

SERIOUS BIRDSTRIKE ACCIDENTS TO MILITARY AIRCRAFT: UPDATED LIST AND SUMMARY

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ABSTRACT

A total of 286 serious bird-related accidents to military aircraft from 32 countries (1950-99 period) are listed here or in two earlier papers. Serious accidents are those where an aircraft was destroyed or people were killed. This paper lists 59 "new" birdstrike accidents from the 32 countries in 1950-99, and provides more details for 110 accidents listed previously. The primary countries considered include most of those in Europe (east to Russia), Canada, U.S.A., Israel, Australia, and New Zealand. For most countries, accident data were provided or corroborated by military Flight Safety Offices, local birdstrike specialists, or aviation historians. Unofficial sources were also used extensively. Records are still incomplete to varying degrees, depending on country.

Of these 286 serious bird-related accidents, at least 63 were fatal, with at least 141 deaths (137 on the aircraft; 4 on the ground). The 1990s were the most costly decade, with at least 68 bird-related fatalities. Countries with maximum known numbers of bird-related accidents in 1950-99 are Germany (60 aircraft from at least 8 countries), U.K. (47), and U.S.A. (46+). Most cases involved jet fighter or attack aircraft with one engine (at least 179 accidents) or two engines (40+), and jet trainers (34+). Among the other military aircraft lost since 1950 were seven 4-engined aircraft (three in the 1990s).

Since 1950, many additional serious birdstrike accidents to military aircraft have been reported in Asia (especially India), and a few in Africa and South America. These reports, most unofficial and of uncertain reliability, are summarized briefly.

Key Words: Military aviation, Mishap investigation, Risk assessment, Low-level, Reporting, Australia, Canada, Europe, India, Israel, New Zealand, Russia, U.S.A., Fatalities, Location, Aircraft type.

1. INTRODUCTION

Until recent years, little information was publically available concerning the numbers and circumstances of serious birdstrike accidents to military aircraft. However, during the 1990s, many military services became more willing to release accident data. A preliminary list of serious accidents to military aircraft from Australia, Canada, the U.S.A., and seven European countries was presented at the 1994 BSCE meeting (Richardson 1994). A follow-up paper at the 1996 IBSC meeting provided a more comprehensive list for aircraft from Europe and Israel (Richardson 1996). In combination, the two papers listed 228 separate accidents in which military aircraft were destroyed or people were killed because of birdstrikes (or attempts to avoid birdstrikes). [One of the 228 is now discounted; the aircraft was repaired and re-flown.]

Analyses of numbers and circumstances of serious accidents caused by birds are relevant in documenting the scope of the problem and the most hazardous situations. Types of birdstrikes that cause serious accidents can differ from the total pool of reported birdstrikes. Thus, it is useful to examine characteristics of serious birdstrikes and not to rely entirely on analyses of all birdstrikes, or even all damaging birdstrikes. However, the number of serious birdstrikes in most countries is too small to provide a meaningful basis for analysis. Also, in some countries, many serious military birdstrikes involve aircraft from other countries (Richardson 1996). A multi-national compilation is needed to deal with the small sample size and cross-boundary problems.

Records in the 1994-96 papers were incomplete in various ways. Not all countries in Europe were included. For included countries, available records covered from 15-46 years. For those years, there were good records for some countries and less complete records for others. Records from the 1950s and '60s were especially incomplete.

This paper is an update of the 1994 and 1996 papers, again dealing with serious birdstrike accidents from 1950 to date. The main body of the paper summarizes accidents to military aircraft from Europe, North America, Israel, Australia and New Zealand (32 "primary" countries). It includes some of the same types of data as the 1994-96 papers but considers more countries and more accidents. Appendix 1 summarizes the sources of new data considered here. Appendix 2 lists 60 "new" birdstrike accidents that were not included in

the 1994 or 1996 papers (59 in 1950-99 and one in 2000). Appendix 2 also provides updated data for 110 of the previously-listed accidents.

Serious birdstrike accidents involving military aircraft from Asia, Africa and South America are also known to occur. Many such accidents have occurred in India (e.g., Satheesan 1994). Available data from these continents are too fragmentary for detailed analysis. However, Appendix 3 provides a preliminary list of reported accidents to military aircraft from a few Asian, African, and South American countries. The text summarizes available accident data from those areas.

2. DATA SOURCES AND PROCEDURES

This paper uses birdstrike accident data compiled for European countries and Israel by Richardson (1996) and for Australia, Canada and the U.S.A. by Richardson (1994), supplemented by additional data acquired subsequently. Accidents from 1950 to date are considered. The paper is based largely on accident data received from or corroborated by military Flight Safety Offices of the countries concerned (Appendix 1). However, unofficial reports, when credible, are also used when official information is lacking. The unofficial reports are marked with a * in the lists of accidents.

During Nov. 1999 – Jan. 2000, enquiries seeking updated accident data were sent to military Flight Safety Offices and/or birdstrike specialists in almost all “primary” countries. We sought information not only about recent accidents (since the 1994 and 1996 papers) but also about older accidents that were previously unknown or inadequately documented. Updated data were received from most “primary” countries, but not all. In addition, as described in Appendix 1, we have continued to search various unofficial sources for information about military aircraft accidents. When unofficial sources indicated that a specific accident may have been caused by birds, we sought corroboration from official sources.

Definitions and procedures here are consistent with the 1994-96 papers. Serious accidents are defined as those in which • a military aircraft was destroyed or damaged beyond economical repair as a result of colliding with birds or while attempting to avoid birds, or • there were human fatalities. Records of aircraft damaged beyond repair (dbr) are probably less complete than those of aircraft that were destroyed.

Even with the additional data now available, coverage is incomplete, especially for the earlier years. Also, there are large differences in investigation and reporting standards among countries and years. In general,

the data reported here are not sufficient to allow quantitative comparison of accident rates in different countries or decades.

3. FREQUENCY OF SERIOUS ACCIDENTS

3.1 Aircraft Losses

At least 283 military aircraft from the 32 “primary” countries were destroyed or damaged beyond repair in 1950-99 as a result of birdstrikes or during manoeuvres to avoid birds (Table 1). Data were very incomplete for the 1950s, and still quite incomplete in the 1960s. Nonetheless, 27 and 55 serious accidents are known from those decades (Table 1). The highest recorded losses were in the '70s (at least 77 aircraft). Data were more complete in the '80s than before, but nonetheless the number of known aircraft losses diminished slightly from the '70s to the '80s (69), with a further decrease in the '90s (55). Some accidents in the late '90s may not yet have come to our attention.

The five “primary” countries whose forces have suffered the largest known numbers of aircraft losses to birds (1950-99) are the U.K. (66 losses), U.S.A. (62), former Soviet Union (FSU, 26), West Germany (24), and Canada (18). The total for West and East Germany combined is 34. However, the U.K. data are undoubtedly more complete than those for the other four countries, with the data for the FSU being especially incomplete. It can be assumed that the U.S., and possibly also the FSU, has lost more aircraft than the U.K. Also, birdstrike losses to Indian military aviation may have been even greater than those for any “primary” country (see §5).

The above figures apply only to the 1950-99 period. For each of the “top five” “primary” countries, we have records of military aircraft lost to birdstrikes before 1950 (West and Richardson unpubl. data). Our pre-1950 records are most complete for the U.K.; at least 45 additional U.K. military aircraft (all piston-engined) were lost to birdstrikes before 1950!

TABLE 1. Minimum numbers of military aircraft of Europe, North America, Israel, Australia and New Zealand lost to birds, 1950 to 1999. Includes aircraft destroyed and damaged beyond repair. "-" means "no official data". "x" means "not applicable".^a

Country of Origin	Service(s)	Yrs With Official Data	Number of Aircraft Lost by Decade					Minimum Totals
			'50s	'60s	'70s	'80s	'90s	
Western & Northern Europe								
Austria	AF	50-95	0	0	0	0	0 ^b	0
Belgium	AF	60-96	-	0	1	3	2 ^b	6
Denmark	all	50-99	0	0	0	0	0	0
Finland	AF	81-99	-	-	-	0	0	0
France	AF	75-99	-	-	0	0	5	5
	Navy	60-Jan96	-	0	0	0	2 ^b	2
Germany (W)	AF	62-99	-	4	6	4	1	15
	Navy	62-99	-	1	6	2	0	9
Greece	AF	65-99	-	0	1	0	2	3
Ireland	AF	-	-	-	1	-	-	1
Italy	AF	61-99	-	0	0	2	2	4
NATO	E-3	81-99	x	x	x	0	1	1
Netherlands	all	56-99	2	3	2	2	1	10
Norway	AF	56-99	0	0	1	1	1	3
Portugal	AF	75-99	-	-	0	1	1	2
Spain	AF	~83-99	-	2	1	1	2	6
Sweden	AF	65-99	-	2	7	0	0	9
Switzerland	AF	<74-99	-	-	1	0	1	2
United Kingdom	AF	50-99	20	10	10	13	3	56
	Navy	58-95	2	2	0	4	0 ^b	8
	Army	64-99	-	0	0	1	1	2
Subtotal			24	24	37	34	25	144
Eastern Europe								
Czech.+Slov. Rep.	AF	~65-99	-	2	0	1	0	3
East Germany	AF	67-88	-	2	5	3	x	10
Former Sov. Union	AF	Incomplete ^c	2	4	10	7	3	26
Hungary	AF	60-99	-	0	0	1	0	1
Other ^d	AF	-	-	-	-	3	3	6
Subtotal			2	8	15	15	6	46
North America								
Canada	all	64-99	-	10	4	2	2	18
U.S.A.	AF	62-99	-	11	10	12	11	44
	N/MC	80-99 ^e	-	-	5	3	9 ^f	17
	Army	72-99	-	-	0	1	0	1
Subtotal			0	21	19	18	22	80
Other								
Israel	AF	72-99	-	1	4	2	2	9
Australia	all	<62-99	-	1	2	0	0	3
New Zealand	AF	54-99	1	0	0	0	0	1
Subtotal			1	2	6	2	2	13
Totals			27	55	77	69	55	283

^a Most footnotes shown in Table 1 of Richardson (1996) apply here as well.

^b No official data for most recent 3 or 4 years.

^c One FSU accident in an unknown decade is included in the '50s column.

^d "Other Eastern Europe" includes unofficial reports from Albania, Bulgaria, Romania, and Yugoslavia (1 each) plus Poland (2).

^e Some USN/USMC losses listed in the '70s column may have been in late '60s. Circumstances of two USN/USMC losses in 1969-71 are unknown.

^f In addition, one USMC helicopter was lost to a birdstrike in Jan '00.

3.2 Fatalities

Subject to the same data limitations, there were at least 141 bird-related fatalities (F) for the 32 “primary” countries since 1950, with 68F in the '90s (Table 2). The 141 deaths occurred during 63 separate fatal accidents. The totals are undoubtedly quite incomplete, especially for the earlier decades and for eastern Europe.

The two worst bird-related accidents were recent: the Belgian AF C-130 collision with Starlings and Lapwings at Eindhoven, Netherlands, on 15 July '96 (34F), and the USAF E-3 collision with Canada Geese at Anchorage, Alaska, on 22 Sep. '95 (24F). A Soviet naval Tu-16 crashed in the Kola Peninsula area in Sep. '69 after striking geese at 5000 ft altitude (V. Jacoby, pers. comm., 1996); there were probably at least 4F (normal crew of Tu-16 was 4-7). Four accidents with 3F are known, including an RAF Canberra lost on 14 July '65 (Appendix 2A) plus three accidents described in Richardson (1994, 1996): Mi-8 helicopter, B-1 bomber, and F-104. The F-104 accident was a probable birdstrike, and the fatalities were civilians on the ground. In addition, 11 accidents with 2F and 45 accidents with 1F are described in Richardson (1994, 1996) and Appendix 2. One of the 1F accidents, in Moldova during 1988, also involved a fatality on the ground.

In 3 of 45 “1F” cases, one of two aircrew was killed by a bird penetrating the windscreen, but the 2nd crewman landed the aircraft. These three accidents, all involving USAF aircraft (details in Richardson 1994), are in addition to the 283 aircraft losses (§3.1). Thus, there were 286 known serious bird-related accidents to aircraft from the 32 “primary” countries in 1950-99.

4. CIRCUMSTANCES OF SERIOUS ACCIDENTS

In this section, we summarize the geographical distribution of the aforementioned 286 serious accidents, the types of aircraft involved, and some special types of bird-related accidents. The oral version of this paper will also summarize the 286 accidents by phase of flight, altitude and speed when struck, parts of aircraft hit, types of birds involved, and seasonal breakdown. Those results will be published elsewhere.

TABLE 2. Minimum numbers of human fatalities attributed to birdstrikes and bird avoidance during military aircraft operations of Europe, North America, Israel, Australia and New Zealand, 1950 to 1999. No known bird-related fatalities for aircraft of other countries listed in Table 1. "-" = "no official data". "x" = "not applicable". Underline = "people on ground". ^a

Country of Origin	Service(s)	Yrs With Official Data	Number of Fatalities by					Minimum Totals
			'50s	'60s	'70s	'80s	'90s	
Western & Northern Europe								
Belgium	AF	60-96	-	0	0	<u>3</u>	34	37
Netherlands	all	56-99	0	0	1	1	0	2
Norway	AF	56-99	0	0	1	0	0	1
Portugal	AF	75-99	-	-	0	0	1	1
Spain	AF	~83-99	-	2	2	1	0	5
Sweden	AF	65-99	-	0	5	0	0	5
United Kingdom	AF	50-99	2	3	0	3	0	8
	Army	64-99	-	0	0	0	1	1
Subtotal			2	5	9	8	36	60
Eastern Europe								
Czech.+Slov. Rep.	AF	~65-99	-	1	0	0	0	1
East Germany	AF	67-88	-	1	4	1	x	6
Former Sov. Union	AF	Incomplete ^b	1	6	4	<u>1</u>	1	13
Hungary	AF	60-99	-	0	0	1	0	1
Other (Albania)	AF	-	-	-	-	1	-	1
Subtotal			1	8	8	4	1	22
North America								
Canada	all	64-99	-	0	2	0	0	2
U.S.A.	AF	62-99 ^c	-	7	4	8	28	47
	N/MC	80-99 ^d	-	-	2	1	1	4
Subtotal			0	7	8	9	29	53
Other								
Israel	AF	72-99	-	-	1	0	2	3
Australia	all	<62-99	-	1	2	0	0	3
Subtotal			0	1	3	0	2	6
Totals			3	21	28	21	68	141

^a Most footnotes shown in Table 2 of Richardson (1996) apply here as well.

^b One FSU fatality in unknown decade is included in the '50s column. For Tu-16 crash in 1969, four fatalities assumed (crew typically 4 - 7).

^c Three USAF fatalities were in aircraft that were not destroyed ('66, '70, '92).

^d Details unknown for two USN/USMC fatalities in '69-71 (Anon. 1972); shown in '70s column.

4.1 Geographic Distribution

Countries where the most birdstrike accidents are known for the 1950-99 period are Germany (38 in West Germany plus 22 in East Germany), the U.K. (47), and the U.S.A. (46+). Actual losses in the U.S. have undoubtedly exceeded those in the U.K, as records for the U.S. (and Germany) are less complete than those for the U.K. Other countries where many serious birdstrike accidents have occurred include France (12 aircraft), Israel (9), Sweden (9), Netherlands (8), and Canada (8) (Table 3). Substantial numbers of birdstrike accidents may have occurred in some other countries for which the records are less complete. The 13 known birdstrike accidents in the Former Soviet Union are no doubt only a small fraction of actual losses there.

Bird-related accidents to military aircraft often occur outside the operating country (Table 3). Serious accidents outside the home country in 1950-99 included 3 Belgian, 7 West German, 1 Italian, 4 Netherlands, and 15 British aircraft lost in other West European countries (Table 3). The tragic Belgian AF C-130 accident in 1996 was in the Netherlands. The NATO E-3 lost in 1996 was based in Germany but crashed in Greece. West European birdstrike accidents outside Europe included a Spanish AF accident (probable birdstrike) in the Canary Islands, two French AF losses in Chad, and eight British losses in various countries: Middle East (4), Hong Kong (2), Nigeria (1), and the Falklands (1).

Eight Canadian and at least nine U.S. aircraft were lost outside those countries in 1950-99. However, out-of-country birdstrike accidents to U.S. military aircraft are probably underestimated. The only known U.S. accidents outside the U.S. during 1950-99 were in Europe (8) and Panama (1), despite the much wider deployment of U.S. aircraft. We are not aware of any USN or USMC losses outside the U.S. other than a USMC AH-1W helicopter lost in Jordan in Jan. 2000, after the 1950-99 period considered in this paper. One of three Australian birdstrike accidents was in Malaysia, and the one known New Zealand loss was in Australia.

4.2 Types of Aircraft

Most military aircraft involved in serious bird-related accidents during 1950-99 have been single-engined fighter or attack aircraft powered by jet engines (179 of 281 known types, or 63.7%; Table 4). Most of these 179 single-engine jet fighter or attack aircraft were flown by a single pilot (141 of 169 for which crew size is known, or 83.4%). A high proportion of these aircraft were lost when birds caused engine failure or penetrated the windscreen (Richardson 1994, 1996; Appendix 2).

Twin-engine jet fighter and attack aircraft were the second most frequent types involved in serious bird related accidents (40 accidents). A higher proportion of these aircraft had two crew (22 of 40, or 55%).

Equal numbers of twin-engine and single-engine jet trainers were involved in serious birdstrike accidents (17 of each). Most single-engine jet trainer accidents were in Europe or Canada, whereas most twin-engine jet trainer accidents were in the U.S.A. This reflects a difference in the types of trainers that predominate in those regions.

We are not aware of any serious birdstrike accidents, thus far, to military trainers powered by one turboprop engine.

Before 1980, at least eight 2-engine jet bombers (Canberra, Ilyushin-28, Tu-16) from “primary” countries were lost to birdstrikes. Other twin-turbine fixed-wing aircraft lost to birdstrikes (in each case engine ingestion) include an EA-6B electronic warfare aircraft, an Irish Air Corps HS.125 business jet, and a U.S. Army RV-1D turboprop.

Seven 4-engine military aircraft are known to have been destroyed because of birdstrikes in 1950-99, and two were lost in the 1940s (Table 5). Of these, three were piston-engined, one was a turboprop, and five were jets. • *Takeoff or initial climb (n=6)*: For two jets, multiple birdstrikes during or just after takeoff caused multiple engine failure and a fatal crash shortly after takeoff. Another two jets hit multiple birds on takeoff but, in hindsight, suffered little damage; takeoff was rejected at high speed, and the aircraft ran off the runway. The two piston-engined aircraft lost because of birdstrikes on takeoff or initial climb involved unique events (Table 5). • *Cruise flight (n=2)*: Two 4-engine aircraft were lost after birdstrikes during cruise—a Halifax after the pilot was disabled by a windscreen penetration, and a B-1B because of an in-flight fire. • *Approach (n=1)*: The Belgian AF C-130 (turboprop) suffered multiple birdstrikes and multiple engine failure on final approach.

A few helicopters (most if not all turboshaft-powered) and piston-engined trainers have been lost to birdstrikes or bird-avoidance manoeuvres since 1950 (Table 4). Many more piston-powered aircraft, including fighter, attack, bomber, trainer and utility aircraft, were lost during and before World War II (West and Richardson, unpubl. data).

TABLE 3. Geographic distribution of serious accidents (writeoffs and/or fatalities) attributed to birds, considering military aircraft of 32 "primary" countries, 1950 to 1999. Table 1 shows the specific years and services for which data from each country were available. No known losses for Austria, Denmark or Finland. "x+y" shows numbers of accidents before 1980 (x) and 1980-99 (y).

Country of Origin	Number of Serious Accidents in Various Countries														Total West. Eur.	All East. Eur.	North Am.	Else-where	Un-known	Minimum Totals
	Bel-gium	Den-mark	Fr-ance	West Germ.	Gr-eece	Ire-land	Italy	Neth-lands	Nor-way	Por-tugal	Sp-ain	Swe-den	Swit-zer-land	UK						
Western European Forces																				
Belgium	0+3	-	-	1+1	-	-	-	0+1	-	-	-	-	-	-	1+5	-	-	-	-	1+5
France	-	-	0+5	-	-	-	-	-	-	-	-	-	-	-	0+5	-	-	0+2	-	0+7
Germany (W)	-	2+2	1+1	14+3	-	-	0+1	-	-	-	-	-	-	-	17+7	-	-	-	-	17+7
Greece	-	-	-	-	1+2	-	-	-	-	-	-	-	-	-	1+2	-	-	-	-	1+2
Ireland	-	-	-	-	-	1+0	-	-	-	-	-	-	-	-	1+0	-	-	-	-	1+0
Italy	-	-	-	-	-	-	0+3	-	-	0+1	-	-	-	-	0+4	-	-	-	-	0+4
NATO	-	-	-	-	0+1	-	-	-	-	-	-	-	-	-	0+1	-	-	-	-	0+1
Netherlands	-	-	-	3+1	-	-	-	4+2	-	-	-	-	-	-	7+3	-	-	-	-	7+3
Norway	-	-	-	-	-	-	-	-	1+2	-	-	-	-	-	1+2	-	-	-	-	1+2
Portugal	-	-	-	-	-	-	-	-	0+2	-	-	-	-	-	0+2	-	-	-	-	0+2
Spain ^a	-	-	-	-	-	-	-	-	-	3+2	-	-	-	-	3+2	-	-	0+1	-	3+3
Sweden	-	-	-	-	-	-	-	-	-	-	9+0	-	-	-	9+0	-	-	-	-	9+0
Switzerland	-	-	-	-	-	-	-	-	-	-	-	1+1	-	-	1+1	-	-	-	-	1+1
United Kingdom	-	1+0	1+0	9+1	-	0+2	-	1+0	-	-	-	-	25+18	37+21	-	-	7+1	-	44+22	
Subtotal	0+	3+	2+	27+	1+	1+	0+	5+	1+	0+	3+	9+	1+	25+	78+	-	-	7+	-	85+
	3	2	6	6	3	2	4	3	2	2	3	0	1	18	55			4		59
Other Forces																				
East. European	-	-	0+1	-	-	-	-	-	-	-	-	-	-	-	0+1	24+19 ^b	-	1+1	-	25+21
Canada	-	1+0	3+0	3+1	-	-	-	-	-	-	-	-	-	-	7+1	-	7+3	-	-	14+4
U.S.A.	-	-	-	0+1	-	-	-	-	-	0+3	-	-	3+1	3+5	-	15+31	0+1	10+0	28+37	
Israel	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5+4	-	5+4	
Australia & N.Z.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4+0	-	4+0	
Totals	0+	4+	5+	30+	1+	1+	0+	5+	1+	0+	3+	9+	1+	28+	88+	24+	22+	17+	10+	161+
	3	2	7	8	3	2	4	3	2	2	6	0	1	19	62	19	34	10	0	125

^a Two of the pre-1980 Spanish AF accidents are assumed to be in Spain.

^b Of 43 known accidents in Eastern Europe, 22 were in East Germany (10 East German and 12 Soviet aircraft). Eleven were in the European part of the FSU, and 10 in other countries in Eastern Europe. Two known FSU accidents were in the Asian part of the FSU.

TABLE 4. Types of aircraft involved in serious accidents (writeoffs and/or fatalities) attributed to birds, considering military aircraft of 32 "primary" countries, 1950 to 1999. "x+y" shows numbers of accidents before 1980 (x) and 1980-99 (y).

Type of Aircraft	Number of Serious Accidents				Minimum Totals	
	1-engine	2-engine	4-engine	?-engine		
Turbine-powered Fixed-Wing						
Jet Fighter & Attack ^a	Crew 1	89+52	7+11	-	-	96+63
	Crew 2+	12+16	10+12	-	-	22+28
	Crew ?	7+3	-	-	0+2	7+5
	Subtotal	108+71	17+23	-	0+2	125+96
Jet Trainer ^b	7+10	10+7	-	-	17+17	
Jet Bomber	-	8+0	0+1	-	8+1	
Other (C,E,P,K) ^c	Jet	-	1+1	1+3	-	2+4
	Turboprop	-	0+1	0+1	-	0+2
Piston-engine Fixed Wing	4+2	-	1+0	-	5+2	
Helicopter	0+1	1+2	-	1+0	2+3	
Unknown	-	-	-	2+0	2+0	
Totals	119+84	37+34	2+5	3+2	161+125	

^a Includes 2-seat training variants of fighter and attack aircraft.

^b A few of these were 2-seat training aircraft flown by a crew of one.

^c Cargo or transport, electronic, patrol, and tanker aircraft.

4.3 Special Cases

4.3.1 Crashes While Manoeuvring to Avoid Birds: Of the 286 serious bird-related accidents considered above, eight crashes – six British and two U.S. – were attributed to low-altitude manoeuvres to avoid collisions with birds (n=7) or simulated birds (n=1). Accidents of this type involving two helicopters and four fixed-wing aircraft were listed by Richardson (1994, 1996). We recently learned of two similar accidents to RAF piston-engine trainers during 1952-53 (Appendix 2A). In addition to these eight accidents during flight at low altitude, a fatal midair collision in California during Oct. '97 was attributed to a bird-avoidance manoeuvre by an F-16, which collided with a T-38 and caused it to crash (Appendix 2C). Caution may be warranted in interpreting some of these accidents because, in the absence of a birdstrike, there is no physical evidence that birds were actually involved.

TABLE 5. Four-engine military aircraft destroyed or damaged beyond repair in birdstrike accidents.

Date Y M D	Oper- ator	Aircraft Type	Eng. Type	Accident Location	Flight Phase	Type of Birds	Personnel	
							Tot.	Fatal
Pre-1950								
440225	RCAF	Halifax V	Pist.	Croft, England	cruise	unknown	8-9	0
Penetrated windscreen, disabling pilot; crash landed by bomb aimer. ^{a,b}								
451215	RAF	Lancaster VII	Pist.	Waddington, Engl.	takeoff	plovers	7	0
Struck plovers; propeller hit ground while trying to avoid; force landed straight ahead. ^a								
1950-99								
550909	RNZAF	Hastings C.3	Pist.	Darwin, Australia	init. climb	kite	25	0
Penetrated perspex at 50 ft altitude and 130 kt, hit inertia crash switch, triggered engine fire extinguishers; force landed on end of runway; overran several obstructions; no fire. ^c								
760928	RAF	Victor K.2	Jet	Marham, Engl.	takeoff	gulls	?	0
Struck nose, wing, fuselage on takeoff roll; little damage; RTO ^d (145 kt); overran; fire. ^e								
801117	RAF	Nimrod MR.2	Jet	Kinloss, Scotl.	init. climb	gulls	20	2
Multiple strikes at 20 ft altitude; 3 engines failed or lost thrust; crashed in trees; fire. ^e								
870928	USAF	B-1B	Jet	La Junta, Colo.	cruise-low	Pelican, Wh.	6	3
Hit engine pylon, cutting fluid lines; in-flight fire; crash. Six crew but only 4 ejection seats. ^f								
950922	USAF	E-3B	Jet	Anchorage, Alas.	takeoff	Geese, Can.	24	24
Multiple strikes at rotation (153 kt); took off but two engines failed; crashed in forest; fire. ^c								
960714	NATO	E-3A	Jet	Aktion, Greece	takeoff	Starl. & hawk	16?	0
Multiple strikes, including #3 engine; little damage; RTO (~140 kt); overran into sea; no fire. ^c								
960715	BelgAF	C-130H	T.Pr.	Eindhoven, Neth.	final appr.	Starl. & Lapw.	41	34
Multiple strikes during attempted overshoot, 2 engines failed, crash landed, fire; firefighters unaware of passengers. ^c								

^a From accident record at Air Historical Branch, London.

^b H. Huffman, pers. comm. (ground crewman for accident aircraft).

^c See Appendix 1 for sources of information.

^d RTO = rejected takeoff.

^e See Richardson (1996) for sources.

^f See Richardson (1994) for sources.

4.3.2 Ejection but Aircraft Not Destroyed: At least seven 2-seat military aircraft have, since 1950, landed successfully after a birdstrike and ejection or bailout of one crewman. These incidents have NOT been included as serious accidents elsewhere in this paper. Four of these incidents – two in the U.S.A.

and two in the U.K. – were described by Richardson (1994, 1996). The other three involved the following: a TA-4F of the U.S.N. that struck a Mallard duck whilst flying near Tallahassee, Florida, on 2 Dec. '69; a T-34C of the U.S.N. at Brewton, Alabama, on 29 Sep. '80; and an AlphaJet of the French AF that struck a Black Kite near Poitiers, France, on 9 June '99. Most of these incidents followed a similar pattern: A bird penetrated the windscreen. Because of windblast, obscured vision, lack of audio communication, etc., one crewman (usually in the rear seat) was unable to ascertain the condition of the other. Assuming his associate to be unconscious or dead, or to have already ejected or bailed out, one person abandoned the aircraft.

A related event occurred in 1934, when a vulture damaged the undercarriage of an RAF Fairey Gordon. Two crew bailed out but the pilot attempted to land. He was uninjured but the aircraft was destroyed (RAF 1934).

5. ACCIDENTS IN ASIA, MIDEAST, AFRICA & SOUTH AMERICA

We have seen little official information on numbers or circumstances of birdstrike accidents to military aircraft from countries other than those discussed in previous sections. However, unofficial sources indicate that many serious birdstrike accidents to military aircraft have occurred in some other countries. Appendix 3 lists 37 specific accidents attributed (often unofficially) to birdstrikes. This list is very incomplete.

India: Indian military services are known to have lost many aircraft to birdstrikes, with numerous fatalities. Satheesan (1994) listed some information about 15 crashes in 1980-94 caused by collisions with a single species, the Indian White-backed Vulture. We found more details about some of those 15 accidents, plus four additional Indian accidents, in unofficial sources (Appendix 3A). (Many Indian military accidents are listed in *Air Forces Monthly*, and Mohan [2000] provides a long but incomplete unofficial list.) A crash on 1 Mar. '90, listed by Satheesan without many details, apparently involved a MiG-27 that crashed on a road near Meerut (Delhi area), killing at least 11 people on the ground (possibly up to 50) and injuring many others.

We do not know the total number of birdstrike losses in Indian military aviation, but the 19 specific accidents listed in Appendix 3A are only a fraction of the total. Birdstrike specialists at the Bombay Natural History Society were quoted in 1988 as stating that, in a 10-year period, at least 25 IndAF aircraft were lost to birdstrikes, with several pilots killed (S. Muthiah *in* Toronto Star, 30 Jan. '88). Ali and Grubh (1984) mention 12 Indian military aircraft lost and

6 fatalities in 1980-82. These reports apparently include at least 16 aircraft losses not listed in Appendix 3A. Also, from Apr '93 to Mar. '96, the IndAF reportedly lost 9 aircraft to birdstrikes (*Jane's Defence Weekly*, quoted in *Australian Aviation* Dec. '96). Of these, five are not listed in Appendix 3A. One IndAF aircraft was lost to a birdstrike in 1996 (*Times of India*, 3 Feb. '98), probably on 9 Feb. '96 (Mohan 2000). Overall, these reports indicate that, besides the 18 Indian crashes listed in Appendix 3A since 1978, at least 22 others apparently occurred, for a total of 40+ in about 22 years. This is more losses per year than are known for any other country (*cf.* Table 1).

Many birdstrike accidents occurred before 1950 in what is now India, Pakistan, Bangladesh, and Burma. We have seen specific accounts of 26 serious bird-related accidents there during 1931-46 (West and Richardson, unpubl. data). Most of these accounts were in official accident records, and most involved British aircraft.

Pakistan: Four PakisAF accidents caused by birdstrikes are listed in Appendix 3A, with at least two aircrew fatalities and two ground fatalities. Masroor Air Base near Karachi is named in honour of a former base commander, killed there in 1967 when a vulture penetrated the windscreen of his B-57 (Khan 1998). Some other PakisAF losses listed unofficially as "possible birdstrikes" are excluded from Appendix 3A.

Taiwan: At least three TaiwAF aircraft and three aircrew have been lost to birdstrikes in the 1990s, according to largely unofficial reports (Appendix 3A). In **China**, at least five military aircraft and three aircrew were lost in 1992-94 (Wei Tianhao 1996).

Mideast: In addition to the Israeli losses in our "primary list" (Tables 1, 2; Appendix 2D), we have seen unofficial information about one Omani AF and two Turkish AF accidents attributed to birds (Appendix 3B). We understand that there have been other TurkAF birdstrike accidents, but have seen no details. There have been no known birdstrike losses to Jordanian AF aircraft (Y. Leshem, pers. comm., Jan. '00). We have not seen information from other mideastern countries.

Africa: The South African AF lost three Impalas (MB-326 variants) to birdstrikes before mid-1991 (MGen. A.A. Repsold, SAAF, quoted in *Air Forces Monthly*, June '91; details not seen). Another Impala loss in Oct. '91 was unofficially reported as a possible birdstrike. A SAAF Mirage F1 and a Zimbabwe AF Hawk reportedly were also lost to birdstrikes (Appendix 3C). No data are available for other African countries.

South America: We have seen unofficial reports of six specific Ecuador AF and Venezuelan AF crashes attributed to birds (Appendix 3D). The crash of an Argentine AF jet trainer (Pampa) in Sep. '99 has been unofficially reported as a possible birdstrike. We have seen no other reports of military birdstrike accidents in South America.

6. CONCLUSIONS

This paper summarizes 286 serious birdstrike accidents during 1950-99, based on data from 32 "primary" countries. It also provides some information concerning ~67 additional serious accidents in other countries (mainly since 1978). Both totals are quite incomplete. We again encourage authorities to release additional accident data. They can be useful in drawing attention to the seriousness of the birdstrike problem, and in identifying recurring types of accidents that deserve greater attention.

Serious birdstrike accidents have been a continuing problem in the 1990s even with recent reductions in military aircraft fleets in many countries. In addition to the continuing losses of 1- and 2-engine fighters and jet trainers, three 4-engine military aircraft have been lost to birdstrikes since 1995, with 58 fatalities. These accidents, along with occasional losses of military helicopters and piston-engine trainers, re-emphasize that any aircraft can be vulnerable to a birdstrike. Although engineering improvements to aircraft may reduce vulnerability, there is a continuing need for vigorous efforts to minimise the collision risk both at aerodromes and en route.

7. ACKNOWLEDGEMENTS

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APPENDIX 1: DATA SOURCES AND NOTES BY COUNTRY

This paper uses birdstrike accident data listed by Richardson (1994, 1996) plus the new and updated data listed in Appendix 2. Data sources listed in the earlier papers are not repeated here. Military Flight Safety offices (henceforth FSO) and birdstrike specialists who provided accident data in response to our recent enquiries are noted below. Updated "official" data were received from many countries, but not all.

We also searched the unofficial lists of military aircraft accidents published in *Air Forces Monthly (AFM)*, *British Aviation Review*, and *Flight International*. Postings to Internet newsgroup rec.aviation.military were occasionally useful. When unofficial sources indicated that a specific accident may have been caused by birds, we sought to obtain corroboration from official sources and by searching for additional unofficial information. Many recent accidents are described (not always accurately) in on-line news accounts and other Internet sources. Serial numbers of aircraft were often found (or checked) in Mitchell et al. (1995), Cline et al. (1999), or previous editions thereof. The "Scramble" military aircraft database was also used to check serials and some other details: www.scramble.nl/milbase.htm

Western & Northern Europe

Austria: There were no known serious birdstrike accidents to Austrian military aviation from 1957 to early 1996. No official information has been obtained since then.

Belgium: The 1996 compilation included BelgAF data from 1960 to early 1996. Information about the two BelgAF birdstrike accidents in mid-1996 was provided by the BelgAF FSO (Maj. G. Transon, pers. comm.). No official information has been obtained since early 1997. Gero (1999) describes the 15 July '96 Hercules accident. As of Feb. '00, the accident report is at www.dds.nl/~nbdc/hercul-2/def_01en.htm

Denmark: No known serious birdstrike accidents to Danish military aircraft since 1945 (Richardson 1994, 1996; Com. S.L. Sørensen, DanAF FSO, Dec. '99).

Finland: No known serious birdstrike accidents to FinnAF aircraft in 1995-99 (Lt.Col. J. Hipeli, FinnAF FSO, Jan. '00) or 1981-95 (Richardson 1996).

France: Air Force records show no additional writeoffs or fatalities subsequent to the five writeoffs in the early-mid 1990s, as listed in the 1996 paper (Maj. Cloitre, French AF FSO, Feb. '00). However, there was a rear-seat ejection after a birdstrike in 1999, with the aircraft being landed successfully by the pilot. A Fouga Magister involved in a bird-related accident on 20 June '94 was repaired and is excluded from this paper. Navy records for 1960 to early 1996 showed two losses of Aéronavale aircraft to birdstrikes (see 1996 paper); no official information has been obtained subsequently.

Germany: There have been no known birdstrike losses to German military aircraft in recent years (J. Becker, pers. comm., Dec. '99). However, we have added one more accident to the previous list of 23 (West) German aircraft lost to birdstrikes since 1962. On 13 Mar. '90, an AlphaJet lost one engine to a birdstrike over the North Sea, returned to base on one engine, but crashed on approach.

Greece: One Hellenic AF aircraft was lost to a birdstrike in recent years, on 21 Apr. '98 (B.Gen. B. Xenogiannis, Hel.AF FSO, Jan. '00). We now have updated information on types of birds involved in the two known accidents in 1965-94 (Appendix 2A).

Ireland[†]: Several unofficial sources indicate that an Irish Air Corps HS.125 was damaged beyond repair when birds triggered a rejected takeoff on 27 Nov. '79 (e.g., Hill et al. 1987). We have seen no official data about this (or other) IAC birdstrikes.

Italy: Italian AF records show one aircraft lost to a birdstrike in July '98 (Lt.Col. L. Goretti, Ital AF FSO, Feb. '00) in addition to the three known losses in 1961-94. The ItalAF concluded that a fatal accident on 17 Nov. '97, widely reported as a possible birdstrike, was in fact not related to birds.

NATO: The NATO E-3A accident was described generally in *Aviation Week & Space Technology* (AWST, 12 Aug. '96, p. 21), *AFM* (Sep. '96, p. 61), and Alexander (1997). Additional details were provided by G. Rapp (NATO AEW FSO, Feb. '00).

Netherlands: The NethAF has lost no aircraft to birdstrikes since 1990 (L. Buurma, RNethAF, Feb. '00). There were 10 known serious birdstrike accidents in 1956-90.

Norway: No known losses of Norwegian military aircraft to birdstrikes since 1995 (C. Aas, Zool. Mus., Oslo, Feb. '00). There were at least 3 losses in 1956-95.

Portugal: The PortAF lost two aircraft to birdstrikes in 1975-95 (Richardson 1996) but none thereafter (PortAF FSO, Jan. '00). An A-7P damaged by a birdstrike on 23 Nov. '98 was repaired, contrary to unofficial speculation.

Spain[†]: Data concerning known and suspected Spanish AF losses to birdstrikes were provided by Maj. J. Clavero (Grupo 15 FSO, May '96) and Lt.Col. F. Molina (SpanAF FSO, Jan. '00). Based on these data, three birdstrike losses from 1984 to date are provisionally listed in Appendix 2A. A fatal 1984 accident was attributed to a probable duck strike on the canopy. A 1992 accident was probably caused by a birdstrike, but the wreckage sank at sea and could not be examined. A 1994 accident is now listed by the Spanish FSO as a probable vulture strike, although earlier there was some question. Also, three earlier fatal birdstrike accidents to Spanish military aircraft are listed in Appendix 2A based on ICAO (1965) and unofficial sources (*Brit. Aviat. Rev.*; "Scramble" database). Excluded from Appendix 2A are a fatal 1983 F-5A accident suspected by the SpanAF to be caused by a birdstrike.

[†] This country was not considered in the previous papers by Richardson (1994, 1996).

Also excluded are accidents on 28 Sep. '82 and 13 Mar. '95; although unofficially reported as birdstrikes, SpanAF sources have indicated that birdstrikes were not the cause. Also excluded, pending corroboration, is a fatal Spanish Navy EAV-8B accident on 19 Feb. '98, unofficially reported as a possible birdstrike. As yet, official information for the Spanish Navy is unavailable.

Sweden: No known Swedish AF losses to birdstrikes since 1977 (SwedAF HQ via B. Larsson, Jan. '00). At least 9 aircraft lost to birdstrikes in 1967-77. Unofficial reports of birdstrike losses on 7 July '82 and 26 Apr. '94 are apparently erroneous.

Switzerland: No known Swiss AF losses to birdstrikes since 1992 (Col. W. Schafroth, Swiss AF FSO, Jan. '00). Two aircraft were lost to birdstrikes in 1974 and 1991.

United Kingdom: The RAF Inspectorate of Flight Safety provided details for one RAF aircraft lost to a birdstrike in 1994-99, on 7 July '98 (S/L R. Lillywhite, IFS, Feb. '00). Other recent RAF accidents reported unofficially as birdstrikes were either not birdstrikes (3 June '97) or not writeoffs (23 Nov. '98). Further review of unofficial sources, followed by checking of official records in the Air Historical Branch, London, has revealed six additional serious birdstrike accidents to RAF aircraft in 1952-55, plus further details on 28 of 49 previously reported RAF losses in the 1950-93 period. One previously reported accident (Gnat T.1 on 12 Oct. '73) has been deleted from the list as it is now known to have been repaired and re-flown by the RAF.

We are not aware of any recent losses of Royal Navy aircraft to birdstrikes, but have seen no official data since early 1996. In addition to the six previously reported losses in 1958-87, two additional losses (in 1962 and 1982) are now known, plus some new details about previously reported accidents (Appendix 2A; data from aviation historians R. Sturtivant and R. Dunn).

The British Army reports no serious bird-related accidents recently (Maj. P.J. Gibbs, Dec. '99). There were at least two such accidents up to 1991 (Richardson 1996).

Eastern Europe

Data for eastern European countries and the former Soviet Union are less complete than for western and northern European countries, and largely unofficial.

Albania, Bulgaria, Poland, Romania, and Yugoslavia[†]: We have seen unofficial reports of birdstrike accidents in these countries (Appendix 2B). However, we have no official information, and the accuracy of the unofficial reports is unknown. These countries were not included in the 1994 and 1996 papers.

Czech and Slovak Republics; former Czechoslovakia: Two serious accidents to Czechoslovak aircraft were listed in Richardson (1996). Dr. R. Krupka (Czech AF, Feb. '00) provided more details for one of these, plus information about a "new" accident in 1966 (Appendix 2B). We understand that no Slovak AF aircraft have been lost to birdstrikes (Dr. B. Murar, Feb. '00).

Former Soviet Union: In addition to 10 losses listed in the 1996 paper, 15 additional losses up to 1990 have recently become known. These include 10 additional losses of Soviet aircraft to birdstrikes in East Germany, described in Herzog (1997) and/or Jacoby (1998). Discrepancies between those two papers have been resolved based on communications with those authors (Jan. '00). Dr. Jacoby also provided unofficial information about five additional Soviet losses in 1969-88 (not in East Germany). Also listed is an unofficial report of a fatal Kazakh AF accident in 1996.

Germany (East): Ten known losses of National Peoples Army (NVA) aircraft prior to unification were listed in the 1996 paper.

Hungary: The one known loss since 1960 was listed in the 1996 paper. The lack of recent losses was confirmed by Lt.Col A. Papp, Hung. Mil. Aviat. Auth., Feb. '00.

North America

Canada: Besides the 17 losses listed in Richardson (1994), a Tutor trainer was lost on 25 Sep. '97 (*Flight Comment* 1998[2]; Capt. S. Karcha, 1 CAD HQ, Nov. '98). Appendix 2C includes previously unreported serial numbers for CAF aircraft lost to birdstrikes (from Bashow 1991 and other sources).

United States: The USAF BASH Team and Air Force Safety Center (AFSC) provided data on four bird-related accidents that occurred after the 1994 paper was compiled, plus a previously unlisted accident in May '73. They and other sources provided additional details for 26 of 44 previously reported USAF birdstrike accidents (Appendix 2C). Contacts included Maj. D. Arrington, Maj. P. Windler, Capt. C. Atkins and E. LeBoeuf (BASH Team), and Col. B. Burklund, J. Clark and L. Alley (AFSC). Other significant sources

included • Schilter Lowe (1995) and *AFM* (Nov. '94, Jan. '95) re an ejection by 1 of 2 aircrew in an F-15E that hit a duck on 16 Sep. '94; • *Anchorage Daily News* (12 Jan. '96 and 25 Feb. '96), Gresch (1996), Alexander (1997), and Anon. (1998) re 22 Sep. '95 E-3B crash; • *AWST* (23 Feb. '98) and *AFM* (May '98) re 22 Oct. '97 midair collision while avoiding birds; • *Sioux City Journal* (14-19 May '98; 15 Oct. '98) and *AFM* (Dec. '98) re 13 May '98 F-16C crash; • *Palm Beach Post* (19 Jan. '00) and *Air Force Times* (31 Jan. '00) re 1 July '99 F-16C crash. Excluded, pending corroboration, are unofficial reports of two USAF aircraft supposedly damaged beyond repair by birdstrikes: a T-38 on 6 May '94, and an F-111D (68-0140) at an unknown date. The BASH Team and AFSC have been unable to find records of these incidents.

The U.S. Army Safety Center confirmed that an 8 Sep. '84 crash in Germany is the only known loss of a U.S. Army aircraft to birds in 1972-99 (V. Hendrix, Feb. '00).

The U.S. Naval Safety Center (NSC) supplied details for six USN and USMC aircraft lost to birdstrikes in 1995 through Jan. '00 (W.B. Brown, Jan. '96; C. Kemmerer, Feb. '00). Ten losses for approx. 1970-94 were listed in Richardson (1994), and new details are now available for most of these (Appendix 2C). The NSC described a bailout by 1 of 2 aircrew in a T-34C that hit a bird on 29 Sep. '80. (See "New Zealand", below, for a related incident.)

Other Countries

Other countries for which official data were available for inclusion in the 1994 or 1996 papers were Australia and Israel. Updated data are available for those two countries, and for New Zealand (Appendix 2D).

Israel: Dr. Y. Leshem (Tel Aviv Univ.) provided details for the F-16B lost on 7 Sep. '97, and mentioned that a Super Mystère is now known to have been lost to a birdstrike in 1961. Seven IsrAF losses in 1972-95 were listed in Richardson (1996); Leshem & Bahat (1999) give additional details.

Australia: There have been no known Australian military aircraft losses to birdstrikes recently (P.F. Blais, RAAF FSO, Jan. '00). Three RAAF aircraft were lost to birdstrikes in 1962-77 (Richardson 1994; Appendix 2C).

New Zealand[†]: Ballantine (1985), Wright (1998) and T. Angelo (RNZAF Mus., Feb '00) provided information about an RNZAF Hastings lost in 1955 due to birdstrikes on takeoff, and about an RNZAF pilot who ejected in 1969 from a 2-seat A-4 in the U.S.A. following a birdstrike. Otherwise, records for 1954-99 show no losses of RNZAF aircraft or aircrew to birdstrikes (F/L A.R. Frost, RNZAF FSO, Feb. '00).

APPENDIX 2: Serious accidents caused by birds to military aircraft from Europe, North America, Israel, Australia & New Zealand.

Full listing is given for accidents that are new (n) or substantially revised (r) relative to lists in Richardson (1994, 1996). When only a limited amount of additional information is available for a previously-listed accident, only the date, aircraft type, and updates are given, in a box. Accidents listed in 1994 or 1996 papers for which no new information is available are excluded. The numbers of new (n), revised (r) and excluded (ex) birdstrike accidents are listed beside each country name. Underlined information represents a correction relative to Richardson (1994, 1996). See Table 1 for services and years covered. Blanks denote unknown. For explanatory notes, see last page of Appendix 2. For data sources, see Appendix 1.

Date Y M D	Location Where Struck	Ser- vice	Aircraft Type	Acc.			Flight Phase/ Time	Altitude AGL (feet)	Parts Hit		
				Cate- gory	A E Kil- led	# Persons			Speed (knots)	W E s	n

A. WESTERN & NORTHERN EUROPE

Austrian AF: no confirmed birdstrike losses

Belgian AF (2n, 2r, 2 ex)

n 960624	Belgium	Morsele	AF SF 260 MB	pT 1	wo	2	na	0	CI	D	Lapwing	200	110	-	F	ST-33
n 960715	Netherl.	Eindhoven	AF C-130 H	Oth 4	wo	41	na	34	OvSh	D	Starlings+Lapwgs	10-50	110	S	F	W CH-06

800512	TF-104 G	sn = FC-05	881117	F-16 A	sn = FA-62
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Danish AF and Finnish AF: no known birdstrike losses

French AF & Navy (0n, 4r, 3 ex)

920613	Jaguar A	sn = A65?	920204	S. Etendard	sn = 34
960119	Mir. 2000 N	sn = 324	960126	S. Etendard	sn = 63

Germany (West) AF & Navy (1n, 4r, 19 ex)

n 900313	Germ.,W	North Sea	AF AlphaJet	T 2	wo	1	1	0	CrL	D	Gull, Herring	250	450	-	F	4160
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771007	TF-104 G	sn = 2818	810706	F-104 G	sn = 2458
781010	F-104 G	sn = 2538	760315	F-104 G	sn = 2673

Hellenic (Greek) AF (1n, 2r, 0 ex)

n 980421	Greece	Chryssoupoli	AF F-5 B	FA 2	wo	2	2	0	CrH	D	>1	2000	380	P	F	50582
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750627	F-84 F	bird = large	921007	Mir. 2000	bird = gull?
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Appendix 2 (page 2 of 7)

Date	YMD	Location	Where Struck	Ser-vice	Aircraft Type	Acc. Cate-gory	Cate-gory	Oth	# Persons A b. j. led	E Kil-	Flight Phase/ Time	Type of Bird(s) Struck	Altitude AGL (feet)	Speed (knots)	Parts Hit W E s n Other	Aircraft Serial Number									
Irish Air Corps (1n, 0r, 0 ex)																									
n	791127	*	Ireland	Dublin-Baldonnell	AF	HS.125	600B	Oth	2	dbr	3	na	0	TO	unkn.	0	[low]	-	I	236					
Italian AF (1n, 0r, 3 ex)																									
n	980715		Spain	Alcaine, Aragon	AF	Tomado	IDS	FA	2	wo	2	2	0	CrH	D	vulture	1100	450	-	F	MM7017				
NATO (1n, 0r, 0 ex)																									
n	960714		Greece	Aktion/Préveza	E-3 A			Oth	4	dbr	16	na	0	TO	D	hawk+Starlings	0	~140	-	I	M	LX-N90457			
Netherlands AF (0n, 4r, 6 ex)																									
600707 Hunter Mk.4 sn = N-189																									
750711 NF-5 A subtype; sn = K-3029																									
Norwegian AF (3 ex) and Portuguese AF (2 ex)																									
Spanish AF (6n, 0r, 0 ex)																									
n	64_?	?	* Spain?					pT	1	wo	na	1	CrL		vulture	650	97	-	-	W					
n	64_?	?	* Spain?	AF	F-86	F		FA	1	wo	1		Ap		vulture	1700	275	-	F						
n	780627	*	Spain	El Arahah	AF	Do.27		pO	1	wo	2	na	2	Cl		vulture						L.9-55			
n	8410		Spain	Daimiel Nat Pk	AF	F-5 A		FA	2	wo	1	0?	1	CrL	D	ducks	300	420	P?						
n	920130		Canary I.	Gando, Canary I.	AF	Mirage F1	EE	FA	1	wo	1	1	0	Cl		prob. birastrike	500	300	-	F	C.14B-59				
n	940816		Spain	Bardenas Range	AF	F-18 A		FA	2	wo	1	1	0	CrL	D	vulture (prob.)	750	500	-	F	C.15-17				
Swedish AF (0n, 3r, 6 ex)																									
730416 Draken S parts hit = - - N? sn = 35933																									
731017 Draken J sn = 35379																									
Swiss AF (0n, 1r, 1 ex)																									
741023 Mirage III S sn = J2307																									
United Kingdom AF (7n, 28r, 21 ex, 1 deleted)																									
n	520424		Germ.,W	Wahn (near)	AF	Meteor	NF.11	FA	2	dbr	2	0	0	Cr_	D	unkn.						-	F	-	WD712
n	521214		UK/Eng.	Cambridge (near)	AF	Chipm. T.10		pT	1	wo	2	na	0	CrL	D	Avoiding flock	40	low	-	-	-	-	-	-	WG325
r	530730		France	Reims	AF	Vampire	FB.5	FA	1	wo	1	0	0	CrL	D	>1	low					S	-	W,I,I	WA383

Appendix 2 (page 3 of 7)

Date Y M D	Location	Where Struck	Ser- vice	Aircraft		Acc. Cate- gory	# Persons		Flight Phase/ Time	Type of Bird(s)	Struck	Altitude		Parts Hit		Aircraft Serial Number
				Type	Cate- gory		A	E				Kil- led	AGL (feet)	Speed (knots)	W	
n 530904	UK/Eng.	Moreton-in-Marsh	AF	Harvard T.2B	pT 1	dbr	2	na	0	CrL D	Avoiding flock	low	low	-	-	KF221
n 530925	Iraq	Habbaniya (near)	AF	Vampire FB.9	FA 1	dbr	1	0	0	CrL T	large, >1	390	390	S	U	WL549
n 540224	Germ.,W?	Gütersloh (near)	AF	Meteor FR.9	FA 2	dbr	1	0	0	CrL D	>1	100		-	F	VZ600
n 550121	Jordan	Amman (near)	AF	Vampire FB.9	FA 1	dbr	1	0	0	CrL D	>1	50	240	-	W,N	WR155
r 550226	UK/Eng.	Wendling, Norf.	AF	Meteor F.8	FA 2	wo	1	1	0	CrL?D	>1	low		-	F	WE884
r 591104	Aden	Khormaksar area	AF	Venom FB.4	FA 1	dbr	1	0	0	CrL D	hawk?	1000	350	-	W,A	WR531
r 600507	UK/Eng.	Somerset/Devon?	AF	Vampire FB.5	FA 1	dbr	1	0	0	—	unkn.	—		-	I	WA445
r 640817	Hong Ko.	Kai Tak	AF	Canberra B.15 B	2	wo	4	0?	0	Cl D	Kites, Black-ear.	15	120	-	F U	WH958
r 650714	Netherl.	Roermond (near)	AF	Canberra B(l)6 B	2	wo	3	0	3	CrL D	unkn.	low		-	F	WT324
r 710225	Germ.,W	Nordholz (E of)	AF	Canberra PR.7 B	2	dbr	2	0	0	CrL D	gulls	500	300	S	- N,F,W	WT523
n 980707	Germany	Laarbruch	AF	Harrier GR.7	FA 1	wo	1	1	0	Ap D	buzzard	200	159	-	F	ZG533

601109	Hunter F.6	Day; parts = - / -
610316	Swift FR.5	Day
620904	Vampire T.11	crew = 2 0 0 ; Day
640930	Jet Prov. T.4	Jedburgh, Scot.; crew = 2 2 0; parts = - F 0
660727	Jet Prov. T.4	crew = 1 1 0; parts = - F -
681120	Canberra T.17	crew = ? 0 0; alt = 0
710629	Jet Prov. T.3	parts = - F F
720627	Harrier GR.1A	ph = CrH; alt = 1200
731012	Gnat T.1	Delete from list : repaired & reflown
800731	Jet Prov. T.3A	parts = - F M
930628	Harrier GR.7	alt/sp = 250 / 420

560127	Vampire FB.5	Day; alt = 1000; parts = - - W
560202	Vampire FB.9	phase = Ap; Day; parts - - W
561003	Hunter F.4	crew = 1 0 0; ph = Cl; Day; parts = - F -
561101	Hunter F.1	ph = CrL; Day; parts = - - I
570410	Vampire T.11	crew = 2 0 0; ph = CrL; Day; speed = 350
570522	Hunter F.1	Day; birds = >1; parts = - - I
570628	Hunter F.4	ph = Ap; Day; alt = low; birds >1; parts - F -
571114	Hunter F.4	Day; parts = - I I
580212	Vampire FB.5	ph = TO; Day; alt/sp = 0 / 90; parts S - -
591110	Hunter F.4	ph = CrL; Day; speed = 360
600329	Hunter FGA.9	Sharjah; Day; parts = - I I

United Kingdom Navy (2n, 3r, 3 ex) and Army (2 ex)

n 621123 *	UK/Scot.	Milltown	Na	Scimitar F.1	FA 2	wo	1	1	0	Ap	unkn.	low	low			XD282
n 820819 *	UK/Engl.	Yeovilton (near)?	Na	Hunter GA.11	FA 1	dbr	1	0	0		unkn.					XE682

580428	Sea Hawk FB.3	ph = CrL
621115	Scimitar F.1	Firth of Tay or Moray Firth

841201	Sea Har.FRS.1	bird = gull?
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Appendix 2 (page 4 of 7)

Date YMD	Location Where Struck	Ser- vice	Aircraft		Acc. Cate- gory	# Persons		Flight Phase/ Time	Type of Bird(s) Struck	Altitude		Parts Hit		Aircraft Serial Number
			Type	Cate- gory		A	E			W	E	AGL (feet)	Speed (knots)	
B. EASTERN EUROPE														
Albania (1n, 0r, 0 ex)														
n 82_____	* Albania	AF	F-7A	FA 1	wo	1	1	TO	unkn.	TO				
Bulgaria (1n, 0r, 0 ex)														
n 970128	* Bulgaria Dobritch AB	AF	MIG-21 MF	FA 1	wo	1	1	0	Ap	Pigeons, Wood			F	
Czechoslovakia (1n, 1r, 1 ex)														
n 6607 ?	Czecho. Prague-Kbely?	AF	Aero L-29R	T 1	wo			TO	partridges	0	low	-	I	
r 850510	Czecho. Bechyn□	AF	MIG-21 MF	FA 1	wo	1	0	0	TO D	Gull, Bl.-head.	5	180	-	I 4306
Former Soviet Union (16n, 1r, 9 ex)														
n 701223	Germ.,E	AF	MIG-21	FA 1	wo	1	1	0?	Cl N	unkn-large	650			
n 711005	Germ.,E	AF	MIG-21	FA 1	wo	1	1		D	unkn.	3300			
n 720406	Germ.,E	AF	MIG-15 U	FA 1	wo	2	2	CrH D	unkn.	13,000				
n 740722	Germ.,E	AF	MIG-21	FA 1	wo	1	1	0	Ap N	unkn.	330			
n 750227	Germ.,E	AF	Su-7 U	FA 1	wo	2	2	0	CrH D	Starlings, Eur.	6500	250	F	
n 750707	Germ.,E	AF	MIG-21	FA 1	wo	1	1	0	CrH D	>1	3600			
n 770408	Germ.,E	AF	MIG-21	FA 1	wo	1?	1		Cir D	unkn.	2000			
n 770521	Germ.,E	AF	MIG-27	FA 1	wo	1	1	0	CrH D	Starlings, Eur.	2000			
n 780518	Germ.,E	AF	MIG-23	FA 1	wo	1	1	0	CrL D	unkn.	1000			
n 820423	* Russia Borisoglebsk	AF	MIG-21 U	FA 1	wo	2	2	0	Ap T	duck	1000	230	-	F
n 840223<*	Ukraine? Azov Sea coast	AF	jet fighter	FA 1	wo	1	0	0	D	unkn.	v.low	75	-	F
n 861028<*	Russia L. Baikal region	AF	jet fighter	FA 1	wo	1	1	0	CrL D	eagle	<1000	300	-	F
n 880907<*	Moldova Tiraspol	AF	MIG-23 U	FA 1	wo	1+	1+	0? +1	Ap D	Cormorant, Gr.	660	low	-	F
n 901022	Germ.,E Neuruppin	AF	Su-17 U	FA 1	wo	2	2	0	Cl D	geese	230			F
n 961014	* Kazakhst. Taldy-Kurgan	AF	MIG-29?	FA 1	wo	1	0	1	Ap	unkn.				

701007 MIG-21 ac.type (FA 1)

n 690913 * Russia Kola Penin. Na Tu-16 B 2 wo na 4+? Ap N geese 5000 380 S I W

Germany (East) AF (0n, 0r, 10 ex)**Hungarian AF (0n, 0r, 1 ex)**

Appendix 2 (page 5 of 7)

Date Y M D	Location	Where Struck	Ser- vice	Aircraft		Acc. Cate- gory	# Persons		Flight Phase/ Time	Type of Bird(s)	Struck	Altitude		Parts Hit		Aircraft Serial Number																																																																																																																																																																								
				Type	Cate- gory		A	E				W	Other	AGL (feet)	Speed (knots)																																																																																																																																																																									
Poland (2n, 0r, 0 ex)																																																																																																																																																																																								
n	891220	* Poland?	AF	Su-22 U	FA 1	wo					unkn.					A1006																																																																																																																																																																								
n	830615	* Poland?	Na	Mi-14 PL	H 2	wo					unkn.																																																																																																																																																																													
Romania (1n, 0r, 0 ex)																																																																																																																																																																																								
n	940629	* Romania	AF	MiG-21	FA 1	wo	1	1	0	"TO"	>1	<50		F ?																																																																																																																																																																										
Yugoslavia (1n, 0r, 0 ex)																																																																																																																																																																																								
n	961113	* Serbia	AF	MiG-21	FA 1	wo	1	1	0		unkn.			F																																																																																																																																																																										
C. NORTH AMERICA																																																																																																																																																																																								
Canada (1n, 17r, 0 ex)																																																																																																																																																																																								
n	970925	Can./Sas.	Assiniboia	Tutor	T 1	wo	2	2	0	CrL T	hawk?	500	230	- F		114048																																																																																																																																																																								
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;">641027</td> <td style="width: 15%;">CF-104</td> <td style="width: 15%;">sn = 12849</td> <td style="width: 15%;"></td> </tr> <tr> <td>650916</td> <td>CF-104 D.2</td> <td>sn = 12659</td> <td></td> </tr> <tr> <td>650916</td> <td>CF-104</td> <td>sn = 12853</td> <td></td> </tr> <tr> <td>660321</td> <td>CF-104</td> <td>sn = 12820</td> <td></td> </tr> <tr> <td>661012</td> <td>CF-104</td> <td colspan="15">Sask (NE of Cold Lake); sn = 12745</td> </tr> <tr> <td>670330</td> <td>CF-104</td> <td>sn = 12768</td> <td></td> </tr> <tr> <td>670718</td> <td>CF-104</td> <td>parts = S F N; sn = 12734</td> <td></td> </tr> <tr> <td>681115</td> <td>CF-104</td> <td>sn = 12741</td> <td></td> </tr> <tr> <td>690425</td> <td>CF-104</td> <td>sn = 104854</td> <td></td> </tr> </table>																	641027	CF-104	sn = 12849																650916	CF-104 D.2	sn = 12659																	650916	CF-104	sn = 12853																	660321	CF-104	sn = 12820																	661012	CF-104	Sask (NE of Cold Lake); sn = 12745															670330	CF-104	sn = 12768																	670718	CF-104	parts = S F N; sn = 12734																	681115	CF-104	sn = 12741																	690425	CF-104	sn = 104854																
641027	CF-104	sn = 12849																																																																																																																																																																																						
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670718	CF-104	parts = S F N; sn = 12734																																																																																																																																																																																						
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United States AF (5n, 26r, 16 ex)																																																																																																																																																																																								
n	730516	UK/Scot.	Tarbert, I. of Lewis	AF	F-111 E	FA 2	wo	2	2	0	CrH D	Gull, Herring	1100	450	- F I	68-0008																																																																																																																																																																								
r	740506	USA/TX	Randolph AFB	AF	T-38 A	T 2	wo	2	2	0	Cl T	>1	v.Low	225	- F																																																																																																																																																																									
r	750305	UK/Eng.	Shapfell, Cumbria	AF	F-111 E	FA 2	wo	2	2	0	CrL D	gulls	1000 [high]		P I M	68-0081																																																																																																																																																																								
r	751105	UK/Eng.	Boston, Lincs.	AF	F-111 E	FA 2	wo	2	2	0	CrL D	duck	400	480	P -	68-0060																																																																																																																																																																								
r	790727	USA/AZ	Bonita	AF	A-10 A	FA 2	wo	1	1	0	CrH D	Vulture, Turkey?	1100		- - W	75-0271																																																																																																																																																																								
r	851030	USA/PA	Emerickville	AF	A-10 A	FA 2	wo	1	1	0	CrL D	Avoiding Birds	400	140	- - -																																																																																																																																																																									
r	921217	USA/TX	Dixie Range	AF	F-16 A	FA 1	wo	1	1	0	CrL D	Hawk, Red-tail.	700	430	- F	83-1078																																																																																																																																																																								
r	940701	USA/TX	Eagle Pass	AF	F-16 B	FA 1	wo	2	2	0	CrL D	Vulture, Turkey	700	410	- F	83-1173																																																																																																																																																																								
n	950922	USA/AK	Anchorage/Elmen.	AF	E-3 B	Oth 4	wo	24	na	24	TO T	Geese, Canada	0	153	- F U	77-0354																																																																																																																																																																								

Appendix 2 (page 6 of 7)

Date Y M D	Location	Where Struck	Ser- vice	Type	Aircraft		Acc. Cate- gory	# Persons		Flight Phase/ Time	Type of Bird(s)	Struck	Altitude		Parts Hit		Aircraft Serial Number	
					Cate- gory	Type		A	E				Kil- led	AGL (feet)	Speed (knots)	W		E
n 971022	USA/CA	Edwards AFB	AF	AT-38 B	T	2	wo	2	0	2	CrH D	"Avoiding Birds"	2750	508	-	-	62-3639?	
n 980513	USA/NE	Ainsworth (near)	AF	F-16 C	FA	1	wo	1	1	0	CrL D	Pelicans, Am.White	820	500	P	F	85-1550	
n 990701	USA/FL	Okeechobee Cty.	AF	F-16 C	FA	1	wo	1	0	1	CrL D	prob. birdstrike	980	480	S?	-	84-1268	
<p>621010 F-102 ph = TO or La; alt = v.low; parts = - / - 730711 F-111 A date; Day; sn = 67-0040 740114 T-38 A crew = 2 2 1; Day; parts = P / - 801113 F-4 E sn = 68-0475 810908 T-38 A sn = 68-8182 820511 F-16 A parts = S F N; sn = 78-0067 840809 F-111 E sn = 68-0019 850402 T-38 A Day; birds = cowbirds 861008 F-16 A sn = 82-0998 861020 F-4 E sn = 68-0373</p>																		
<p>870520 F-4 E sp = 350; sn = 72-0160 870928 B-1 B parts = - / W; sn = 84-0052 890104 F-16 A sn = 83-1116 890105 F-16 C sn = 84-1228 900410 OA-37 B Day; sn = 73-1104 910418 F-16 A sp = 480; sn = 82-0920 920918 F-16 A date; subtype; sp = 100; sn = 80-0566 930620 T-38 A date; Day; alt/sp = 0 / 145; sn = 68-8095 930706 T-38 A Day; alt/sp = 40 / 140</p>																		

United States Army (1r), Navy & Marines (6n, 9r, 1 ex)

r 840908	Germ., W	Wiesbaden	Ar	RV-1D	Oth	2	wo	2	2	0	Cl	>1	[low]	[low]	U		64-14238	
n 950114	USA/NC	Rocky Mount (nr)	Na	TAV-8 B	FA	1	wo	2	2	0	CrL D	Gull, Herring	500	460	P	-	164541	
n 951005	USA/AZ	Kofa Mtns	Na	F-18 D	FA	2	wo	2	2	0	CrL D	large	500	420	-	F	164064	
n 960916	USA/NC	Phelps Lk.	Na	AV-8 B	FA	1	wo	1	1	0	CrL D	Vulture, Black	low	460	-	W	163852	
n 961101	USA/TX	Kingsville	Na	T-45 A	T	1	wo	2	2	0	Ap N	Duck, Canvasb.	450	120	-	F	163627	
n 970415	USA/TX	Kingsville	Na	T-45 A	T	1	wo	1	1	0	Cir D	large	low	115	-	F	163634	
n 000131	Jordan		Na	AH-1 W	H	2	wo	2	na	0	Hov? D	unkn.	low	low	-	T		
<p>70 ~ A-4 B parts = - / - 73 032 1 AV-8 A date (not 750327); sn = 158388 801031 A-4 M parts = - - W 840505 A-4 E Day; sn = 149654 860117 AV-8 B sn = 162724</p>																		
<p>900421 TAV-8 B sn = 163856 920528 F-18 A Worthington Spr., FL; sn = 163125 931015 AV-8 B sn = 163421 940308 EA-6 B ac cat. = <u>Oth</u> 2; Day; alt = 25-30</p>																		

D. OTHER COUNTRIES

Israel (2n, 2r, 5 ex)

n 610220	Israel	central-west	Isr.	AF	S. Mystère	FA	1	wo	1	1	0	startings	~750		M		
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Appendix 2 (page 7 of 7)

Date Y M D	Location	Where Struck	Ser- vice	Type	Aircraft		Acc. Cate- gory	# Persons			Flight Phase/ Time	Type of Bird(s) Struck	Altitude		Parts Hit		Aircraft Serial Number	
					Type	FA		wo	A	E			Kil- led	AGL (feet)	Speed (knots)	W		E
n 970907	Israel	Negev Des.	AF	F-16 B	FA	1	wo	2	2	0	CrL	D	Buzzard, Honey	400	530	P	-	
			sn = <u>015</u>		950810 F-15 D subtype; alt = 1000; sn = 965													
Australia (0n, 3r, 0 ex)																		
			sn = A94-958		770930 F-111 C sn = A8-133													
			sn = A3-074															
New Zealand (1n, 0r, 0ex)																		
n 550909	Aust./NT	Darwin	AF	Hastings C.3	pO	4	wo	25	na	0	Cl	D	kites	50	130	P	F	NZ5804

n, r (in left column): new or substantially revised relative to lists in Richardson (1994) for Australia, Canada, and U.S.A., or Richardson (1996) for Europe and Israel.

- * Unofficial report of uncertain accuracy.
- Service: AF = Air Force; Ar = Army; Na = Navy.
- Aircraft Category: B = Bomber; FA = Fighter/Attack; H = Helicopter; T = Trainer; Oth = Other. Prefix "p" means piston-engined.
- Following digit shows number of engines.
- Accident Category: wo = aircraft written off (destroyed); dbr = damaged beyond (economical) repair.
- # Persons: Ab. = Number of aircrew aboard; Ej = # who ejected; Killed = # aircrew killed (+ ground fatalities if relevant).
- Flight Phase: TO = takeoff; Cl = Climb; CrL = cruise at low-level (up to 1000 ft AGL); CrH = cruise at high altitude (above 1000 ft AGL); Ap = approach; La = land; T&G = touch and go landing; OvSh = overshoot; Dem = demonstration flight; Cir. = in circuit; Hov = hover.
- Time: D = Day; N = Night; T = Twilight.
- Parts Hit. Ws = windshield or canopy: - = not struck; S = struck, not reported as penetrated; P = penetrated.
- En = Engine(s): - = no ingestion; I = ingestion, damage limited or uncertain; F = engine failure after ingestion.
- Other parts reported struck: A = antenna or probe; F = fuselage; I = intake; L = landing gear; M = multiple parts; N = nose or radome; T = tail; U = unknown other parts; W = wing(s).

APPENDIX 3: Serious military aircraft accidents attributable to birds, considering aircraft from Asia, Mideast, Africa, and South America.

Excludes military birdstrike accidents for which details are unavailable; also excludes those reported as "possible birdstrike". Information is very incomplete and (except for India) largely unofficial. Blanks denote unknown. For data sources, see text (section 5). For explanatory notes, see last page of Appendix 2.

Date	Location	Where Struck	Ser-vice	Aircraft		Acc. # Persons			Flight		Altitude		Parts Hit		Aircraft Serial Number
				Type	Cate-gory	Cate-gory	A	E	Kil-led	Phase/Time	Bird(s) Struck	AGL (feet)	Speed (knots)	W	
A. Asia															
Indian AF															
650910 *	India	Haliwara	AF	Canberra	B 2	wo	2	0	0	TO D	unkn.	0	low	P -	
801021	India	N. India	AF	helicopter	H	wo	na	0	0	Cr_ D	Vulture, Wh.-bk.				
801023	India	New Delhi (W of)	AF	Su-7	FA 1	wo	1	1	0	CrL D	Vulture, Wh.-bk.	330		- - W,T	
810416 *	India		AF	Jaguar	FA 2	wo	1			Cr_ vulture	"low"				J1006/XZ397
831108	India	NW India	AF	jet fighter	FA	wo		1		Ap D	Vulture, Wh.-bk.	2500		P I -	
850213	India	NE India	AF	jet fighter	FA	wo		0		Cr_ D	Vulture, Wh.-bk.			- F -	
861016	India	Jamnagar (near)	AF	jet fighter	FA	wo		?		Cl D	Vulture, Wh.-bk.	3300		- F -	
870604	India	Kutch	AF	jet fighter	FA	wo		1	0	CrL D	Vulture, Wh.-bk.	500		- F N	
871030	India	NW India	AF	jet fighter	FA	wo		0		Ap D	Vulture, Wh.-bk.	425		- F N	
871109	India	Adampur AFB	AF	jet fighter	FA	wo	1	1?		Ap D	Vulture, Wh.-bk.	1300		- F N	
890123	India	Chandigarh	AF	MIG-21	FA 1	wo		0		Ap D	Vulture, Wh.-bk.	1150		S I N	
891110	India	Adampur AFB	AF	MIG-21	FA 1	wo		0		Cl D	Vulture, Wh.-bk.	165		- F -	
900301	India	Meerut	AF	MIG-27 M	FA 1	wo	1	1	0	CrH D	Vulture, Wh.-bk.	2300		- F -	
921009	India	NW India	AF	jet fighter	FA	wo		0		CrH D	Vulture, Wh.-bk.	1500		- F N	
930217	India	Jodhpur	AF	MIG-21 bis	FA 1	wo	1	0	0	Ap	unkn.				
930421	India	NW India	AF	jet fighter	FA	wo		0		Ap D	Vulture, Wh.-bk.	1650		- F -	
940127	India	Maharajpur AFS	AF	Mir. 2000	FA 1	wo	1	1	0	Cl D	Vulture, Wh.-bk.	560		S - -	
940419	India	S. India	AF	jet fighter	FA	wo		0		CrL D	Vulture, Wh.-bk.	330		- F -	C2251
950106	India	India	AF	MIG-21 bis	FA 1	wo	1	1	0	unkn.	unkn.				
Pakistan AF															
6705	Pakistan	Masroor AB	AF	B-57	B 2	wo	2?	0?	1+	Ap	vulture	low		P -	
870323 *	Pakistan	Rawalpindi	AF	Mirage III	FA 1	wo		0			unkn.				
940426 *	Pakistan	Sargodha AB	AF	F-16 A	FA 1	wo	1	1	+2		unkn.				
971003 *	Pakistan	Bakkar reg., Punj.	AF	CAC F-7 P	FA 1	wo	1	1	0		unkn.				
Taiwan AF															
910524 *	Taiwan	Tainin (near)	AF	F-5E	FA 2	wo	1	1	1	Cl	unkn.			- I	5135

Appendix 3 (page 2 of 2)

Date YMD	Location Where Struck	Ser- vice	Aircraft		Acc. # Persons			Flight		Altitude AGL (feet)	Parts Hit			Aircraft Serial Number
			Type	Cate- gory	Cate- gory	A	E	Kil- led	Phase/ Time		Type of Bird(s) Struck	Speed (knots)	W	
981203 *	Taiwan	AF	F-5F	FA 2	wo	2	0?	2	La	N	prob. birdstrike	[low]	[low]	5394
991015	Taiwan	AF	Mir. 2000	5Di FA 1	wo	2	2	0	Cr_	D	unkn.		- F	2053
B. Mideast														
Oman AF														
911217 *	Oman?	AF	Jaguar S	FA 2	wo	1	1	0			unkn.			207
Turkish AF														
690223 *	Turkey	AF	F-4 E	?	wo			1			eagle			
960828 *	Turkey	AF	F-4 E	FA 2	wo	2	2	0			unkn.			
C. Africa														
South Africa AF														
920215 *	S. Africa	AF	Mirage F1	AZ FA 1	wo	1	1	0			unkn.		- F	
Zimbabwe AF														
93100_ *	Zimbab. Kwekwe?	AF	Hawk T.60	T 1	wo	2	2	0	CrL?		unkn.	low		
D. South America														
Ecuador AF														
?_*	Ecuador?	AF	Kfir	FA 1	wo						unkn.			
900330 *	Ecuador	AF	Jaguar	FA 2	wo	1	1	1			unkn.		F	FAE-289?
9712__ *	Ecuador	AF	?	?	wo	2	2	2			>1			
Venezuela AF														
930405 *	Venez.	AF	Mirage 50	V FA 1	wo	1	1	0	Cr_		>1		F	FAV-2056
940420 *	Venez.	AF	F-16 B	FA 1	wo	1?	1?	0			unkn.			FAV-9581
9508__ *	Venez.	AF	F-16 A	FA 1	wo	1	1	0	Ap		unkn.	low?		

* Unofficial report of uncertain accuracy. For explanatory notes, see last page of Appendix 2.

++ The accident at Meerut, India, on 1 March 1990 reportedly killed at least 11 people on the ground. Some reports mention 50 fatalities.