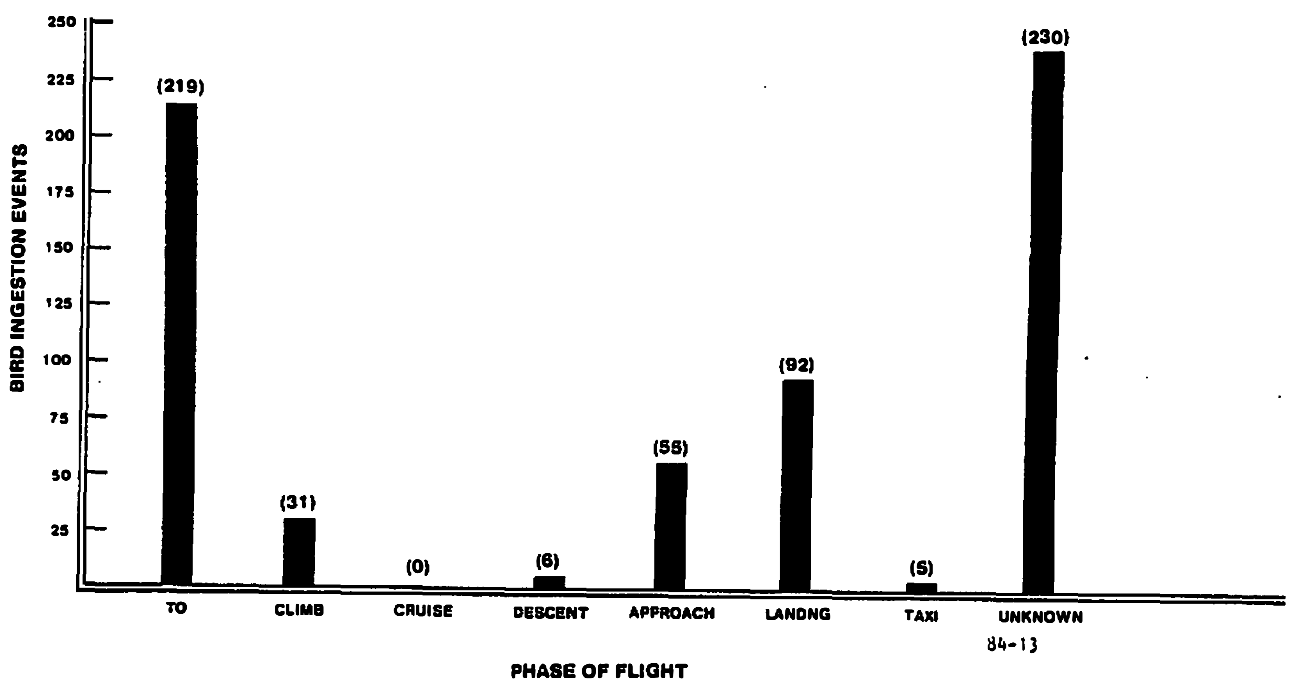
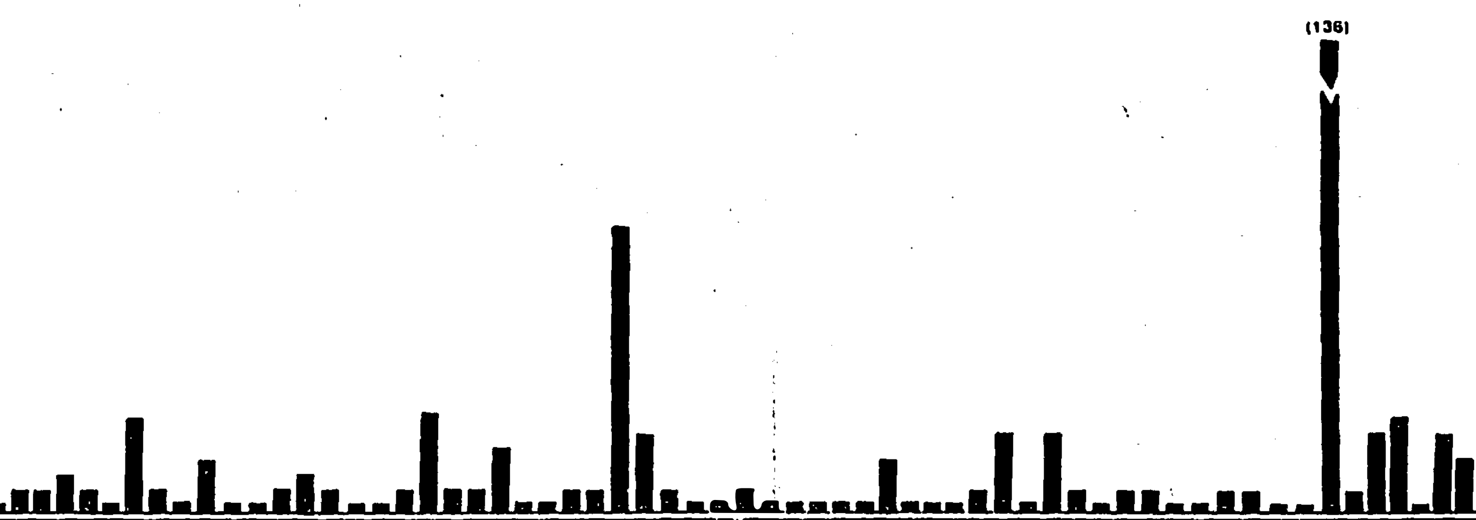


FIGURE 3.7 PHASE-OF-FLIGHT VERSUS NUMBER OF BIRD INGESTION EVENTS

From the OAG tapes it was determined that approximately 429 airports worldwide accommodated the eight aircraft types studied. Sixty-two of these airports are located in the United States and 367 are in foreign locations. During the course of this study, engine bird ingestions were experienced at 22 known United States airport locations and 115 known foreign airport locations. Figure 3.8 lists these airports along with the number of ingestion events which occurred at each location. The acronym identifiers for these 137 airports are listed in appendix G. It should be noted that airport identifiers XUS and XFO denote bird ingestions in United States and foreign locations, respectively; however, the exact airport where the ingestion occurred is not known. In addition, the bird ingestion data base



ORTS

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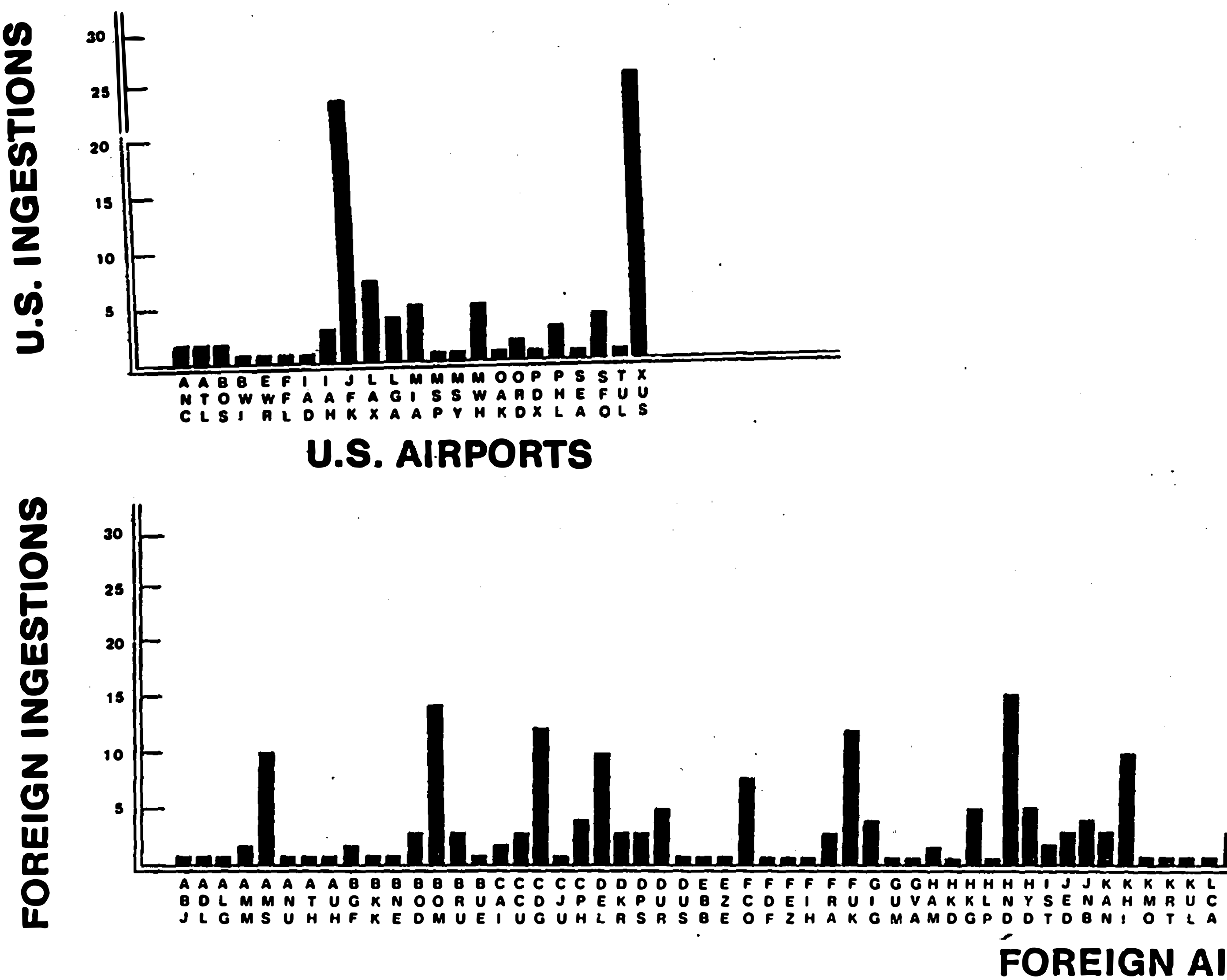
NGESTION FREQUENCY VERSUS AIRPORTS


U.S. INGESTIONS
30
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U.S. AIRPORTS
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FOREIGN AI

FIGURE 3.8 BI

(appendix E) lists an airport identifier XXX which denotes that the bird ingestion occurred at a totally unknown location. Often it is known that a bird ingestion has taken place as evidenced by preflight and postflight inspections of the engines or during an engine teardown for maintenance. In most of these cases the exact geographic ingestion location is unknown. It is possible, in many cases, to determine whether the ingestion occurred in the United States or in a foreign location by extrapolating the known data such as operations between United States or foreign city pairs and operator route structures. Utilizing this technique, it was possible to broadly identify the United States or foreign ingestion location for 161 of the 208 unknown ingestion locations. The remaining 47 events occurred at an unknown location (XXX). Table 3.11 lists the geographic distribution of engine bird ingestion events, including the general locations XUS and XFO.

TABLE 3.11 GEOGRAPHIC DISTRIBUTION OF BIRD INGESTION EVENTS

	U.S.	Foreign	Worldwide
Known Location Ingestions	72	358	----
Extrapolated Location Ingestions	25 (XUS)	136 (XFO)	----
Unknown Location Ingestions	----	----	47 (XXX)
Total Ingestions	97	494	638

The geographic distribution of the 430 bird ingestion events where geographic location is known are shown on the world map, figure 3.9.

As previously stated, the 638 engine bird ingestion events which have been reported during this study have occurred at 137 airports around the world. This yields a worldwide airport bird ingestion event rate of 4.65 bird ingestion events per airport. All airports which experienced 5 or more bird ingestion events during the course of this study were examined. Results are presented in table 3.12. Analysis of the data contained in this table shows that 25 airports account for 36.5 percent of all worldwide bird ingestion events for the aircraft types studied. In addition, most of these airports are located in 5 distinct geographic areas of the world — the interior of the Indian subcontinent, extreme Western Europe (including England), the United States east coast (including the Canadian Great Lakes Region), the United States and Canadian West Coast, and the islands of Japan. Figure 3.9 depicts these locations as well as other, less frequent bird ingestion locations. Appendix H lists all airports including bird ingestion events, operations, and ingestion rates by aircraft type.

In addition, appendix H lists 19 airports which have experienced multiple engine ingestions. Twenty-five such events occurred (22 two-engine events and three three-engine events). Four of the multiple-engine ingestions resulted in at least one of the engines failing. In one of these cases, two engines failed on a four-engined aircraft during the approach phase of the flight. This was the only

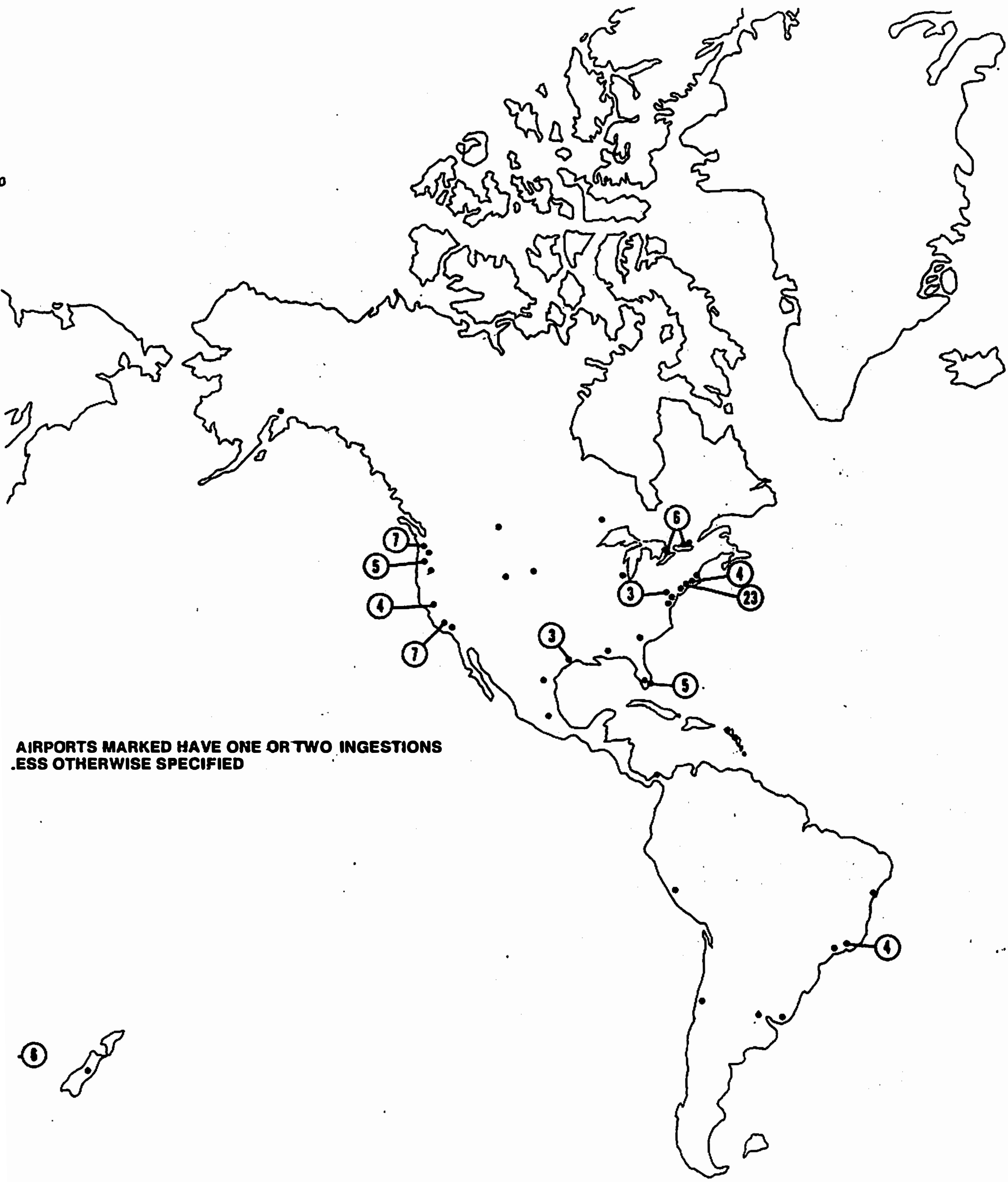
TABLE 3.12 AIRPORT BIRD INGESTION RATES

(5 Or More Ingestions)

Airport	Operations	Ingestions	Rate/10K Ops	Rank
LYS	3863	7	18.12	1
TLS	3573	6	16.79	2
HYD	3232	5	15.47	3
NBO	7767	8	10.30	4
DUR	5739	5	8.71	5
NGS	5861	5	8.53	6
YUL	7041	6	8.52	7
YVR	9266	7	7.55	8
KHI	17013	10	5.88	9
DEL	17190	10	5.82	10
AMS	17279	10	5.79	11
BOM	26062	14	5.37	12
FUK	22698	12	5.28	13
ORY	41689	22	5.28	14
FCO	27501	8	2.91	15
CDG	47054	12	2.55	16
YYZ	24982	6	2.40	17
HND	65874	15	2.28	18
SYD	27631	6	2.17	19
LHR	64731	13	2.01	20
JFK	116769	23	1.97	21
MHW	39167	5	1.28	22
OSA	55474	6	1.08	23
MIA	64913	5	0.77	24
LAX	103027	7	0.68	25

NOTE: See appendix G for airport identifiers.

FIGURE 3.9 WORLD MA



'IRD INGESTION LOCATION

two-engine failure determined during this study. None of the three-engine ingestion events resulted in an engine failure. A summary of the multiple engine ingestion events are presented in table 3.13.

TABLE 3.13 MULTIPLE ENGINE INGESTION EVENTS

Airport	Aircraft Type	Engines Involved	Phase Of Flight	No. Of Birds	Bird Weight (oz.)
AMS	B747	3	Takeoff	-,-,2	8 oz.
BOD	A300	2	Takeoff	1,1	32 oz.
BWI	DC10	2	Landing	-,-	- oz.
CPH	D747	2	Approach	1,2	16 oz.
CPH	DC10	2*	Takeoff	1,2	14 oz.
DPS	B747	2	Takeoff	-,-	- oz.
EBB	DC10	2	Takeoff	1,2	40 oz.
EZE	B747	2	Takeoff	3,4	13 Oz.
HND	DC10	2	Approach	-,-	20 oz.
JED	B747	2**	Approach	-,-	11 oz.
KAN	DC10	2	Landing	-,-	- oz.
KHI	B747	2	Takeoff	1,1	40 oz.
LHE	A300	2	Landing	1,1	32 oz.
LHR	L1011	2	Takeoff	1,1	10 oz.
LHR	B747	3	Landing	-,-,-	- oz.
MEL	A300	2	Takeoff	1,1	24 oz.
MEL	B747	2*	Climb	5,4	20 oz.
MWH	B747	2	Approach	1,1	80 oz.
ORY	A300	2	Takeoff	2,2	11 oz.
ORY	B747	2	Takeoff	1,1	10 oz.
SYD	B747	3	Takeoff	2,2,2	11 oz.
YVR	B747	2	Landing	-,-	- oz.
ZRH	B747	2*	Takeoff	6,3	13 oz.
XXX	DC10	2	Unknown	-,-	- oz.
XXX	B747	2	Unknown	1,3	9 oz.

(*) Represents One Engine Failed
(**) Represents Two Engines Failed
(XXX) Unknown Location
(-) Unknown

The location of airports within the aforementioned geographic areas, as well as other areas of the world, often determines the magnitude of the bird ingestion problem which the airports experience. Often they are located in bird flyways or along bird migration routes. The vast open areas of airports are a natural resting place for the birds in these situations. Although it was not a specific objective of this study to determine why birds often prefer to inhabit the airport environment, the reports of the engine manufacturers (PWA, GE, RR) in many cases contained great detail with regard to the airport environment where a particular bird ingestion had taken place. Such factors as the grass height, availability of food, proximity to bodies of water, number of aircraft operations, number of runways, and other factors often determine not only the quantity of birds present on the airport, but the type of bird as well. Many airports have instituted bird control programs with varying degrees of success. On the surface it appears that such programs must be tailored to the particular needs of each airport.

A summary of the information contained in this airport section is presented in table 3.14.

TABLE 3.14 SUMMARY OF AIRPORT INGESTION EVENTS

	Aircraft Types						
	DC10	A300	B747	B757	B767	L1011	Total
Known Airport Locations							
Operations	526,256	415,694	704,785	3,384	13,162	378,090	2,041,371
Events	71	103	194	1	3	55	427
Rates/10K Ops	1.35	2.48	2.75	2.96	2.28	1.45	2.09
World							
Operations	692,616	516,246	883,150	6,400	25,138	589,000	2,712,550
Events	97	144	297	1	4	91	634
Rates/10K Ops	1.40	2.79	3.36	1.56	1.59	1.54	2.34
Percent of Worldwide Operations at Known Airport Locations	76.0	80.5	79.8	52.9	52.4	64.2	75.4

NOTE: Airport statistics are based on 137 airports identified in appendix E. The the events for Unknown United States (XUS), Unknown Foreign (XFO), and Unknown locations (XXX), are excluded from known airport location statistics. For the DC8 and A310 aircraft, data by airports is not available.

3.5 ENGINE DAMAGE AND FAILURE DESCRIPTION.

Damage assessment was determined by utilizing the engine manufacturers' written reports, photographs of individual bird ingestion events, and detailed review of the evidence by FAA Technical Center personnel. The engines experienced 666 ingestions during the 26 months of this study. Sixty-two percent (416) of these engines experienced some degree of damage. For the purposes of this study, nine generalized engine damage categories were defined. FAA Technical Center personnel reviewed each of the 666 engine ingestions and characterized the damage according to the nine generalized categories. The results of this detailed technical damage assessment for each engine ingestion are tabulated in appendix E. The nine generalized damage categories, coded 1 through 9, are:

1. N/A - No damage.
2. Bent - One to 10 fan blades bent (minor damage).
3. Bent Many - More than 10 fan blades bent.
4. Broken - Broken fan blade(s), leading edge and/or tip pieces missing, other blades also bent.
5. Transverse Fracture - A fan blade broken chordwise (across) and the piece is missing (includes secondary hard object damage).
6. Spinner - Dented, broken, or cracked spinner (includes spinner cap).
7. Core - Bent/broken compressor blades/vanes, blade/vane clash, blocked/ disrupted airflow in low, intermediate, and high pressure compressors.
8. Nacelle - Dents and/or punctures to the engine enclosure (includes cowl).
9. Other - Any damage not previously listed.

Most of the above damage categories are pictorially represented in appendix I.

Figure 3.10 depicts the damage categories for all 666 engines which experienced a bird ingestion. As can be seen, category 1 (no damage) and category 2 (minor damage) comprise the majority of the entries (over 60 percent).

Figure 3.10 also depicts the damage sustained by those engines which are considered to have failed. During the course of this study, an engine failure was defined as the engine's inability to attain and/or maintain approximately 50 percent thrust. The ability of the engine to achieve this level of power was based upon the engineering judgment of a combined group of U.S. Government aerospace propulsion engineers. Their assessment of engine failure was based upon photographic evidence, extent of fan and/or core damage, transverse fracture of a fan blade, phase-of-flight, engine action and pilot reaction, in-flight engine data, and personal interviews (by the contractor) with the pilot. All of these criteria were not always available. Neither this report nor the evidence gathered during this study is intended to define the failure mechanism of these engines. However, it can be stated that each failure mode is unique and complex. No attempts were made to compare the relative merits or shortcomings among the engine models, or for that matter, the aircraft types. Examination of figure 3.10 shows that engines which fail (and many which do not fail) tend to have multiple damage categories associated with them. This is evidenced by the fact that 32 engines were considered to have failed, however, the damage associated with these engines appears 103 times (filled-in circles figure 3.10). This is expected, due to the secondary hard object damage which the engine can experience after a severly damaging bird ingestion. In these cases, typically, a bird ingestion may cause a stage 1 fan blade fracture (or spinner failure) which, in turn, releases hard objects such as pieces of blade (or spinner material). These hard objects are reingested into the fan and/or core engine which causes secondary damage. For example, an engine which experiences a severely damaging ingestion may suffer a transverse blade fracture (category 5) which releases a metal blade piece. This piece is reingested into the fan causing other blades to break (category 4) and bending still other blades (category 3), damaging the nacelle with the loose fragments (category 8). Finally, these fragments may be ingested into the core engine (category 7). In many cases

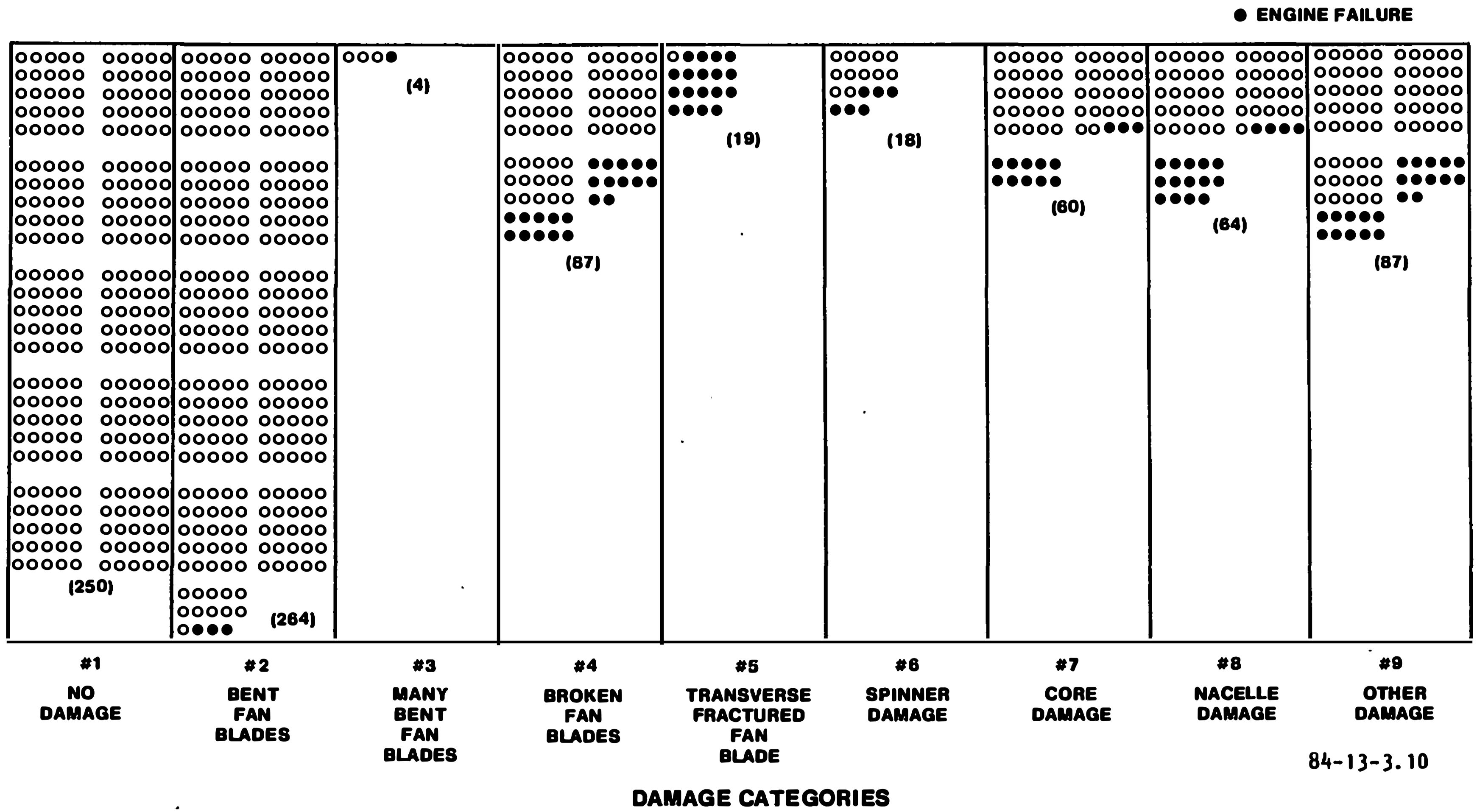


FIGURE 3.10 BIRD INGESTION DAMAGE CODES

where the engine failed, such a scenario is common. It must be reemphasized, however, that an engine failure is the exception rather than the norm.

Figure 3.11 shows that of the 666 engines which experienced a bird ingestion, information was available with regard to the weight and number of birds ingested in 335 cases. Additionally, of the 32 engine failures, information regarding the weight and number of birds ingested was available in 30 cases. Figure 3.11 presents these data and shows that approximately 81 percent of the bird ingestions involve only one bird, with a corresponding failure rate in that category of 5.9 percent (16 engine failures, 272 ingestions). The 19 percent of the ingestions which involve more than one bird have a corresponding failure rate of 22 percent.

The preceding discussion points out a pertinent observation. Namely, the engine failure rate for single bird ingestions (0.81 X 0.059 = 0.048) and multiple bird ingestions (0.19 X 0.22 = 0.042) are almost identical and compare favorably with the worldwide bird ingestion engine failure rate of 4.8 percent (32 engine failures, 666 ingestions). Therefore, with regard to the numbers of birds ingested, the data indicate that once the ingestion has occurred, be it a single bird or multiple birds, the probability of experiencing an engine failure is approximately 5 percent in either case.

With regard to the weights of these birds, figure 3.11 shows that birds of 8 ounces or less do not generally cause HBPR engines to fail. Examination of appendix E for this weight category also reveals that, primarily, minor or no damage is incurred. Half of the bird ingestions and engine failures occurred between 9 and 24 ounces (>1/2 to 1 1/2 pounds). Examining the weight interval, 0 to 24 ounces, and comparing the engine failures against ingestions, yields a failure rate of 7.8 percent (217 ingestions versus 17 failures). Likewise, the weight interval, 25 to 48 ounces, produces a rate of 7.2 percent (97 ingestions versus 7 failures). However, the weight interval 49 ounces and greater, produces a failure rate of 28.6 percent (21 ingestions versus 6 failures) which indicates that once the bird weight exceeds a certain value (in this case, 3 pounds) experiencing an engine failure becomes more probable.

Attempts have been made to determine the association among engine failures, phase-of-flight, number of birds, and bird weight. (It should be noted that 22 engine failures out of 32, occurred at takeoff and 5 engine failures occurred during the climb phase-of-flight. These two phases-of-flight account for 84 percent of the engine failures.) The results of these attempts have been inconclusive because insufficient data exists to allow an indepth analysis. However, an analysis was conducted which sought to determine the association between bird weight and number of birds for engines which failed and also for engines which did not fail. Tables 3.15 and 3.16 are each 2 X 3 contingency tables which show the data of figure 3.11 condensed for analysis purposes. Note that the weight categories (1 to 24, 25 to 48, > 49) and the numbers of birds (1, >1) are the same as the previous analysis.

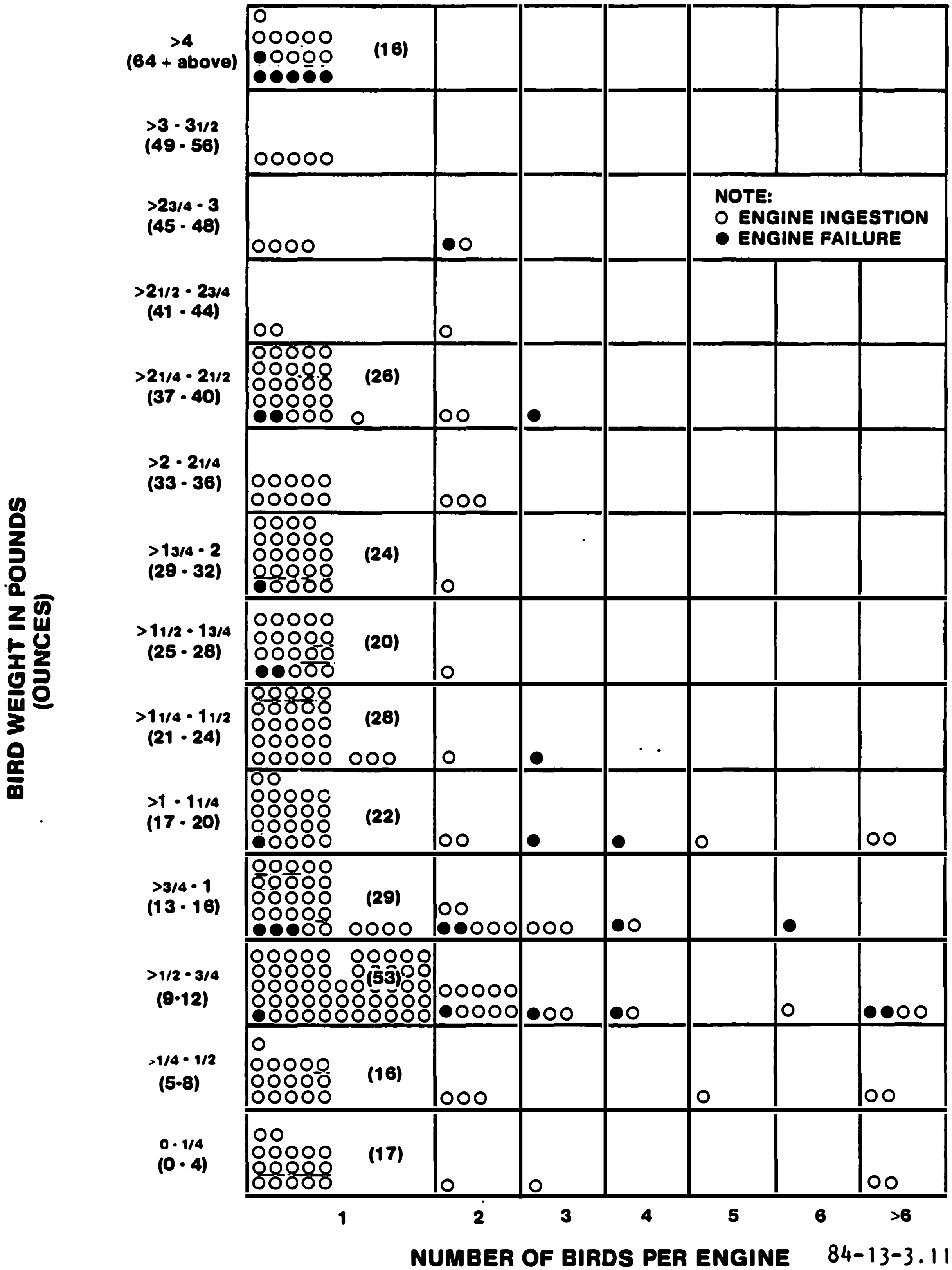


FIGURE 3.11 BIRD WEIGHT, NUMBER PER INGESTION AND ENGINE FAILURE DISTRIBUTION

TABLE 3.15 ENGINE FAILURE FREQUENCIES BY BIRD WEIGHT AND NUMBER OF BIRDS

Number of Birds	Bird Weight			
	1-24 ounces	25-48 ounces	>49 ounces	Total
1	5	5	6	16
>1	12	2	0	14
Total	17	7	6	30

TABLE 3.16 NON-FAILED ENGINE FREQUENCIES BY BIRD WEIGHT AND NUMBER OF BIRDS

Number of Birds	Bird Weight			
	1-24 ounces	25-48 ounces	>49 ounces	Total
1	160	81	15	256
>1	40	9	0	49
Total	200	90	15	305

The Test of Association of Contingency Tables (appendix C) was used to determine whether a strong association exists between bird weight and number. It yielded a value of 10.08 for table 3.15 data and a value of 6.83 for table 3.16 data. Both values are chi-square distributed with 2 degrees-of-freedom. Both values are significant at the 95 percent confidence level and negate the assertion that the two factors, bird weight and number of birds, are independent. The measure of association between these two factors for the data of tables 3.15 and 3.16 are 0.502 and 0.149, respectively. (Values close to zero indicate lack of association between the row and column factors of the contingency table, whereas, values closer to 1.0 indicate strong association.) The association measure for engines which failed is relatively stronger than the measure obtained for engines which did not fail. Although, this analysis establishes association between the two factors, it does not indicate that engine failures are predictable based on the knowledge of number of birds and their weight. The underlying reasoning for this inference arises from the fact that the chi-square values imputed in the data of tables 3.15 and 3.16, 10.08 and 6.83, respectively, exhibit no significant differences in their magnitudes to suggest that the underlying distribution of these two samples are drastically different. The test to determine whether these two chi-square values come from different distributions shows, at the 95 percent confidence level, that there is no difference in the underlying distributions in the data of tables 3.15 and 3.16. This supports the inference that association between the two factors cited, namely bird weight and bird number, does not provide, by itself, the basis for predicting an engine failure as a function of bird weight and number of birds.

3.6 PROBABILITY ESTIMATES OF BIRD INGESTION RELATED EVENTS.

The bird ingestion data which has been collected during the 2 years of this study are well suited to the discussion of probabilities. As has been stated, one of the reasons this study was continued into a second year was in order to verify bird ingestion trends which were observed during the first year. In many areas, such as geographic ingestion distribution, total ingestion events, weight distribution, multiple engine ingestions, and others, the repeatability between first and second year data was very good. The following discussion addresses certain of these areas.

3.6.1 Probability of Ingestion of One or More Birds of A Given Weight Range.

Table 3.17 gives the frequency of single and multiple bird ingestion events by bird weight. The probability estimate of ingesting one or more birds of a given weight range can be obtained by dividing the total number of events in that weight range by the total number of bird ingestion events. For example, the probability of ingesting one or more birds in the 1- to 8-ounce weight range is calculated by: 43/335 = 0.128. The remaining weight range probabilities are calculated in a similar fashion.

TABLE 3.17 INGESTION PROBABILITIES OF SINGLE AND MULTIPLE BIRDS BY WEIGHT CATEGORY

	Bird Weight								
	1-8 ozs.	9-16 ozs.	17-24 ozs.	25-32 ozs.	33-40 ozs.	41-48 ozs.	49-56 ozs.	>56 ozs.	TOTAL
Single Bird	33	82	50	44	36	6	5	16	272
Multiple Bird	10	33	9	2	6	3	0	0	63
Total	43	115	59	46	42	9	5	16	335
Conditional Probability	0.128	0.343	0.176	0.137	0.125	0.027	0.015	0.048	
Unconditional Probability	30×10^{-6}	80×10^{-6}	41×10^{-6}	32×10^{-6}	29×10^{-6}	6.3×10^{-6}	3.5×10^{-6}	11×10^{-6}	

The calculated probability is conditional. The condition being that an ingestion has taken place. The unconditional probability is obtained by multiplying the conditional probability estimate by the worldwide ingestion occurrence probability of 2.33×10^{-4} (638 ingestions/2,738,382 operations). Therefore, the unconditional probability of ingesting one or more birds in the 1- to 8-ounce weight range is $0.128 \times (2.33 \times 10^{-4}) = 30 \times 10^{-6}$. In other words, this data indicates that for every one million HBPR aircraft operations, it is expected that 30 bird ingestions of single or multiple birds in the 1- to 8-ounce weight range will occur.

3.6.2 Probability of Ingestion of Multiple Birds Per Engine.

The data show that 65 engines have experienced an ingestion of more than one bird (multiple birds per ingestion). It is known that a total of 666 engines experienced a bird ingestion. The conditional probability estimate of experiencing a multiple birds per engine ingestion is therefore 0.098 (65 multiple bird ingestions/666 engine ingestions). The unconditional probability estimate of such an event occurring is 22.7×10^{-6} or about 23 multiple bird ingestions per one million operations.

3.6.3 Probability of Multiple Engine Ingestions. Twenty-five multiple engine ingestion events occurred during this study. The conditional probability estimate of such an event occurring is 0.039 (25 multiple engine ingestion events/638 ingestion events). The unconditional probability estimate is approximately 9×10^{-6} or nine multiple engine ingestions events per million operations.

4. SUMMARY.

The purpose of this investigation was to determine the numbers, weights, and species of birds which are being ingested into large high bypass ratio (HBPR) turbine aircraft engines during service operation and determine what damage, if any, resulted. To meet this objective, the FAA Technical Center and three engine contractors — Pratt and Whitney Aircraft, General Electric Company, and Rolls-Royce Incorporated — gathered worldwide bird ingestion data.

During the course of this study, 1513 HBPR engined aircraft conducted 2.7 million operations and were involved in 638 bird ingestion events. The first and second year's bird ingestion distributions were compared. It was determined that their distributions were statistically similar, therefore, no further data was collected.

The United States and foreign bird environments were compared. This comparison suggested that the bird weight distribution differed in these two environments. A comparison of the single and multiple engine bird ingestion rates was conducted. Both foreign rates were significantly higher than the U.S. rates. Finally, the average, most likely, and median bird weights were compared. In all three instances, the U.S. bird weights were higher than the foreign bird weights.

Worldwide, gulls (family Laridae) were ingested most often. The following selected bird species (for 5 or more ingestions) are presented in decreasing order of ingestion frequency on a worldwide basis:

1. Milvus migrams (Black Kite) - 46 ingestions
2. Larus ridibundus (Common Black-headed Gull) - 34 ingestions
3. Larus argentatus (Herring Gull) - 27 ingestions
4. Columba palumbus (Wood Pigeon) - 23 ingestions
5. Larus crassirostris (Black-tailed Gull) - 14 ingestions
6. Larus delawarensis (Ring-billed Gull) - 11 ingestions
7. Vanellus vanellus (Common Lapwing) - 10 ingestions
8. Anas Platyrhynchos (Mallard Duck) - 9 ingestions
9. Columba livia (Common Rock Dove) - 8 ingestions
10. Tyto alba (Common Barn Owl) - 6 ingestions
11. Corvus corone (Carrion Crow) - 6 ingestions
12. Larus atricilla (Laughing Gull) - 5 ingestions
13. Larus novaehollandae (Silver Gull) - 5 ingestions
14. Francolinus francolinus (Francolin) - 5 ingestions

The overwhelming majority of the 85 species of birds identified by this study are flocking or grouping birds. Bird flocks are the greatest hazard to aircraft and are responsible for almost all multiple engine ingestions.

In most cases, the bird debris was identified by an ornithologist who determined weights and species.

Seasonal changes appear to have an effect on the bird ingestion rate. The largest number of bird ingestions occurred during the late summer and early fall.

A comparison of the ingestion rates according to generic aircraft type was conducted. Analysis revealed that the center engine position of the three-engined aircraft experienced significantly lower bird ingestions than the wing-mounted engines. From a bird ingestion standpoint, the center engine position may be considered to be practically non-existent. Analysis indicates that an aircraft with four wing-mounted engines may be expected to have approximately twice the ingestion rate of aircraft with only two wing-mounted engines.

Seventy-six percent of bird ingestion occur during the takeoff and landing phase-of-flight. Most bird ingestions occur at the airport when the aircraft is close to, or on, the ground. Twenty-two United States and 115 foreign airports experienced bird ingestions during this study. Some airports present a greater bird ingestion hazard than others as indicated by the analysis that 18 percent (25) of these airports account for almost 36 percent of all reported worldwide bird ingestions for the aircraft types studied. This suggests that the bird ingestion phenomenon is primarily airport environment dependent.

Sixty-two percent of bird ingestions resulted in some engine damage, both minor and major. However, the vast majority of bird ingestions caused minor damage to the engine. Usually, only a small number of fan blades need replacement (minor damage). But in severely damaging bird ingestion events, the damage includes broken fan blades, transversely fractured fan blades, spinner damage, core engine damage, fan shroud and nacelle damage.

The 638 aircraft bird ingestion events involved 666 engines. Twenty-five multiple engine ingestions occurred; three of these involved three engines. Sixty-five multiple bird ingestions per engine occurred. Thirty-two engine failures were identified. Of these thirty-two engine failures, one incident occurred involving a two-engine failure to a four-engine aircraft during the approach phase-of-flight.

The majority of bird ingestions, engine damage, and engine failures are caused by birds weighing between 9 and 24 ounces. Although there appears to be a correlation between the number and weight of the ingested birds, it is not possible to predict engine failure based upon these two parameters alone.

Tables 4.1 and 4.2 review some of the relationships presented in this report. It should be noted that the takeoff and climb phases-of-flight produces the highest percentages in all ingestion categories. Although approach and landing constitute a significant portion (36 percent) of all known phases-of-flight, the percentages of damaging ingestions and engine failure ingestions are significantly lower than in takeoff and climb. Multiple birds per engine occur in a significantly high percentage of engine failure ingestions. Multiple engine ingestions do not produce significant percentages in any ingestion category.

TABLE 4.1 MULTIPLE ENGINE AND MULTIPLE BIRD INVOLVEMENT ANALYSIS

	Total Ingestion Events (638)	Damaging Ingestion Events (401)	Engine Failure Ingestions (32)
Multiple Engine Ingestion Events	25 (4%))	19 (5%)	4 (13%)
Multiple Bird Ingestions (per engine)	65 (10%)	47 (12%)	14 (44%)

TABLE 4.2 PHASE-OF-FLIGHT (POF) ANALYSIS

	Known POF Ingestion Events (408)	Known POF Damaging Ingestion Events (250)	Known POF Engine Failures (32)
Takeoff and Climb	249 (61%)	215 (86%)	27 (84%)
Approach and Landing	147 (36%)	35 (14%)	4 (12%)

5. CONCLUSIONS.

1. A bird ingestion to a high bypass ratio (HBPR) engined aircraft is a rare, but probable, event. Approximately 2.7 million operations were conducted during the 26 months of this study; 638 bird ingestion events occurred. This results in approximately 25 bird ingestions per month.

2. The most commonly ingested birds worldwide, are the family Laridae (gulls) which account for 35 percent of all ingestions to HBPR engines. These are closely followed by the family Accipitridae (kites) which account for 20 percent of all ingestions.

3. The United States and foreign bird weight distributions are different. United States birds are heavier than birds found in the foreign environment.

4. The United States single and multiple engine bird ingestion rates are lower than the foreign rates.

5. Flocking and grouping birds are the greatest hazard to aircraft and are responsible for almost all multiple engine ingestions.

6. The largest number of bird ingestions occur in the late summer and early fall. Seasonal changes appear to have an effect on the bird ingestion rate.

7. Wing-mounted HBPR engines are more susceptible to bird ingesitions than center aft-mounted HBPR engines. Center aft-mounted HBPR engines experience very few bird ingestions.

8. Four-engined aircraft experience approximately twice the ingestion rate of two-engined aircraft (wing-mounted engines only).

9. The majority of bird ingestions resulted in either minor or no damage to the engines.

10. Seventy-six percent of all bird ingestions occur during takeoff or landing.

11. Certain airports present a greater bird ingestion hazard than others. Eighteen percent of the 137 airports which experienced bird ingestions during this study accounted for 36 percent of all reported worldwide bird ingestions for the aircraft type studied.

12. Sixty-two percent of all bird ingestions result in some engine damage.

13. The majority of bird ingestions, engine damaging ingestions, and engine failures are caused by birds weighing between 1/2 pound and 1 1/2 pounds.

14. Once a bird ingestion has occurred, the probability of experiencing an engine failure from one bird or multiple of birds is approximately 5 percent.

15. Engine failure cannot be predicted based upon knowledge of the bird weight and bird number alone. Engine failure modes are complex.

16. Only limited data analysis could be accomplished on the DC8-70 series, A310, B757, and B767, due to their limited service experience.

6. REFERENCES.

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4. Robbins, C. S., Bruun, B., and Zinn, H. S., Birds of North America, Golden Press, New York, 1966.

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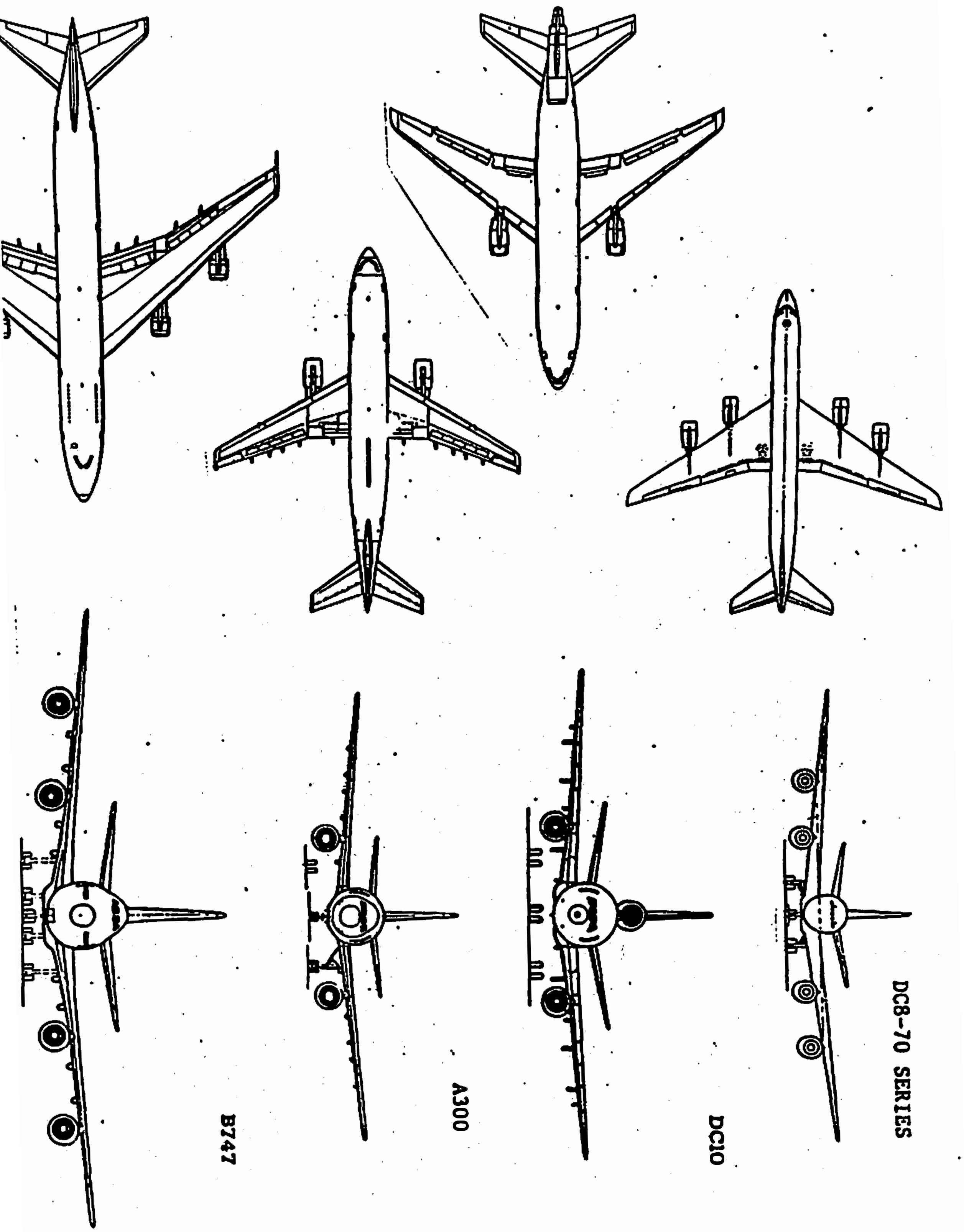
APPENDIX A

COMPARISON OF HBPR ENGINE AIRCRAFT



'ARISON OF HBPR ENGINE AIRCRAFT

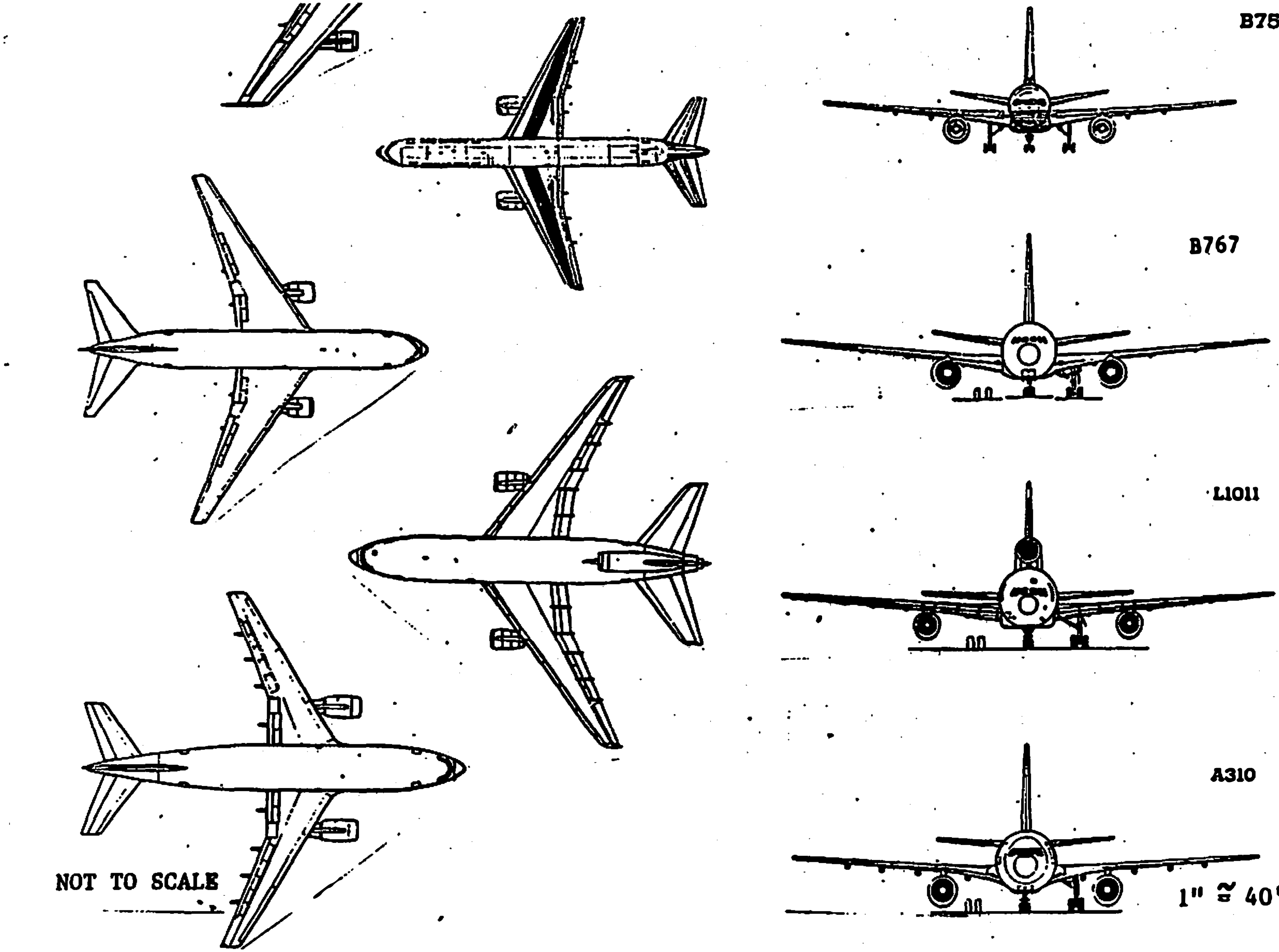
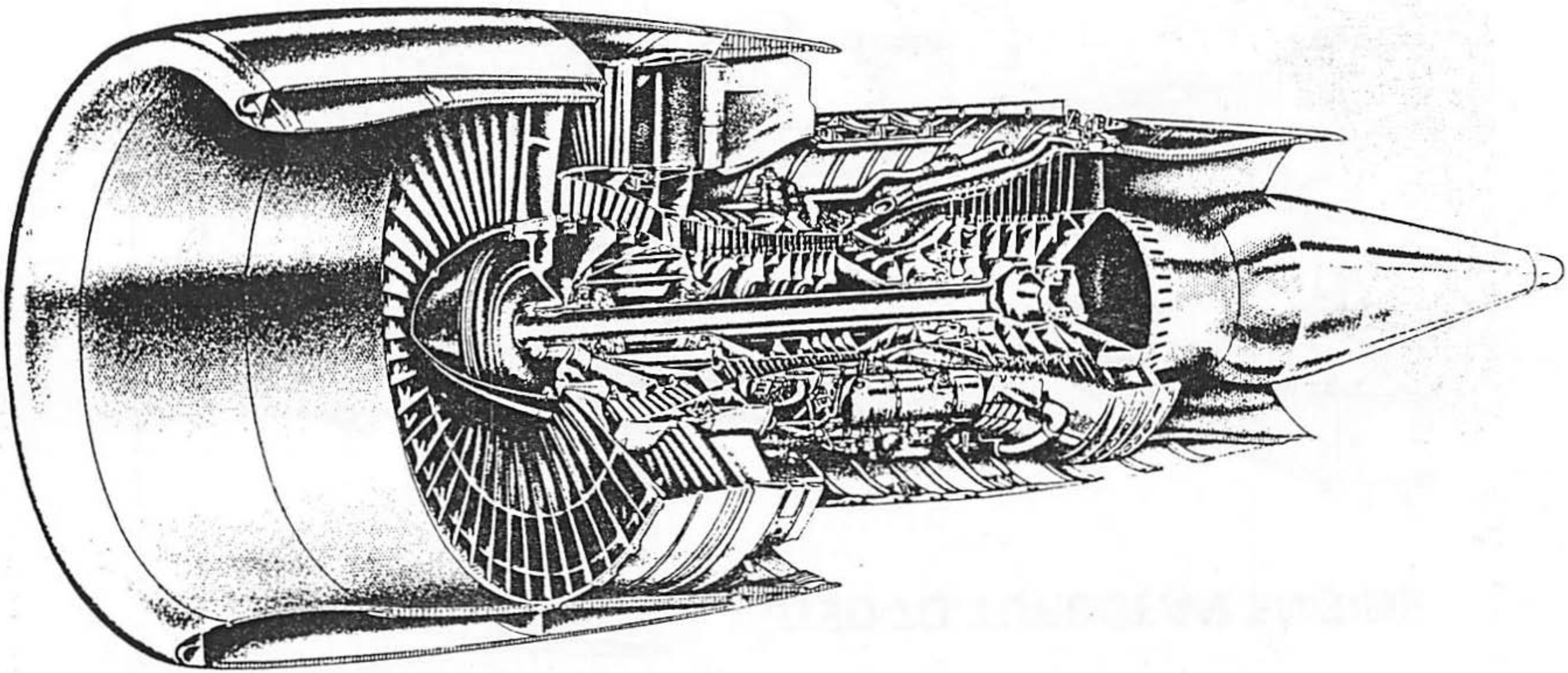


FIGURE A-1. C

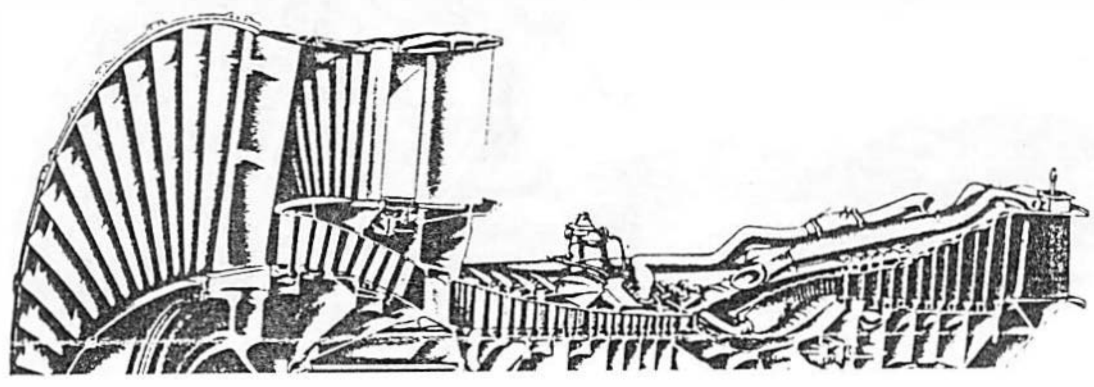
APPENDIX B

HBPR ENGINES

JT9D-7Q/747 PROPULSION SYSTEM



JT9D-7Q TURBOFAN



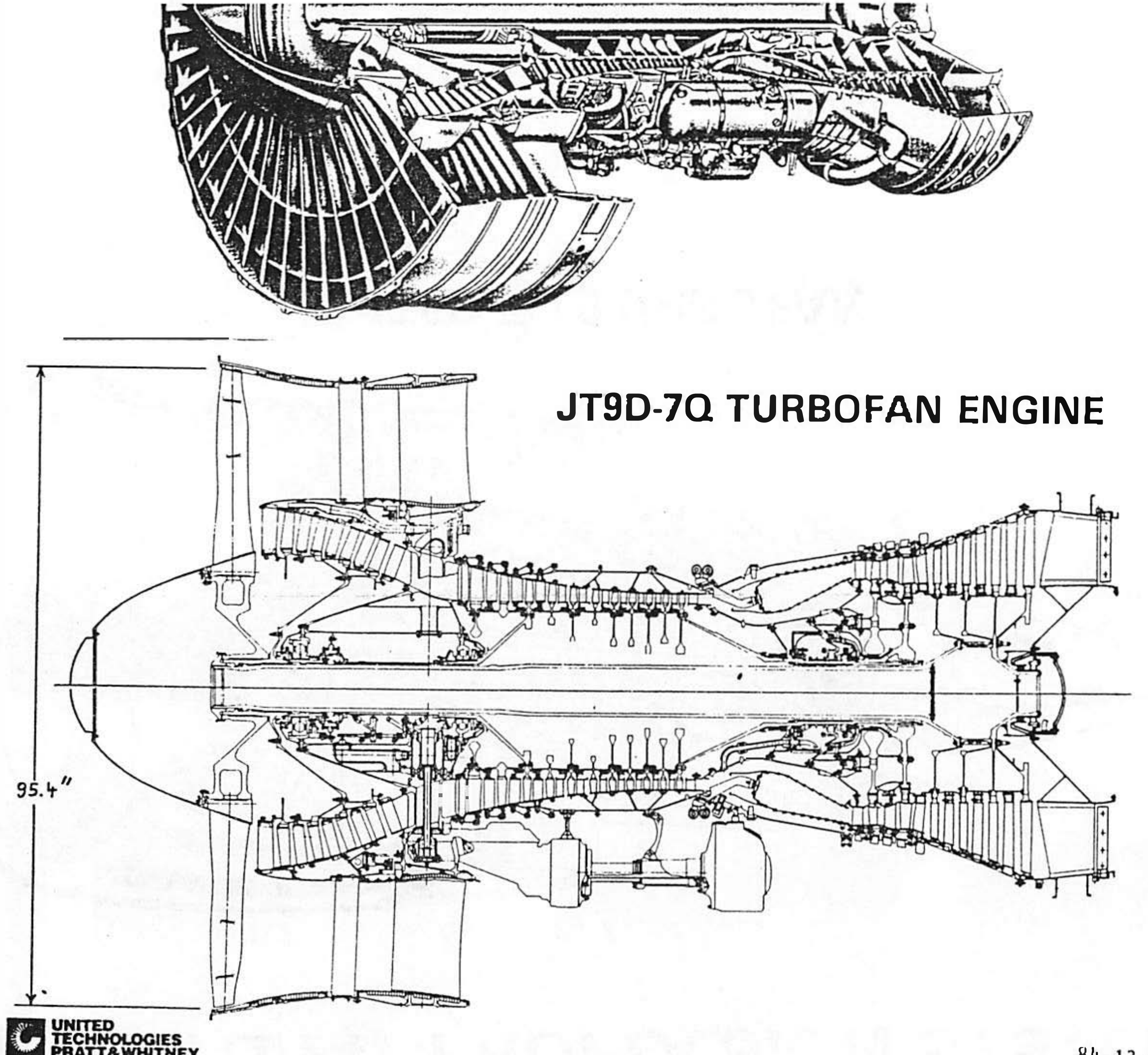
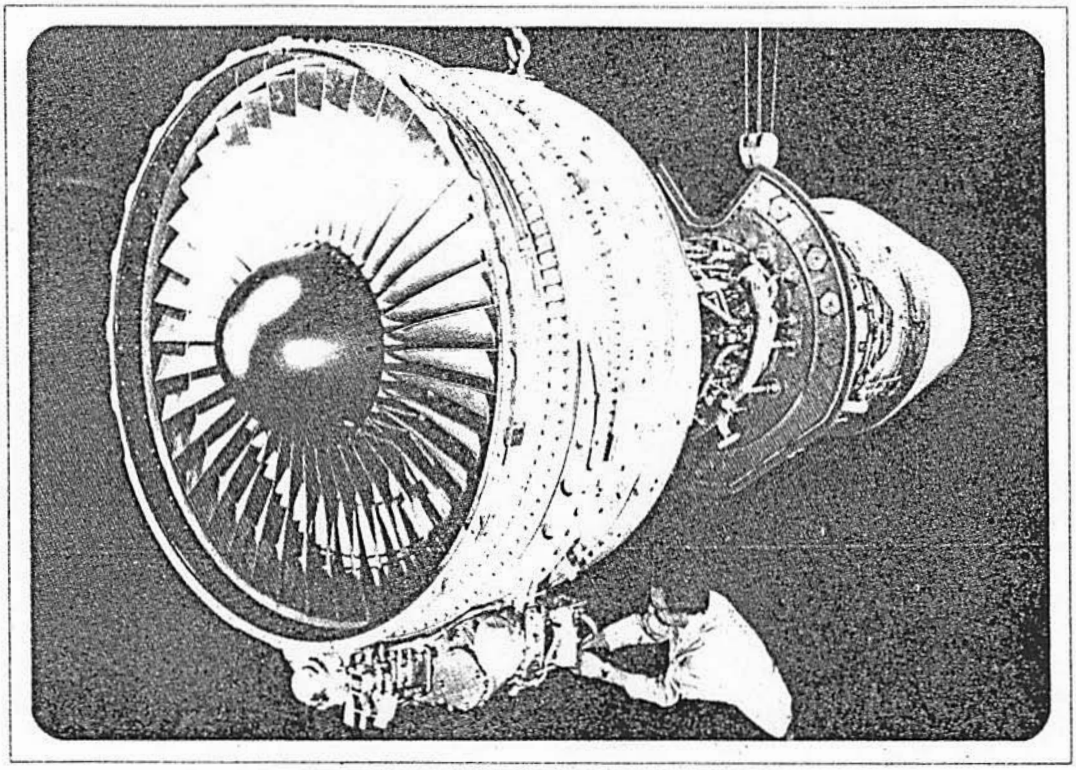


FIGURE B-3. PWA JT9D-7Q ENGINE



GENERAL ELECTRIC
U.S.A.

CF6-50 High Bypass Turbofan Engine

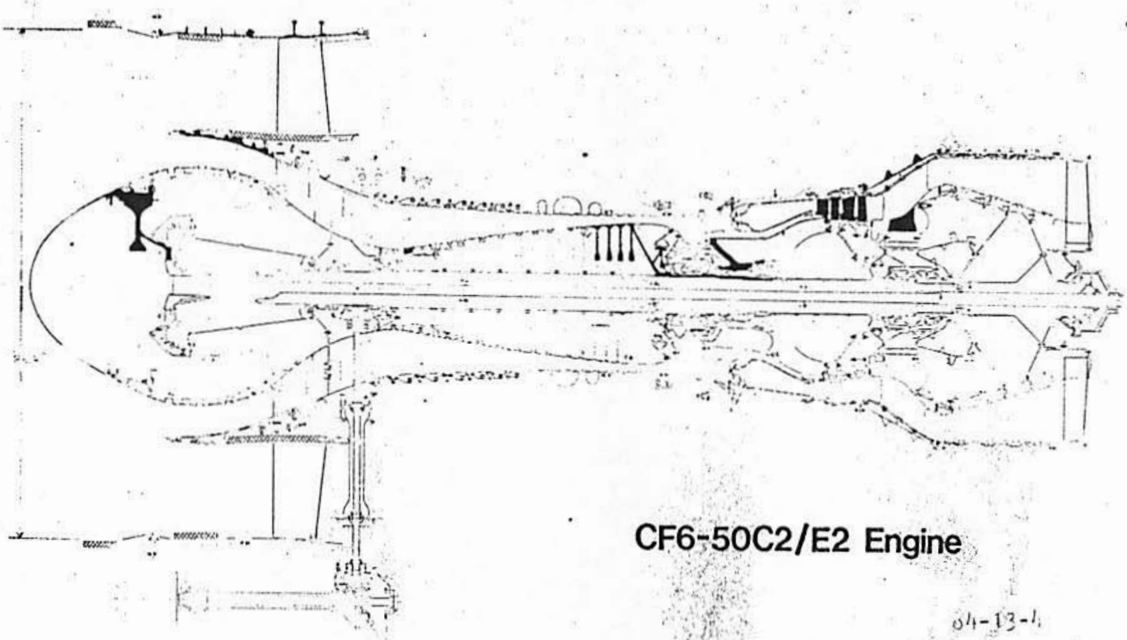
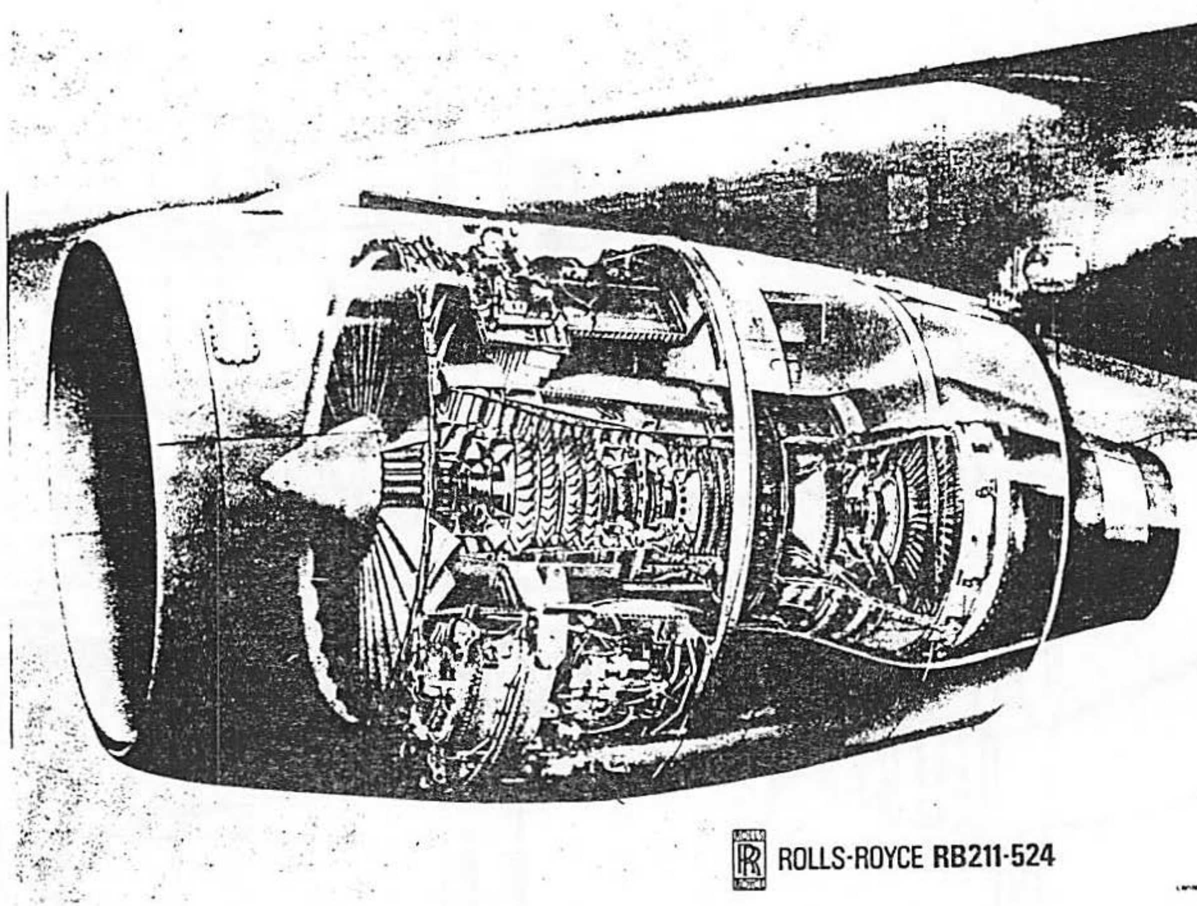
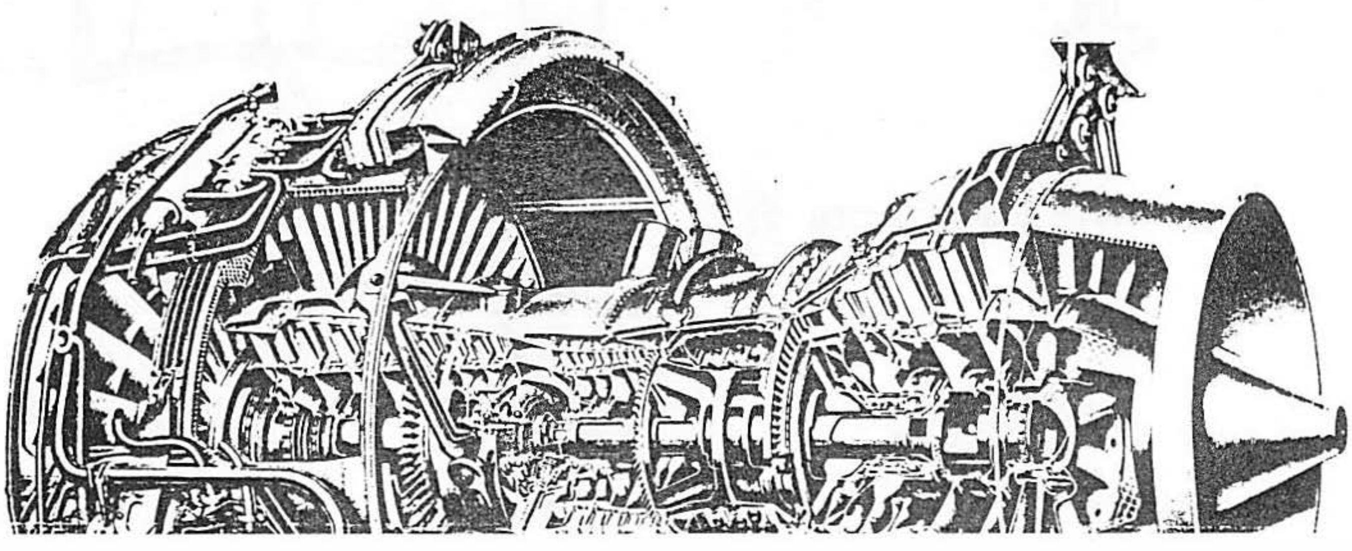
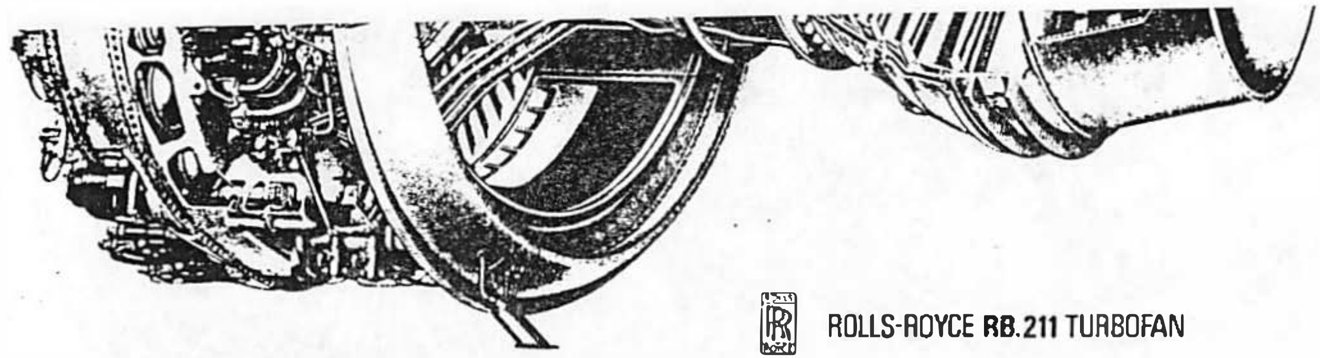


FIGURE B-4. GE CF6-50 ENGINE



ROLLS-ROYCE RB211-524





ROLLS-ROYCE RB.211 TURBOFAN

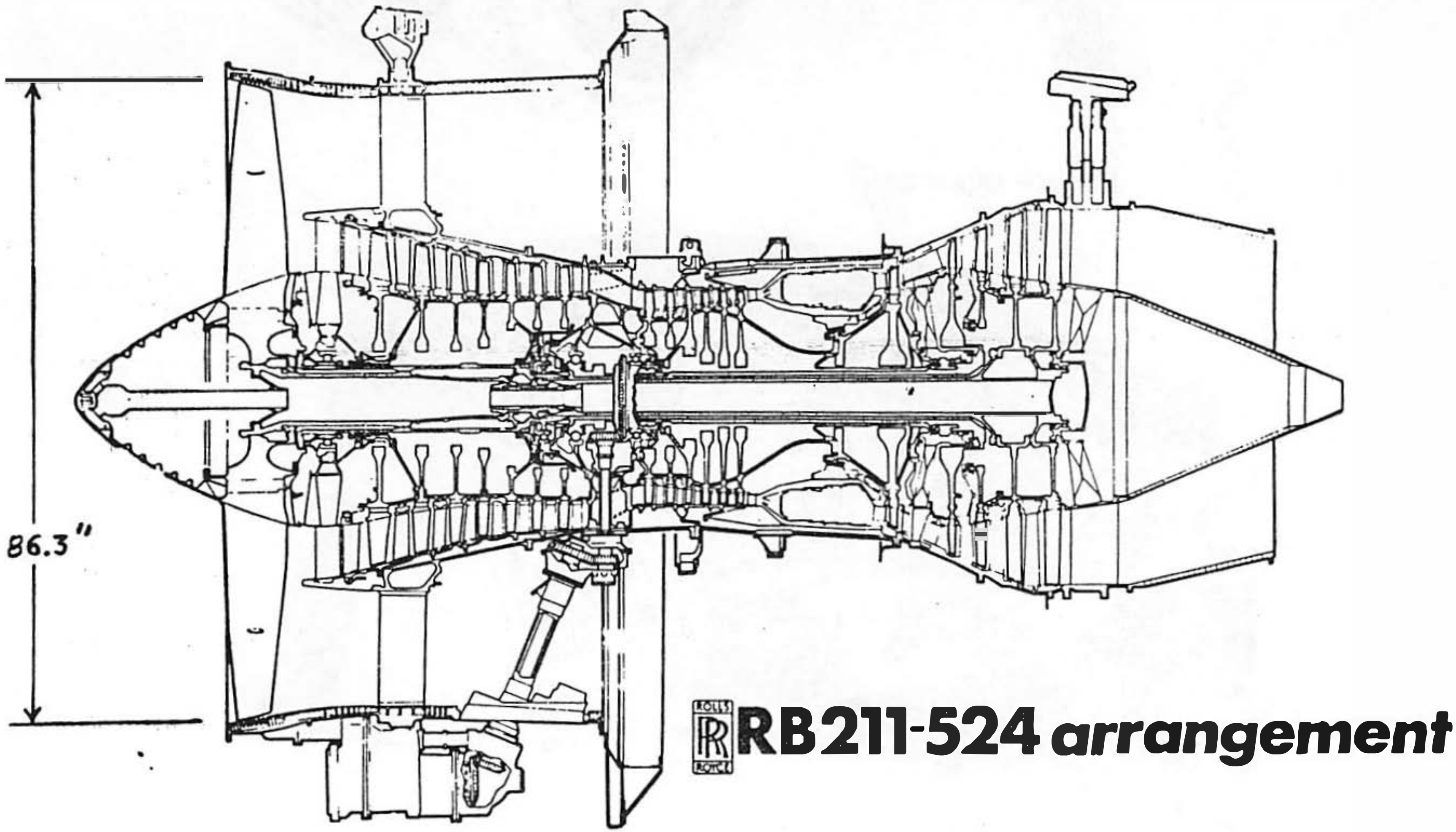


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FIGURE B-5. RR RB211-524 ENGINE

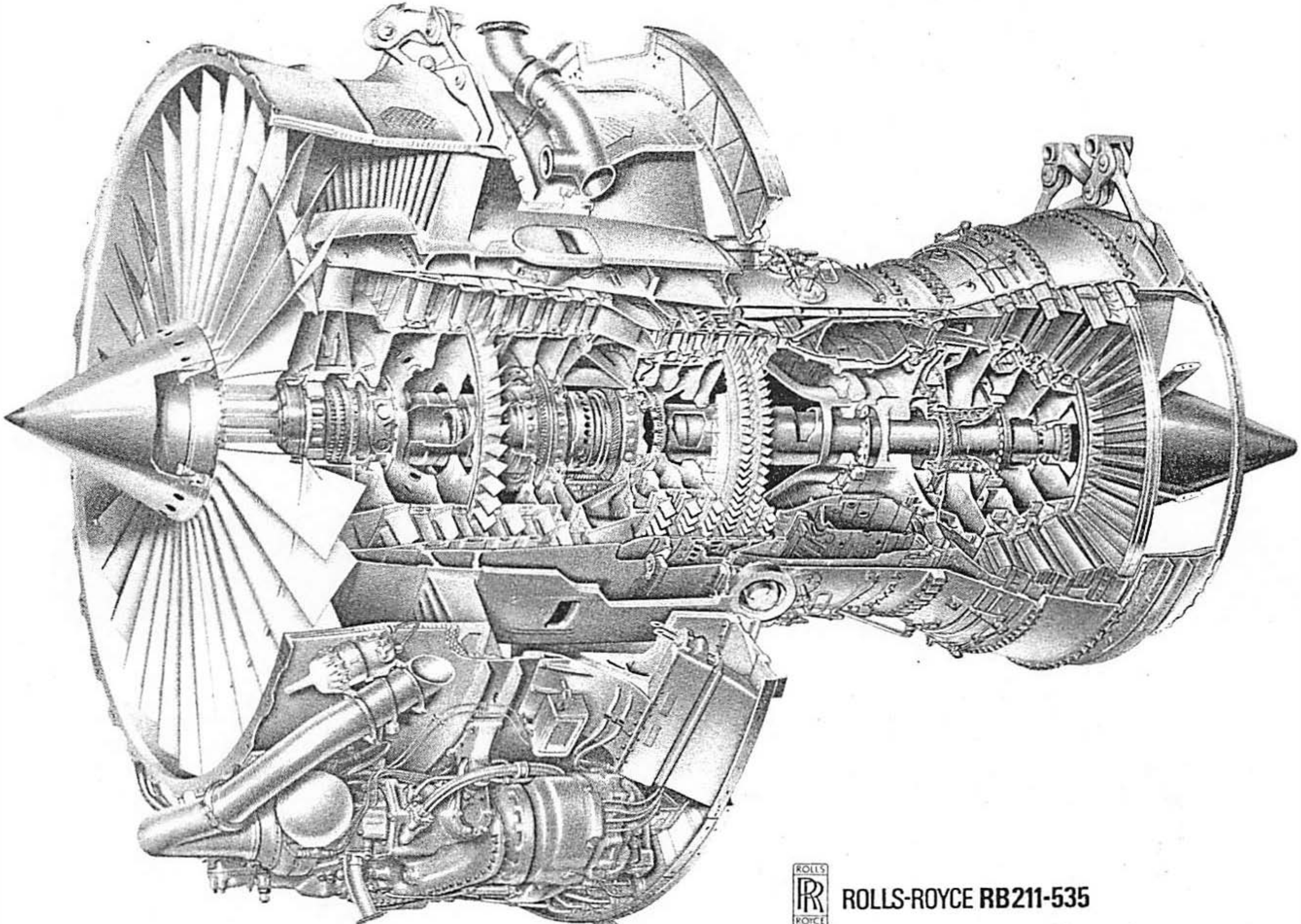
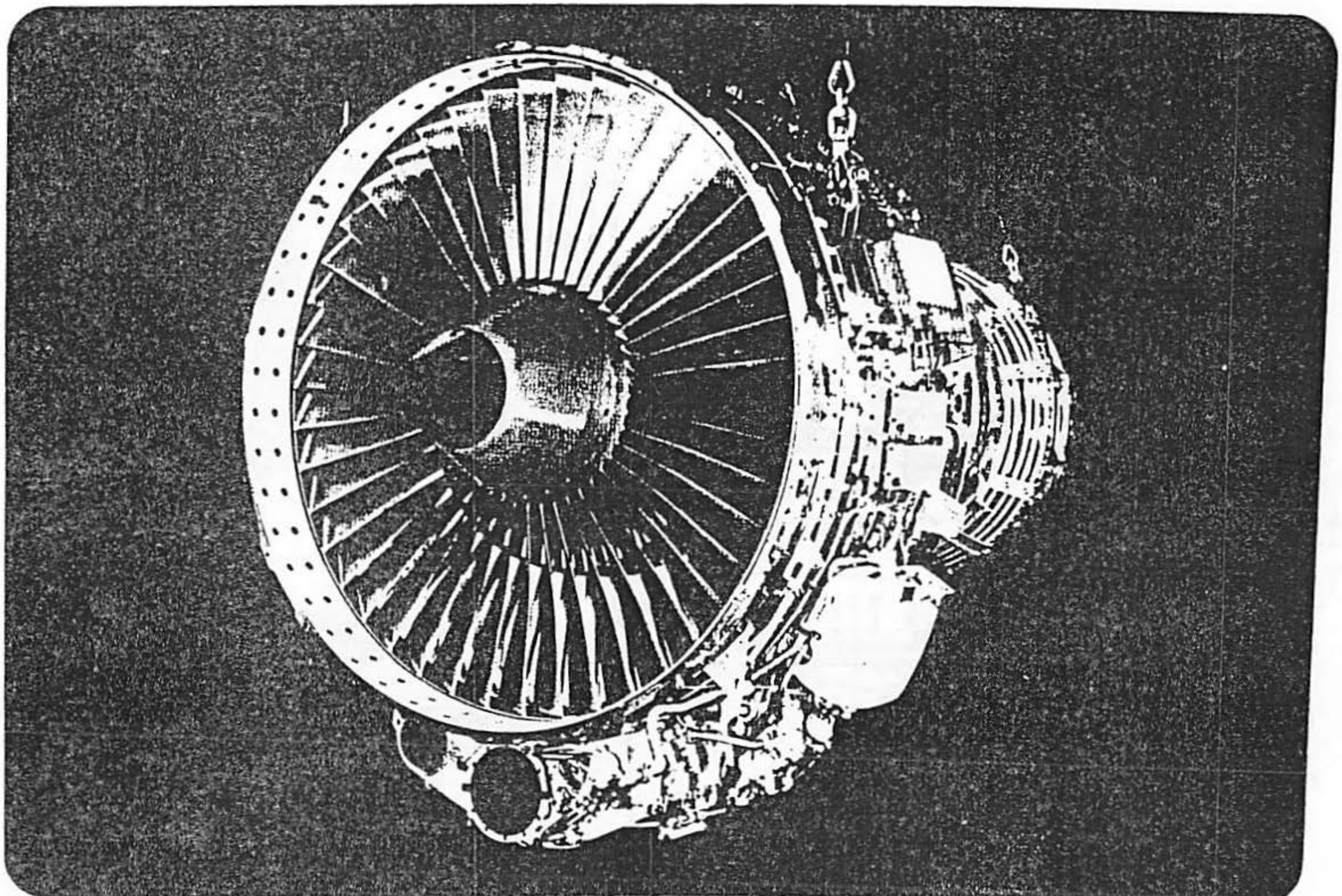
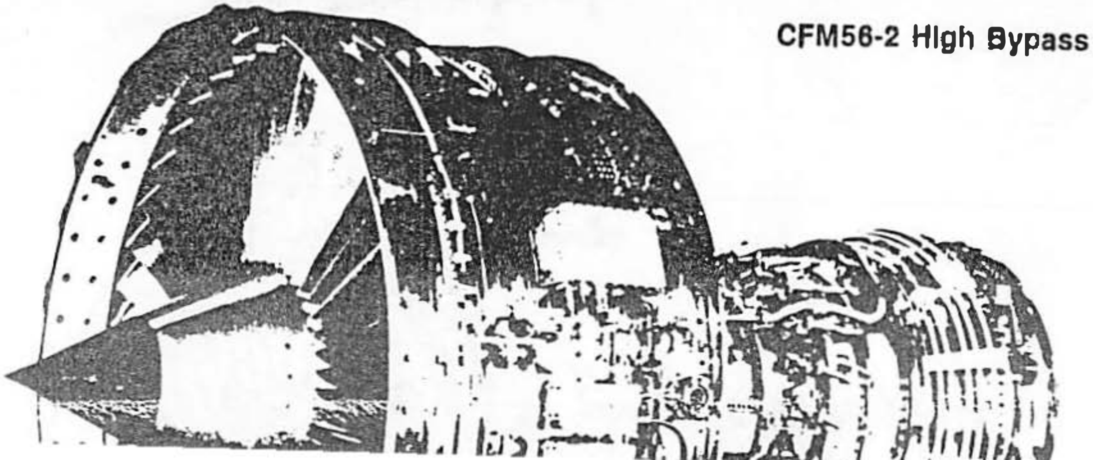
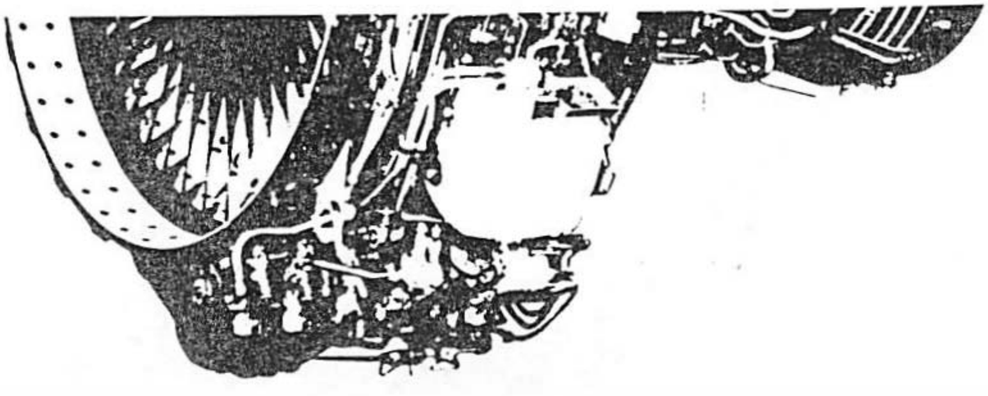


FIGURE B-6. RR RB211-535 ENGINE



CFM56-2 High Bypass Turbofan Engine





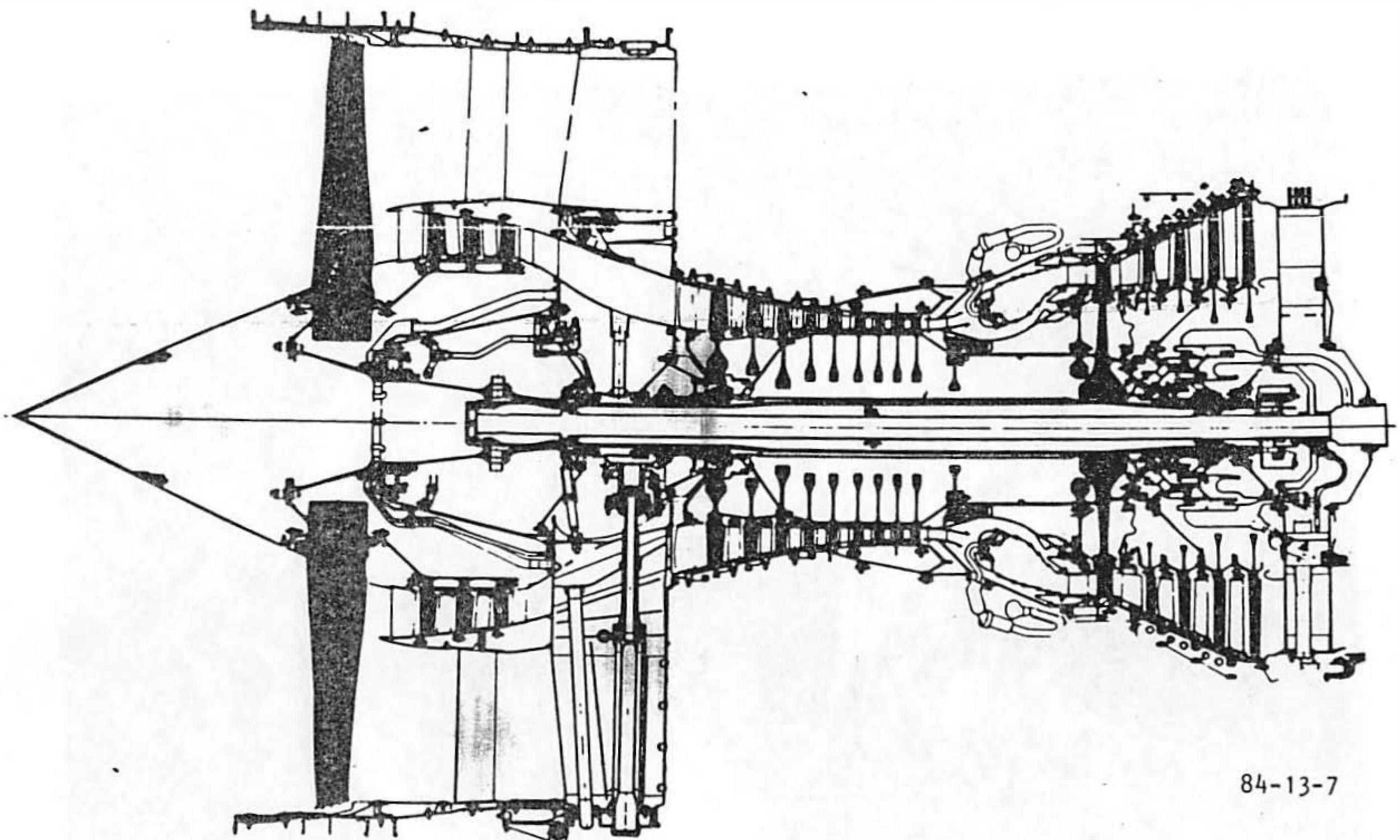


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FIGURE B-7. CFM1 CFM56-2 ENGINE

APPENDIX C

STATISTICAL PROCEDURES

APPENDIX C

STATISTICAL PROCEDURES

C-1 KOLOMOGOROV-SMIRNOV TWO-SAMPLE TEST

The Kolomogorov-Smirnov (KS) two-sample test is a test of whether two independent samples have been drawn from the same population (or from populations with the same distribution). The two-tailed test is sensitive to any kind of differences in the distributions from which the two samples were drawn - differences in location, in dispersion, in skewness, etc.

The maximum difference (D) between the two cumulative distributions of the two samples is called KS statistics. For a large number of observations (greater than 40), the critical value of the KS distribution of difference D can be obtained from the following table for a selected significance level. If the observed difference D is greater than the critical value D, then we reject the null hypothesis. That is, the two distributions are the same.

CRITICAL VALUES OF D IN THE KOLOMOGOROV-SMIRNOV
TWO-SAMPLE TEST
(Large Samples Two-tailed Test)

Level of Significance	Value of D so large to call for Rejection of H_0 at the indicated level of significance.
0.10	$1.224 \sqrt{\frac{n_1 + n_2}{n_1 n_2}}$
0.05	$1.358 \sqrt{\frac{n_1 + n_2}{n_1 n_2}}$
0.025	$1.480 \sqrt{\frac{n_1 + n_2}{n_1 n_2}}$
0.01	$1.628 \sqrt{\frac{n_1 + n_2}{n_1 n_2}}$

Where; $D = \max \left| S_{n_1}(X) - S_{n_2}(X) \right|$

(D = max difference between two cumulative distributions.

C-2 BIRD WEIGHT CLASS INTERVAL SELECTION METHOD

There is no exact method available in determining the class intervals. Selection of class interval is often based on judgmental factors, however, the following formula helps to determine the class interval when the judgmental factors are not available.

$$\text{Class Interval} = \frac{\text{Range}}{1 + 3.322 \times \log(n)}$$

where:

Range = largest observed value minus smallest observed value.
n = number of observations.
Log = log base 10.

The bird weight class interval of 8 oz., or its multiple, used in this study is based on the formula given above.

C-3 COMPARISON OF INGESTION RATES

In comparing the ingestion rates, we assumed that estimated rates in fact are the maximum likelihood estimates of the parameters of the Poisson distribution. For example, comparing the U.S. ingestion rate against the Foreign ingestion we assumed that rates are the estimate of the Poisson distribution parameter (λ) which is the same for both U.S. and Foreign. The number of observations being large, we invoked the asymptotic property of Poisson and used the asymptotic test rather than the exact test. Some of the asymptotic tests used are the chi-square, the normal test, and in some cases, the binomial test.

C-4 TEST OF ASSOCIATION AND HOMOGENIETY OF CONTINGENCY TABLES

To test the association between the rows and columns of the contingency tables, we employed the chi-square test of independence, as well as the chi-square test to ascertain the homogeniety of the two population observations which are drawn independently.

To measure the extent of association between the row and column factors of the contingency table, Pearson's coefficient (C) and Cramer Statistics (V) were computed as follows:

$$C = \sqrt{X^2 / (X^2 + N)}$$

$$V = \sqrt{X^2 / (N \times \min[(I-1), (J-1)])}$$

where:

X^2, N are the Chi-square and number of observations.
I, J are the number of rows and columns respectively.

Values of C and V close to zero indicate lack of association between the row and column factors of the contingency table, whereas values closer to 1.0 indicate strong association.

APPENDIX D

BIRD TYPES, WEIGHTS, INGESTION LOCATION, AND CODES

The ingested bird species code (reference 2) as shown in this appendix is helpful for computer applications. Each order of birds was assigned a code letter according to its position in the taxonomic sequence. Each family of birds was assigned a code number according to its position within the order. Each species of bird was assigned a code number according to its position within the family. To avoid confusing numbers, the code designation was assembled by putting the family number first, the order letter second, and the species number last (for example: 3K28 not K328; also, this is the black kite (common name) which belongs to the order Falconiformes, family Accipitridae, and species Milvus migrams).

BIRD TYPE	AVERAGE WEIGHT OZ. (+ RANGE)	INGESTIONS, LOCATION U.S.	FOREIGN	UNKNOWN	CODE
<u>FALCONIFORMES - HAWKS, EAGLES, VULTURES, KITES</u>					
CATHARTIDAE - VULTURES					
Cathartes aura - Turkey Vulture	50 (31-85)	2			1K1
PANDIONIDAE - OSPREY					
Pandion haliaetus - Osprey	54 (40-72)		1	1	2K1
ACCIPITRIDAE - HAWKS, EAGLES, KITES, VULTURES					
Milvus migrams - Black Kite	28 (20-42)		46		3K28
Milvus milvus - Red Kite	36 (28-56)		2		3K29
Haliaeetus leucocephalus - Bald Eagle	181 (136-232)		1		3K37
Gyps bengalensis - Indian White-backed Vulture	187 (194-200)		3		3K46
Gyps fulvus - Griffon Vulture	282 (150-529)		2		3K51
Sarcogyps calvus - Indian Black Vulture	158 (131-190)		1		3K54
Buteo nitidus - Gray Hawk or Mexican Goshawk	17 (11-23)		1		3K163
Buteo platypterus - Broad-winged Hawk	14 —	1	2		3K168
Buteo jamaicensis - Red-tailed Hawk	39 —	1			3K179
Buteo buteo - Common Buzzard	28 (17-48)		3		3K180
Buteo lagopus - Rough-legged Hawk	35 (21-59)	1			3K183
FALCONIDAE - FALCONS					
Falco sparvarius - American Sparrowhawk (Kestral)	4 —		2		5K26
Falco cherrug - Saker Falcon	36 (26-46)		1		5K54
<u>GALLIFORMES - CHICKEN-LIKE BIRDS</u>					
PHASIANIDAE - QUAILS, PHEASANTS, PEAFOWLS					
Francolinus francolinus - Black Partridge (Francolin)	16 (8-20)		5		4L44
Phasianus colchicus - Common or Ring-necked Pheasant	39 (18-71)		2	1	4L161
<u>GRUIFORMES - BUTTONQUAILS, CRANES, RAILS</u>					
RALLIDAE - RAILS, CRAKES, COOTS, GALLINULES					
Crex crex - Corncrake	5 (3-7)		1		7M49

BIRD TYPE	AVERAGE WEIGHT OZ. (+ RANGE)	INGESTIONS, LOCATION U.S.	FOREIGN	UNKNOWN	CODE
<u>CHARADRIIFORMES - SHOREBIRDS</u>					
HAEMATOPODIDAE - OYSTERCATCHERS					
Haematopus ostralegus - Common Oystercatcher	18 (12-28)		2		4N1
CHARADRIIDAE - PLOVERS, LAPWINGS					
Vanellus vanellus - Common Lapwing	8 (4-11)		10		5N1
Pluvialis apricaria - Eurasian Golden Plover	7 (3-8)		3		5N25
Pluvialis squatarola - Black-bellied Plover	7 (4-11)	1	2	1	5N27
SCOLOPACIDAE - SANDPIPERS, SNIPES					
Limosa limosa - Black Tailed Godwit	10 (7-13)		2		6N1
Gallinago undulata - Giant Snipe	———		1		6N50
BURHINIDAE - STONE CURLEWS (THICK-KNEES)					
Burhinus capensis - Spotted Thick-knee or Cape Dikkop	15 (14-16)		1		9N4
LARIDAE - GULLS, TERNS					
Larus crassirostris - Black-tailed Gull	20 (15-23)		14		14N10
Larus delawarensis - Ring-billed Gull	17 —	8	1	2	14N12
Larus argentatus - Herring Gull	36 (21-64)	20	4	3	14N14
Larus fuscus - Lesser Black-backed Gull	29 (19-42)	1	3		14N17
Larus californicus - California Gull	24 (17-29)	1			14N18
Larus marinus - Great Black-backed Gull	60 (40-80)	2			14N21
Larus glaucescens - Glaucous-winged Gull	38 —	2	2		14N22
Larus atricilla - Laughing Gull	10 —	1	4		14N26
Larus cirrocephalus - Gray-headed Gull	10 (6-14)		2		14N29
Larus pipixcan - Franklin's Gull	9 —		1		14N31
Larus novaehollandiae - Silver Gull	12 —		5		14N32
Larus maculipennis - Brown-hooded Gull	———		3		14N35
Larus ridibundus - Common Black-headed Gull	10 (4-14)		30	4	14N36
<u>COLUMBIFORMES - PIGEONS, DOVES, SANDGROUSES</u>					
COLUMBIDAE - PIGEONS, DOVES					
Columba livia - Common Rock Dove	14 (7-20)	2	5	1	2P1
Columba palumbus - Wood Pigeon	16 (9-26)	2	21		2P9
Streptopelia turtur - Common Turtle Dove	5 (3-6)		1	1	2P50
Zenaida macroura - Mourning Dove	4 (3-6)	2		1	2P105

BIRD TYPE	AVERAGE WEIGHT OZ. (+ RANGE)	INGESTIONS, LOCATION U.S.	FOREIGN	UNKNOWN	CODE
Zenaida auriculata - Eared Dove	———		1		2P106
<u>STRIGIFORMES - BARN OWLS AND TYPICAL OWLS</u>					
TYTONIDAE - BARN OWLS					
Tyto alba - Common Barn Owl	11 (7-23)	2	2	2	1S2
STRIGIDAE - OWLS					
Asio flammeus - Short-eared Owl	13 (9-18)		3		2S124
<u>CAPRIMULGIFORMES - NIGHTJARS, FROGMOUTHS</u>					
CAPRIMULGIDAE - NIGHTJARS					
Caprimulgus salvini - Chipwillow	2 —		1		5T26
<u>APODIFORMES - SWIFTS, HUMMINGBIRDS</u>					
APODIDAE - SWIFTS					
Cypseloides niger - Black Swift	2 —			1	1U31
<u>CORACIIFORMES - KINGFISHERS, MOTMOTS, HORNBILLS</u>					
CORRACIIDAE - ROLLERS					
Coracias garrulus - European Roller	5 (4-6)		1		5X1
<u>PASSERIFORMES - PERCHING BIRDS</u>					
ALAUDIDAE - LARKS					
Melanocorypha yeltoniensis - Black Lark	2 (1-2)		1		17Z50
Calandrella raytal - Indian Sand-Lark	———		1		17Z54
Alauda gulgula - Lesser Skylark	———		1		17Z73
Eremophila alpestris - Horned Lark	1 (1-2)	1			17Z74
CORVIDAE - CROWS, JAYS					
Corvus splendens - House Crow	11 (9-13)		1		22Z73
Corvus frugilegus - Rook	15 (10-21)		1		22Z84
Corvus corone - Carrion Crow	19 (11-24)		6		22Z94

BIRD TYPE	AVERAGE WEIGHT OZ. (+ RANGE)	INGESTIONS, LOCATION U.S.	FOREIGN	UNKNOWN	CODE
TURDIDAE - THRUSHES					
Catharus ustulatus - Swainson's Thrush	1 —	1			41Z246
Turdus naumanni - Dusky Thrush	3 (3-4)		2		41Z279
Turdus migratorius - American Robin	3 —	1			41Z314
MOTACILLIDAE - WAGTAILS, PIPITS					
Anthus novaeseelandiae - Richard's Pipit	1 —		1		47Z21
ICTERIDAE - BLACKBIRDS & AMERICAN ORIOLES					
Sturnella neglecta - Western Meadowlark	4 (3-4)		1		64Z68
Molothrus ater - Brown-headed Cowbird	2 (1-2)	1			64Z94
FRINGILLIDAE - FINCHES, GROSBEAKS, SPARROWS					
Fringilla coelebs - Common Chaffinch	1 —		1		68Z41
ESTRILDIDAE - WAXBILLS					
Lonchura malacca - Chestnut Munia	1 —		1		69Z104
Amadina erythrocephala - Red-headed Finch	1 —		1		69Z124
OTHER CATEGORIES					
Bats (included due to flight behavior)	1 —		2		99Z999

APPENDIX E

DATA BASE

APPENDIX E

DATA BASE

Legend

1. FAA Bird Ingestion event number (EVT #)
2. Data (month, day, year) (DATE)
3. Local time (TIME)
4. Aircraft type (AC)
5. Engine Position (ENG POS)
6. Airport (ARPT)
7. Phase of Flight (FLIGHT PHASE)
8. Weather (WX)
9. Engine Damage Codes (DAMAGE)
10. Power Loss or Power Reduction (POWER LOSS/RED)
11. Was the damage contained within the nacelle? (CONT DAMG)
12. Reason for in-flight shutdown of engine (IFSD REASON)
13. Was the bird seen prior to the ingestion? (BIRD SEEN)
14. Species of bird ingested (BIRD SPECIES) (Referenced in Appendix D)
15. Number of birds ingested (# BD). An entry of "9" in this column indicates a flock, not nine birds. The bird number is unknown but is assumed to be greater than six birds.
16. Average weight of the bird in ounces (AV WT OZ)
17. Pilot reaction to bird ingestion (PILOT ACT)
18. Important/unusual circumstances regarding this bird ingestion event (SIGNIFICANT REASON)

The legend lists the information contained in this Appendix. It was not possible in all cases to obtain all the information desired. For example, when the local time of the ingestion is unknown, the column entry is listed as "0000". Likewise, when the number of birds or bird weight are unknown, the column entry is "0". In all other cases an unknown quantity is listed as "UNK". In those cases where a particular column entry does not apply, the term "N/A" is entered. An example of this might be a case wherein a bird ingestion has occurred but no damage resulted, therefore, the "IFSD REASON", "PILOT ACT", and "SIGNIFICANT REASON" columns may all have an "N/A" entry. The "EVT #" is computer generated and sequential by date of bird ingestion occurrence. The term "EVENT", as used in this report, refers to an <u>aircraft</u> bird ingestion occurrence. More than a single computer line entry in Appendix E, having the same number, indicates multiple engine involvement. The only exceptions to this are events #3 and #220, which are not multiple engine events, however, two different bird species wee ingested into the engine at the same time.

The following codes refer to entries in Appendix E.

<u>AIRCRAFT (AC)</u>

1 - DC8
2 - DC10
3 - A300
4 - B747
5 - B757
6 - B767
7 - L1011
8 - A310

<u>WEATHER (WX)</u>

IFR - Instrument Flight Rules
VFR - Visual Flight Rules
UNK - Unknown

<u>(DAMAGE)</u>

(See Text)

<u>(Bird Species)</u>

(See Appendix D)

INFLIGHT ENGINE SHUTDOWN (IFSD REASON)

N/A - Not applicable

Vibes - Engine vibrations

Stal/Srg - Compressor Stall/Surge

Hi Egt - High Exhaust Gas Temperature

Epr - Incorrect Engine Pressure Ratio

Invlntry - Involuntary engine shutdown

Paramtrs - Incorrect engine parameters

Other - Other reasons not listed

UNK - Unknown reason

PILOT ACTION (PILOT ACT)

N/A - Not applicable

ATO - Aborted Takeoff

ATB - Air turnback

UNK - Unknown

(SIGNIFICANT REASON)

N/A - Not applicable

Eng Mult - Multiple Engine ingestion

Bds Mult - Multiple Bird ingestion

IPWRLOSS - Involuntary power loss

TRVSFRAC - Transverse fan blade fracture

AIRWRTHY - Engine related airworthiness effects

OTHER - Other significant reasons

EVT#	DATE	TIME	A C	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD REASON	BIRD SEEN	BIRD SPECIES		# B D	AV WT OZ	PI-LOT ACT	SIGNI-FICANT REASON
1	050381	0000	2	1	ABJ	CLIMB	UNK	2	YES	YES	VIBES	UNK	0X	0	0	0	ATB	N/A
2	050681	0814	3	2	ORY	TO	VFR	2	YES	YES	N/A	YES	2P	9	2	11.	ATO	ENG MULT
2	050681	0814	3	1	ORY	TO	VFR	2	YES	YES	N/A	YES	2P	9	2	11.	ATO	ENG MULT
3	050681	1830	7	3	YVR	TO	VFR	29	YES	YES	VIBES	YES	2J	84	1	48	ATB	BDS MULT
3	050681	1830	7	3	YVR	TO	VFR	29	YES	YES	VIBES	YES	22Z	94	1	24	ATB	BDS MULT
4	051081	0000	3	2	BOM.	TO	UNK	45789	YES	NO	N/A	UNK	3K	28	1	28	ATO	TRVSFRAC
5	051981	0000	4	3	XXX	UNK	UNK	2	NO	YES	N/A	UNK	0X	0	0	0	N/A	N/A
6	051981	0000	2	1	XXX	UNK	UNK	2	NO	YES	N/A	UNK	0X	0	0	0	N/A	N/A
7	052281	0000	4	4	XFO	UNK	UNK	1	NO	YES	N/A	NO	0X	0	0	0	N/A	N/A
8	052381	1430	4	3	XFO	UNK	VFR	48	NO	YES	N/A	NO	4L	44	1	17	N/A	N/A
9	052781	0000	3	1	FCO	LANDNG	UNK	1	NO	N/A	N/A	UNK	0X	0	0	0	N/A	N/A
10	052981	1422	7	2	AMM	TO	UNK	1	YES	N/A	VIBES	YES	0X	0	0	0	N/A	N/A
11	053081	1730	4	2	JFK	CLIMB	UNK	4	NO	YES	N/A	NO	0X	0	1	14	N/A	N/A

****** SAMPLE SIZE FOR MAY 81 = 11 # STRIKES WITH DAMAGE = 8 % = 72.727

EVT#	DATE	TIME	A C	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD REASON	BIRD SEEN	BIRD SPECIES		# B D	AV WT OZ	PI-LOT ACT	SIGNI-FICANT REASON
12	060281	0452	3	2	LYS	TO	VFR	1	NO	YES	N/A	YES	3K	29	1	36	N/A	N/A
13	060381	0000	4	3	MWH	TO	UNK	7	NO	YES	N/A	UNK	14N	22	1	40	N/A	N/A
14	060381	0000	3	2	DUR	TO	UNK	2	NO	YES	N/A	UNK	0X	0	0	0	N/A	N/A

EVT#	DATE	TIME	A C	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD REASON	BIRD SEEN	BIRD SPECIES		# B D	AV WT OZ	PI-LOT ACT	SIGNI-FICANT REASON
15	060581	0127	4	4	ILV	TO	VFR	2	NO	YES	N/A	NO	1S	2	1	16	N/A	N/A
16	060881	0000	2	3	VCP	TO	UNK	2	YES	YES	N/A	UNK	0X	0	0	0	ATB	N/A
17	061081	0000	3	1	XFO	UNK	UNK	7	NO	YES	N/A	UNK	3K	29	1	32	N/A	N/A
18	061081	1229	4	4	LHR*	TO	UNK	4569	YES	YES	HI EGT	UNK	2P	1	2	11	ATB	TRVSFRAC
19	061281	0000	3	2	KHI	TO	VFR	2	YES	YES	N/A	UNK	3K	28	1	24	N/A	N/A
20	061381	0000	4	4	LYS	LANDNG	VFR	1	N/A	N/A	N/A	UNK	3K	180	0	28*	N/A	N/A
21	061381	0000	4	4	XXX	UNK	UNK	2	NO	YES	N/A	UNK	0X	0	0	0	N/A	N/A
22	061381	0000	4	4	KHI	LANDNG	UNK	4	UNK	UNK	N/A	UNK	0X	0	2	0	UNK	N/A
23	061481	0000	4	4	XFO	UNK	UNK	1	NO	N/A	N/A	UNK	0X	0	0	0	N/A	N/A
24	061581	0700	7	3	PHL	LANDNG	VFR	489	NO	YES	N/A	NO	14N	14	1	48	N/A	N/A
25	061681	0000	2	1	DKR	TO	VFR	2	YES	N/A	N/A	UNK	0X	0	0	0	N/A	N/A
26	061681	0000	2	1	CDG	UNK	UNK	2	NO	YES	N/A	UNK	0X	0	0	0	N/A	N/A
27	061781	0450	3	1	LYS	TO	VFR	2	YES	YES	N/A	YES	0X	0	0	0	N/A	N/A
28	061781	1729	3	1	ORY	TO	VFR	2	YES	YES	N/A	YES	2P	9	1	16*	N/A	N/A
29	061781	0000	3	1	XFO	UNK	UNK	1	NO	N/A	N/A	UNK	0X	0	0	0	N/A	N/A
30	061881	1514	3	2	ORY	TO	VFR	1	NO	YES	N/A	YES	2P	9	2	16*	N/A	N/A

DATA RECORDED & PROCESSED AT FAA TECHNICAL CENTER, ATLANTIC CITY AIRPORT, N.J. 08405 ON 07/16/84 G FRINGS ACT-320 UNIT 6 PAGE 4

EVT#	DATE	TIME	A C	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD REASON	BIRD SEEN	BIRD SPECIES	# B O	AV WT OZ	PI- LOT ACT	SIGNI- FICANT REASON
31	061981	0000	4	3	AMS	TO	UNK	2	YES	YES	VIBES	UNK	0X 0	0	0	ATB	N/A
32	061981	0000	4	1	GIG	LANDNG	UNK	28	NO	YES	N/A	UNK	0X 0	0	0	ATB	N/A
33	062081	0000	2	1	KAN	TO	UNK	4	YES	YES	VIBES	UNK	3K 28	1	24	UNK	N/A
34	062281	0000	2	3	XXX	UNK	UNK	2	NO	YES	N/A	NO	0X 0	0	0	N/A	N/A
35	062381	0000	7	1	JFK	APPRCH	VFR	1	NO	N/A	N/A	YES	14N 14	1	36*	N/A	N/A
36	062381	0830	4	3	HND	APPRCH	IFR	1	NO	YES	N/A	YES	0X 0	0	0	N/A	BDS MULT
37	062581	0000	7	3	XXX	UNK	UNK	1	NO	N/A	N/A	NO	1U 31	1	2	N/A	N/A
38	062581	0000	4	2	DKR	TAXI	UNK	1	UNK	YES	N/A	NO	4L 44	1	15	N/A	N/A
39	062681	2037	3	1	LYS	LANDNG	IFR	1	NO	YES	N/A	NO	0X 0	0	0	N/A	N/A
40	062781	0000	4	1	LIS	TO	UNK	4	NO	YES	N/A	YES	2P 1	1	10	N/A	N/A
41	062781	0700	4	4	JNB*	TO	VFR	7	YES	YES	HI EGT	UNK	14N 29	1	16	ATB	IPWRLOSS
42	062881	0000	3	1	MPL	LANDNG	VFR	1	NO	N/A	N/A	UNK	0X 0	1	35	UNK	N/A
43	062881	0000	3	1	XXX	UNK	UNK	1	NO	N/A	N/A	NO	1S 2	1	16	N/A	N/A
44	062981	0000	4	1	MNL	TO	UNK	8	NO	N/A	N/A	UNK	0X 0	0	0	N/A	N/A
****** SAMPLE SIZE FOR JUN 81 = 33					# STRIKES WITH DAMAGE = 21						% = 63.636						
45	070381	0000	3	1	DEL	LANDNG	VFR	7	NO	YES	N/A	UNK	3K 28	1	24	N/A	N/A
46	070381	0000	4	4	XUS	UNK	UNK	2	NO	YES	N/A	NO	0X 0	1	0	N/A	N/A

DATA RECORDED & PROCESSED AT FAA TECHNICAL CENTER, ATLANTIC CITY AIRPORT, N.J. 08405 ON 07/16/84 G FRINGS ACT-320 UNIT 6 PAGE 5

EVT#	DATE	TIME	A C	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD REASON	BIRD SEEN	BIRD SPECIES	# B D	AV WT OZ	PI- LOT ACT	SIGNI- FICANT REASON
47	070381	0000	4	0	XXX	UNK	UNK	1	NO	N/A	N/A	NO	0X 0	0	0	N/A	N/A
48	070681	0435	3	2	HOD	LANDNG	VFR	2	NO	YES	N/A	YES	3K 28	1	29	N/A	N/A
49	070681	0000	2	3	LGW*	TO	UNK	4589	YES	NO	INVLNTRY	UNK	2P 9	2	18	ATB	TRVSFRAC
50	070881	0000	4	1	CDG	TO	VFR	2	YES	YES	N/A	UNK	0X 0	0	0	ATB	N/A
51	071081	0000	3	2	MRS	APPRCH	UNK	1	NO	N/A	N/A	UNK	0X 0	0	0	N/A	N/A
52	071081	0000	4	1	XXX	UNK	VFR	1	NO	YES	N/A	NO	0X 0	1	0	N/A	N/A
53	071081	1930	7	1	ATL	TO	VFR	2	YES	YES	N/A	YES	2P 9	1	16*	ATO	N/A
54	071181	0000	2	3	NGO	TO	UNK	2	NO	YES	N/A	NO	5N 1	1	10	N/A	N/A
55	071381	0000	3	1	XFO	UNK	UNK	2	NO	YES	N/A	NO	0X 0	0	0	N/A	N/A
56	071481	0000	3	2	DKR	LANDNG	VFR	1	NO	N/A	N/A	UNK	0X 0	0	0	N/A	N/A
57	071481	0000	3	2	NKC	TO	VFR	1	YES	N/A	N/A	YES	5K 26	0	4*	ATO	N/A
58	071681	0000	3	2	XFO	UNK	UNK	1	N/A	N/A	N/A	NO	5T 26	1	2	N/A	N/A
59	071681	2123	4	4	JFK	TO	VFR	2	NO	YES	STAL/SRG	UNK	14N 14	2	40	ATB	N/A
60	071781	0815	3	1	ORY	TO	VFR	2	YES	YES	N/A	YES	2P 9	1	16*	ATB	N/A
61	071981	0000	4	2	XXX	UNK	UNK	1	NO	N/A	N/A	UNK	2P 50	1	4	N/A	N/A
62	071981	0000	2	1	XUS	UNK	UNK	2	NO	YES	N/A	NO	0X 0	0	0	N/A	N/A

EVT#	DATE	TIME	A C	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD REASON	BIRD SEEN	BIRD SPECIES	# B D	AV WT OZ	PI- LOT ACT	SIGNI- FICANT REASON
63	072181	0000	2	1	XFO	UNK	UNK	2	NO	YES	N/A	NO	0X 0	0	0	N/A	N/A
64	072181	2145	4	1	LHR*	TO	UNK	458	YES	NO	VIBES	YES	14N 36	3	10	ATB	TRVSFRAC
65	072281	0000	2	3	XUS	UNK	UNK	2	NO	YES	N/A	NO	0X 0	1	0	N/A	N/A
66	072581	0000	4	2	XUS	UNK	UNK	1	NO	YES	N/A	NO	14N 14	1	36*	N/A	N/A
67	072681	1200	7	3	BOM	LANDNG	IFR	9	NO	YES	N/A	NO	222 73	1	11*	N/A	N/A
68	073181	0000	7	2	LHR	TO	UNK	8	NO	YES	N/A	YES	14N 36	1	10	N/A	ENG MULT
68	073181	0000	7	3	LHR	TO	UNK	2	NO	YES	N/A	YES	14N 36	1	10	N/A	ENG MULT
****** SAMPLE SIZE FOR JUL 81 = 24						# STRIKES WITH DAMAGE = 16					% = 66.667						
69	080181	0000	3	1	TLS	TO	UNK	2	NO	YES	N/A	UNK	0X 0	0	0	N/A	N/A
70	080181	0000	4	4	NGS	TO	VFR	2	UNK	YES	N/A	UNK	3K 28	1	28	UNK	N/A
71	080281	0000	4	2	BOM	TO	IFR	29	NO	YES	N/A	NO	3K 28	1	40	N/A	N/A
72	080281	0000	4	1	HND	LANDNG	UNK	29	NO	YES	N/A	UNK	0X 0	0	0	N/A	N/A
73	080281	0000	4	1	YUL	APPRCH	UNK	7	NO	YES	N/A	UNK	2J138	1	19	N/A	N/A
74	080681	0000	3	2	DEL	LANDNG	UNK	1	NO	YES	N/A	UNK	3K 28	1	24	N/A	N/A
75	080781	0000	3	1	KHI	LANDNG	UNK	1	NO	N/A	N/A	UNK	3K 28	1	24	N/A	N/A
76	080781	1200	4	2	HND	TO	UNK	1	NO	YES	HI EGT VIBES	YES	11 42	1	24	ATB	N/A
77	080781	2133	7	2	PHL	DESCNT	UNK	1	NO	N/A	N/A	YES	0X 0	1	0	N/A	N/A

EVT#	DATE	TIME	A C	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD REASON	BIRD SEEN	BIRD SPECIES	# B D	AV WT OZ	PI-LOT ACT	SIGNI-FICANT REASON
78	080781	2350	7	1	YUL	TAXI	VFR	1	NO	N/A	N/A	NO	0X 0	0	0	N/A	N/A
79	080851	0000	4	1	XXX	UNK	UNK	2	NO	YES	N/A	NO	0X 0	0	0	N/A	N/A
80	080881	0000	4	1	OOM	TO	UNK	489	NO	YES	N/A	UNK	3K 28	1	32	ATO	N/A
81	080881	0000	4	4	XXX	UNK	UNK	1	NO	YES	N/A	NO	2P105	1	4	N/A	N/A
82	080881	0430	7	3	LCA	TO	UNK	1	YES	N/A	N/A	YES	7M 49	1	7	ATO	N/A
83	080881	0651	7	3	KHI	TO	IFR	2	NO	YES	N/A	YES	3K 28	1	24	N/A	N/A
84	080981	0000	3	1	DEL	LANDNG	VFR	1	NO	N/A	N/A	UNK	5X 1	1	5	N/A	N/A
85	080981	0000	4	4	XFO	UNK	UNK	29	NO	YES	N/A	NO	0X 0	1	0	N/A	N/A
86	081281	0000	3	2	SXR	LANDNG	UNK	1	NO	YES	N/A	NO	0X 0	0	0	N/A	N/A
87	081481	0000	3	1	HAM	UNK	UNK	1	NO	N/A	N/A	UNK	0X 0	0	0	N/A	N/A
88	081481	0000	7	1	XXX	UNK	VFR	2	NO	YES	N/A	NO	2P 1	1	11	N/A	N/A
89	081681	0000	7	3	XFO	UNK	VFR	1	NO	N/A	N/A	NO	3K 28	1	26	N/A	N/A
90	081781	0000	2	3	FIH	TO	UNK	2	UNK	YES	VIBES	UNK	0X 0	0	0	ATB	N/A
91	081781	0000	4	4	XXX	UNK	UNK	2	NO	YES	N/A	NO	0X 0	1	0	N/A	N/A
92	081881	0000	7	3	XFO	UNK	UNK	1	NO	N/A	N/A	NO	0X 0	0	0	N/A	N/A
93	081981	0000	3	1	DEL	LANDNG	UNK	47	NO	YES	N/A	UNK	3K 28	1	28	N/A	N/A

DATA RECORDED & PROCESSED AT FAA TECHNICAL CENTER, ATLANTIC CITY AIRPORT, N.J. 08405 ON 07/16/84 G FRINGS ACT-320 UNIT 6 PAGE 8

EVT#	DATE	TIME	A C	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD REASON	BIRD SEEN	BIRD SPECIES	# B D	AV WT OZ	PI-LOT ACT	SIGNI-FICANT REASON
94	081981	0000	3	2	MAA	TO	VFR	27	NO	YES	N/A	UNK	0X 0	0	0	N/A	N/A
95	082081	1643	3	2	CDG	TO	VFR	2	YES	YES	N/A	YES	2P 9	1	11	ATB	N/A
96	082081	0000	4	3	XXX	UNK	UNK	1	NO	YES	N/A	NO	0X 0	0	0	N/A	N/A
97	082181	0402	4	2	LHR	LANDNG	VFR	1	NO	YES	N/A	YES	14N 29	2	10*	N/A	N/A
98	082381	0930	2	1	HND	APPRCH	IFR	1	NO	YES	N/A	YES	14N 10	9	20*	N/A	ENG MULT
98	082381	0930	2	3	HND	APPRCH	IFR	1	NO	YES	N/A	YES	14N 10	9	20*	N/A	ENG MULT
99	082481	0000	2	1	LIN	TO	VFR	4	YES	YES	N/A	UNK	222 94	1	17	ATO	N/A
100	082581	0000	2	3	FCO	TO	VFR	2	YES	YES	N/A	UNK	0X 0	0	0	N/A	N/A
101	082581	0000	2	3	OKA	UNK	UNK	2	NO	YES	N/A	YES	5N 25	2	6	N/A	BDS MULT
102	082581	0000	2	1	XXX	UNK	UNK	1	NO	N/A	N/A	NO	0X 0	0	0	N/A	ENG MULT
102	082581	0000	2	3	XXX	UNK	UNK	1	NO	N/A	N/A	NO	0X 0	0	0	N/A	ENG MULT
103	082681	0000	2	1	FUK	APPRCH	UNK	1	NO	YES	N/A	YES	2P 9	1	10	N/A	N/A
104	082651	0000	2	3	ORD*	TO	UNK	4589	YES	YES	VIBES	UNK	14N 12	4	15	ATB	TRVSFRAC
105	082681	0000	4	2	XUS	UNK	UNK	1	NO	N/A	N/A	NO	0X 0	1	0	N/A	N/A
106	082681	0750	4	1	CPH	TO	UNK	1	UNK	N/A	N/A	UNK	14N 14	1	40	UNK	N/A
107	082781	1925	4	2	HND	TO	VFR	2	NO	YES	N/A	NO	14N 10	1	20*	N/A	N/A

EVT#	DATE	TIME	A C	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD REASON	BIRD SEEN	BIRD SPECIES	# B D	AV WT OZ	PI-LOT ACT	SIGNI-FICANT REASON
108	082981	0000	2	1	MTY	TO	VFR	2	YES	YES	N/A	UNK	3K163	1	29	N/A	N/A
109	082981	0000	4	2	XXX	UNK	UNK	2	NO	YES	N/A	NO	0X 0	1	0	N/A	N/A
110	082981	0730	4	1	WLG*	TO	VFR	79	YES	YES	STAL/SRG. HI EGT	YES	14N 17	1	32	ATB	N/A
111	082981	1900	2	3	OSA	LANDNG	VFR	1	NO	N/A	N/A	NO	992999	9	1*	N/A	N/A
112	082981	2030	4	4	OSA	APPRCH	VFR	1	NO	N/A	N/A	NO	992999	9	1*	N/A	N/A
113	083081	0000	2	2	SNN	TO	UNK	2	YES	YES	N/A	UNK	2P 1	1	11	N/A	N/A
114	083081	0000	2	3	BKK	LANDNG	UNK	7	NO	N/A	N/A	UNK	0X 0	1	0	N/A	N/A
115	083181	0000	2	1	LAX	TO	UNK	2	NO	YES	N/A	YES	14N 18	2	24*	ATO	BDS MULT

****** SAMPLE SIZE FOR AUG.81 = 47 # STRIKES WITH DAMAGE = 26 % = 55.319

EVT#	DATE	TIME	A C	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD REASON	BIRD SEEN	BIRD SPECIES	# B D	AV WT OZ	PI-LOT ACT	SIGNI-FICANT REASON
116	090181	0000	3	2	STR	LANDNG	VFR	1	NO	N/A	N/A	UNK	0X 0	0	0	N/A	N/A
117	090181	0500	4	4	LHR	LANDNG	UNK	1	NO	N/A	N/A	UNK	0X 0	0	0	N/A	N/A
117	090181	0500	4	2	LHR	LANDNG	UNK	1	NO	N/A	N/A	UNK	0X 0	0	0	N/A	N/A
117	090181	0500	4	1	LHR	LANDNG	UNK	1	NO	N/A	N/A	UNK	0X 0	0	0	N/A	N/A
118	090281	0000	2	0	FCO	TAXI	UNK	1	NO	N/A	N/A	UNK	0X 0	0	0	N/A	N/A
119	090581	0000	2	3	BOM	TO	UNK	2	NO	YES	N/A	UNK	0X 0	0	0	N/A	N/A
120	090681	0000	4	4	XXX	UNK	VFR	2	NO	YES	N/A	NO	0X -0	1	32	N/A	N/A
121	090781	0000	2	3	YUL	TO	VFR	1	NO	N/A	N/A	UNK	222 94	1	16	N/A	N/A

EVT#	DATE	TIME	AC	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD REASON	BIRD SEEN	BIRD SPECIES	# B D	AV WT OZ	PILOT ACT	SIGNIFICANT REASON
122	090881	0000	2	3	KAN	LANDNG	VFR	1	NO	N/A	N/A	UNK.	0X 0	0	0	N/A	N/A
122	090381	0000	2	1	KAN	LANDNG	VFR	2	NO	YES	N/A	UNK	0X 0	0	0	N/A	N/A
123	090881	0647	7	3	PHL	APPRCH	VFR	79	NO	YES	N/A	YES	2J 30	1	112	N/A	N/A
124	091181	0000	2	3	LGW	LANDNG	VFR	1	NO	N/A	N/A	UNK	0X 0	0	0	N/A	N/A
125	091181	0900	4	2	FEZ	TO	VFR	4	NO	YES	N/A	NO	0X 0	1	0	N/A	N/A
126	091281	1045	4	2	DEL*	LANDNG	VFR	4589	YES	NO	HI EGT	YES	3K 46	1	176	N/A	TRVSFRAC
127	091281	1730	2	3	LAX	TO	UNK	2	NO	YES	N/A	NO	0X 0	1	0	N/A	N/A
128	091381	0000	7	1	ATL	CLIMB	VFR	29	YES	YES	OTHER	YES	3K179	1	40	ATB	N/A
129	091481	1400	2	3	LAX	TO	UNK	29	YES	YES	VIBES	UNK	2P 9	1	11	ATB	N/A
130	091581	0000	3	1	HYD	TO	VFR	2	YES	YES	N/A	UNK	0X 0	0	0	ATB	N/A
131	091581	0500	7	1	LHR	LANDNG	VFR	2	NO	YES	N/A	UNK	14N 36	1	15	N/A	N/A
132	091781	0000	3	1	ATH	TO	VFR	1	NO	N/A	N/A	UNK	0X 0	0	0	N/A	N/A
133	091781	0700	4	2	JFK	APPRCH	UNK	49	NO	YES	N/A	YES	14N 14	1	20	N/A	N/A
134	091881	1830	4	4	FUK	UNK	UNK	1	NO	N/A	N/A	NO	14N 10	1	20	N/A	N/A
135	092181	0000	3	1	HYD	TO	VFR	1	NO	N/A	N/A	UNK	3K 28	1	28	N/A	N/A
136	092281	1230	7	3	XFO	UNK	VFR	1	NO	N/A	N/A	UNK	0X 0	1	0	N/A	N/A

EVT#	DATE	TIME	A C	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD REASON	BIRD SEEN	BIRD SPECIES	# B D	AV WT OZ	PI-LOT ACT	SIGNI-FICANT REASON
137	092381	0000	3	2	LGA	LANDNG	VFR	2	NO	YES	N/A	UNK	14N 14	1	32	N/A	N/A
138	092381	0942	7	1	KMQ	TO	VFR	1	NO	N/A	N/A	YES	3K 28	1	32*	N/A	N/A
139	092381	2400	4	1	FCO	TO	UNK	1	NO	N/A	N/A	UNK	0X 0	0	0	ATO	N/A
140	092681	1345	4	3	XFO	UNK	VFR	1	NO	N/A	N/A	NO	11 50	1	14	N/A	N/A
141	092781	0000	2	1	FCO	TAXI	UNK	1	NO	N/A	N/A	UNK	14N 12	1	28*	N/A	N/A
142	092781	0000	3	1	PUS	LANDNG	VFR	2	NO	YES	N/A	UNK	0X 0	0	0	N/A	N/A
143	092781	1350	4	2	YMX	LANDNG	UNK	1	UNK	N/A	N/A	NO	0X 0	0	0	N/A	N/A
144	092981	1100	4	3	YYZ	LANDNG	UNK	4	NO	YES	N/A	NO	0X 0	1	0	N/A	N/A
145	093081	0000	4	0	XXX	UNK	UNK	2	NO	YES	N/A	NO	0X 0	0	0	N/A	N/A
146	093081	0000	3	1	HYD	LANDNG	VFR	2	NO	YES	N/A	UNK	3K 28	1	28	N/A	N/A

****** SAMPLE SIZE FOR SEP 81 = 31 # STRIKES WITH DAMAGE = 17 % = 54.839

EVT#	DATE	TIME	A C	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD REASON	BIRD SEEN	BIRD SPECIES	# B D	AV WT OZ	PI-LOT ACT	SIGNI-FICANT REASON
147	100181	0000	4	4	CDG	TO	VFR	2	YES	YES	N/A	UNK	0X 0	0	0	N/A	N/A
148	100381	0000	7	1	XXX	UNK	VFR	1	NO	N/A	N/A	NO	0X 0	1	0	N/A	N/A
149	100481	0000	2	3	ZRH	TO	VFR	2	NO	YES	N/A	UNK	0X 0	0	0	N/A	N/A
150	100481	0000	2	3	BGF*	CLIMB	UNK	4789	YES	YES	STAL/SRG	YES	5I 17	1	240	ATB	IPWRLOSS
151	100581	0000	3	1	HYD	TO	VFR	2	NO	YES	N/A	UNK	3K 28	1	28	N/A	N/A
152	100581	0000	7	1	LIM	CLIMB	UNK	1	NO	N/A	N/A	UNK	0X 0	0	0	N/A	N/A

EVT#	DATE	TIME	A C	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD REASON	BIRD SEEN	BIRD SPECIES	# B D	AV WT OZ	PI- LOT ACT	SIGNI- FICANT REASON
153	100681	0000	4	3	NBO	TO	UNK	7	NO	YES	STAL/SRG	UNK	3K 28	1	28*	ATB	N/A
154	100681	0735	4	3	DEL	LANDNG	UNK	48	NO	YES	N/A	UNK	0X 0	0	0	N/A	N/A
155	100881	0000	3	2	ORY	LANDNG	IFR	1	NO	N/A	N/A	UNK	0X 0	0	0	N/A	N/A
156	100881	0000	2	3	NBO*	TO	UNK	59	YES	YES	N/A	UNK	3K 51	1	282*	ATO	N/A
157	100881	1300	4	3	LAX	TO	UNK	2	NO	YES	VIBES	UNK	2P 1	1	10	ATB	N/A
158	100981	0000	3	2	XFO	UNK	UNK	1	NO	N/A	N/A	UNK	0X 0	0	0	N/A	N/A
159	101081	0000	3	2	JFK	DESCNT	UNK	2	NO	YES	N/A	UNK	0X 0	0	0	N/A	N/A
160	101081	0200	4	2	BOM	TO	UNK	1	NO	N/A	N/A	YES	3K 28	1	24*	ATO	N/A
161	101081	1240	7	3	NGS	LANDNG	VFR	1	NO	N/A	N/A	YES	3K 28	1	28*	N/A	N/A
162	101281	0000	2	3	XFO	UNK	UNK	2	NO	YES	N/A	NO	0X 0	1	22	UNK	N/A
163	101281	0000	2	3	KAN	LANDNG	UNK	2	NO	YES	N/A	UNK	0X 0	0	0	N/A	N/A
164	101281	0900	7	3	NGO	LANDNG	VFR	2	NO	YES	N/A	NO	2P 9	1	10*	N/A	N/A
165	101381	0000	3	1	ORY	LANDNG	IFR	1	NO	N/A	N/A	UNK	2P 9	1	11*	N/A	N/A
166	101381	1622	4	4	YYZ	APPRCH	VFR	4	NO	YES	N/A	NO	642 68	1	5	N/A	N/A
167	101481	0000	3	2	XFO	UNK	UNK	1	NO	N/A	N/A	UNK	0X 0	0	0	N/A	N/A
168	101581	0000	4	1	BOS	TO	VFR	2	YES	YES	N/A	UNK	14N 14	1	44	ATB	N/A

EVT#	DATE	TIME	A C	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD REASON	BIRD SEEN	BIRD SPECIES	# B D	AV WT OZ	PI-LOT ACT	SIGNI-FICANT REASON
169	101681	0706	3	1	ORY	LANDNG	IFR	1	NO	YES	N/A	YES	2P 9	1	11•	N/A	N/A
170	101981	0000	3	1	TUN	TO	VFR	2	YES	YES	N/A	UNK	0X 0	0	0	ATB	N/A
171	102381	0700	4	1	XXX	UNK	UNK	1	NO	N/A	N/A	NO	14N 36	1	9	N/A	ENG MULT
171	102081	0700	4	2	XXX	UNK	UNK	1	NO	N/A	N/A	NO	14N 36	3	9	N/A	ENG MULT
172	102081	1745	4	4	HND	TO	UNK	4	NO	YES	N/A	NO	2J 95	1	32	N/A	N/A
173	102181	0000	4	3	XFO	UNK	UNK	1	NO	N/A	N/A	UNK	0X 0	0	0	N/A	N/A
174	102181	0000	7	1	XFO	UNK	UNK	1	NO	N/A	N/A	NO	0X 0	0	0	N/A	N/A
175	102181	0000	3	2	SXR	TAXI	VFR	2	NO	YES	N/A	UNK	0X 0	0	0	N/A	N/A
176	102281	2050	4	1	YVR	APPRCH	UNK	7	NO	YES	N/A	UNK	2J 26	1	80	N/A	N/A
177	102381	0000	2	1	XXX	UNK	UNK	2	NO	YES	N/A	UNK	0X 0	0	0	N/A	N/A
178	102381	0800	4	1	XFO	UNK	UNK	2	NO	N/A	N/A	UNK	2J125	1	32	N/A	N/A
179	102381	0000	4	1	XFO	UNK	UNK	1	NO	N/A	N/A	NO	0X 0	1	0	N/A	N/A
180	102381	0850	4	4	HND	CLIMB	VFR	48	NO	YES	N/A	NO	3K 28	1	32	N/A	N/A
181	102581	0000	7	1	NGS	LANDNG	VFR	1	NO	N/A	N/A	YES	3K 28	1	28•	N/A	N/A
182	102581	0000	4	2	XFO	UNK	UNK	1	NO	N/A	N/A	UNK	0X 0	0	0	N/A	N/A
183	102681	0000	2	1	IAH	TO	UNK	2	NO	YES	N/A	UNK	0X 0	0	0	N/A	N/A

EVT#	DATE	TIME	A C	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD REASON	BIRD SEEN	BIRD SPECIES		# B D	AV WT OZ	PI-LOT ACT	SIGNI-FICANT REASON
184	102681	0000	7	2	XEO	UNK	UNK	2	NO	YES	N/A	NO	0X	0	0	0	N/A	N/A
185	102681	0000	3	2	CCU	TO	VFR	2	YES	YES	N/A	UNK	0X	0	0	0	ATO	N/A
186	102681	0500	4	4	JFK	UNK	IFR	1	NO	N/A	N/A	NO	14N	14	1	40	N/A	OTHER
187	102881	0000	2	3	DPS	TO	UNK	1	NO	N/A	N/A	UNK	0X	0	0	0	N/A	N/A
188	102881	0000	4	4	GIG	DESCNT	VFR	2	NO	YES	N/A	UNK	2J	84	1	32	N/A	N/A
189	103081	0000	7	3	XXX	UNK	UNK	7	NO	YES	N/A	UNK	14N	12	1	18	N/A	N/A
190	103081	1230	4	3	FUK	TO	UNK	4	UNK	YES	N/A	NO	14N	10	1	24	N/A	N/A
191	103081	1500	7	3	NGS	TO	VFR	29	YES	YES	N/A	YES	3K	28	1	28*	ATO	N/A
192	103181	1125	4	4	SFO	CLIMB	UNK	1	NO	N/A	N/A	YES	2J	65	1	32	N/A	N/A
****** SAMPLE SIZE FOR OCT 81 = 46							# STRIKES WITH DAMAGE = 28					% = 60.870						
193	110181	0000	4	1	XXX	UNK	UNK	2	NO	YES	N/A	UNK	0X	0	0	0	N/A	N/A
194	110381	0000	4	2	HKG	TO	UNK	2	YES	YES	N/A	NO	3K	28	1	32	N/A	N/A
195	110381	0000	3	1	ORY	LANDNG	IFR	1	NO	N/A	N/A	UNK	2P	9	1	11*	N/A	N/A
196	110481	0000	3	1	MRS	LANDNG	IFR	1	NO	N/A	N/A	UNK	0X	0	0	0	N/A	N/A
197	110581	0000	3	2	HND	APPRCH	UNK	2	NO	YES	N/A	UNK	0X	0	0	0	N/A	N/A
198	110681	0000	3	1	HYD	TO	VFR	469	YES	YES	N/A	UNK	0X	0	0	0	ATO	N/A
199	110781	0000	7	1	XXX	UNK	UNK	89	NO	YES	N/A	NO	14N	14	1	44	N/A	N/A

EVT#	DATE	TIME	A C	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT. DAMG	IFSD. REASON	BIRD SEEN	BIRD SPECIES	# B D	AV WT. OZ	PI-LOT ACT	SIGNI-FICANT REASON
200	110881	0000	3	2	LPA	TO	VFR	2	YES	YES	N/A	YES	14N 36	1	10*	ATO	N/A
201	111081	0000	4	2	XFO	UNK	UNK	1	NO	N/A	N/A	NO	0X 0	0	0	N/A	N/A
202	111181	0815	4	2	MWH*	CLIMB	VFR	34589	YES	YES	HI EGT	YES	2J 84	2	45	ATB	BDS MULT
203	111381	1700	7	1	YVR	APPRCH	VFR	1	UNK	N/A	N/A	YES	14N 14	1	34	N/A	N/A
204	111481	0000	3	1	MAA	TO	VFR	2	YES	YES	VIBES	UNK	0X 0	0	0	ATB	N/A
205	111581	1630	4	3	OSA	CLIMB	UNK	4	UNK	YES	N/A	NO	0X 0	0	0	N/A	N/A
206	111781	2000	7	1	FUK	TO	UNK	2	NO	YES	N/A	UNK	0X 0	1	0	N/A	N/A
207	112081	0000	2	3	IST	TO	UNK	29	NO	YES	N/A	UNK	0X 0	0	0	N/A	N/A
208	112181	0000	4	1	AMS	TO	UNK	7	YES	YES	STAL/SRG	NO	14N 14	1	40	N/A	AIRWRTHY
209	112281	0000	4	2	XFO	UNK	UNK	1	NO	N/A	N/A	NO	0X 0	0	0	N/A	N/A
210	112381	0000	4	1	SNN	TO	UNK	2	UNK	YES	N/A	UNK	0X 0	1	13	N/A	N/A
211	112481	0000	4	4	XFO	UNK	UNK	2	NO	N/A	N/A	NO	0X 0	0	0	N/A	N/A
212	112481	0000	4	2	XFO	UNK	UNK	1	NO	N/A	N/A	UNK	0X 0	0	0	N/A	N/A
213	113081	0000	4	3	XXX	UNK	UNK	1	NO	N/A	N/A	NO	0X 0	0	0	N/A	N/A
214	113081	1400	4	2	VIE*	TO	VFR	458	YES	NO	PARAMTRS	UNK	222 84	1	14	N/A	TRVSFRAC

****** SAMPLE SIZE FOR NOV 81 = 22 # STRIKES WITH DAMAGE = 15 % = 68.182

EVT#	DATE	TIME	A C	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT. DAMG	IFSD. REASON	BIRD SEEN	BIRD SPECIES	# B D	AV WT. OZ	PI-LOT ACT	SIGNI-FICANT REASON
215	120281	1330	7	2	YYC	APPRCH	VFR	1	NO	N/A	N/A	YES	2J 84	1	56	N/A	N/A

DATA RECORDED & PROCESSED AT FAA TECHNICAL CENTER, ATLANTIC CITY AIRPORT, N.J. 08405 ON 07/16/84 G FRINGS ACT-320 UNIT 6 PAGE 16

EVT#	DATE	TIME	A C	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD REASON	BIRD SEEN	BIRD SPECIES	# B D	AV WT OZ	PI-LOT ACT	SIGNI-FICANT REASON
216	120981	1720	7	3	HND	APPRCH	VFR	1	NO	N/A	N/A	YES	0X 0	1	0	N/A	N/A
217	121181	0000	2	3	XFO	UNK	UNK	7	NO	YES	N/A	NO	0X 0	0	0	N/A	N/A
218	121381	0000	4	4	BOM	TO	UNK	568	NO	YES	N/A	NO	2S124	1	12	N/A	N/A
219	121581	0000	3	1	CDG	LANDNG	UNK	1	NO	YES	N/A	UNK	14N 36	1	10	ATB	N/A
220	121581	1215	3	2	CDG	TO	UNK	49	YES	YES	N/A	UNK	14N 36	1	14	ATB	BDS MULT
220	121581	1215	3	2	CDG	TO	UNK	49	YES	YES	N/A	UNK	4L 44	1	12	ATB	BDS MULT
221	121681	0000	2	1	NIM	TO	UNK	2	YES	YES	VIBES	UNK	0X 0	0	0	ATB	N/A
222	122181	0000	2	1	BRU	TO	UNK	2	UNK	YES	N/A	UNK	0X 0	0	0	ATB	N/A
223	122281	0900	4	4	JFK	TO	VFR	2	NO	YES	STAL/SRG	NO	14N 21	2	48	ATB	BDS MULT
224	122781	0000	3	2	LGA	APPRCH	IFR	4	NO	YES	N/A	YES	2P 9	1	11	N/A	N/A
225	122781	0000	7	3	XUS	APPRCH	VFR	1	NO	N/A	N/A	NO	14N 12	0	17*	N/A	N/A
226	122881	0000	3	1	XFO	UNK	UNK	1	NO	N/A	N/A	UNK	0X 0	0	0	N/A	N/A
227	122981	0756	3	2	ORY	TO	IFR	2	YES	YES	N/A	YES	14N 36	1	10*	ATB	N/A
228	122981	0000	4	1	XXX	UNK	UNK	2	NO	YES	N/A	NO	0X 0	1	0	N/A	N/A
229	122981	0000	3	2	PEN	TO	IFR	49	NO	YES	N/A	UNK	0X 0	0	0	N/A	N/A
230	123181	0000	3	1	LPA	CLIMB	VFR	7	NO	YES	OTHER	UNK	0X 0	0	0	UNK	N/A

EVT#	DATE	TIME	AC	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD. REASON	BIRD SEEN	BIRD SPECIES	# B D	AV WT OZ	PI-LOT ACT	SIGNI-FICANT REASON
231	123181	0000	3	1	XFO	UNK	VFR	1	NO	N/A	N/A	UNK	3K 28	1	24	N/A	N/A

****** SAMPLE SIZE FOR DEC 81 = 17 # STRIKES WITH DAMAGE = 11 % = 64.706

EVT#	DATE	TIME	AC	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD. REASON	BIRD SEEN	BIRD SPECIES	# B D	AV WT OZ	PI-LOT ACT	SIGNI-FICANT REASON
232	010182	1030	3	1	CCU*	DESCNT	UNK	4589	YES	NO	VIBES	UNK	3K 46	1	176	N/A	TRVSFRAC
233	010382	1100	4	4	YVR	TO	VFR	478	NO	YES	STAL/SRG	YES	3K 37	1	180	ATO	BDS MULT
234	010482	0000	3	2	XFO	UNK	UNK	2	NO	YES	N/A	UNK	0X 0	0	0	N/A	N/A
235	010482	0000	2	1	XXX	UNK	UNK	2	NO	N/A	N/A	UNK	0X 0	0	0	N/A	N/A
236	010982	0000	4	3	XFO	UNK	VFR	2	NO	YES	N/A	UNK	2J108	1	20	N/A	N/A
237	011482	0000	3	1	KHI	APPRCH	UNK	1	NO	N/A	N/A	UNK	0X 0	0	0	N/A	N/A
238	011482	0830	4	3	MIA	CLIMB	IFR	4	NO	YES	N/A	NO	14N 26	1	11	N/A	N/A
239	011482	1335	4	2	JFK	APPRCH	VFR	8	NO	YES	N/A	YES	2J 88	1	40*	N/A	N/A
240	011682	0000	4	2	DUR	LANDNG	IFR	4	NO	YES	N/A	YES	0X 0	1	0	N/A	N/A
241	011782	0000	3	1	XFO	UNK	UNK	2	NO	YES	N/A	NO	3K 28	1	28	N/A	N/A
242	012282	0000	4	1	SID	UNK	UNK	2	UNK	YES	N/A	NO	3K 28	1	24	N/A	N/A
243	012382	0000	4	3	XXX	UNK	UNK	2	YES	YES	N/A	NO	0X 0	0	0	N/A	N/A
244	012682	1730	7	3	FLL*	TO	VFR	7	YES	YES	STAL/SRG OTHER	YES	14N 12	1	18	ATB	N/A
245	012782	0000	4	1	ORY	LANDNG	UNK	1	NO	N/A	N/A	UNK	0X 0	0	0	N/A	N/A
246	012782	0000	4	2	FRA	APPRCH	UNK	2	NO	YES	N/A	UNK	0X 0	1	0	N/A	N/A

****** SAMPLE SIZE FOR JAN 82 = 15 # STRIKES WITH DAMAGE = 13 % = 86.667

247	020682	0000	2	3	JFK	TO	UNK 2	NO	YES	N/A	UNK	14N	14	1	40	N/A	N/A	
248	020782	0000	4	1	XFO	UNK	UNK 1	NO	N/A	N/A	NO	0X	0	1	3	N/A	N/A	
249	020982	0000	2	3	LOS	CLIMB	UNK 1	NO	N/A	N/A	UNK	0X	0	0	0	N/A	N/A	
250	020982	1930	4	2	JNB	TO	UNK 48	UNK	YES	N/A	UNK	0X	0	0	0	N/A	N/A	
251	021182	0000	4	1	OSA	TO	VFR 2	NO	YES	N/A	UNK	14N	36	1	15	UNK	N/A	
252	021382	0000	4	1	XFO	UNK	UNK 47	NO	YES	N/A	NO	14N	36	1	11	N/A	N/A	
253	021682	0000	4	4	NBO	LANDNG	UNK 2	NO	YES	N/A	UNK	0X	0	0	0	N/A	N/A	
254	022382	0000	3	1	DUR	TO	VFR 29	YES	YES	N/A	UNK	0X	0	0	0	ATO	N/A	
255	022782	0000	4	1	XFO	UNK	UNK 2	NO	YES	N/A	NO	14N	36	1	10	N/A	N/A	
256	022882	1200	4	2	BRU*	TO	UNK 4589	YES	NO	HI,FGT	YES	14N	36	4	11	ATB	BDS	MULT IPWRLOSS

****** SAMPLE SIZE FOR FEB 82 = 10 # STRIKES WITH DAMAGE = 8 % = 80.000

257	030282	0000	3	1	XFO	UNK	UNK 2	NO	N/A	N/A	UNK	0X	0	0	0	N/A	N/A	
258	030382	0000	4	3	MWH	APPRCH	VFR 7	YES	YES	N/A	NO	2J	30	1	80	N/A	ENG	MULT
258	030382	0000	4	4	MWH	APPRCH	VFR 1	NO	N/A	N/A	NO	2J	30	1	80	N/A	ENG	MULT
259	030582	0000	2	1	MIA	CLIMB	UNK 2	YES	YES	N/A	YES	14N	17	2	30	UNK	N/A	
260	030682	1200	4	1	SNN	TO	UNK 2	NO	YES	N/A	NO	SN	1	1	8*	N/A	N/A	

EVT#	DATE	TIME	A C	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD REASON	BIRD SEEN	BIRD SPECIES	# B D	AV WT OZ	PI- LOT ACT	SIGNI- FICANT REASON
261	030782	1000	4	4	SFO	TO	UNK	1	NO	N/A	N/A	YES	0X 0	0	0	N/A	N/A
262	030882	0110	4	3	XFO	UNK	UNK	4	NO	YES	N/A	NO	5N 1	1	10	N/A	N/A
263	030982	0200	2	3	HND	TO	VFR	1	NO	YES	N/A	NO	412229	1	3	N/A	N/A
264	031182	0000	2	3	LAX	LANDNG	UNK	1	NO	YES	N/A	UNK	0X 0	0	0	UNK	N/A
265	031182	1700	2	3	BGF	TO	UNK	27	YES	YES	N/A	UNK	0X 0	0	0	UNK	N/A
266	031382	0000	2	3	BWI	LANDNG	UNK	1	NO	YES	N/A	UNK	0X 0	0	0	N/A	ENG MULT
266	031382	0000	2	1	BWI	LANDNG	UNK	1	NO	N/A	N/A	UNK	0X 0	0	0	N/A	ENG MULT
267	031482	0930	4	2	ZRH	LANDNG	UNK	2	NO	YES	N/A	NO	0X 0	1	40*	N/A	N/A
268	031582	0000	7	1	MIA	APPRCH	UNK	1	NO	N/A	N/A	UNK	0X 0	1	0	N/A	N/A
269	031682	0000	4	2	XFO	UNK	UNK	28	NO	YES	N/A	UNK	0X 0	0	0	N/A	N/A
270	031682	2100	4	3	JNB	LANDNG	VFR	489	NO	YES	N/A	NO	9N 4	1	11	N/A	N/A
271	031782	0000	4	1	XXX	UNK	UNK	1	NO	N/A	N/A	NO	0X 0	1	0	N/A	N/A
272	031982	0000	7	3	XXX	UNK	UNK	9	NO	N/A	N/A	NO	5N 27	1	8	N/A	N/A
273	031982	0220	4	2	LHR	LANDNG	VFR	1	NO	YES	N/A	YES	0X 0	0	0	N/A	N/A
274	032082	0000	4	2	JFK	APPRCH	VFR	1	UNK	YES	N/A	UNK	14N 14	1	40	N/A	N/A
275	032182	1845	7	1	JFK	APPRCH	IFR	1	NO	N/A	N/A	YES	642 94	1	2	N/A	N/A

EVT#	DATE	TIME	AC	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD REASON	BIRD SEEN	BIRD SPECIES	# B D	AV WT OZ	PILOT ACT	SIGNIFICANT REASON
276	032282	0000	4	3	JED	TO	UNK	49	YES	YES	HI EGT	UNK	11 57	1	88	ATB	N/A
277	032382	0000	3	2	MEL	TO	IFR	9	UNK	YES	N/A	YES	14N 10	1	24	UNK	ENG MULT
277	032382	0000	3	1	MEL	TO	IFR	1	UNK	YES	N/A	YES	14N 10	1	24	UNK	ENG MULT
278	032382	0600	4	2	JFK	APPRCH	VFR	2	UNK	YES	N/A	YES	14N 14	1	40	N/A	N/A
279	032382	0700	4	1	JED*	APPRCH	VFR	4689	YES	NO	HI EGT	UNK	6N 1	9	11	N/A	BDS MULT IPWRLOSS
279	032382	0700	4	2	JED*	APPRCH	VFR	45689	YES	NO	VIBES	UNK	6N 1	9	11	N/A	BDS MULT IPWRLOSS
280	032682	1632	2	1	MSP	UNK	UNK	26	NO	YES	N/A	YES	3K183	1	36	N/A	N/A
281	032782	0000	4	1	PTY*	TO	UNK	469	UNK	YES	STAL/SRG	YES	3K168	1	16	ATB	N/A
282	032782	0000	3	1	CAI	CLIMB	UNK	2	NO	YES	N/A	UNK	0X 0	1	0	ATB	N/A
283	032782	0000	4	4	HND	LANDNG	UNK	28	NO	N/A	N/A	UNK	0X 0	0	0	N/A	N/A
284	032782	1415	3	2	CAI	TO	VFR	28	YES	YES	N/A	UNK	3K 28	1	24	ATB	N/A
285	032882	0000	4	4	XFO	UNK	UNK	2	UNK	YES	N/A	NO	0X 0	1	0	N/A	N/A
286	032882	1700	4	4	AMS	TO	VFR	29	YES	YES	VIBES	UNK	0X 0	0	0	ATB	N/A
****** SAMPLE SIZE FOR MAR 82 = 30						# STRIKES WITH DAMAGE = 21					% = 70.000						
287	040982	0000	7	3	LIS	CLIMB	UNK	2	UNK	YES	VIBES	YES	0X 0	1	0	ATB	N/A
288	041082	0000	3	2	XFO	UNK	VFR	4	NO	YES	N/A	UNK	0X 0	0	0	N/A	N/A
289	041182	0000	4	2	XFO	UNK	UNK	28	NO	YES	N/A	UNK	0X 0	0	0	N/A	N/A

EVT#	DATE	TIME	A C	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD REASON	BIRD SEEN	BIRD SPECIES	# B D	AV WT OZ	PI-LOT ACT	SIGNI-FICANT REASON
290	041382	1940	2	1	YYZ	TO	VFR	2	YES	YES	N/A	UNK	2S124	1	12	ATB	N/A
291	041582	0000	3	1	XUS	UNK	UNK	1	NO	N/A	N/A	NO	0X 0	0	0	N/A	N/A
292	041892	0000	7	1	XFO	UNK	UNK	9	NO	YES	N/A	NO	14N 22	1	52	N/A	N/A
293	042082	0000	3	2	XFO	UNK	VFR	1	NO	N/A	N/A	NO	0X 0	0	0	N/A	N/A
294	042182	0000	3	1	XUS	UNK	UNK	2	NO	YES	N/A	NO	0X 0	0	0	N/A	N/A
295	042182	1000	7	3	YYZ	TO	IFR	2	YES	YES	VIBES	YES	14N 12	1	18	ATB	N/A
296	042282	0000	4	1	TNR	LANDNG	UNK	2	NO	YES	N/A	YES	0X 0	1	0	N/A	N/A
297	042482	0755	4	4	CPH	APPRCH	IFR	1	NO	N/A	N/A	YES	4N 1	1	16	N/A	ENG MULT
297	042492	0755	4	2	CPH	APPRCH	IFR	1	NO	N/A	N/A	YES	4N 1	2	16	N/A	ENG MULT BDS MULT
298	043082	0000	3	2	XFO	UNK	UNK	2	NO	N/A	N/A	NO	5N 1	1	10	N/A	N/A
299	043082	0000	4	4	XFO	UNK	UNK	1	NO	N/A	N/A	NO	14N 10	1	24	N/A	N/A
****** SAMPLE SIZE FOR APR 82 = 13 # STRIKES WITH DAMAGE = 9 % = 69.231																	
300	050182	1000	4	3	SFO	APPRCH	UNK	1	NO	N/A	N/A	NO	0X 0	1	0	N/A	N/A
301	050282	0000	7	1	XFO	UNK	IFR	1	NO	N/A	N/A	NO	0X 0	0	0	N/A	N/A
302	050292	0000	2	3	XXX	UNK	UNK	2	NO	YES	N/A	UNK	0X 0	1	0	N/A	N/A
303	050592	0000	3	1	MPL	TO	UNK	8	NO	YES	N/A	UNK	0X 0	1	0	N/A	N/A
304	050682	0000	4	3	XFO	UNK	UNK	2	NO	YES	N/A	NO	0X 0	0	0	N/A	N/A

EVT#	DATE	TIME	A C	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD REASON	BIRD SEEN	BIRD SPECIES	# B D	AV WT. OZ	PI-LOT ACT	SIGNI-FICANT REASON
305	050682	1300	4	2	LHR	TO	VFR	2	YES	YES	PARAMTRS	NO	2J 84	1	40	AIB	N/A
306	050782	0000	4	2	HKG	TO	UNK	7	UNK	YES	N/A	NO	0X 0	0	0	ATO	N/A
307	050782	1430	4	3	HKG	APPRCH	IFR	7	UNK	YES	N/A	YES	2K 1	1	729	N/A	N/A
308	050882	0000	4	4	XXX	UNK	UNK	1	NO	N/A	N/A	NO	14N 36	1	15	N/A	N/A
309	050982	0000	4	2	XFO	UNK	UNK	1	NO	N/A	N/A	NO	17Z 54	3	1	N/A	N/A
310	051582	0600	4	2	XUS	UNK	UNK	1	NO	N/A	N/A	NO	14N 14	1	40	N/A	N/A
311	051582	1355	4	4	IPE	TO	UNK	1	NO	N/A	N/A	YES	0X 0	0	0	N/A	N/A
312	051782	0000	3	1	XFO	UNK	UNK	1	NO	N/A	N/A	NO	0X 0	0	0	N/A	N/A
313	051982	0000	2	3	XUS	UNK	UNK	1	NO	N/A	N/A	NO	0X 0	0	0	N/A	N/A
314	051982	0000	7	1	XFO	UNK	UNK	2	NO	YES	N/A	NO	0X 0	0	0	N/A	N/A
315	052482	0000	4	4	XFO	UNK	VFR	2	NO	YES	N/A	NO	3K 28	1	24	N/A	N/A
316	052682	1630	4	2	SYD	TO	VFR	2	YES	YES	N/A	YES	14N 32	2	11	N/A	ENG MULT BDS MULT
316	052682	1630	4	4	SYD	TO	VFR	2	YES	YES	N/A	YES	14N 32	2	11	N/A	ENG MULT BDS MULT
316	052682	1630	4	3	SYD	TO	VFR	2	NO	YES	N/A	YES	14N 32	2	11	N/A	ENG MULT BDS MULT
317	052782	0000	3	2	XFO	UNK	UNK	2	NO	YES	N/A	NO	0X 0	0	0	N/A	N/A
318	052982	0000	4	3	XFO	UNK	UNK	1	NO	N/A	N/A	NO	0X 0	0	0	N/A	N/A

EVT#	DATE	TIME	A C	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD. REASON	BIRD SEEN	BIRD SPECIES	# B D	AV WT OZ	PI- LOT ACT	SIGNI- FICANT REASON
319	052982	0000	3	1	BOD	TO	UNK	279	UNK	YES	N/A	UNK	3K 28	1	24	N/A	N/A
320	052982	0730	4	1	SYD	APPRCH	IFR	1	NO	N/A	N/A	YES	14N 36	1	11*	N/A	N/A
321	052982	0745	4	4	SYD	TO	IFR	1	NO	N/A	N/A	YES	14N 36	1	11*	N/A	N/A
322	052982	2235	4	3	TSV	TO	UNK	2	YES	YES	VIBES	YES	0X 0	0	0	ATB	N/A
323	053082	0615	2	1	LHE	CLIMB	UNK	2	YES	YES	VIBES	UNK	0X 0	0	0	ATB	N/A
324	053082	2358	7	3	JFK	TO	VFR	489	YES	YES	VIBES	YES	14N 21	1	56*	ATO	N/A
325	053182	0000	3	1	ORY	CLIMB	VFR	2	YES	UNK	N/A	UNK	0X 0	0	0	ATB	N/A
326	053182	0000	7	1	XFO	UNK	UNK	1	NO	N/A	N/A	NO	0X 0	0	0	N/A	N/A

****** SAMPLE SIZE FOR MAY 82 = 27 # STRIKES WITH DAMAGE = 15 % = 55.556

EVT#	DATE	TIME	A C	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD. REASON	BIRD SEEN	BIRD SPECIES	# B D	AV WT OZ	PI- LOT ACT	SIGNI- FICANT REASON
327	060282	0000	3	2	CDG	LANDNG	IFR	1	NO	N/A	N/A	UNK	222 94	1	20	N/A	N/A
328	060482	0000	3	1	XFO	UNK	UNK	1	NO	YES	N/A	NO	0X 0	1	20	N/A	N/A
329	060582	0000	4	2	NBO	TO	UNK	1	NO	N/A	N/A	YES	0X 0	1	0	N/A	N/A
330	060682	0000	7	3	XFO	UNK	UNK	1	NO	N/A	N/A	NO	0X 0	0	0	N/A	N/A
331	061082	0000	4	4	CDG	TO	UNK	29	YES	UNK	N/A	UNK	0X 0	0	0	ATB	N/A
332	061182	0000	3	2	ORY	LANDNG	VFR	2	NO	YES	N/A	UNK	0X 0	0	0	N/A	N/A
333	061282	2000	7	3	XXX	UNK	UNK	1	YES	N/A	VIBES	NO	0X 0	1	0	N/A	N/A
334	061682	0000	3	1	LYS	LANDNG	UNK	29	NO	YES	N/A	UNK	3K 28	1	24	N/A	N/A

EVT#	DATE	TIME	A C	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD REASON	BIRD SEEN	BIRD SPECIES		# B D	AV WT OZ	PI-LOT ACT	SIGNI-FICANT REASON
335	061782	0000	3	1	XFO	UNK	UNK	2	NO	YES	N/A	NO	2P	9	1	11	N/A	N/A
336	061782	0000	2	3	XFO	UNK	UNK	8	NO	YES	N/A	UNK	0X	0	0	0	N/A	N/A
337	061882	0000	2	3	SSA	TO	UNK	2	YES	YES	VIBES	UNK	6N	50	1	13	ATB	N/A
338	062482	0000	3	1	ORY	LANDNG	UNK	1	NO	N/A	N/A	UNK	0X	0	1	0	N/A	N/A
339	062582	0000	3	1	ORY	UNK	UNK	1	NO	N/A	N/A	UNK	0X	0	1	0	N/A	N/A
340	062782	0000	1	4	ORY	TO	UNK	2	NO	YES	N/A	UNK	2P	9	1	11	N/A	N/A
341	062882	0000	7	3	XFO	UNK	UNK	1	NO	N/A	N/A	NO	0X	0	0	0	N/A	N/A
342	062982	0000	2	3	XFO	UNK	UNK	2	UNK	YES	N/A	UNK	0X	0	0	0	ATB	N/A
343	063082	0000	3	2	XFO	UNK	UNK	1	NO	N/A	N/A	UNK	0X	0	1	0	N/A	N/A

****** SAMPLE SIZE FOR JUN 82 = 17 # STRIKES WITH DAMAGE = 8 % = 47.059

EVT#	DATE	TIME	A C	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD REASON	BIRD SEEN	BIRD SPECIES		# B D	AV WT OZ	PI-LOT ACT	SIGNI-FICANT REASON
344	070182	0000	4	3	XFO	UNK	UNK	1	NO	N/A	N/A	NO	0X	0	0	0	N/A	N/A
345	070682	0000	4	1	FDF	APPRCH	UNK	4	UNK	YES	N/A	UNK	0X	0	0	0	N/A	N/A
346	070682	0000	3	1	XFO	UNK	UNK	2	NO	N/A	N/A	NO	0X	0	0	0	N/A	N/A
347	070782	0000	7	3	BOM	TO	UNK	39	YES	YES	VIBES	UNK	0X	0	0	0	ATO	N/A
348	070782	0000	4	3	YVR	APPRCH	UNK	26	NO	YES	N/A	NO	2P	9	2	14	N/A	BDS MULT
349	070982	0000	3	2	NCE	LANDNG	UNK	2	NO	YES	N/A	UNK	0X	0	0	0	N/A	N/A
350	070982	0000	4	4	XFO	UNK	UNK	2	UNK	YES	N/A	UNK	2P	1	1	12	N/A	N/A

EVT#	DATE	TIME	A C	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD REASON	BIRD SEEN	BIRD SPECIES		# B D	AV WT OZ	PI- LOT ACT	SIGNI- FICANT REASON
351	071182	0000	3	2	TLS	TO	UNK	2	YES	YES	N/A	UNK	0X	0	0	0	N/A	N/A
352	071182	0000	3	2	TLS	LANDNG	UNK	1	NO	N/A	N/A	UNK	3K180		1	28*	N/A	N/A
353	071182	1340	4	4	MEL	CLIMB	UNK	4789	YES	YES	VIBES	UNK	2P	9	5	20	ATB	ENG MULT BDS MULT
353	071182	1340	4	3	MEL*	CLIMB	UNK	45789	YES	NO	INVLNTRY	UNK	2P	9	4	20	ATB	BDS MULT ENG MULT
354	071182	1848	7	1	NGS	APPRCH	IFR	1	N/A	N/A	N/A	YES	2J	95	1	30*	N/A	N/A
355	071382	0000	4	2	XXX	UNK	UNK	2	NO	YES	N/A	NO	1S	2	1	19	N/A	N/A
356	071382	0000	4	1	XFO	UNK	UNK	1	NO	N/A	N/A	NO	0X	0	0	0	N/A	N/A
357	071482	0000	4	1	XXX	UNK	UNK	2	NO	YES	N/A	NO	0X	0	0	0	N/A	N/A
358	071582	0000	4	3	XXX	UNK	UNK	1	NO	N/A	N/A	UNK	0X	0	0	0	N/A	N/A
359	071582	2215	4	1	LAX	TO	VFR	1	YES	N/A	N/A	NO	0X	0	1	6	N/A	N/A
360	071582	2230	4	4	CDG	TO	UNK	29	YES	YES	VIBES	UNK	0X	0	0	0	ATB	N/A
361	071782	0000	4	4	DEL*	TO	UNK	7	UNK	YES	N/A	UNK	0X	0	0	0	ATO	IPWRLOSS
362	071882	0000	4	2	XFO	UNK	UNK	2	NO	YES	N/A	NO	0X	0	0	0	N/A	N/A
363	071882	0000	4	4	XFO	UNK	IFR	1	NO	N/A	N/A	NO	14N	10	1	20*	N/A	N/A
364	072182	1800	4	3	XFO	UNK	UNK	7	NO	YES	N/A	NO	0X	0	0	0	N/A	N/A
365	072282	0000	4	4	SCL	TO	UNK	2	YES	YES	N/A	UNK	2P106		1	5	N/A	N/A

EVT#	DATE	TIME	A C	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD REASON	BIRD SEEN	BIRD SPECIES	# B D	AV WT OZ	PI-LOT ACT	SIGNI-FICANT REASON
366	072282	0000	3	2	XFO	UNK	UNK	1	NO	N/A	N/A	UNK	0X 0	1	0	N/A	N/A
367	072282	0000	3	1	XFO	UNK	UNK	1	NO	N/A	N/A	NO	0X 0	0	0	N/A	N/A
368	072282	1200	4	4	XFO	UNK	UNK	1	NO	N/A	N/A	NO	0X 0	0	0	N/A	N/A
369	072382	0000	4	1	XFO	UNK	UNK	1	NO	N/A	N/A	NO	0X 0	0	0	N/A	N/A
370	072382	0000	2	1	XFO	UNK	UNK	2	NO	YES	N/A	UNK	0X 0	0	0	N/A	N/A
371	072582	0000	4	3	XFO	UNK	UNK	1	NO	N/A	N/A	NO	0X 0	0	0	N/A	N/A
372	072682	0000	4	1	DRY	TO	VFR	1	YES	YES	N/A	UNK	0X 0	0	0	N/A	N/A
373	072782	1500	4	2	KHI	LANDNG	VFR	1	NO	N/A	N/A	UNK	3K 51	1	192	N/A	N/A
374	072982	0000	4	3	LHR	TO	UNK	2	NO	YES	N/A	UNK	14N 36	1	10*	N/A	N/A
375	073082	0900	7	1	HKD	TO	UNK	29	YES	YES	N/A	YES	0X 0	1	0	ATO	N/A
376	073082	1700	2	3	ORD	APPRCH	UNK	1	NO	N/A	N/A	UNK	0X 0	0	0	N/A	BDS MULT

****** SAMPLE SIZE FOR JUL 82 = 33 # STRIKES WITH DAMAGE = 18 % = 54.545

EVT#	DATE	TIME	A C	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD REASON	BIRD SEEN	BIRD SPECIES	# B D	AV WT OZ	PI-LOT ACT	SIGNI-FICANT REASON
377	080182	0000	7	3	XXX	UNK	UNK	2	NO	YES	N/A	NO	14N 12	1	15	N/A	N/A
378	080182	0000	4	1	XXX	UNK	UNK	2	NO	YES	N/A	NO	0X 0	0	0	N/A	N/A
379	080282	0000	4	3	HND	UNK	IFR	1	NO	N/A	N/A	NO	0X 0	0	0	N/A	N/A
380	080282	1800	4	4	OSA	LANDNG	IFR	7	NO	YES	N/A	NO	2J 91	1	32	N/A	N/A
381	080382	1544	4	2	SEL	APPRCH	VFR	2	NO	YFS	N/A	YES	4L161	1	35	N/A	N/A

DATA RECORDED & PROCESSED AT FAA TECHNICAL CENTER, ATLANTIC CITY AIRPORT, N.J. 08405 ON 07/16/84 G FRINGS ACT-320 UNIT 6 PAGE 27

EVT#	DATE	TIME	A C	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD REASON	BIRD SEEN	BIRD SPECIES	# B D	AV WT OZ	PI-LOT ACT	SIGNI-FICANT REASON
382	080482	0000	4	2	ECQ	TO	UNK	6	YES	YES	N/A	UNK	14N 17	1	28	N/A	N/A
383	080482	0800	7	3	YUL	LANDNG	VFR	1	NO	N/A	N/A	YES	14N 10	1	18•	N/A	N/A
384	080582	0000	3	2	NCE	APPRCH	UNK	1	NO	N/A	N/A	UNK	14N 10	1	24	N/A	N/A
385	080882	0000	4	4	AMS	TO	UNK	29	YES	YES	VIBES	UNK	0X 0	0	0	ATB	N/A
386	080882	0000	4	3	ISI	TO	UNK	1	NO	N/A	N/A	UNK	0X 0	0	0	ATO	N/A
387	080882	0000	2	3	JFK	TO	UNK	478	YES	YES	VIBES	UNK	3K168	1	15	N/A	N/A
388	081082	0000	3	2	KR	TO	UNK	4	YES	YES	N/A	UNK	3K 28	1	24	ATB	N/A
389	081082	1230	4	3	FUK	TO	VFR	4	YES	YES	N/A	YES	0X 0	1	20	ATB	N/A
390	081182	0000		2	DOM	TO	UNK	2	YES	YES	N/A	UNK	0X 0	0	0	N/A	N/A
391	081282	1800	4	2	SYD•	TO	VFR	489	YES	NO	VIBES	YES	2J 80	3	24	ATB	BDS MULT
392	081382	0000	4	2	XFO	UNK	UNK	2	NO	YES	N/A	UNK	0X 0	1	0	N/A	N/A
393	081482	0000	3	2	FUK	APPRCH	UNK	2	NO	YES	N/A	UNK	61 21	1	0	N/A	N/A
394	081482	1500	7	3	YYZ	TO	VFR	279	YES	YES	VIBES	YES	2P 1	9	11	ATB	BDS MULT
395	081782	0000	4	4	XFO	UNK	UNK	1	NO	N/A	N/A	NO	692124	2	1•	N/A	BDS MULT
396	081282	0000	4	1	CPIL	APPRCH	UNK	1	NO	YES	N/A	NO	5K 26	1	7	N/A	N/A
397	081882	0000	7	3	YUL	LANDNG	VFR	1	NO	N/A	N/A	NO	0X 0	0	0	N/A	N/A

EVT#	DATE	TIME	A C	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD REASON	BIRD SEEN	BIRD SPECIES	# B D	AV WT OZ	PI- LOT ACT	SIGNI- FICANT REASON
398	081882	1300	7	1	FUK	LANDNG	VFR	2	NO	YES	N/A	YES	2P 9	1	11*	N/A	N/A
399	082082	0000	2	1	HGQ	LANDNG	UNK	1	NO	N/A	N/A	UNK	0X 0	0	0	N/A	N/A
400	082082	0000	7	3	LHR*	CLIMB	UNK	459	YES	YES	VIBES	UNK	14N 36	1	10*	ATB	TRVSFRAC
401	082182	0000	3	2	XFO	UNK	UNK	1	NO	N/A	N/A	UNK	0X 0	1	0	N/A	N/A
402	082182	0000	4	3	XFO	UNK	UNK	1	NO	N/A	N/A	UNK	0X 0	1	0	N/A	N/A
403	082282	0000	3	2	XFO	UNK	VFR	2	NO	YES	N/A	NO	0X 0	0	0	N/A	N/A
404	082482	2230	4	1	HDH	TO	UNK	1	YES	YES	N/A	NO	5N 25	2	6	ATO	BDS MULT
405	082682	0000	3	1	XFO	UNK	UNK	1	NO	N/A	N/A	NO	0X 0	0	0	N/A	N/A
406	082782	0000	3	2	GVA	TO	UNK	2	YES	YES	N/A	UNK	0X 0	0	0	N/A	N/A
407	082982	1715	4	2	FUK	TO	VFR	2	UNK	YES	N/A	NO	0X 0	0	0	N/A	N/A
408	083182	0000	7	3	XXX	UNK	UNK	7	NO	YES	N/A	NO	14N 14	1	36*	N/A	N/A
****** SAMPLE SIZE FOR AUG 82 = 32						# STRIKES WITH DAMAGE = 20						% = 62.500					
409	090382	0000	2	1	JFK	TO	UNK	268	YES	YES	N/A	UNK	0X 0	0	0	ATO	N/A
410	090482	0000	4	4	XXX	UNK	UNK	6	N/A	YES	N/A	NO	0X 0	0	0	N/A	N/A
411	090482	1630	3	1	HKG	TO	VFR	489	YES	YES	VIBES	YES	3K 28	2	36	ATB	N/A
412	090582	0000	2	1	XFO	UNK	UNK	26	NO	YES	N/A	UNK	0X 0	0	0	N/A	N/A
413	090582	1300	4	2	LGW	LANDNG	UNK	1	NO	N/A	N/A	YES	14N 36	2	10*	N/A	N/A

EVT#	DATE	TIME	A C	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD REASON	BIRD SEEN	BIRD SPECIES		# B D	AV WT OZ	PI- LOT ACT	SIGNI- FICANT REASON
414	090782	0728	4	4	FCO	LANDNG	UNK	1	NO	N/A	N/A	YES	14N	36	6	11	N/A	BDS MULT
415	090882	1020	4	3	YVR	LANDNG	UNK	1	NO	N/A	N/A	YES	0X	0	0	0	N/A	ENG MULT
415	090882	1020	4	4	YVR	LANDNG	UNK	1	NO	N/A	N/A	YES	0X	0	0	0	N/A	ENG MULT
416	091082	0000	4	3	XFO	UNK	UNK	46	NO	YES	N/A	NO	0X	0	2	10•	N/A	BDS MULT
417	091182	0000	2	3	EWR	TO	VFR	2	YES	YES	VIBES	UNK	0X	0	0	0	ATB	N/A
418	091282	0000	7	3	JFK	APPRCH	UNK	1	NO	N/A	N/A	NO	14N	14	1	47	N/A	N/A
419	091382	1631	4	4	LUX	TO	UNK	48	YES	YES	VIBES PARAMTRS	YES	2P	9	1	11•	ATB	N/A
420	091382	2350	4	3	AMS	CLIMB	VFR	2	YES	YES	N/A	UNK	0X	0	0	0	ATB	N/A
421	091482	0000	2	1	XFO	UNK	UNK	1	NO	N/A	N/A	NO	0X	0	0	0	N/A	N/A
422	091582	0940	4	4	MXP	TO	UNK	49	YES	YES	VIBES	NO	4L	44	2	16	N/A	BDS MULT
423	091682	0450	4	1	DEL	APPRCH	IFR	2	NO	YES	N/A	NO	0X	0	0	0	N/A	N/A
424	091782	1855	7	2	JFK	CLIMB	VFR	1	YES	N/A	VIBES	NO	0X	0	1	0	ATB	N/A
425	091882	0000	4	4	LHR	TO	UNK	1	NO	N/A	N/A	NO	5N	1	1	8	N/A	N/A
426	091982	0000	3	1	LGA	UNK	UNK	1	NO	N/A	N/A	UNK	0X	0	1	0	N/A	N/A
427	092182	0000	7	1	XEO	UNK	UNK	2	NO	YES	N/A	NO	14N	36	1	11	N/A	N/A
428	092282	1100	7	3	OSA	TO	VFR	1	NO	N/A	N/A	YES	2P	50	1	5•	N/A	N/A

EVT#	DATE	TIME	AC	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD REASON	BIRD SEEN	BIRD SPECIES	# B D	AV WT OZ	PI-LOT ACT	SIGNI-FICANT REASON
429	092382	0000	2	1	XFO	UNK	UNK	1	NO	N/A	N/A	UNK	0X 0	1	0	N/A	N/A
430	092382	0000	4	4	XFO	UNK	UNK	1	NO	N/A	N/A	UNK	0X 0	1	0	N/A	N/A
431	092382	1025	4	4	DOM	TO	UNK	7	UNK	YES	N/A	NO	0X 0	1	0	ATO	N/A
432	092482	0000	2	3	ZRH	TO	IFR	29	NO	YES	VIBES	UNK	14N 36	1	11	ATB	N/A
433	092582	0000	4	4	MWH	UNK	VFR	1	NO	N/A	N/A	UNK	5N 27	1	8	N/A	N/A
434	092782	0000	4	1	XFO	UNK	UNK	1	NO	N/A	N/A	NO	0X 0	1	0	N/A	N/A
435	092782	0000	4	3	XFO	UNK	UNK	1	NO	N/A	N/A	UNK	0X 0	1	0	N/A	N/A
436	092882	0000	4	4	ORY	LANDNG	UNK	1	NO	N/A	N/A	UNK	0X 0	1	0	N/A	N/A
437	092882	0000	3	2	XFO	UNK	UNK	1	NO	N/A	N/A	UNK	0X 0	1	0	N/A	N/A
****** SAMPLE SIZE FOR SEP 82 = 29		# STRIKES WITH DAMAGE = 13		% = 44.828													
438	100182	0000	7	1	DUS	TO	VFR	3	YES	YES	VIBES	YES	5K 54	1	24	ATO	N/A
439	100182	2100	4	3	AUH	APPRCH	VFR	1	YES	N/A	N/A	NO	5N 27	1	9	N/A	N/A
440	100282	0000	4	3	XFO	UNK	UNK	1	NO	N/A	N/A	UNK	0X 0	1	0	N/A	N/A
441	100282	0000	3	2	PEN	LANDNG	UNK	2	NO	YES	N/A	UNK	0X 0	1	0	N/A	N/A
442	100482	0000	7	1	XXX	UNK	UNK	9	NO	YES	N/A	NO	0X 0	0	0	N/A	N/A
443	100682	0000	4	3	XFO	UNK	UNK	1	NO	N/A	N/A	UNK	0X 0	1	0	N/A	N/A
444	100882	0000	4	3	XXX	UNK	VFR	1	NO	N/A	N/A	NO	0X 0	0	0	N/A	N/A

EVT#	DATE	TIME	A C	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD REASON	BIRD SEEN	BIRD SPECIES	# B D	AV WT OZ	PI-LOT ACT	SIGNI-FICANT REASON
445	101182	0000	3	2	LIN	TO	UNK	29	NO	YES	N/A	UNK	0X 0	1	0	N/A	N/A
446	101182	0000	2	1	XUS	UNK	VFR	7	NO	YES	PARAMTRS	NO	412246	1	1	N/A	N/A
447	101282	0000	7	1	KHL	TO	UNK	29	YES	YES	VIBES	UNK	0X 0	0	0	N/A	N/A
448	101282	0000	4	2	XFO	UNK	UNK	9	NO	N/A	N/A	UNK	0X 0	1	0	N/A	N/A
449	101282	0705	7	1	KHI	TO	IFR	3	YES	YES	VIBES	YES	5K 54	1	100	ATB	N/A
450	101382	1445	4	4	NRT	CLIMB	VFR	2	YES	YES	N/A	YES	14N 36	1	10	N/A	N/A
451	101582	0000	4	2	JED	UNK	VFR	7	NO	YES	N/A	NO	0X 0	0	0	N/A	OTHER
452	101582	1335	4	2	AMS*	TO	UNK	7	YES	YES	HI EGT	NO	2J 84	1	40	ATB	IPWRLOSS
453	101982	0000	4	1	XFO	UNK	UNK	1	NO	N/A	N/A	UNK	0X 0	1	0	N/A	N/A
454	102082	0000	7	1	DEL*	TO	UNK	7	YES	YES	PARAMTRS	UNK	0X 0	0	0	N/A	IPWRLOSS
455	102082	1230	4	3	FUK	TO	VFR	7	YES	YES	N/A	NO	3K 28	1	40	ATO	N/A
456	102082	1600	4	3	FUK	LANDNG	VFR	489	NO	YES	N/A	NO	3K 28	1	32	N/A	N/A
457	102182	0000	4	4	SEA	APPRCH	IFR	2	NO	YES	N/A	NO	14N 14	1	40	N/A	N/A
458	102382	0000	4	2	FCO	TO	UNK	2	YES	YES	N/A	UNK	0X 0	1	0	N/A	N/A
459	102482	0000	7	1	XFO	UNK	UNK	2	NO	YES	N/A	UNK	0X 0	0	0	N/A	N/A
460	102482	0000	7	1	XFO	UNK	UNK	7	UNK	YES	N/A	NO	0X 0	0	0	N/A	N/A

EVT#	DATE	TIME	A C	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD REASON	BIRD SEEN	BIRD SPECIES	# B D	AV WT OZ	PI-LOT ACT	SIGNI-FICANT REASON
461	102782	0000	4	3	XFO	UNK	UNK	8	NO	N/A	N/A	UNK	0X 0	1	0	N/A	N/A
462	102782	0000	5	2	PDX	TO	UNK	49	YES	YES	VIBES	YES	14N 12	3	16	UNK	BDS MULT
463	103082	0000	7	3	XUS	UNK	UNK	1	NO	N/A	N/A	NO	2P 1	1	11	N/A	N/A
464	103082	1140	4	3	FUK	TAXI	VFR	2	NO	YES	N/A	YES	3K 28	1	32	N/A	N/A
465	103082	2125	4	4	KUL	LANDNG	UNK	1	N/A	N/A	N/A	NO	0X 0	0	0	N/A	N/A
466	103182	0000	7	1	AMM	UNK	VFR	1	NO	YES	N/A	NO	0X 0	1	0	N/A	N/A
467	103182	0000	4	2	XFO	UNK	UNK	9	UNK	YES	N/A	YES	26 26	1	7	N/A	N/A

****** SAMPLE SIZE FOR OCT 82 = 30 # STRIKES WITH DAMAGE = 22 % = 73.333

EVT#	DATE	TIME	A C	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD REASON	BIRD SEEN	BIRD SPECIES	# B D	AV WT OZ	PI-LOT ACT	SIGNI-FICANT REASON
468	110182	0000	4	2	LHR	APPRCH	UNK	1	NO	N/A	N/A	NO	14N 10	1	16	N/A	N/A
469	110282	0000	7	1	XFO	UNK	UNK	2	UNK	YES	N/A	NO	0X 0	0	0	N/A	N/A
470	110382	0000	2	3	EBB	TO	VFR	29	NO	YES	N/A	UNK	51 6	1	40	ATB	ENG MULT
470	110382	0000	2	1	EBB	TO	VFR	2	YES	YES	VIBES	UNK	51 6	2	40	ATB	ENG MULT BDS MULT
471	110582	0000	5	2	CJU*	LANDNG	UNK	45789	YES	UNK	N/A	NO	4L161	3	40	N/A	TRVSFRAC BDS MULT
472	110882	0000	4	1	XUS	UNK	UNK	6	NO	YES	N/A	NO	412314	1	3	N/A	N/A
473	110882	1130	2	1	AMS	TO	IFR	2	YES	YES	N/A	UNK	0X 0	1	0	ATB	N/A
474	110982	0000	3	1	XFO	UNK	UNK	7	NO	YES	N/A	NO	0X 0	1	0	N/A	N/A
475	110982	0830	4	3	HND	APPRCH	IFR	1	NO	N/A	N/A	NO	14N 22	1	28	N/A	N/A

EVT#	DATE	TIME	A C	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD REASON	BIRD SEEN	BIRD SPECIES		# B D	AV WT OZ	PI- LOT ACT	SIGNI- FICANT REASON
476	111082	0000	3	2	ALG	LANDNG	UNK	2	NO	YES	N/A	UNK	0X	0	1	0	N/A	N/A
477	111082	0000	3	2	TRV	TO	VFR	2	YES	YES	N/A	UNK	0X	0	1	0	N/A	N/A
478	111282	0000	6	1	TUL	UNK	UNK	1	NO	N/A	N/A	NO	0X	0	1	0	N/A	N/A
479	111282	0000	3	2	ORY	LANDNG	UNK	1	NO	YES	N/A	UNK	0X	0	0	0	N/A	N/A
480	111282	0000	4	3	XFO	UNK	UNK	28	NO	YES	N/A	NO	0X	0	0	0	N/A	N/A
481	111292	0705	4	4	ADL	LANDNG	VFR	1	NO	N/A	N/A	YES	14N	36	2	10	N/A	BDS MULT
482	111482	0925	4	4	DUR	TO	UNK	48	YES	YES	N/A	UNK	3K	28	2	26	ATB	N/A
483	111582	1730	2	1	HLP	APPRCH	VFR	1	NO	N/A	N/A	YES	692104		1	1	N/A	N/A
484	111682	0000	4	3	XFO	UNK	UNK	2	NO	YES	N/A	NO	0X	0	1	0	N/A	N/A
485	111682	0000	4	1	XFO	UNK	UNK	1	NO	N/A	N/A	NO	0X	0	1	0	N/A	N/A
486	111682	0000	1	2	XUS	UNK	UNK	2	NO	YES	N/A	NO	0X	0	1	0	N/A	N/A
487	111882	0820	4	1	ZRH*	TO	UNK	2	YES	YES	INVLNTRY STAL/SRG	UNK	14N	36	6	13	N/A	ENG MULT BDS MULT
487	111882	0820	4	2	ZRH	TO	UNK	4	YES	YES	VIBES	UNK	14N	36	3	13	N/A	ENG MULT BDS MULT
488	111982	0000	2	1	IAH	TO	UNK	49	YES	YES	N/A	UNK	14N	12	1	14	ATB	N/A
489	111982	0000	7	1	SCQ	TO	UNK	2	YES	YES	VIBES	NO	0X	0	0	0	ATB	N/A
490	111992	1200	2	1	OAK	TO	VFR	279	YES	YES	N/A	UNK	1K	1	1	72	ATO	N/A

EVT#	DATE	TIME	A C	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD REASON	BIRD SEEN	BIRD SPECIES	# B D	AV WT OZ	PI-LOT ACT	SIGNI-FICANT REASON
491	112082	0000	7	3	MSY	TO	VFR	4	NO	YES	N/A	YES	14N 12	1	15	N/A	N/A
492	112282	0000	4	3	XFO	UNK	VFR	1	NO	N/A	N/A	NO	0X 0	0	0	N/A	N/A
493	112582	0000	3	2	MIA	TO	UNK	2	YES	YES	N/A	UNK	2P105	1	4	ATB	N/A
494	112582	1330	4	1	DEL*	CLIMB	UNK	468	YES	YES	STAL/SRG VIBES	YES	3K 46	1	240	ATB	IPWRLOSS
495	112882	1813	2	1	HND	TO	VFR	48	YES	NO	VIBES	NO	1I 57	1	51	ATB	AIRWRTHY
496	112882	1855	4	3	NRT	APPRCH	VFR	1	NO	N/A	N/A	NO	412279	1	3	N/A	N/A
497	113082	1300	7	3	YMX	LANDNG	IFR	1	NO	N/A	N/A	YES	0X 0	0	0	N/A	N/A
498	113082	1640	2	1	FUK	TO	UNK	48	NO	YES	N/A	YES	2J115	1	24	N/A	N/A

****** SAMPLE SIZE FOR NOV 82 = 31 # STRIKES WITH DAMAGE = 21 % = 67.742

EVT#	DATE	TIME	A C	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD REASON	BIRD SEEN	BIRD SPECIES	# B D	AV WT OZ	PI-LOT ACT	SIGNI-FICANT REASON
499	120182	0000	4	4	NBO	TO	UNK	29	YES	YES	OTHER	UNK	0X 0	1	0	ATB	N/A
500	120282	1905	4	1	XFO	UNK	VFR	1	NO	N/A	N/A	NO	14N 10	1	20	N/A	N/A
501	120382	0930	4	1	BOM	TO	UNK	489	YES	YES	VIBES	UNK	3K 28	1	43	ATB	AIRWRTHY
502	120482	0900	3	1	LHE	LANDNG	VFR	1	NO	YES	N/A	UNK	22Z 94	1	32	N/A	ENG MULT
502	120482	0900	3	2	LHE	LANDNG	VFR	2	NO	YES	N/A	UNK	22Z 94	1	32	N/A	ENG MULT
503	120482	1500	4	4	AMS	TO	VFR	2	NO	YES	N/A	UNK	14N 26	9	8	ATO	ENG MULT
503	120482	1500	4	1	AMS	TO	VFR	49	YES	UNK	N/A	UNK	14N 26	9	8	ATO	ENG MULT
503	120482	1500	4	2	AMS	TO	VFR	2	NO	YES	N/A	UNK	14N 26	2	8	ATO	BDS MULT ENG MULT

EVT#	DATE	TIME	A C	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD REASON	BIRD SEEN	BIRD SPECIES	# B. D	AV WT OZ	PI-LOT ACT	SIGNI-FICANT REASON
504	120482	1823	4	3	VCP	TO	UNK	2	YES	YES	N/A	UNK	0X 0	1	24*	N/A	N/A
505	120682	0000	2	1	IAH	APPRCH	UNK	26	NO	YES	N/A	UNK	0X 0	1	0	N/A	N/A
506	120682	0000	4	4	XUS	UNK	UNK	1	YES	N/A	HI EGT	NO	0X 0	0	0	N/A	N/A
507	120682	0000	4	3	HKG	APPRCH	UNK	1	NO	N/A	N/A	UNK	0X 0	0	0	N/A	N/A
508	120882	1115	4	3	ORY	TO	IFR	2	NO	N/A	N/A	NO	14N 36	1	10	ATB	ENG MULT
508	120982	1115	4	2	ORY	TO	IFR	2	NO	YES	N/A	NO	14N 36	1	10	ATB	ENG MULT
509	120892	1530	4	3	LOS*	TO	UNK	4589	YES	UNK	N/A	NO	14N 31	2	16	ATO	TRVSFRAC
510	120982	0000	4	3	MWH	UNK	IFR	1	NO	N/A	N/A	UNK	172 74	1	2	N/A	N/A
511	121082	0000	4	2	CDG	CLIMB	UNK	2	NO	YES	N/A	NO	2S124	1	17	N/A	N/A
512	121082	0000	2	3	XFO	UNK	IFR	1	NO	N/A	N/A	NO	0X 0	0	0	N/A	N/A
513	121082	0000	4	2	XFO	UNK	UNK	1	NO	N/A	N/A	NO	0X 0	0	0	N/A	N/A
514	121082	1010	4	2	NBO	TO	IFR	2	YES	YES	N/A	NO	3K180	1	28*	UNK	N/A
515	121582	0000	3	2	LYS	TO	UNK	2	NO	YES	N/A	UNK	3K 28	1	24	N/A	N/A
516	121882	0000	4	2	HBO	LANDNG	UNK	1	NO	N/A	N/A	NO	0X 0	1	0	N/A	N/A
517	121882	0000	2	3	XFO	UNK	UNK	4	NO	YES	N/A	UNK	0X 0	1	0	N/A	N/A
518	121882	0700	4	4	KHI	CLIMB	UNK	48	UNK	NO	N/A	YES	3K 28	1	28	N/A	AIRWRTHY

EVT#	DATE	TIME	A C	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD REASON	BIRD SEEN	BIRD SPECIES	# B D	AV WT OZ	PI-LOT ACT	SIGNI-FICANT REASON
519	121882	1100	4	4	MEL	TO	VFR	2	NO	YES	N/A	NO	0X 0	0	0	N/A	N/A
520	121982	0925	4	2	DUR	TO	UNK	7	YES	YES	STAL/SRG	NO	3K 28	1	26	ATB	N/A
521	122682	1600	4	3	BRU	TO	UNK	4	UNK	NO	N/A	UNK	0X 0	0	0	N/A	BDS MULT
522	122782	0000	4	4	XFO	UNK	UNK	1	NO	N/A	N/A	UNK	172 50	1	4	N/A	N/A
523	122982	0600	4	3	HND	APPRCH	UNK	1	UNK	UNK	N/A	NO	0X 0	0	0	N/A	N/A
****** SAMPLE SIZE FOR DEC 82 = 25	# STRIKES WITH DAMAGE = 16	% = 64.000															
524	010183	0000	2	3	XFO	UNK	VFR	2	NO	YES	N/A	NO	0X 0	1	0	N/A	N/A
525	010283	0000	4	1	CDG	TO	UNK	2	YES	YES	N/A	UNK	0X 0	1	0	N/A	N/A
526	010283	1400	4	2	DPS	TO	UNK	1	NO	N/A	N/A	YES	0X 0	0	0	N/A	ENG MULT
526	010283	1400	4	1	DPS	TO	UNK	1	NO	N/A	N/A	YES	0X 0	0	0	N/A	ENG MULT
527	010783	0000	7	1	XXX	UNK	UNK	1	NO	N/A	N/A	NO	4L161	1	40	N/A	N/A
528	011083	0000	3	1	TLS	LANDNG	UNK	1	NO	N/A	N/A	UNK	5N 1	1	9	N/A	N/A
529	011083	0000	4	4	XFO	UNK	UNK	2	NO	YES	N/A	NO	4L 44	1	15	N/A	N/A
530	011383	0000	3	1	ORY	TO	UNK	2	NO	YES	N/A	UNK	0X 0	0	0	ATO	N/A
531	011383	1500	3	2	ORY	TO	UNK	2	NO	YES	N/A	UNK	0X 0	0	0	ATO	N/A
532	011483	0000	3	2	CCU	TO	VFR	28	YES	YES	N/A	UNK	0X 0	0	0	ATO	N/A
533	011483	2146	4	3	DPS	APPRCH	UNK	1	NO	N/A	N/A	YES	14N 36	9	10	N/A	N/A

EVT#	DATE	TIME	A C	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD REASON	BIRD SEEN	BIRD SPECIES	# B D	AV WT OZ	PI-LOT ACT	SIGNI-FICANT REASON
534	011583	0000	4	3	NBO	TO	UNK	2	NO	YES	N/A	YES	0X 0	1	10•	N/A	N/A
535	011683	1717	4	4	XXX	UNK	UNK	2	NO	YES	N/A	NO	14N 36	0	10•	N/A	N/A
536	011783	0000	3	2	CDG	TO	UNK	29	YES	YES	N/A	UNK	0X 0	0	0	ATB	N/A
537	011983	0000	7	3	POS	DESCNT	UNK	7	YES	YES	VIBES	NO	14N 26	1	12	N/A	N/A
538	011983	0000	3	2	GIG	TO	UNK	2	NO	YES	N/A	UNK	0X 0	0	0	N/A	N/A
539	012083	0000	4	2	XFO	UNK	UNK	1	NO	N/A	N/A	NO	472 21	1	1	N/A	N/A
540	012283	0000	3	2	BOM	TO	VFR	2	YES	YES	N/A	UNK	0X 0	0	0	ATB	N/A
541	012283	0000	4	4	SIN	UNK	UNK	1	NO	N/A	N/A	NO	0X 0	0	0	N/A	N/A
542	012383	0000	4	3	XFO	UNK	UNK	28	NO	YES	N/A	UNK	0X 0	0	0	N/A	N/A
543	012583	1900	4	2	PUS	UNK	VFR	1	NO	N/A	N/A	NO	0X 0	1	0	N/A	N/A
544	012683	0000	3	1	XFO	UNK	VFR	2	NO	YES	N/A	UNK	0X 0	0	0	N/A	N/A
545	012683	0000	3	1	GIG	TO	VFR	78	NO	YES	N/A	UNK	1S 2	1	19	N/A	N/A
546	012883	0000	4	3	XXX	UNK	UNK	1	NO	N/A	N/A	NO	0X 0	0	0	N/A	N/A

****** SAMPLE SIZE FOR JAN 83 = 23 # STRIKES WITH DAMAGE = 15 % = 65.217

EVT#	DATE	TIME	A C	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD REASON	BIRD SEEN	BIRD SPECIES	# B D	AV WT OZ	PI-LOT ACT	SIGNI-FICANT REASON
547	020183	1900	7	1	LGA	TO	VFR	79	YES	YES	STAL/SRG VIBES	NO	14N 14	2	42	ATB	BDS MULT
548	020683	0000	4	4	SNN	APPRCH	UNK	48	UNK	YES	N/A	NO	5N 1	5	8	N/A	BDS MULT
549	020783	0000	3	2	XFO	UNK	UNK	2	NO	YES	N/A	NO	0X 0	0	0	N/A	N/A

EVT#	DATE	TIME	A C	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD REASON	BIRD SEEN	BIRD SPECIES	# B D	AV WT OZ	PI- LOT ACT	SIGNI- FICANT REASON
550	020983	0000	4	1	MXP	TO	UNK	2	NO	YES	N/A	UNK	0X 0	0	0	N/A	N/A
551	021183	0000	7	1	ANU	TO	UNK	2	NO	YES	N/A	YES	1I 50	1	16*	N/A	N/A
552	021183	0000	2	3	XFO	UNK	UNK	1	NO	N/A	N/A	NO	68Z 41	1	1	N/A	N/A
553	021183	0000	4	4	MEL	UNK	UNK	1	NO	N/A	N/A	NO	0X 0	0	0	N/A	N/A
554	021183	0758	6	2	XUS	TO	UNK	7	YES	YES	STAL/SRG	NO	14N 22	2	36	ATB	BDS MULT
555	021283	0000	3	2	XFO	UNK	UNK	2	NO	YES	N/A	UNK	0X 0	0	0	N/A	N/A
556	021483	0000	7	2	XUS	UNK	UNK	2	NO	YES	N/A	NO	2J 84	1	40	N/A	N/A
557	021783	0000	3	1	TLS	LANDNG	UNK	1	NO	YES	N/A	UNK	0X 0	0	0	N/A	N/A
558	021783	1535	4	4	TPE	APPRCH	VFR	1	NO	N/A	N/A	YES	2P 9	1	10	N/A	N/A
559	021983	0000	2	3	XFO	UNK	UNK	2	NO	YES	N/A	NO	0X 0	0	0	N/A	N/A
560	021983	1945	2	3	JFK	CLIMB	UNK	489	YES	YES	N/A	UNK	1S 2	1	19	UNK	N/A
561	022083	0000	2	3	LAX	UNK	UNK	29	NO	YES	N/A	UNK	0X 0	0	0	N/A	N/A
562	022183	0000	4	1	EZE	TO	UNK	2	NO	YES	N/A	YES	14N 35	3	13	ATO	ENG MULT BDS MULT
562	022183	0000	4	2	EZE	TO	UNK	2	YES	YES	N/A	YES	14N 35	4	13	ATO	ENG MULT BDS MULT
563	022183	0000	3	2	TRV	TO	VFR	2	NO	YES	N/A	UNK	0X 0	0	0	N/A	N/A
564	022183	0833	4	3	SYD	LANDNG	VFR	2	NO	YES	N/A	YES	0X 0	0	0	N/A	N/A

EVT#	DATE	TIME	A C	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD REASON	BIRD SEEN	BIRD SPECIES	# B D	AV WT OZ	PI-LOT ACT	SIGNI-FICANT REASON
565	022483	0000	2	3	XFO	UNK	UNK	1	NO	N/A	N/A	NO	0X 0	0	0	N/A	N/A
566	022483	0000	2	1	XFO	UNK	UNK	2	NO	YES	N/A	NO	0X 0	0	0	N/A	N/A
567	022583	0000	8	2	TLS	TO	UNK	1	NO	N/A	N/A	NO	5N 1	4	10	N/A	BDS MULT
568	022683	1500	4	2	LYS	TO	UNK	47	NO	YES	N/A	YES	5N 1	1	8	N/A	N/A
569	022583	0000	4	3	GUM	TO	UNK	27	UNK	YES	N/A	UNK	5N 25	1	7	N/A	N/A
570	022883	0000	4	3	XFO	UNK	UNK	1	NO	N/A	N/A	UNK	14N 35	1	13	N/A	N/A

****** SAMPLE SIZE FOR FEB 83 = 24 # STRIKES WITH DAMAGE = 17 % = 70.833

EVT#	DATE	TIME	A C	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD REASON	BIRD SEEN	BIRD SPECIES	# B D	AV WT OZ	PI-LOT ACT	SIGNI-FICANT REASON
571	030583	0000	4	1	BNE	UNK	UNK	1	NO	N/A	N/A	NO	0X 0	0	0	N/A	N/A
572	030683	1230	4	4	MNL	LANDNG	VFR	2	NO	YES	N/A	UNK	2P 9	1	10	N/A	N/A
573	030783	0000	4	1	XUS	UNK	UNK	1	NO	N/A	N/A	NO	14N 12	1	18	N/A	N/A
574	030783	1400	4	1	TLV	LANDNG	VFR	2	UNK	YES	N/A	YES	14N 36	1	11	N/A	N/A
575	030783	1500	3	1	ORY	TO	UNK	2	YES	YES	VIBES	UNK	0X 0	0	0	AIB	N/A
576	030983	0018	2	1	AMS	CLIMB	VFR	2	NO	YES	N/A	UNK	0X 0	0	0	N/A	N/A
577	030983	0800	4	2	JFK	APPRCH	UNK	1	NO	N/A	N/A	YES	14N 14	1	40	N/A	N/A
578	031083	0000	2	1	MAD	DESCNT	UNK	1	NO	N/A	N/A	NO	0X 0	0	0	N/A	N/A
579	031183	0640	4	1	XFO	UNK	UNK	1	NO	N/A	N/A	NO	14N 14	1	36	N/A	N/A
580	031183	1445	3	2	MIA	LANDNG	VFR	48	NO	YES	N/A	UNK	14N 12	1	15	N/A	N/A

DATA RECORDED & PROCESSED AT FAA TECHNICAL CENTER, ATLANTIC CITY AIRPORT, N.J. 08405 ON 07/16/84 G FRINGS ACT-320 UNIT 6 PAGE 40

EVT#	DATE	TIME	A C	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD REASON	BIRD SEEN	BIRD SPECIES	# B D	AV WT OZ	PI-LOT ACT	SIGNI-FICANT REASON
581	031783	0000	4	4	BUE	TO	UNK	2	YES	YES	N/A	UNK	0X 0	0	0	N/A	N/A
582	031783	1930	4	1	JFK	CLIMB	UNK	2	UNK	YES	N/A	UNK	14N 14	1	36*	N/A	N/A
583	031983	0000	3	2	XFO	UNK	UNK	1	NO	N/A	N/A	NO	0X 0	0	0	N/A	N/A
584	032083	0000	4	4	XFO	UNK	UNK	4	NO	YES	N/A	NO	14N 32	1	11	N/A	N/A
585	032183	0000	2	1	IAD	APPRCH	UNK	8	NO	YES	N/A	UNK	0X 0	0	0	N/A	N/A
586	032483	1100	2	3	CPH*	TO	IFR	45789	YES	UNK	VIBES	YES	14N 36	2	14	ATB	ENG MULT BDS MULT
586	032483	1100	2	1	CPH	TO	IFR	27	UNK	YES	N/A	YES	14N 36	1	14	ATB	ENG MULT
587	032883	0100	4	4	JFK*	TO	UNK	45689	YES	NO	VIBES STAL/SRG	NO	2J 84	1	28	ATB	TRVSFRAC IPWRLOSS
588	032983	0000	4	2	XFO	UNK	UNK	2	NO	YES	N/A	NO	0X 0	0	0	N/A	N/A
589	032983	0000	7	2	XUS	UNK	UNK	2	NO	YES	N/A	NO	0X 0	0	0	N/A	N/A
590	033083	0000	3	2	XFO	UNK	UNK	7	NO	YES	N/A	NO	0X 0	0	0	N/A	N/A
591	033183	0000	2	1	FRA	CLIMB	UNK	2	YES	YES	VIBES	UNK	0X 0	0	0	ATB	N/A
592	033183	1420	4	4	AMS	CLIMB	IFR	2	NO	YES	N/A	UNK	0X 0	0	0	ATB	N/A
****** SAMPLE SIZE FOR MAR 83 = 22	# STRIKES WITH DAMAGE = 16	X = 72.727															
593	040283	0640	4	1	LHR	LANDNG	UNK	1	NO	N/A	N/A	NO	0X 0	0	0	N/A	N/A
594	040483	0904	4	3	KHI	TO	UNK	4	NO	YES	N/A	YES	3K 28	1	40	N/A	ENG MULT
594	040483	0904	4	2	KHI	TO	UNK	2	NO	YES	N/A	YES	3K 28	1	40	N/A	ENG MULT

EVT#	DATE	TIME	A C	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD REASON	BIRD SEEN	BIRD SPECIES	# B D	AV WT OZ	PI-LOT ACT	SIGNI-FICANT REASON
595	040583	1735	4	1	XFO	TO	VFR	4	YES	YES	VIBES	YES	3K168	1	18	ATB	N/A
596	040683	0000	4	1	MVD	TO	UNK	2	NO	YES	N/A	UNK	0X 0	0	0	N/A	N/A
597	041383	0700	2	1	YUL	LANDNG	VFR	1	NO	N/A	N/A	YES	0X 0	0	0	N/A	N/A
598	041383	0700	4	1	HAM	APPRCH	UNK	1	NO	N/A	N/A	YES	5N 1	1	8	N/A	N/A
599	041483	0000	7	1	XFO	UNK	UNK	9	NO	YES	N/A	NO	0X 0	0	0	N/A	N/A
600	041483	0000	7	1	XUS	UNK	UNK	1	NO	N/A	N/A	NO	14N 14	1	40	N/A	N/A
601	041683	1300	7	1	YYZ	LANDNG	VFR	1	NO	N/A	N/A	YES	0X 0	0	0	N/A	N/A
602	041783	0000	2	1	MEX	TO	VFR	1	NO	N/A	N/A	UNK	0X 0	0	0	N/A	N/A
603	042083	0000	4	4	XFO	UNK	UNK	1	NO	YES	N/A	NO	0X 0	0	0	N/A	N/A
604	042083	0000	3	2	THR	LANDNG	UNK	1	NO	N/A	N/A	UNK	0X 0	0	0	N/A	N/A
605	042183	0000	3	2	XFO	UNK	UNK	1	NO	N/A	N/A	UNK	0X 0	0	0	N/A	N/A
606	042283	0000	4	3	XFO	UNK	UNK	2	NO	YES	N/A	UNK	0X 0	0	0	N/A	N/A
607	042483	0000	2	1	LOS	CLIMB	UNK	2	NO	YES	N/A	UNK	0X 0	0	0	N/A	N/A
608	042483	0130	6	1	YVR	LANDNG	VFR	1	NO	N/A	N/A	YES	14N 10	1	24•	N/A	N/A
609	042983	1012	7	3	SFO•	TO	VFR	279	YES	YES	N/A	YES	1K 1	1	72	ATO	AIRWRTHY

•••••• SAMPLE SIZE FOR APR 83 = 17 # STRIKES WITH DAMAGE = 7 % = 41.176

EVT#	DATE	TIME	A C	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD REASON	BIRD SEEN	BIRD SPECIES	# B D	AV WT OZ	PI-LOT ACT	SIGNI-FICANT REASON
610	050383	0000	7	3	XFO	UNK	UNK	7	NO	YES	N/A	NO	0X 0	0	0	N/A	N/A

EVT#	DATE	TIME	A C	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD REASON	BIRD SEEN	BIRD SPECIES	# B D	AV WT OZ	PI-LOT ACT	SIGNI-FICANT REASON
611	050483	0600	3	2	LHE	TO	VFR	2	NO	YES	N/A	UNK	0X 0	0	0	N/A	N/A
612	050683	0000	4	2	XXX	UNK	UNK	1	NO	N/A	N/A	NO	14N 14	1	32	N/A	N/A
613	050983	0000	4	4	XFD	UNK	VFR	1	NO	N/A	N/A	NO	17Z 73	1	2	N/A	N/A
614	051283	1210	4	3	OKA	TO	UNK	2	NO	YES	N/A	NO	0X 0	1	24•	N/A	N/A
615	051483	0000	7	1	XUS	UNK	UNK	29	UNK	YES	N/A	NO	61 21	1	16	N/A	N/A
616	051483	0000	3	2	MPL	APPRCH	UNK	1	NO	N/A	N/A	UNK	14N 36	3	12	N/A	N/A
617	051483	0000	3	1	XFO	UNK	UNK	1	NO	N/A	N/A	NO	0X 0	0	0	N/A	N/A
618	051483	0000	4	1	ANC	TO	VFR	29	UNK	YES	N/A	UNK	2J 84	2	36	ATO	BDS MULT
619	051483	0000	3	1	XFD	UNK	UNK	Z	NO	N/A	N/A	UNK	0X 0	0	0	N/A	N/A
620	051883	1235	6	1	BOS	TO	VFR	2	N/A	YES	N/A	UNK	0X 0	0	0	N/A	N/A
621	052083	0000	8	2	FRA	TO	UNK	4789	YES	UNK	N/A	UNK	2P 9	2	18	ATB	BDS MULT
622	052183	0000	3	2	XUS	UNK	UNK	1	NO	N/A	N/A	NO	0X 0	0	0	N/A	N/A
623	052483	1700	4	1	JNB	TO	UNK	2	YES	YES	N/A	UNK	5N 27	1	6	N/A	N/A
624	052783	0000	7	2	XUS	UNK	UNK	1	NO	N/A	N/A	NO	2P105	1	4	N/A	N/A
625	052783	1400	4	2	SYD	LANDNG	IFR	1	NO	N/A	N/A	YES	14N 32	1	12	N/A	N/A
626	052883	0000	2	3	JFK	LANDNG	IFR	48	UNK	YES	N/A	UNK	14N 14	1	40	N/A	N/A

EVT#	DATE	TIME	A C	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD REASON	BIRD SEEN	BIRD SPECIES	# B D	AV WT OZ	PI-LOT ACT	SIGNI-FICANT REASON
627	052983	0000	4	4	XFO	UNK	UNK	1	NO	N/A	N/A	NO	0X 0	0	0	N/A	N/A

****** SAMPLE SIZE FOR MAY 83 = 18 # STRIKES WITH DAMAGE = 10 % = 55.556

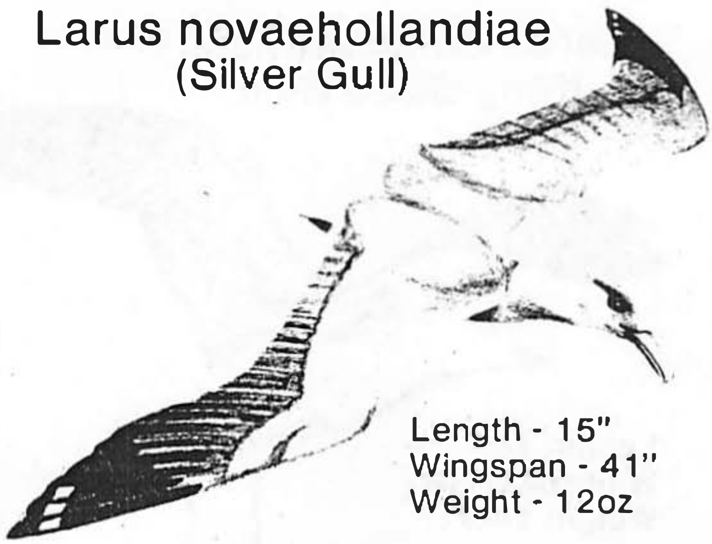
EVT#	DATE	TIME	A C	ENG POS	ARPT	FLIGHT PHASE	WX	DAMAGE	POWR LOSS /RED	CONT DAMG	IFSD REASON	BIRD SEEN	BIRD SPECIES	# B D	AV WT OZ	PI-LOT ACT	SIGNI-FICANT REASON
628	060383	0000	4	4	XXX	UNK	UNK	9	UNK	YES	N/A	NO	2K 1	1	56	N/A	N/A
629	060483	0000	4	1	ANC	UNK	UNK	1	UNK	UNK	N/A	UNK	0X 0	0	0	UNK	N/A
630	060583	0700	4	4	JFK	TO	VFR	489	NO	YES	N/A	YES	14N 14	1	40	ATO	N/A
631	060883	0000	3	1	XFO	UNK	UNK	29	NO	YES	N/A	NO	0X 0	0	0	N/A	N/A
632	061183	1900	3	2	SUB	UNK	UNK	28	NO	YES	N/A	NO	2J 4	1	25*	N/A	N/A
633	061383	0000	7	1	XUS	UNK	UNK	9	NO	YES	N/A	NO	1S 2	2	14	N/A	BDS MULT
634	061883	0000	3	2	XUS	UNK	UNK	2	NO	YES	N/A	NO	0X 0	0	0	N/A	N/A
635	061883	1300	4	2	BOM	TO	UNK	6	NO	YES	N/A	YES	0X 0	1	0	N/A	N/A
636	062983	0000	3	2	VIE	TO	UNK	2	NO	YES	N/A	UNK	0X 0	0	0	N/A	N/A
637	062983	0000	4	4	BOM	TO	UNK	7	YES	YES	STAL/SRG	NO	3K 28	1	32	ATB	IPWBLOSS
638	062983	0745	3	1	BOD	TO	VFR	2	NO	YES	N/A	UNK	3K 28	1	32	ATO	ENG MULT
638	062983	0745	3	2	BOD	TO	VFR	2 9	NO	YES	N/A	UNK	3K 28	1	32	ATO	ENG MULT

****** SAMPLE SIZE FOR JUN 83 = 11 # STRIKES WITH DAMAGE = 10 % = 90.909

APPENDIX F

MOST COMMONLY INGESTED BIRD SPECIES DRAWINGS

Larus novaehollandiae
(Silver Gull)



Length - 15"
Wingspan - 41"
Weight - 12oz

INGESTION LOCATION
Foreign - 5
US - 0
Unknown - 0

Larus crassiros
(Black-Tailed Gu

Length - 16"
Wingspan - 48"
Weight - 20oz

INGESTION LOCAT
Foreign - 14
US - 0
Unknown - 0

Larus ridibundus
(Common Black-headed Gull)

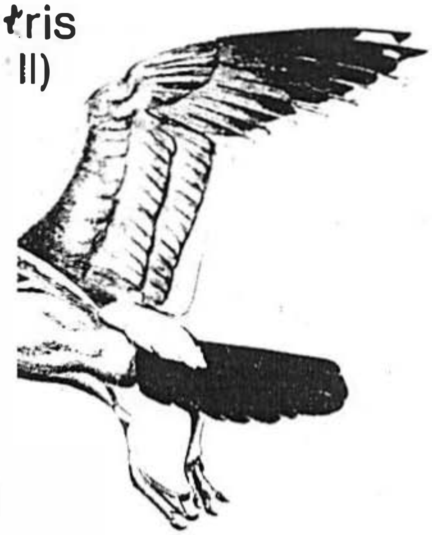
Length - 14"
Wingspan - 38"
Weight - 10oz

INGESTION LOCATION
Foreign - 30
US - 0
Unknown - 4

Larus a
(Laughin

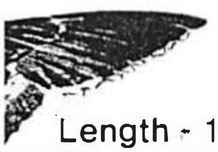
INGESTION LO
Foreign - 4
US - 1
Unknown - 0

tris
ll)



ION

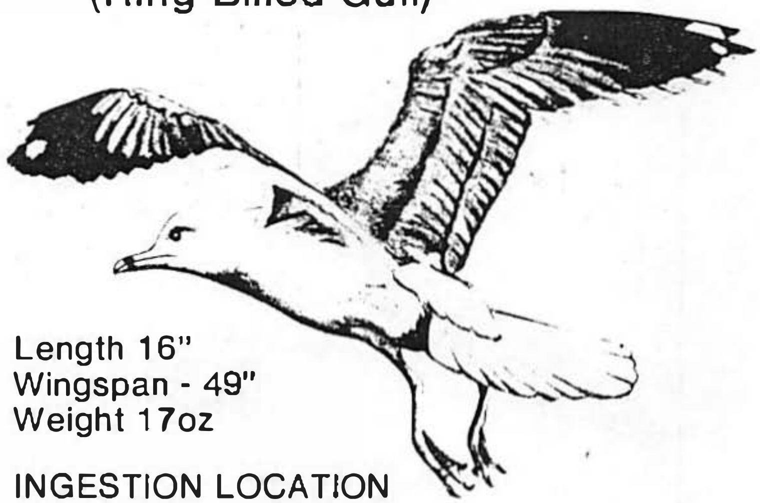
ricilla
Gull)



Length - 13"
Wingspan - 41"
Weight - 10oz

CATION

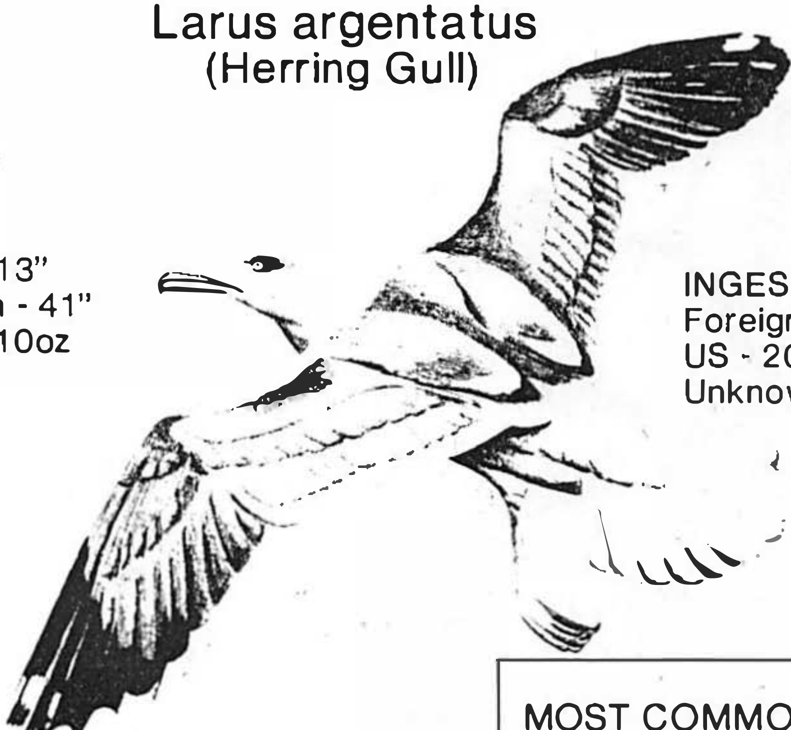
Larus delawarensis
(Ring-Billed Gull)



Length 16"
Wingspan - 49"
Weight 17oz

INGESTION LOCATION
Foreign - 1
US - 8
Unknown - 2

Larus argentatus
(Herring Gull)

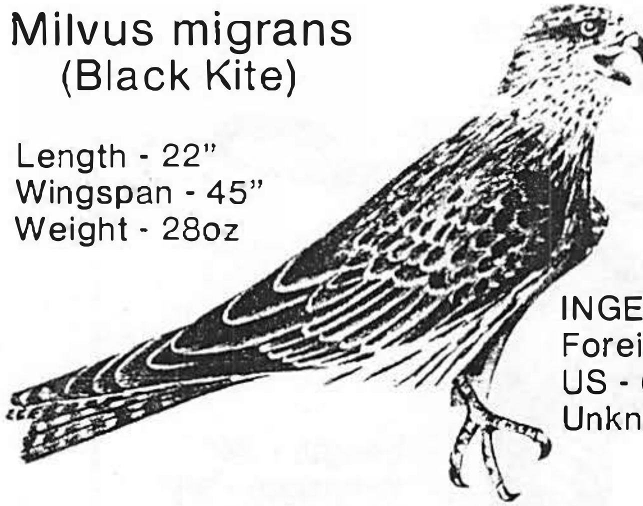


Length - 20"
Wingspan - 55"
Weight - 36oz

INGESTION LOCATION
Foreign - 4
US - 20
Unknown - 3

MOST COMMONLY INGESTED
BIRD SPECIES

Milvus migrans
(Black Kite)



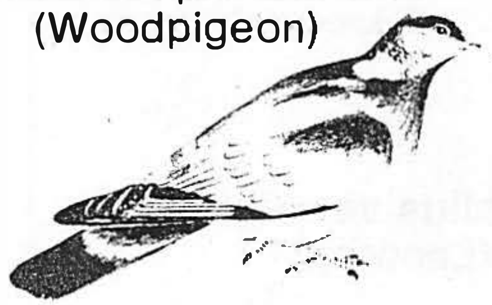
Length - 22"
Wingspan - 45"
Weight - 28oz

INGESTION LOCATION
Foreign - 46
US - 0
Unknown - 0

Corvus coro
(Carrion Cro

Length - 18"
Wingspan - 36"
Weight -19oz

Columba palumbus
(Woodpigeon)



Length - 16"
Wingspan - 21"
Weight - 16oz

INGESTION LOCATION
Foreign - 21
US - 2
Unknown - 0

Columba livia
(Rock Dove)

Tyto alba
(Barn Owl)

Length - 14"
Wingspan - 44"
Weight 11oz

INGESTION LOCATION
Foreign - 2
US - 2
Unknown - 2

Fran
(Black Fra

Length -
Wingspa
Weight -

INGESTI
Foreign -
US - 0
Unknow

MOST COMMONLY INGESTED BIRD SPECIES

ne
W)

INGESTION LOCATION
Foreign - 6
US - 0
Unknown - 0

Length - 13"
Wingspan - 17"
Weight - 14oz

INGESTION LOCATION
Foreign - 5
US - 2
Unknown - 1

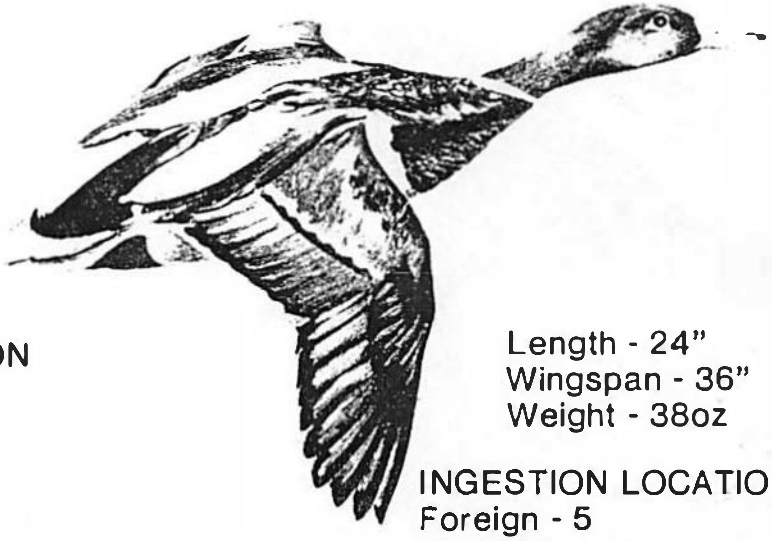
colinus francolinus
ncolin or Black Partridge)

13"
22"
16oz

N LOCATION
5

- 0

Anas platyrhynchos
(Mallard Duck)

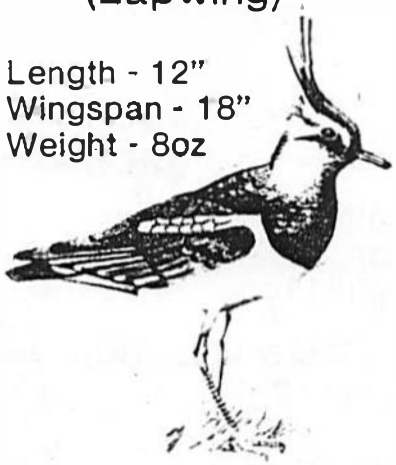


Length - 24"
Wingspan - 36"
Weight - 38oz

INGESTION LOCATION
Foreign - 5
US - 4
Unknown - 0

Vanellus vanellus
(Lapwing)

Length - 12"
Wingspan - 18"
Weight - 8oz



INGESTION LOCATION
Foreign - 10
US - 0
Unknown - 0

APPENDIX G

AIRPORT IDENTIFIERS

APPENDIX G

AIRPORT IDENTIFIERS

ABJ	Abidjan, Ivory Coast
ADL	Adelaide, S. Australia
ALG	Alamosa, Colorado, USA
AMM	Amman, Jordan
AMS	Amsterdam, Netherlands
ANC	Anchorage, Alaska, USA
ANU	Antigua, West Indies
ATH	Athens, Greece
ATL	Altanta, Georgia, USA
AUH	Abu Dhabi, UA Emirates
BGF	Bangui, Cen. African Republic
BKK	Bangkok, Thailand
BNE	Brisbane, Australia
BOD	Bordeaux, France
BOM	Bombay, India
BOS	Boston, Massachusetts, USA
BRU	Brussels, Belgium
BWI	Baltimore, Maryland, USA
CAI	Cairo, Arab Republic of Egypt
CCU	Calcutta, India
CDG	Paris, France (Charles de Gaulle Airport)
CJU	Cheju, Republic of Korea
CPH	Copenhagen, Denmark
DEL	Delhi, India
DKR	Dakar, Senegal
DPS	Denpasar, India
DUR	Durban, South Africa
DUS	Dusseldorf, Republic of Germany
EBB	Entebbe/Kampala, Uganda
EWR	New York, NY-Newark Airport, USA
EZE	Buenos Aires, Arg.-Ezeiza Airport
FCO	Rome, Italy, L. DaVinci (Fium) Airport
FDF	Port de France, Martinique
FEZ	Fez, Morocco
FIH	Kinshasa, Zaire
FLL	Ft. Lauderdale/Hollywood, Florida, USA
FRA	Frankfurt, Republic of Germany
FUK	Fukuoka, Japan
GIG	Rio De Janeiro, Brazil International
GUM	Guam Island, Mariana Is.
GVA	Geneva, Switzerland
HAM	Hamburg, Republic of Germany
HKD	Hakodate, Japan
HKG	Hong Kong, Hong Kong

HLP	Jakarta, Indonesia - Halim Per A
HND	Tokyo, Japan - Haneda Airport
HYD	Hyderabad, India
IAD	Washington - Dulles Airport, USA
IAH	Houston, Texas - International Airport
IST	Instanbul, Turkey
JED	Jeddah, Saudia Arabia
JFK	New York, NY - Kennedy International Airport, USA
JNB	Johannesburg, South Africa
KAN	Kano, Nigeria
KHI	Karachi, Pakistan
KMQ	Komatsu, Japan
KRT	Khartoum, Sudan
KUL	Kuala Lumpur, Malaysia
LAX	Los Angeles, California, USA
LCA	Larnaca, Cyprus
LGA	Laguardia Airport, New York, USA
LGW	London, England, Gatwick Airport
LHE	Lahore, Pakistan
LHR	London, England, Heathrow Airport
LIM	Lima, Peru
LIN	Milan, Italy - Forlanini-Linate
LIS	Lisbon, Portugal
LOS	Lagos, Nigeria
LPA	Las Palmas, Canary Is.
LUX	Luxembourg, Luxembourg
LYS	Lyon, France
MAA	Madras, India
MAD	Madrid, Spain
MEL	Melbourne, Australia
MEX	Mexico City, Mexico
MGQ	Mogadishu, Somalia
MIA	Miami, Florida, USA
MNL	Manila, Philippines
MPL	Montpellier, France
MRS	Marseille, France
MSP	Minneapolis/St. Paul, Minnesota, USA
MSY	New Orleans, Louisiana, USA
MTY	Monterrey, Mexico
MVD	Montevideo, Uruguay
MWH	Moses Lake, Washington, USA
MXP	Milan, Italy - Malpensa Airport
NBO	Nairobi, Kenya
NCE	Nice, France
NGO	Nagoya, Japan
NGS	Nagasaki, Japan
NIM	Niamey, Niger

NKC	Nouakchott, Mauritania
NRT	Tokyo, Japan - Narita Airport
OAK	San Francisco, California - Oakland Airport, USA
OKA	Okinawa, Ryukyu Is., Japan
ORD	Chicago, Illinois, O'Hare Airport, USA
ORY	Paris, France, Orly Airport
OSA	Osaka, Japan
PDX	Portland, Oregon, USA
PEN	Penang, Maylaysia
PHL	Philadelphia, Pennsylvania, USA
POS	Port of Spain, Trin. & Tob.
PTY	Panama City, Panama Republic
PUS	Pusan, Republic of Korea
SDL	Sundsvall, Sweden
SCQ	Santiago De Compostela, Spain
SEA	Seattle/Tacoma, Washington, USA
SEL	Seoul, Republic of Korea
SFO	San Francisco, California, USA
SID	Sal Island, Cape Verde, Is.
SIN	Singapore, Singapore
SNN	Shannon, Republic of Ireland
SSA	Salvador, Brazil
STR	Stuttgart, Republic of Germany
SUB	Surabaya, Indonesia
SXR	Srinagai, India
SYD	Sydney, NSW Australia
THR	Tehran, Islamic Republic of Iran
TLS	Toulouse, France
TLV	Tel Aviv - Yafo, Israel
TNR	Antananarivo, Dem. Rep. Madagascar
TPE	Taipei, Taiwan
TRV	Trivandrum, India
TSV	Townsville, Qld, Australia
TUL	Tulsa, Oklahoma, USA
TUN	Tunis, Tunesia
VCP	Sao Paulo, Brazil - Viracopos Airport
VIE	Vienna, Austria
WDH	Windhoek, Namibia
WLG	Wellington, New Zealand
XFO	Unknown Location, Foreign
XUS	Unknown Location, United States
XXX	Unknown Location, Worldwide

YMX	Montreal, Quebec - Mirabel International
YUL	Montreal, Quebec, Canada
YVR	Vancouver, B.C., Canada
YYC	Calgary, Alta., Canada
YYZ	Toronto, Ontario, Canada
ZRH	Zurich, Switzerland

APPENDIX H

EVENTS, OPERATIONS, AND RATES

AIRPORT: BIRDS INGESTION EVENTS, OPERATIONS AND INGESTION RATES/10K OPERATIONS BY AIRCRAFT TYPES

			AIRCRAFT TYPE							
			1	2	3	4	5	6	7	8	OVER-ALL
1	ABJ										
		EVENTS	0	1	0	0	0	0	0	0	1
		OPERATIONS	0	3348	84	868	0	0	0	0	4300
		RATE/10K	0.0	2.987	0.0	0.0	0.0	0.0	0.0	0.0	2.326
2	ADL										
		EVENTS	0	0	0	1	0	0	0	0	1
		OPERATIONS	0	0	0	267	0	0	0	0	267
		RATE/10K	0.0	0.0	0.0	37.453	0.0	0.0	0.0	0.0	37.453
3	ALG										
		EVENTS	0	0	1	0	0	0	0	0	1
		OPERATIONS	0	0	5101	65	0	0	56	0	5222
		RATE/10K	0.0	0.0	1.960	0.0	0.0	0.0	0.0	0.0	1.915
4	AMM										
		EVENTS	0	0	0	0	0	0	2	0	2
		OPERATIONS	0	505	1384	1631	0	0	2572	0	6091
		RATE/10K	0.0	0.0	0.0	0.0	0.0	0.0	7.776	0.0	3.284
5	AMS										
		EVENTS	0	2	0	8	0	0	0	0	10
		OPERATIONS	0	4925	638	11552	0	0	164	0	17279
		RATE/10K	0.0	4.061	0.0	6.925	0.0	0.0	0.0	0.0	5.787
6	ANC										
		EVENTS	0	0	0	2	0	0	0	0	2
		OPERATIONS	0	6780	0	15954	0	0	0	0	22734
		RATE/10K	0.0	0.0	0.0	1.254	0.0	0.0	0.0	0.0	0.880
7	ANU										
		EVENTS	0	0	0	0	0	0	1	0	1
		OPERATIONS	0	660	409	460	0	0	1112	0	2641
		RATE/10K	0.0	0.0	0.0	0.0	0.0	0.0	8.993	0.0	3.786
8	ATH										
		EVENTS	0	0	1	0	0	0	0	0	1
		OPERATIONS	0	2347	12627	6424	0	0	1823	0	23221
		RATE/10K	0.0	0.0	0.792	0.0	0.0	0.0	0.0	0.0	0.431
9	ATL										
		EVENTS	0	0	0	0	0	0	2	0	2
		OPERATIONS	0	2067	9758	763	796	1518	49661	0	64514
		RATE/10K	0.0	0.0	0.0	0.0	0.0	0.0	0.403	0.0	0.310
10	AUH										
		EVENTS	0	0	0	1	0	0	0	0	1
		OPERATIONS	0	1684	2866	5642	0	0	4300	0	14492
		RATE/10K	0.0	0.0	0.0	1.772	0.0	0.0	0.0	0.0	0.690

AIRPORT: BIRDS INGESTION EVENTS, OPERATIONS AND INGESTION RATES/10K OPERATIONS BY AIRCRAFT TYPES

			<——— AIRCRAFT TYPE ———>							
			1	2	3	4	5	6	7	8	OVER-ALL
11	BGF										
		EVENTS	0	2	0	0	0	0	0	0	2
		OPERATIONS	0	323	0	0	0	0	0	0	323
		RATE/10K	0.0	61.919	0.0	0.0	0.0	0.0	0.0	0.0	61.919
12	BKK										
		EVENTS	0	1	0	0	0	0	0	0	1
		OPERATIONS	0	8256	9394	14900	0	86	4465	0	37101
		RATE/10K	0.0	1.211	0.0	0.0	0.0	0.0	0.0	0.0	0.270
13	BNE										
		EVENTS	0	0	0	1	0	0	0	0	1
		OPERATIONS	0	489	1962	2631	0	0	0	0	5082
		RATE/10K	0.0	0.0	0.0	3.801	0.0	0.0	0.0	0.0	1.968
14	BOD										
		EVENTS	0	0	3	0	0	0	0	0	3
		OPERATIONS	0	228	3018	472	0	0	0	0	3718
		RATE/10K	0.0	0.0	9.940	0.0	0.0	0.0	0.0	0.0	8.069
15	BOM										
		EVENTS	0	1	2	9	0	0	2	0	14
		OPERATIONS	0	2734	10013	9637	0	0	3673	0	26062
		RATE/10K	0.0	3.658	1.997	9.339	0.0	0.0	5.445	0.0	5.372
16	BOS										
		EVENTS	0	0	0	1	0	1	0	0	2
		OPERATIONS	0	12419	10595	6456	89	443	14271	0	44272
		RATE/10K	0.0	0.0	0.0	1.549	0.0	22.573	0.0	0.0	0.452
17	BRU										
		EVENTS	0	1	0	2	0	0	0	0	3
		OPERATIONS	0	3426	0	2768	0	0	122	0	6316
		RATE/10K	0.0	2.919	0.0	7.225	0.0	0.0	0.0	0.0	4.750
18	BWI										
		EVENTS	0	1	0	0	0	0	0	0	1
		OPERATIONS	0	3680	926	0	0	61	217	0	4884
		RATE/10K	0.0	2.717	0.0	0.0	0.0	0.0	0.0	0.0	2.048
19	CAI										
		EVENTS	0	0	2	0	0	0	0	0	2
		OPERATIONS	0	1068	9761	5233	0	0	2823	0	18885
		RATE/10K	0.0	0.0	2.049	0.0	0.0	0.0	0.0	0.0	1.059
20	CCU										
		EVENTS	0	0	3	0	0	0	0	0	3
		OPERATIONS	0	150	3969	428	0	0	338	0	4885
		RATE/10K	0.0	0.0	7.559	0.0	0.0	0.0	0.0	0.0	6.141

AIRPORT: BIRDS INGESTION EVENTS, OPERATIONS AND INGESTION RATES/10K OPERATIONS BY AIRCRAFT TYPES

			<------ AIRCRAFT TYPE ------>								
			1	2	3	4	5	6	7	8	OVER-ALL
21	CDG										
		EVENTS	0	1	5	6	0	0	0	0	12
		OPERATIONS	0	4083	18939	15793	94	0	8146	0	47054
		RATE/10K	0.0	2.449	2.640	3.799	0.0	0.0	0.0	0.0	2.550
22	CJU										
		EVENTS	0	0	1	0	0	0	0	0	1
		OPERATIONS	0	0	1799	0	0	0	0	0	1799
		RATE/10K	0.0	0.0	5.559	0.0	0.0	0.0	0.0	0.0	5.559
23	CPH										
		EVENTS	0	1	0	3	0	0	0	0	4
		OPERATIONS	0	2628	1738	3257	88	0	140	0	7851
		RATE/10K	0.0	3.805	0.0	9.211	0.0	0.0	0.0	0.0	5.095
24	DEL										
		EVENTS	0	0	4	5	0	0	1	0	10
		OPERATIONS	0	1468	6749	7674	0	0	1299	0	17190
		RATE/10K	0.0	0.0	5.927	6.516	0.0	0.0	7.698	0.0	5.817
25	DKR										
		EVENTS	0	1	1	1	0	0	0	0	3
		OPERATIONS	0	1421	1482	954	0	0	0	0	3807
		RATE/10K	0.0	7.037	6.748	10.482	0.0	0.0	0.0	0.0	7.880
26	DPS										
		EVENTS	0	1	0	2	0	0	0	0	3
		OPERATIONS	0	3420	547	1973	0	0	0	0	5890
		RATE/10K	0.0	2.924	0.0	10.137	0.0	0.0	0.0	0.0	5.093
27	DUR										
		EVENTS	0	0	2	3	0	0	0	0	5
		OPERATIONS	0	0	6411	328	0	0	0	0	5739
		RATE/10K	0.0	0.0	3.120	91.463	0.0	0.0	0.0	0.0	8.712
28	DUS										
		EVENTS	0	0	0	0	0	0	1	0	1
		OPERATIONS	0	2397	1308	671	0	0	54	0	4430
		RATE/10K	0.0	0.0	0.0	0.0	0.0	0.0	185.185	0.0	2.257
29	EBB										
		EVENTS	0	1	0	0	0	0	0	0	1
		OPERATIONS	0	105	0	0	0	0	0	0	105
		RATE/10K	0.0	95.238	0.0	0.0	0.0	0.0	0.0	0.0	95.238
30	EWR										
		EVENTS	0	1	0	0	0	0	0	0	1
		OPERATIONS	0	10275	2845	1956	331	273	5498	0	21178
		RATE/10K	0.0	0.973	0.0	0.0	0.0	0.0	0.0	0.0	0.472

AIRPORT: BIRDS INGESTION EVENTS, OPERATIONS AND INGESTION RATES/10K OPERATIONS BY AIRCRAFT TYPES

			<—— AIRCRAFT TYPE ——>							
			1	2	3	4	5	6	7	8	OVER-ALL
31	EZE										
		EVENTS	0	0	0	2	0	0	0	0	1
		OPERATIONS	0	2048	1261	4572	0	0	581	0	8412
		RATE/10K	0.0	0.0	0.0	4.374	0.0	0.0	0.0	0.0	2.378
32	FCO										
		EVENTS	0	3	1	4	0	0	0	0	8
		OPERATIONS	0	5344	10229	10094	88	0	1746	0	27501
		RATE/10K	0.0	5.614	0.978	3.963	0.0	0.0	0.0	0.0	2.909
33	FDF										
		EVENTS	0	0	0	1	0	0	0	0	1
		OPERATIONS	0	188	0	1527	0	0	9	0	1724
		RATE/10K	0.0	0.0	0.0	6.549	0.0	0.0	0.0	0.0	5.800
34	FEZ										
		EVENTS	0	0	0	1	0	0	0	0	1
		OPERATIONS	0	113	113	226	0	0	0	0	452
		RATE/10K	0.0	0.0	0.0	44.248	0.0	0.0	0.0	0.0	22.124
35	FIH										
		EVENTS	0	1	0	0	0	0	0	0	1
		OPERATIONS	0	2011	0	594	0	0	34	0	2739
		RATE/10K	0.0	4.973	0.0	0.0	0.0	0.0	0.0	0.0	3.651
36	FLL										
		EVENTS	0	0	0	0	0	0	1	0	1
		OPERATIONS	0	1385	2987	0	91	0	9024	0	13486
		RATE/10K	0.0	0.0	0.0	0.0	0.0	0.0	1.108	0.0	0.742
37	FRA										
		EVENTS	0	1	0	1	0	0	0	1	3
		OPERATIONS	0	7865	16762	19928	0	0	3365	0	47920
		RATE/10K	0.0	1.271	0.0	0.502	0.0	0.0	0.0	0.0	0.626
38	FUK										
		EVENTS	0	2	1	7	0	0	2	0	12
		OPERATIONS	0	6756	1753	4402	0	0	9786	0	22698
		RATE/10K	0.0	2.960	5.705	15.902	0.0	0.0	2.044	0.0	5.287
39	GIG										
		EVENTS	0	0	2	2	0	0	0	0	4
		OPERATIONS	0	7767	2908	6966	0	0	690	0	18231
		RATE/10K	0.0	0.0	7.123	2.871	0.0	0.0	0.0	0.0	2.194
40	GUM										
		EVENTS	0	0	0	1	0	0	0	0	1
		OPERATIONS	0	304	0	2761	0	0	0	0	3065
		RATE/10K	0.0	0.0	0.0	3.622	0.0	0.0	0.0	0.0	3.263

AIRPORT: BIRDS INGESTION EVENTS, OPERATIONS AND INGESTION RATES/10K OPERATIONS BY AIRCRAFT TYPES

			<—— AIRCRAFT TYPE ——>							
		1	2	3	4	5	6	7	8	OVER-ALL
41 GVA										
	EVENTS	0	0	1	0	0	0	0	0	1
	OPERATIONS	0	4382	475	1820	0	0	1057	0	7735
	RATE/10K	0.0	0.0	21.053	0.0	0.0	0.0	0.0	0.0	1.293
42 HAM										
	EVENTS	0	0	1	1	0	0	0	0	2
	OPERATIONS	0	28	2480	2511	0	0	0	0	5019
	RATE/10K	0.0	0.0	4.032	3.982	0.0	0.0	0.0	0.0	3.985
43 HKD										
	EVENTS	0	0	0	0	0	0	1	0	1
	OPERATIONS	0	0	0	122	0	0	1887	0	2009
	RATE/10K	0.0	0.0	0.0	0.0	0.0	0.0	5.299	0.0	4.978
44 HKG										
	EVENTS	0	0	1	4	0	0	0	0	5
	OPERATIONS	0	5238	8361	20059	0	211	7636	0	41505
	RATE/10K	0.0	0.0	1.196	1.994	0.0	0.0	0.0	0.0	1.205
45 HLP										
	EVENTS	0	1	0	0	0	0	0	0	1
	OPERATIONS	0	8904	4775	3691	0	0	9	0	17379
	RATE/10K	0.0	1.123	0.0	0.0	0.0	0.0	0.0	0.0	0.575
46 HND										
	EVENTS	0	3	1	10	0	0	1	0	15
	OPERATIONS	0	9876	5778	29694	0	0	2027	0	65874
	RATE/10K	0.0	3.038	1.731	3.368	0.0	0.0	4.933	0.0	2.277
47 HYD										
	EVENTS	0	0	5	0	0	0	0	0	5
	OPERATIONS	0	0	3232	0	0	0	0	0	3232
	RATE/10K	0.0	0.0	15.470	0.0	0.0	0.0	0.0	0.0	15.470
48 IAD										
	EVENTS	0	1	0	0	0	0	0	0	1
	OPERATIONS	0	6471	0	2906	0	380	725	0	10482
	RATE/10K	0.0	1.545	0.0	0.0	0.0	0.0	0.0	0.0	0.954
49 IAH										
	EVENTS	0	3	0	0	0	0	0	0	3
	OPERATIONS	0	6091	1652	3826	0	279	3110	0	14958
	RATE/10K	0.0	4.925	0.0	0.0	0.0	0.0	0.0	0.0	2.006
50 IST										
	EVENTS	0	1	0	1	0	0	0	0	2
	OPERATIONS	0	1707	513	474	0	0	157	0	2851
	RATE/10K	0.0	5.858	0.0	21.097	0.0	0.0	0.0	0.0	7.015

AIRPORT: BIRDS INGESTION EVENTS, OPERATIONS AND INGESTION RATES/10K OPERATIONS BY AIRCRAFT TYPES

			AIRCRAFT TYPE							
		1	2	3	4	5	6	7	8	OVER-ALL
51 JED										
	EVENTS	0	0	0	3	0	0	0	0	3
	OPERATIONS	0	1883	2564	8200	0	0	12452	0	25119
	RATE/10K	0.0	0.0	0.0	3.659	0.0	0.0	0.0	0.0	1.194
52 JFK										
	EVENTS	0	5	1	12	0	0	5	0	23
	OPERATIONS	0	30418	4897	53330	0	463	27661	0	116769
	RATE/10K	0.0	1.644	2.042	2.250	0.0	0.0	1.808	0.0	1.970
53 JNB										
	EVENTS	0	0	0	4	0	0	0	0	4
	OPERATIONS	0	1332	10302	4490	0	0	31	0	16155
	RATE/10K	0.0	0.0	0.0	8.909	0.0	0.0	0.0	0.0	2.476
54 KAN										
	EVENTS	0	3	0	0	0	0	0	0	3
	OPERATIONS	0	3622	73	1146	0	0	0	0	4841
	RATE/10K	0.0	8.283	0.0	0.0	0.0	0.0	0.0	0.0	6.197
55 KHI										
	EVENTS	0	0	3	4	0	0	3	0	10
	OPERATIONS	0	4113	5505	5595	0	0	2092	0	17013
	RATE/10K	0.0	0.0	5.450	7.149	0.0	0.0	14.340	0.0	5.878
56 KNO										
	EVENTS	0	0	0	0	0	0	1	0	1
	OPERATIONS	0	0	0	2183	0	0	1842	0	4025
	RATE/10K	0.0	0.0	0.0	0.0	0.0	0.0	5.429	0.0	2.484
57 KRT										
	EVENTS	0	0	1	0	0	0	0	0	1
	OPERATIONS	0	14	557	0	0	0	1169	0	1740
	RATE/10K	0.0	0.0	17.953	0.0	0.0	0.0	0.0	0.0	5.747
58 KUL										
	EVENTS	0	0	0	1	0	0	0	0	1
	OPERATIONS	0	3420	9133	2615	0	0	1049	0	16217
	RATE/10K	0.0	0.0	0.0	3.824	0.0	0.0	0.0	0.0	0.617
59 LAX										
	EVENTS	0	5	0	2	0	0	0	0	7
	OPERATIONS	0	47030	1870	32124	0	804	21199	0	103027
	RATE/10K	0.0	1.063	0.0	0.623	0.0	0.0	0.0	0.0	0.679
60 LCA										
	EVENTS	0	0	0	0	0	0	1	0	1
	OPERATIONS	0	429	0	0	0	507	0	0	936
	RATE/10K	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.684

AIRPORT: BIRDS INGESTION EVENTS, OPERATIONS AND INGESTION RATES/10K OPERATIONS BY AIRCRAFT TYPES

			<—— AIRCRAFT TYPE ——>								
			1	2	3	4	5	6	7	8	OVER-ALL
61	LGA	EVENTS	0	0	3	0	0	0	1	0	4
		OPERATIONS	0	4089	14545	0	121	1653	6598	0	27005
		RATE/10K	0.0	0.0	2.063	0.0	0.0	0.0	1.516	0.0	1.481
62	LGW	EVENTS	0	2	0	1	0	0	0	0	3
		OPERATIONS	0	8157	0	3905	0	0	1853	0	13925
		RATE/10K	0.0	2.452	0.0	2.561	0.0	0.0	0.0	0.0	2.154
63	LHE	EVENTS	0	1	2	0	0	0	0	0	3
		OPERATIONS	0	556	2021	0	0	0	0	0	2577
		RATE/10K	0.0	17.986	9.896	0.0	0.0	0.0	0.0	0.0	11.641
64	LHR	EVENTS	0	0	0	10	0	0	3	0	13
		OPERATIONS	0	2927	11297	32592	1235	0	16612	0	64731
		RATE/10K	0.0	0.0	0.0	3.068	0.0	0.0	1.806	0.0	2.008
65	LIM	EVENTS	0	0	0	0	0	0	1	0	1
		OPERATIONS	0	2996	0	1573	0	0	1060	0	5629
		RATE/10K	0.0	0.0	0.0	0.0	0.0	0.0	9.434	0.0	1.777
66	LIN	EVENTS	0	1	1	0	0	0	0	0	2
		OPERATIONS	0	0	2062	0	0	0	185	0	2247
		RATE/10K	0.0	0.0	4.850	0.0	0.0	0.0	0.0	0.0	8.901
67	LIS	EVENTS	0	0	0	1	0	0	1	0	2
		OPERATIONS	0	3907	399	1184	0	0	940	0	6430
		RATE/10K	0.0	0.0	0.0	8.446	0.0	0.0	10.638	0.0	3.110
68	LOS	EVENTS	0	2	0	1	0	0	0	0	3
		OPERATIONS	0	6520	20	1440	0	0	0	0	7980
		RATE/10K	0.0	3.067	0.0	6.944	0.0	0.0	0.0	0.0	3.759
69	LPA	EVENTS	0	0	2	0	0	0	0	0	2
		OPERATIONS	0	421	1163	1140	0	0	0	0	2724
		RATE/10K	0.0	0.0	17.197	0.0	0.0	0.0	0.0	0.0	7.342
70	LUX	EVENTS	0	0	0	1	0	0	0	0	1
		OPERATIONS	0	138	0	418	0	0	0	0	556
		RATE/10K	0.0	0.0	0.0	23.923	0.0	0.0	0.0	0.0	17.986

AIRPORT: BIRDS INGESTION EVENTS, OPERATIONS AND INGESTION RATES/10K OPERATIONS BY AIRCRAFT TYPES

			<—— AIRCRAFT TYPE ——>								
			1	2	3	4	5	6	7	8	OVER-ALL
71	LYS										
		EVENTS	0	0	5	2	0	0	0	0	7
		OPERATIONS	0	191	3071	601	0	0	0	0	3863
		RATE/10K	0.0	0.0	16.281	33.278	0.0	0.0	0.0	0.0	18.121
72	MAA										
		EVENTS	0	0	2	0	0	0	0	0	2
		OPERATIONS	0	468	2812	0	0	0	0	0	3280
		RATE/10K	0.0	0.0	7.112	0.0	0.0	0.0	0.0	0.0	6.098
73	MAD										
		EVENTS	0	1	0	0	0	0	0	0	1
		OPERATIONS	0	6939	7684	5651	0	0	61	0	20335
		RATE/10K	0.0	1.441	0.0	0.0	0.0	0.0	0.0	0.0	0.492
74	MEL										
		EVENTS	0	0	1	3	0	0	0	0	4
		OPERATIONS	0	1744	5491	10485	0	0	0	0	17720
		RATE/10K	0.0	0.0	1.821	2.861	0.0	0.0	0.0	0.0	2.257
75	MEX										
		EVENTS	0	1	0	0	0	0	0	0	1
		OPERATIONS	0	11372	0	3576	0	0	2119	0	17066
		RATE/10K	0.0	0.879	0.0	0.0	0.0	0.0	0.0	0.0	0.586
76	MGQ										
		EVENTS	0	1	0	0	0	0	0	0	1
		OPERATIONS	0	202	0	0	0	0	0	0	202
		RATE/10K	0.0	49.505	0.0	0.0	0.0	0.0	0.0	0.0	49.505
77	MIA										
		EVENTS	0	1	2	1	0	0	1	0	5
		OPERATIONS	0	15198	13077	10061	297	334	25946	0	64913
		RATE/10K	0.0	0.658	1.529	0.994	0.0	0.0	0.385	0.0	0.770
78	MNL										
		EVENTS	0	0	0	2	0	0	0	0	2
		OPERATIONS	0	3629	4021	6162	0	21	1719	0	15551
		RATE/10K	0.0	0.0	0.0	3.246	0.0	0.0	0.0	0.0	1.286
79	MPL										
		EVENTS	0	0	3	0	0	0	0	0	3
		OPERATIONS	0	0	1442	0	0	0	0	0	1442
		RATE/10K	0.0	0.0	20.804	0.0	0.0	0.0	0.0	0.0	20.804
80	MRS										
		EVENTS	0	0	2	0	0	0	0	0	2
		OPERATIONS	0	971	6879	1221	0	0	0	0	9071
		RATE/10K	0.0	0.0	2.907	0.0	0.0	0.0	0.0	0.0	2.205

AIRPORT: BIRDS INGESTION EVENTS, OPERATIONS AND INGESTION RATES/10K OPERATIONS BY AIRCRAFT TYPES

			<——— AIRCRAFT TYPE ———>								
			1	2	3	4	5	6	7	8	OVER-ALL
81	MSP										
		EVENTS	0	1	0	0	0	0	0	0	1
		OPERATIONS	0	10788	0	2514	0	143	122	0	13566
		RATE/10K	0.0	0.927	0.0	0.0	0.0	0.0	0.0	0.0	0.737
82	MSY										
		EVENTS	0	0	0	0	0	0	1	0	1
		OPERATIONS	0	295	0	0	16	136	4031	0	4478
		RATE/10K	0.0	0.0	0.0	0.0	0.0	0.0	2.481	0.0	2.233
83	MTY										
		EVENTS	0	1	0	0	0	0	0	0	1
		OPERATIONS	0	2767	0	0	0	0	0	0	2767
		RATE/10K	0.0	3.614	0.0	0.0	0.0	0.0	0.0	0.0	3.614
84	MVD										
		EVENTS	0	0	0	1	0	0	0	0	1
		OPERATIONS	0	867	771	470	0	0	55	0	2163
		RATE/10K	0.0	0.0	0.0	21.277	0.0	0.0	0.0	0.0	4.623
85	MWH										
		EVENTS	0	0	0	5	0	0	0	0	5
		OPERATIONS	0	0	0	39167	0	0	0	0	39167
		RATE/10K	0.0	0.0	0.0	1.270	0.0	0.0	0.0	0.0	1.276
86	MXP										
		EVENTS	0	0	0	2	0	0	0	0	2
		OPERATIONS	0	3784	354	2558	0	0	0	0	6696
		RATE/10K	0.0	0.0	0.0	7.819	0.0	0.0	0.0	0.0	2.987
87	NBO										
		EVENTS	0	1	0	7	0	0	0	0	8
		OPERATIONS	0	2276	0	5491	0	0	0	0	7767
		RATE/10K	0.0	4.394	0.0	12.748	0.0	0.0	0.0	0.0	10.300
88	NCE										
		EVENTS	0	0	2	0	0	0	0	0	2
		OPERATIONS	0	677	7946	669	0	0	442	0	9734
		RATE/10K	0.0	0.0	2.517	0.0	0.0	0.0	0.0	0.0	2.055
89	NGO										
		EVENTS	0	1	0	0	0	0	1	0	2
		OPERATIONS	0	123	362	56	0	0	3904	0	4445
		RATE/10K	0.0	81.301	0.0	0.0	0.0	0.0	2.561	0.0	4.499
90	NGS										
		EVENTS	0	0	0	1	0	0	4	0	5
		OPERATIONS	0	0	790	1350	0	0	3721	0	5861
		RATE/10K	0.0	0.0	0.0	7.407	0.0	0.0	10.750	0.0	8.531

AIRPORT: BIRDS INGESTION EVENTS, OPERATIONS AND INGESTION RATES/10K OPERATIONS BY AIRCRAFT TYPES

			<-------- AIRCRAFT TYPE -------->							
			1	2	3	4	5	6	7	8	OVER-ALL
91	NIM										
		EVENTS	0	1	0	0	0	0	0	0	1
		OPERATIONS	0	1127	15	364	0	0	0	0	1506
		RATE/10K	0.0	8.873	0.0	0.0	0.0	0.0	0.0	0.0	6.640
92	NKC										
		EVENTS	0	0	1	0	0	0	0	0	1
		OPERATIONS	0	227	236	0	0	0	0	0	462
		RATE/10K	0.0	0.0	42.373	0.0	0.0	0.0	0.0	0.0	21.645
93	NRT										
		EVENTS	0	0	0	2	0	0	0	0	2
		OPERATIONS	0	7689	2168	42689	0	0	1223	0	53769
		RATE/10K	0.0	0.0	0.0	0.469	0.0	0.0	0.0	0.0	0.372
94	OAK										
		EVENTS	0	1	0	0	0	0	0	0	1
		OPERATIONS	0	2952	0	129	0	0	0	0	3081
		RATE/10K	0.0	3.388	0.0	0.0	0.0	0.0	0.0	0.0	3.246
95	OKA										
		EVENTS	0	1	0	1	0	0	0	0	2
		OPERATIONS	0	3015	160	4741	0	0	4668	0	12584
		RATE/10K	0.0	3.317	0.0	2.109	0.0	0.0	0.0	0.0	1.589
96	ORD										
		EVENTS	0	2	0	0	0	0	0	0	2
		OPERATIONS	0	51679	258	18170	78	2843	6577	0	79604
		RATE/10K	0.0	0.387	0.0	0.0	0.0	0.0	0.0	0.0	0.251
97	ORY										
		EVENTS	1	0	17	4	0	0	0	0	22
		OPERATIONS	0	2299	30925	6770	0	0	1694	0	41689
		RATE/10K	0.0	0.0	5.497	5.908	0.0	0.0	0.0	0.0	5.277
98	OSA										
		EVENTS	0	1	0	4	0	0	1	0	6
		OPERATIONS	0	11418	3928	22101	0	0	18028	0	55474
		RATE/10K	0.0	0.876	0.0	1.810	0.0	0.0	0.555	0.0	1.082
99	PDX										
		EVENTS	0	0	0	0	1	0	0	0	1
		OPERATIONS	0	2153	782	32	30	247	2709	0	5953
		RATE/10K	0.0	0.0	0.0	0.0	333.333	0.0	0.0	0.0	1.680
100	PEN										
		EVENTS	0	0	2	0	0	0	0	0	2
		OPERATIONS	0	692	3316	0	0	0	467	0	4475
		RATE/10K	0.0	0.0	6.031	0.0	0.0	0.0	0.0	0.0	4.469

AIRPORT: BIRDS INGESTION EVENTS, OPERATIONS AND INGESTION RATES/10K OPERATIONS BY AIRCRAFT TYPES

			<------- AIRCRAFT TYPE ------->							
		1	2	3	4	5	6	7	8	OVER-ALL
101 PHL										
	EVENTS	0	0	0	0	0	0	3	0	3
	OPERATIONS	0	6636	1997	929	0	213	7237	0	17013
	RATE/10K	0.0	0.0	0.0	0.0	0.0	0.0	4.145	0.0	1.763
102 POS										
	EVENTS	0	0	0	0	0	0	1	0	1
	OPERATIONS	0	1333	287	543	0	0	2212	0	4375
	RATE/10K	0.0	0.0	0.0	0.0	0.0	0.0	4.521	0.0	2.286
103 PTY										
	EVENTS	0	0	0	1	0	0	0	0	1
	OPERATIONS	0	2350	0	262	0	0	1163	0	3775
	RATE/10K	0.0	0.0	0.0	38.168	0.0	0.0	0.0	0.0	2.649
104 PUS										
	EVENTS	0	0	1	1	0	0	0	0	2
	OPERATIONS	0	794	1796	0	0	0	0	0	2590
	RATE/10K	0.0	0.0	5.568	0.0	0.0	0.0	0.0	0.0	7.722
105 SCL										
	EVENTS	0	0	0	1	0	0	0	0	1
	OPERATIONS	0	1729	244	1018	0	0	1193	0	4184
	RATE/10K	0.0	0.0	0.0	9.823	0.0	0.0	0.0	0.0	2.390
106 SCQ										
	EVENTS	0	0	0	0	0	0	1	0	1
	OPERATIONS	0	0	0	50	0	0	0	0	50
	RATE/10K	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	200.000
107 SEA										
	EVENTS	0	0	0	1	0	0	0	0	1
	OPERATIONS	0	16298	1404	5385	30	260	6766	0	30143
	RATE/10K	0.0	0.0	0.0	1.857	0.0	0.0	0.0	0.0	0.332
108 SEL										
	EVENTS	0	0	0	1	0	0	0	0	1
	OPERATIONS	0	2664	6757	7821	0	43	37	0	17322
	RATE/10K	0.0	0.0	0.0	1.279	0.0	0.0	0.0	0.0	0.577
109 SFO										
	EVENTS	0	0	0	3	0	0	1	0	4
	OPERATIONS	0	20172	2983	15806	0	1108	11450	0	51518
	RATE/10K	0.0	0.0	0.0	1.898	0.0	0.0	0.873	0.0	0.776
110 SID										
	EVENTS	0	0	0	1	0	0	0	0	1
	OPERATIONS	0	0	0	2030	0	0	0	0	2030
	RATE/10K	0.0	0.0	0.0	4.926	0.0	0.0	0.0	0.0	4.926

AIRPORT: BIRDS INGESTION EVENTS, OPERATIONS AND INGESTION RATES/10K OPERATIONS BY AIRCRAFT TYPES

			<——— AIRCRAFT TYPE ———>								
			1	2	3	4	5	6	7	8	OVER-ALL
111	SIN										
		EVENTS	0	0	0	1	0	0	0	0	1
		OPERATIONS	0	9532	16721	18081	0	0	1247	0	45581
		RATE/10K	0.0	0.0	0.0	0.553	0.0	0.0	0.0	0.0	0.219
112	SNN										
		EVENTS	0	1	0	3	0	0	0	0	4
		OPERATIONS	0	131	0	2633	0	0	0	0	2764
		RATE/10K	0.0	76.336	0.0	11.394	0.0	0.0	0.0	0.0	14.472
113	SSA										
		EVENTS	0	1	0	0	0	0	0	0	1
		OPERATIONS	0	431	280	0	0	0	0	0	711
		RATE/10K	0.0	23.202	0.0	0.0	0.0	0.0	0.0	0.0	14.065
114	STR										
		EVENTS	0	0	1	0	0	0	0	0	1
		OPERATIONS	0	0	1319	0	0	0	0	0	1319
		RATE/10K	0.0	0.0	7.581	0.0	0.0	0.0	0.0	0.0	7.581
115	SUB										
		EVENTS	0	0	1	0	0	0	0	0	1
		OPERATIONS	0	0	2378	0	0	0	0	0	2378
		RATE/10K	0.0	0.0	4.205	0.0	0.0	0.0	0.0	0.0	4.205
116	SXR										
		EVENTS	0	0	2	0	0	0	0	0	2
		OPERATIONS	0	0	657	0	0	0	0	0	657
		RATE/10K	0.0	0.0	30.441	0.0	0.0	0.0	0.0	0.0	30.441
117	SYD										
		EVENTS	0	0	0	6	0	0	0	0	6
		OPERATIONS	0	2666	6769	18196	0	0	0	0	27631
		RATE/10K	0.0	0.0	0.0	3.297	0.0	0.0	0.0	0.0	2.171
118	THR										
		EVENTS	0	0	1	0	0	0	0	0	1
		OPERATIONS	0	213	3703	767	0	0	0	0	4783
		RATE/10K	0.0	0.0	2.701	0.0	0.0	0.0	0.0	0.0	2.091
119	TLS										
		EVENTS	0	0	5	0	0	0	0	1	6
		OPERATIONS	0	0	3573	0	0	0	0	0	3573
		RATE/10K	0.0	0.0	13.994	0.0	0.0	0.0	0.0	0.0	16.793
120	TLV										
		EVENTS	0	0	0	2	0	0	0	0	2
		OPERATIONS	0	657	1227	2721	0	0	1595	0	6200
		RATE/10K	0.0	0.0	0.0	7.350	0.0	0.0	0.0	0.0	3.226

AIRPORT: BIRDS INGESTION EVENTS, OPERATIONS AND INGESTION RATES/10K OPERATIONS BY AIRCRAFT TYPES

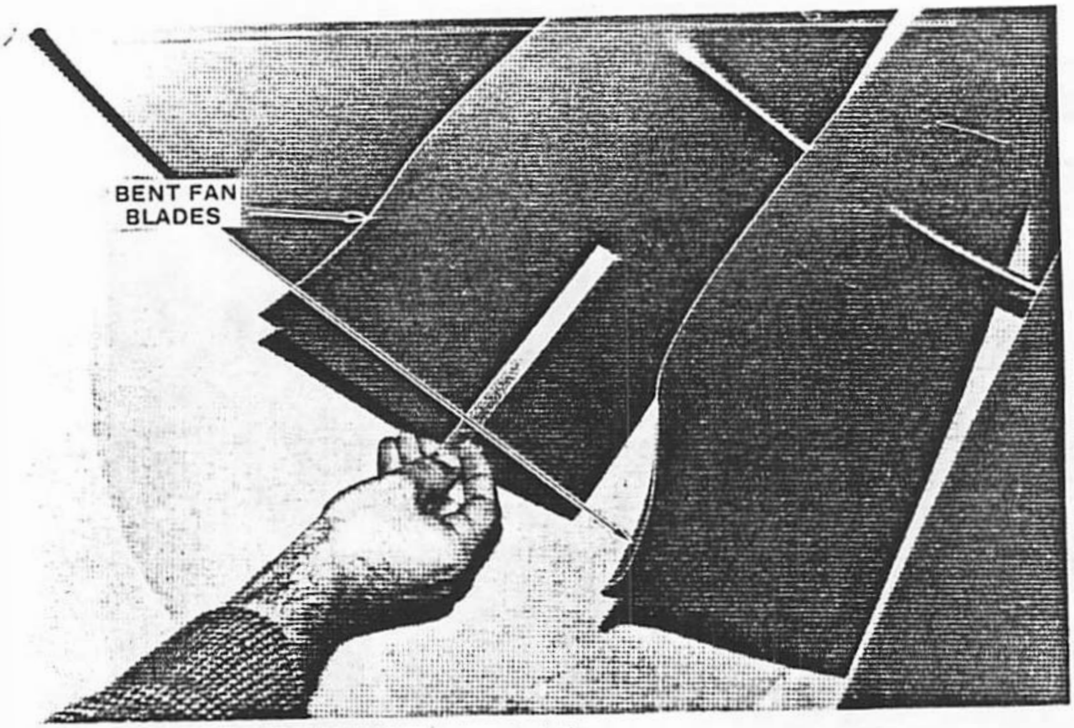
			1	2	3	4	5	6	7	8	OVER-ALL
			⟨——— AIRCRAFT TYPE ———⟩								
121	TNR										
		EVENTS	0	0	0	1	0	0	0	0	1
		OPERATIONS	0	0	0	656	0	0	0	0	656
		RATE/10K	0.0	0.0	0.0	15.244	0.0	0.0	0.0	0.0	15.244
122	TPE										
		EVENTS	0	0	0	2	0	0	0	0	2
		OPERATIONS	0	2541	7845	10664	0	189	4542	0	25780
		RATE/10K	0.0	0.0	0.0	1.875	0.0	0.0	0.0	0.0	0.776
123	TRV										
		EVENTS	0	0	2	0	0	0	0	0	2
		OPERATIONS	0	0	1055	0	0	0	0	0	1055
		RATE/10K	0.0	0.0	18.957	0.0	0.0	0.0	0.0	0.0	18.957
124	TSV										
		EVENTS	0	0	0	1	0	0	0	0	1
		OPERATIONS	0	0	0	193	0	0	0	0	193
		RATE/10K	0.0	0.0	0.0	51.813	0.0	0.0	0.0	0.0	51.813
125	TUL										
		EVENTS	0	0	0	0	0	1	0	0	1
		OPERATIONS	0	26	0	26	0	0	0	0	52
		RATE/10K	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	192.308
126	TUN										
		EVENTS	0	0	1	0	0	0	0	0	1
		OPERATIONS	0	0	1375	0	0	0	106	0	1481
		RATE/10K	0.0	0.0	7.273	0.0	0.0	0.0	0.0	0.0	6.752
127	VCP										
		EVENTS	0	1	0	1	0	0	0	0	2
		OPERATIONS	0	2470	0	1750	0	0	59	0	4279
		RATE/10K	0.0	4.049	0.0	5.714	0.0	0.0	0.0	0.0	4.674
128	VIE										
		EVENTS	0	0	1	1	0	0	0	0	2
		OPERATIONS	0	218	784	1369	0	0	0	0	2371
		RATE/10K	0.0	0.0	12.755	7.305	0.0	0.0	0.0	0.0	8.435
129	WDH										
		EVENTS	0	0	0	1	0	0	0	0	1
		OPERATIONS	0	0	0	26	0	0	0	0	26
		RATE/10K	0.0	0.0	0.0	384.615	0.0	0.0	0.0	0.0	384.615
130	WLG										
		EVENTS	0	0	0	1	0	0	0	0	1
		OPERATIONS	0	6102	1130	22035	0	0	0	0	29267
		RATE/10K	0.0	0.0	0.0	0.454	0.0	0.0	0.0	0.0	0.342

AIRPORT: BIRDS INGESTION EVENTS, OPERATIONS AND INGESTION RATES/10K OPERATIONS BY AIRCRAFT TYPES

			<—— AIRCRAFT TYPE ——>								
			1	2	3	4	5	6	7	8	OVER-ALL
131	XFO										
		EVENTS	0	16	36	67	0	0	17	0	136
		OPERATIONS	0	0	0	0	0	0	0	0	0
		RATE/10K	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
132	XUS										
		EVENTS	1	4	4	7	0	1	8	0	25
		OPERATIONS	0	0	0	0	0	0	0	0	0
		RATE/10K	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
133	XXX										
		EVENTS	0	6	1	29	0	0	11	0	47
		OPERATIONS	0	0	0	0	0	0	0	0	0
		RATE/10K	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
134	YMX										
		EVENTS	0	0	0	1	0	0	1	0	2
		OPERATIONS	0	3702	0	6715	0	0	1403	0	11820
		RATE/10K	0.0	0.0	0.0	1.489	0.0	0.0	7.128	0.0	1.692
135	YUL										
		EVENTS	0	1	0	1	0	0	4	0	6
		OPERATIONS	0	715	578	197	0	180	5371	0	7041
		RATE/10K	0.0	13.986	0.0	50.761	0.0	0.0	7.447	0.0	8.522
136	YVR										
		EVENTS	0	0	0	4	0	1	2	0	7
		OPERATIONS	0	2616	0	3039	0	161	3450	0	9266
		RATE/10K	0.0	0.0	0.0	13.162	0.0	62.112	5.797	0.0	7.554
137	YYC										
		EVENTS	0	0	0	0	0	0	1	0	1
		OPERATIONS	0	2267	0	262	0	186	3034	0	5748
		RATE/10K	0.0	0.0	0.0	0.0	0.0	0.0	3.296	0.0	1.740
138	YYZ										
		EVENTS	0	1	0	2	0	0	3	0	6
		OPERATIONS	0	7378	358	5352	0	420	11473	0	24982
		RATE/10K	0.0	1.355	0.0	3.737	0.0	0.0	2.615	0.0	2.402
139	ZRH										
		EVENTS	0	2	0	2	0	0	0	0	4
		OPERATIONS	0	7737	76	4366	0	0	946	0	13124
		RATE/10K	0.0	2.585	0.0	4.581	0.0	0.0	0.0	0.0	3.048

APPENDIX I

ENGINE DAMAGE PICTURES



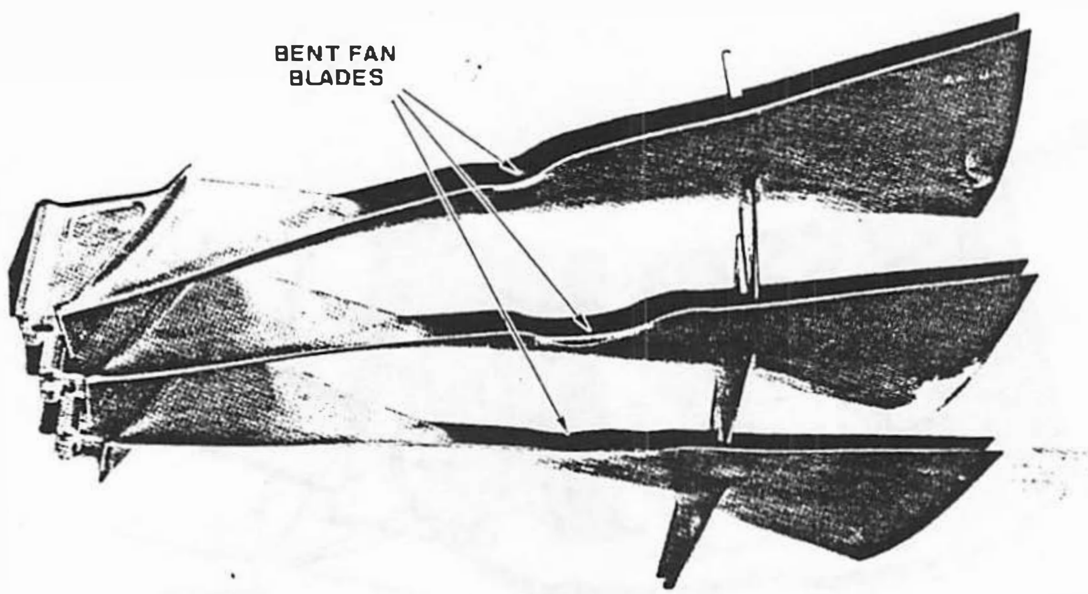
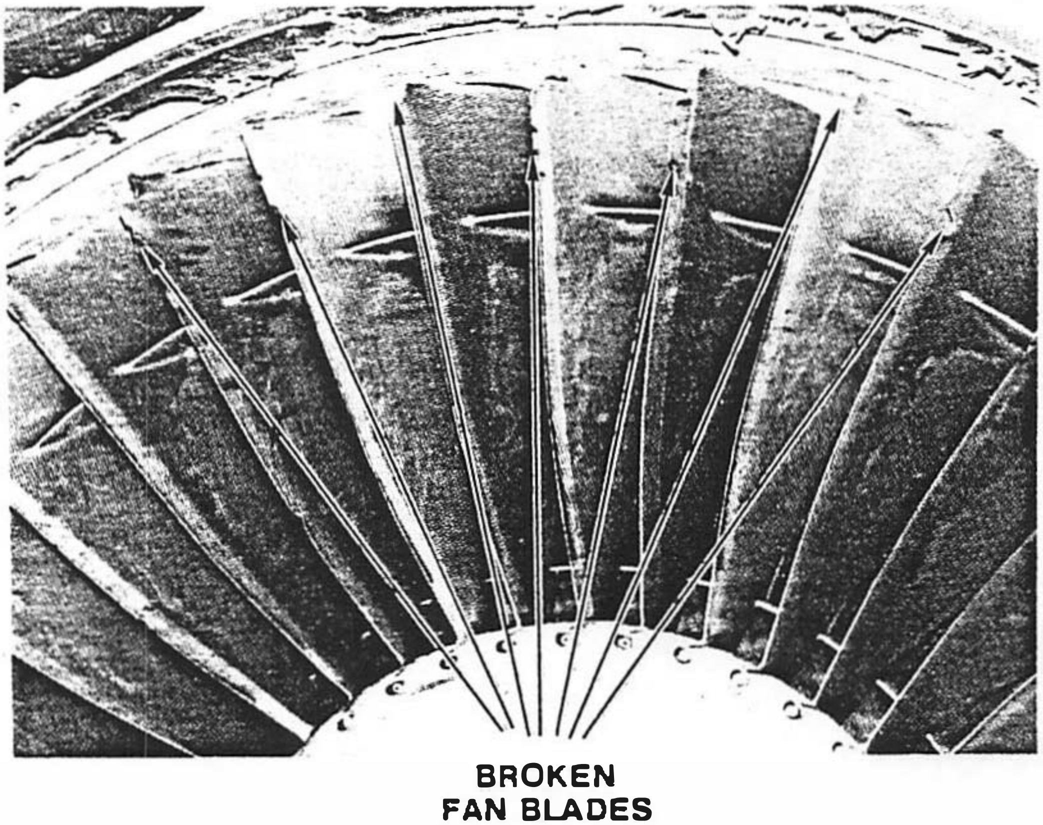


FIGURE I-1. TYPICAL DAMAGE EVENTS (CATEGORY 2)



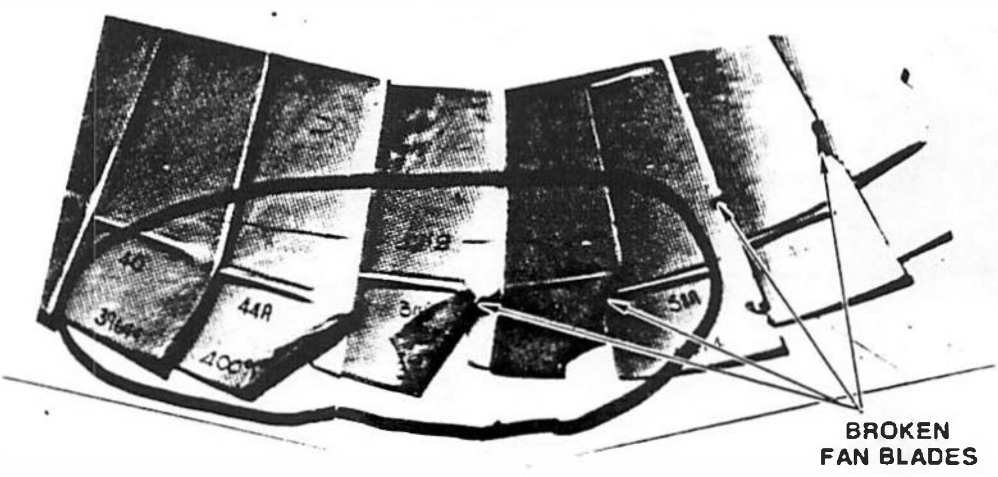
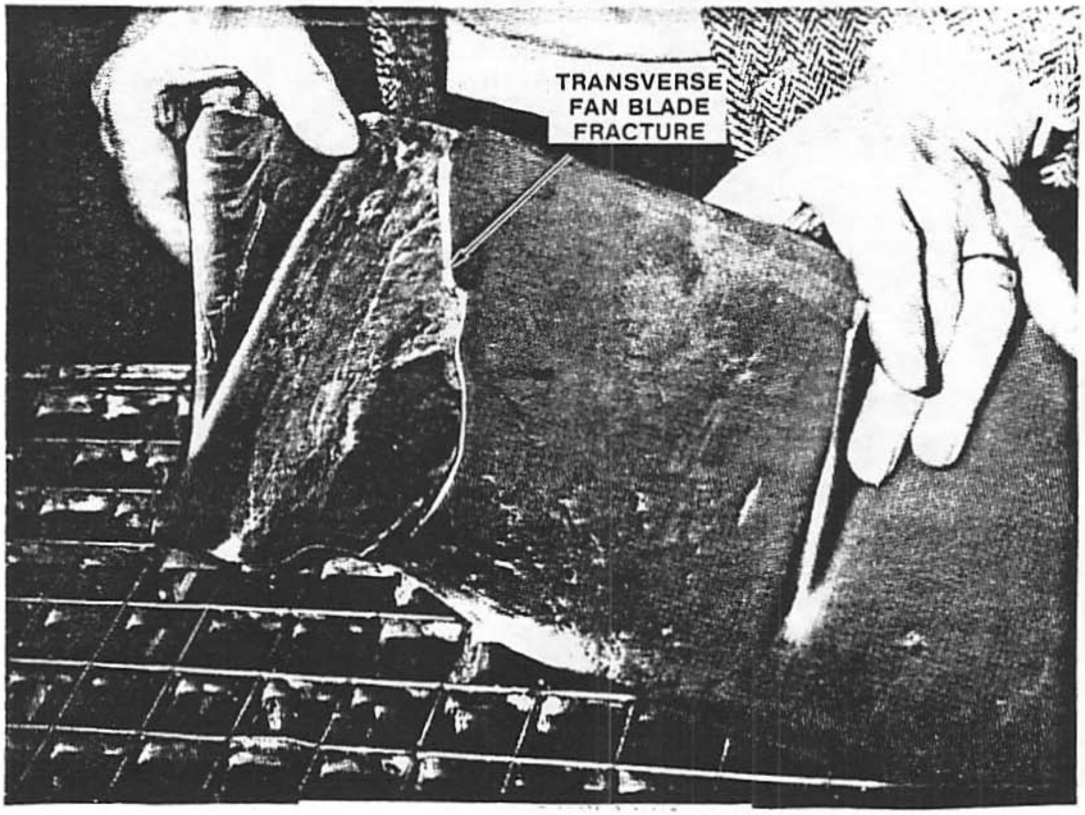


FIGURE I-2. TYPICAL DAMAGE EVENTS (CATEGORY 4)



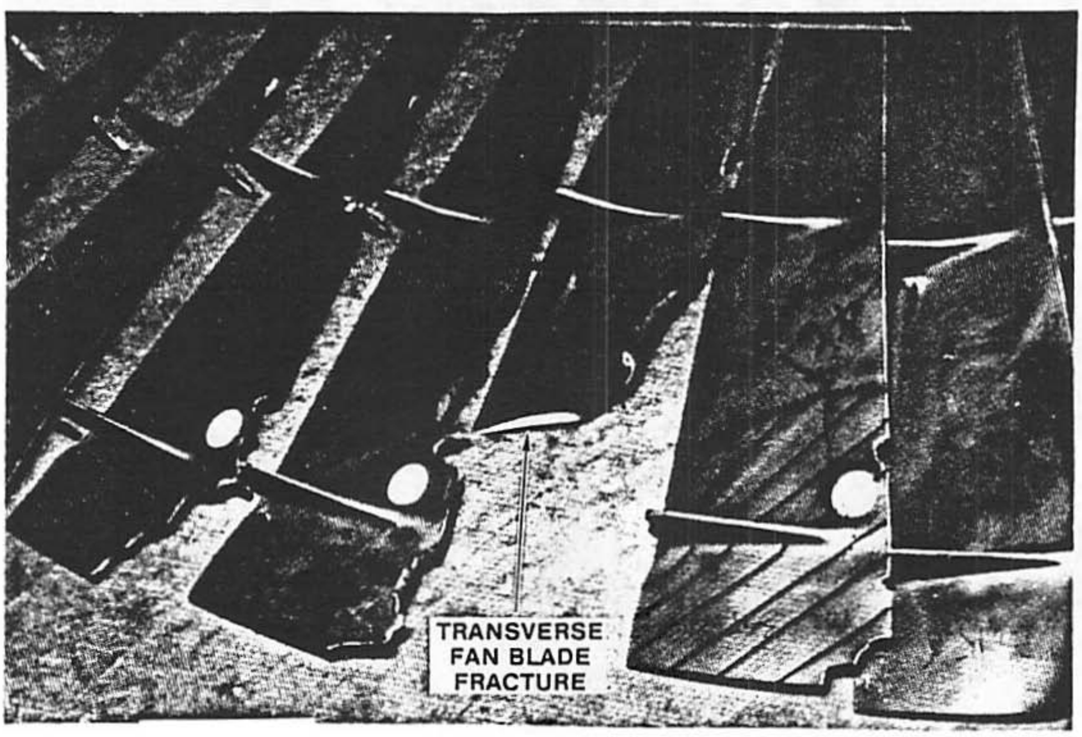
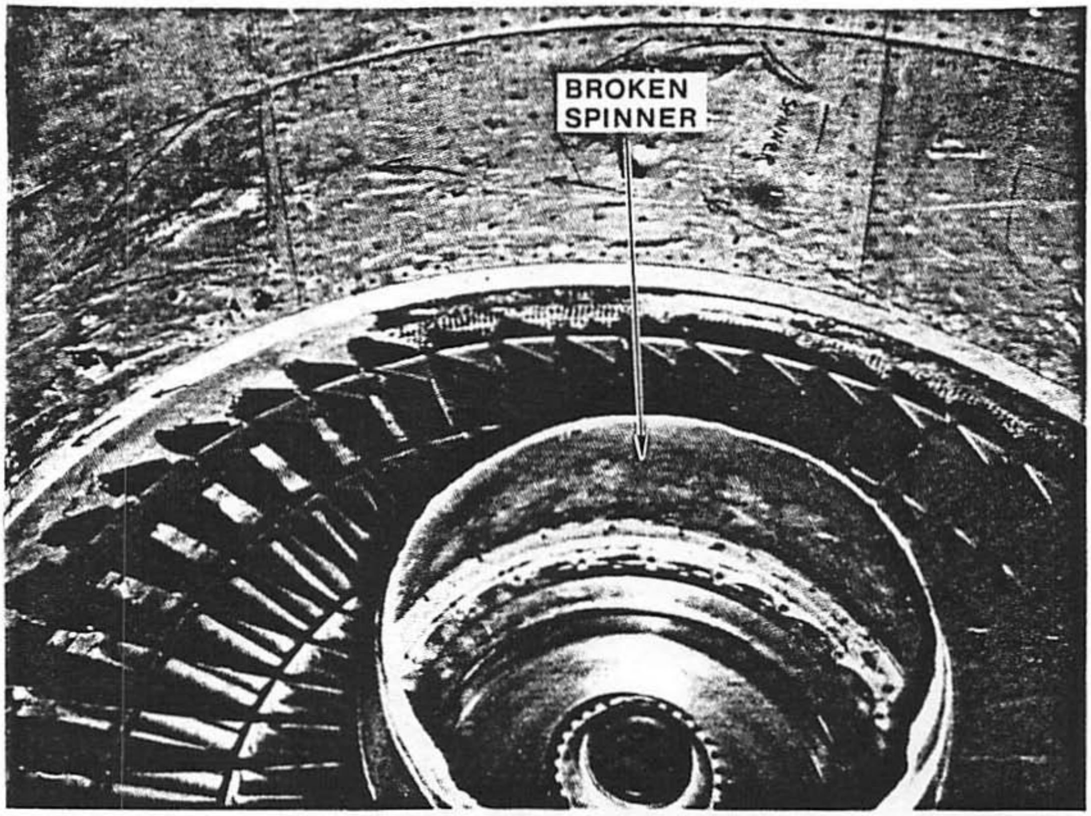


FIGURE I-3. TYPICAL DAMAGE EVENTS (CATEGORY 5)



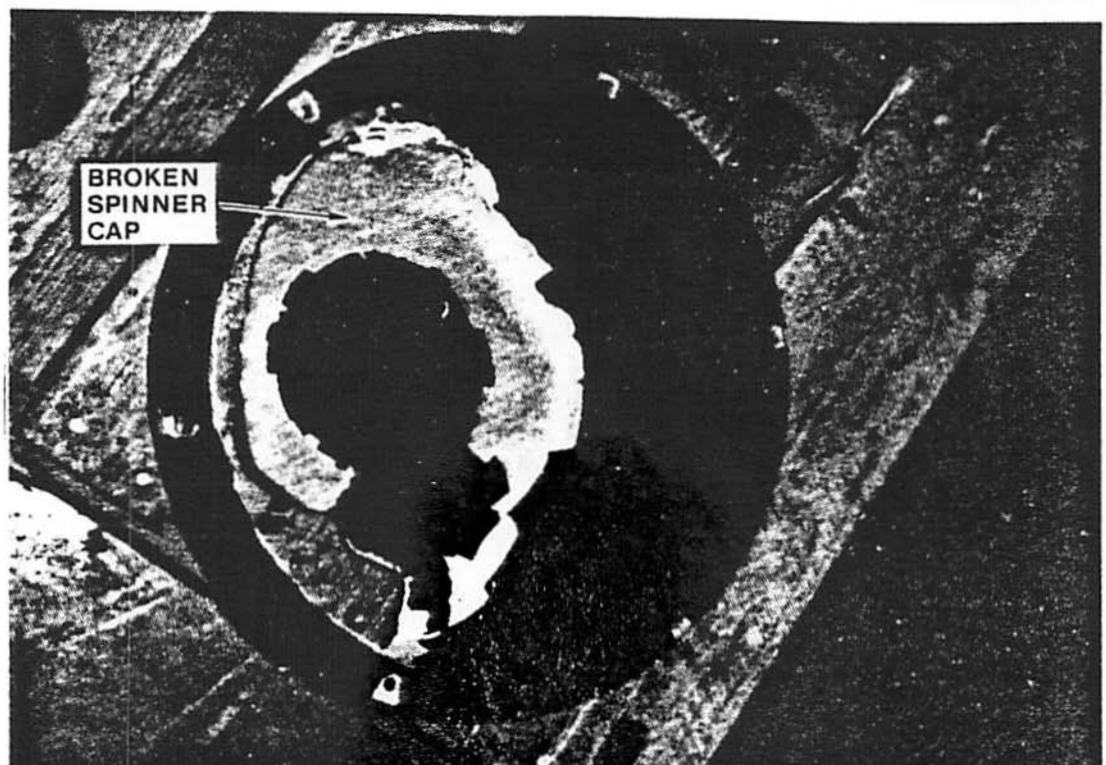


FIGURE I-4. TYPICAL DAMAGE EVENTS (CATEGORY 6)

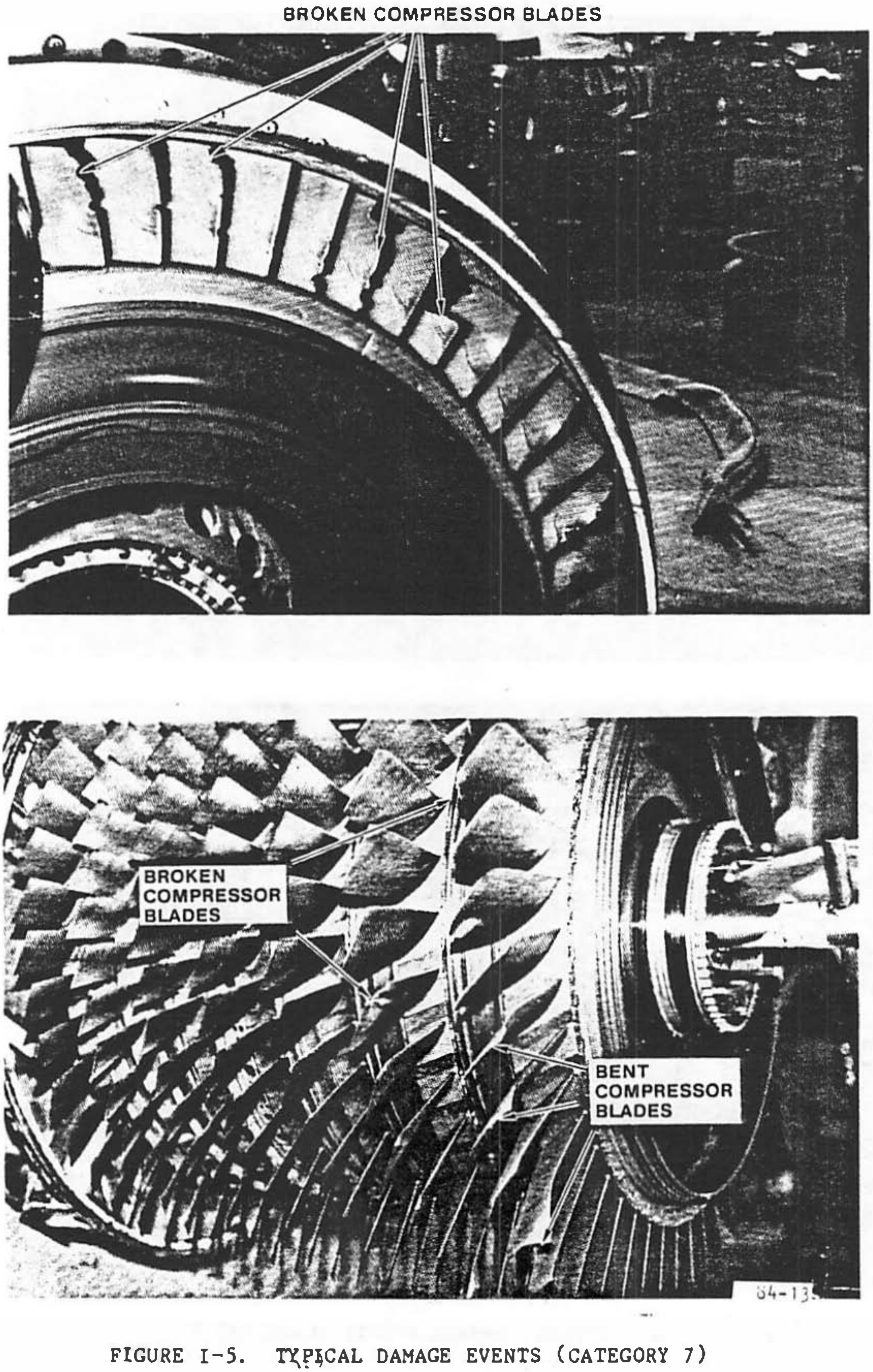
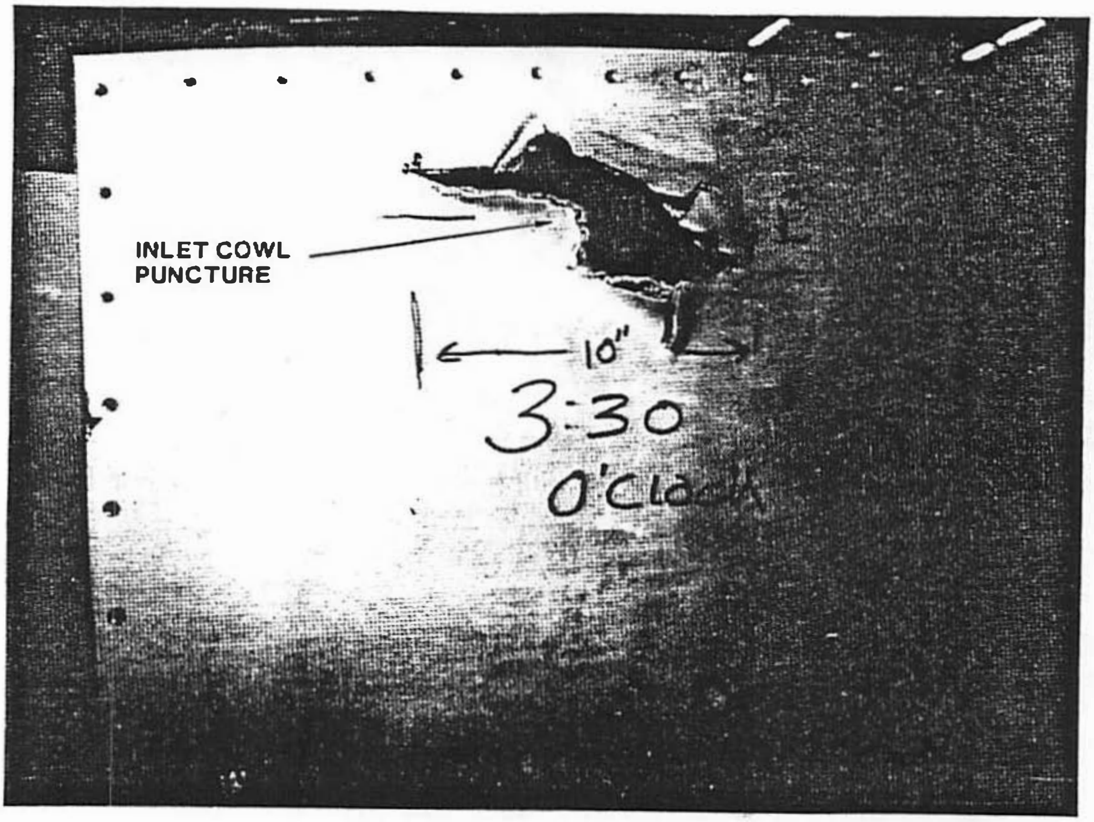


FIGURE I-5. TYPICAL DAMAGE EVENTS (CATEGORY 7)



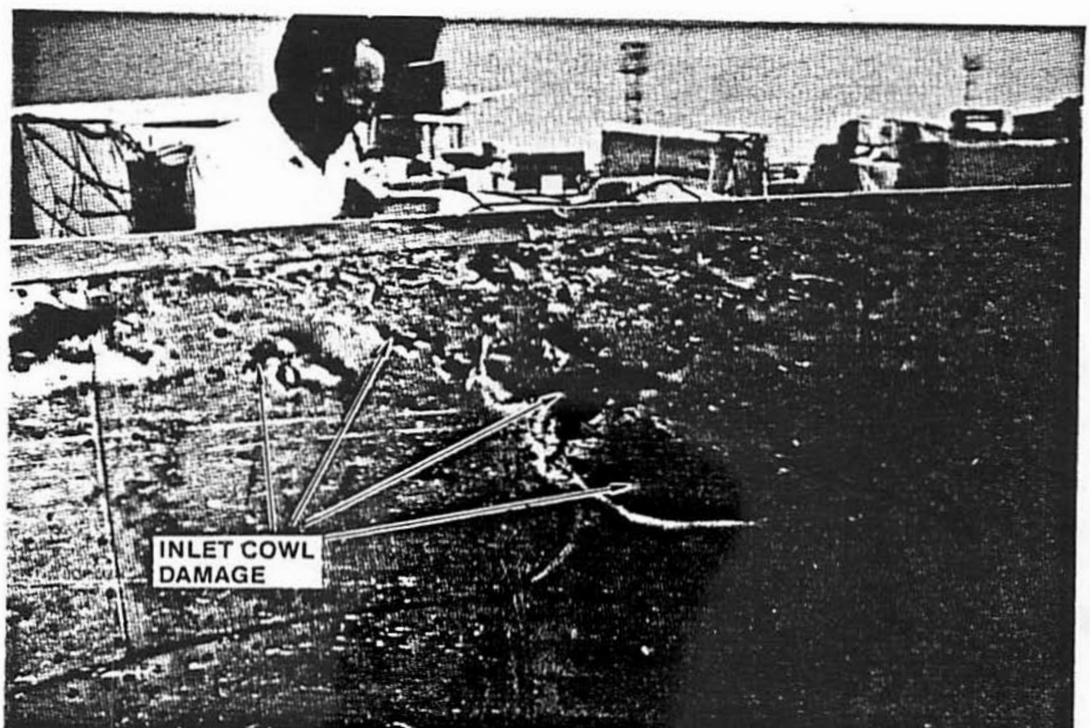
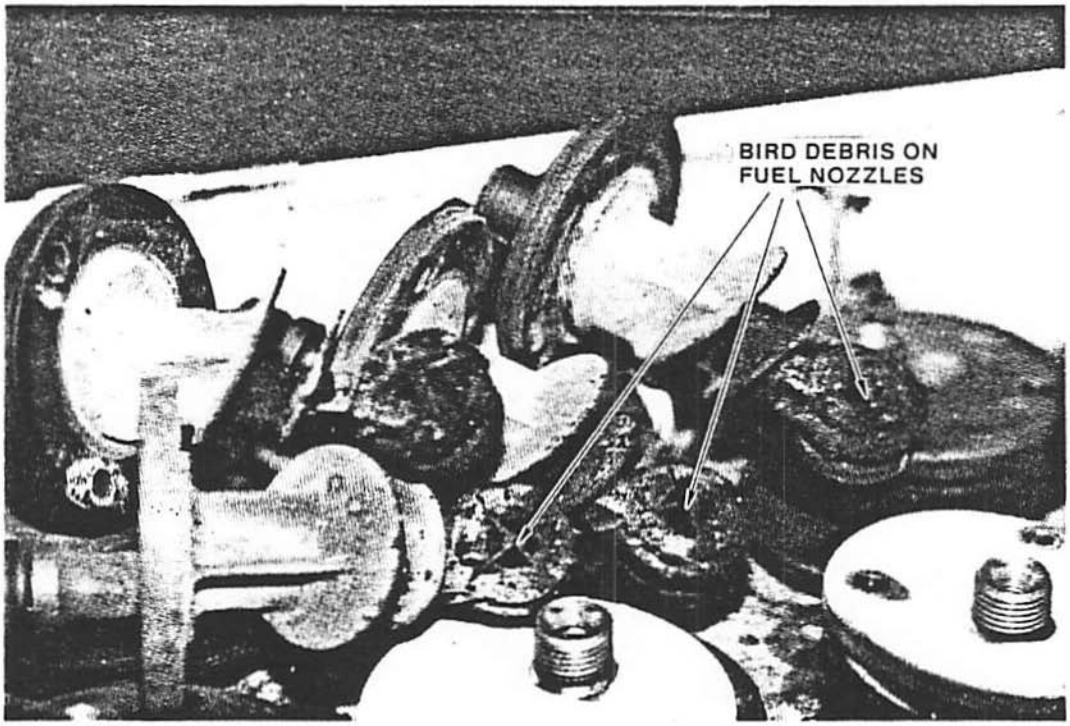


FIGURE I-6. TYPICAL DAMAGE EVENTS (CATEGORY 8)



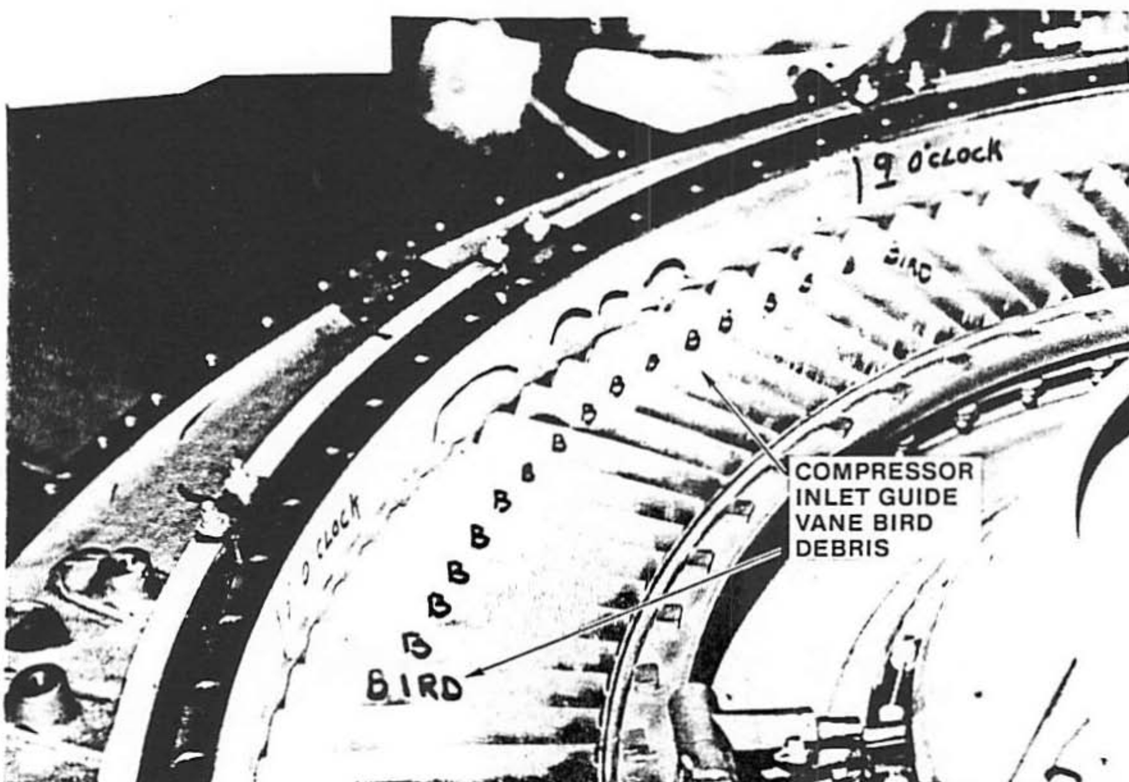


FIGURE I-7. TYPICAL DAMAGE EVENTS (CATEGORY 9)