

**Birdstrikes with military aircraft  
and flight altitudes of raptors  
in Germany**

**By**

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Summary

In Germany about 16% of the birdstrikes with known species were caused by raptors. Kestrels (almost exclusively recently fledged birds) were involved mainly in summer (July - Sept.), while soaring raptors caused two maxima. the first one from March to May, the second one from July to September. Most of the birdstrikes occurred in the 500 ft level, yet the absolute height maximum was 3500 ft. An observation program revealed that some species of soaring raptors regularly reach flight heights of 3000 m (approx. 10.000 ft) in spring (territorial behaviour). Flight altitude increases again in autumn before migration starts. Flight height is positively correlated with air temperature and quality of thermals, maximum height is reached around noon time. That means the risk of having a birdstrike with a buzzard or any other soaring raptor is highest at noon on days with good thermals in spring or in August/September.

Keywords: Military low level, Raptors, Statistics, Flight height

## **Introduction**

During the 15 years period from 1977 to 1991 15.6% of the birdstrikes the remains of *which 1* (Kusters) got for identification were caused by raptors (KUSTERS, 1993). Though in 1991 the minimum flight level in military low level flying in Germany had been raised from 500 ft to 1000 ft GND, this percentage did not change very much, between 1992 and 1997 it was 16.7% with a maximum of 23.3% in 1993 and a minimum of 12.7% in 1995. But what has changed is the ratio of the different raptor species. In the earlier period 10.3% of them were buzzards and only 3.2% kestrels, while after-1991 the ratio between kestrels and buzzards was even (7.8% each). In order to find out about the reasons for this change the birdstrikes with raptors have been examined with respect to their altitude, and the time of the year and of the day at which they occurred. Furthermore an investigation program has been carried out to determine the flight altitudes of several raptor species at different times of the year and under different weather conditions.

## **Birdstrikes with raptors**

From 1978 to 1997 415 remains of raptors have been identified in the German Military Geophysical Office. With 275 specimen soaring birds (buzzards, kites) were by far the majority, only 118 were falcons and 22 other species (sparrowhawk, goshawk, harrier). The monthly distribution (fig. 1) shows a two-peak curve (as any birdstrike distribution in Central Europe does) with a low spring maximum and a much higher second maximum in summer (that means much earlier than in the usual birdstrike distribution graphs, where the second maximum occurs in autumn). Separating the different ecological groups of raptors, one can see that falcons are involved in birdstrikes mainly from July to September. The reason for that is that airbases with their large buildings and extended grassland areas are ideal breeding grounds for the kestrel. So as soon as the young fledge the birdstrike rate increases dramatically because the young birds searching for food do not know about the hazard that arises from starting or landing aircraft and therefore many of them are struck on the runway. (Adult and young kestrels can easily be separated by their plumage, so we know that almost all of those that caused birdstrikes from July to September were young ones). Since birdstrikes with kestrels occurred on airfields almost exclusively, that means at very low altitudes, their numbers are not influenced by changes in the minimum altitude of low level flights, and the percentage increase is just a matter of a reduction in the total number of birdstrikes (the absolute number of birdstrikes with kestrels has decreased slightly: 6.4 per year between 1978 and 1990, 5.0 per year between 1991 and 1997).

The graph of the birdstrikes with soaring birds shows a pretty symmetric curve with a first maximum from March till May and a second one from July to September, that means during the phase of courtship and determination of the territory's boundaries and again in summer *when* the insolation provides good thermals. Despite a much higher number of buzzards in Germany during the winter months due to wintering migrators from Eastern Europe and Scandinavia the number of birdstrikes is very low in winter because by that time the birds show very little flight activity only.

On the height distribution graph of birdstrikes with soaring raptors (fig. 2) the military lowlevel flight levels 500 ft and 1000 ft show clearly (the total number on this graph is much lower than that of identified remains of buzzards and kites because in about 50% of those birdstrikes the altitude is unknown). Though flights of military aircraft in other altitudes than the low level minima are much less frequent, exactly 20% of the birdstrikes occurred at altitudes higher than 1000 ft with an absolute maximum of 3500 ft. This raised the question how high those birds usually fly.

## **Flight height of raptors**

In literature only very little information can be found on this topic. For example CRAMP & SIMMONS (1980) wrote about flight altitudes of the B117-rd (*Buteo buteo*) that low patrolling flights take place at heights of less than 50 m above ground, migration at 1- 100 m or 150 - 500 m. About the height of the most interesting part of the flight activity - the territorial behaviour (high-circling, sky-dance) - CRAMP & SIMMONS do not give any details, the only information is „dives for up to 200 m", which means that the bird must have been much higher before. According to GLUTZ von BLOTZHEIM (1989) the buzzard flies 30 to 80 m above ground, and SCHUBERT (1957) wrote „during migration 2000 m above sea level" which unfortunately does not give any information about the height above ground. So one of us (Scheller) carried out investigations about the flight altitudes of Lesser Spotted Eagle (*Aquila pomarina*), Buzzard, Red Kite (*Milvus milvus*), Marsh Harrier (*Circus aeruginosus*), Honey Buzzard (*Pernis ptilorhynchus*), and White-tailed Eagle (*Haliaeetus albicilla*). At this occasion some observations of other species were made, too (Crane - *Grus grus* -, Raven - *Corvus corax*-, White Stork - *Ciconia ciconia* - and some others). The investigations were carried out in the northern part of the state Mecklenburg-Western Pomerania in 1996 and 1997. On 41 days birds have been watched for about 10 hours per day, so any change in flight height during the day could be

registered. Best documented species with 844 observations is the Lesser Spotted Eagle, three specimen of which had been equipped with 30 g radio transmitters. In order to make height estimation easier, one time a helicopter of the German forces (Bell UH-1D) flew at defined heights above the investigators which made it possible to take the helicopter's tail fin (1.25 m) as a reference to be compared with the wingspan of the birds (Buzzard 1.13 - 1.28 m, Marsh Harrier 1.15 - 1.30 m, Lesser Spotted Eagle 1.35 - 1.6 m, Red Kite 1.75 - 1.95 m). Moreover in the investigation area there is an entry point (500 m above ground) for jet planes landing on Laage air base, so flight heights of the birds could be compared with that of landing aircraft. Weather data for correlation with flight heights of the birds were taken by the investigators and at nearby meteorological stations on Laage air base and on Wittstock range.

The results of the observations (table 1) show that there are specific differences between the raptor species with respect to maximum and favourite flight height.

Species	Height		Number of observations
	mean value (m GND)	maximum (m GND)	
Lesser Spotted Eagle	216	3000	844
White-tailed Eagle	666	3000	9
Buzzard	132	1300	157
Red Kite	93	1000	211
Marsh Harrier	61	250	35
Honey Buzzard	91	250	26
Goshawk	81	150	3
Sparrowhawk		100	2

Table 1 - Flight height of some raptor species in northern Germany

The Lesser Spotted Eagle and the White-tailed Eagle reached the greatest altitudes (sometimes perhaps even more than 3000 m) but since there were only 9 observations of the White-tailed Eagle, this species will not be considered in detail. During 39.7 hours of flight activity on 38 days of observation the Lesser Spotted Eagle spent by far most of the time (77.26%) in altitudes lower than 300 m (approx. 1000 ft). Yet the fact that more than 22% of the flight time were spent higher than 300 m and almost 4% even higher than 1000 m (table 2) proves that despite the raise of the minimum military low level flight altitudes there is still a relatively high risk of birdstrikes.

Height (m GND)	Percentage of total flight activity
≤ 50	19.96
50 - ≤ 100	33.09
100 - ≤ 300	24.21
300 - ≤ 500	10.54
500 - ≤ 1000	8.42
> 1000	3.78

Table 2 - Percentage distribution of flight height of the Lesser Spotted Eagle

The Red Kite and the Buzzard (211 resp. 157 observations) were the only other species that reached heights up to 1000 m or more, with the Red Kite flying significantly lower than the Buzzard when hunting (mean flight height 93 m- Buzzard 132 m), and even under conditions of good thermals the maximum height is lower than that reached by the Buzzard.

The mean flight height of the Buzzard fits quite good with the maximum of the birdstrikes which occurred in 500 ft (150 m).

All other raptor species flew much lower, they did not reach the low level altitude of jet planes, therefore they do not constitute a hazard en route, but during take-off and landing only. Figure 3 shows differences in the flight height of the Buzzard at different times of the day. After a first peak early in the morning (probably territorial behaviour) altitudes are lower until about noon; maximum heights are reached around noon time.

The statistics of birdstrikes with buzzards that occurred in altitudes of 500 R or higher show a clear maximum between 11 a.m. and 1 p.m. (fig. 4), that means at exactly the time when the highest flight altitudes of buzzards had been observed.

In 1996 there were no seasonal differences in the flight altitude of the Lesser Spotted Eagle from June to September (fig. 5). Yet in 1997 an unusual lot of very high flights were performed from the end of May until the beginning of June. The reason for that was that the eagles had returned from their winter quarters 14 days later than in other years and therefore many of them did not start breeding at all and were less territorial than breeding pairs are. Since those birds crossed occupied territories much more often than under normal circumstances the owners of the territories responded to this challenge with frequent high-circling to mark the borders.

In September the average flight height rises again. This is a preparation for the migration and under conditions of good thermals migration to the winter quarters starts from one of those high-circling flights one day.

Maximum flight heights of soaring raptors are negatively correlated with wind speed (the stronger the wind, the lower is the maximum flight height), precipitation, and cloud cover. A strong positive correlation exists between flight height and air temperature as well as quality of thermals (fig. 6). On days with thermal quality lower than 2 flight altitudes higher than 300 m were reached only six times, while on days with better thermals in 22 cases maximum flight height was above 300 m.

The result of those observations is that the risk of birdstrikes with soaring raptors even in flight levels higher than 1000 ft GND is highest on days with good thermals between 11 a.m. and 1 p.m. (Z) in March, April, May, August and September.

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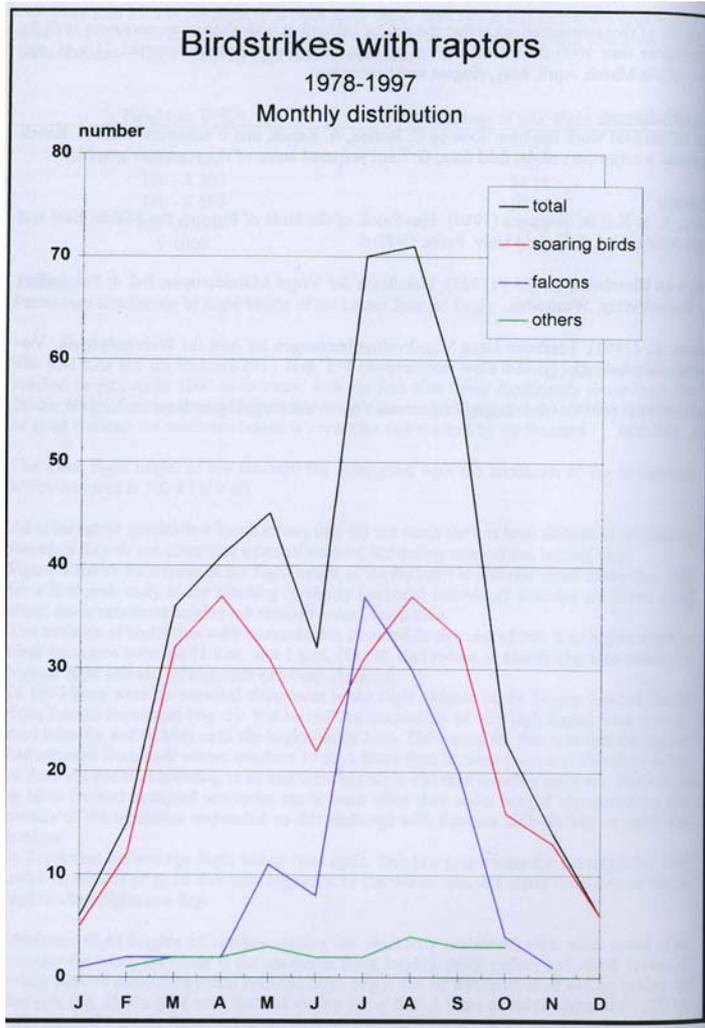


Figure 1 – Monthly distribution of birdstrikes with raptors

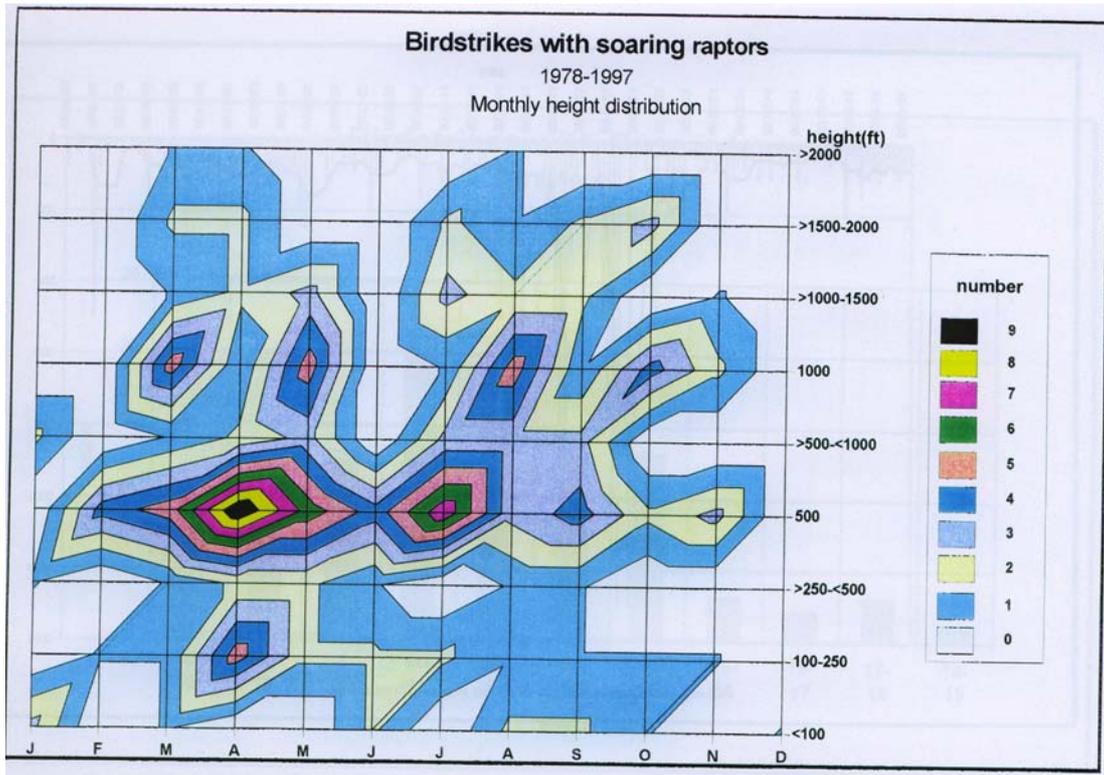


Figure 2 – Monthly height distribution of birdstrikes with soaring raptors

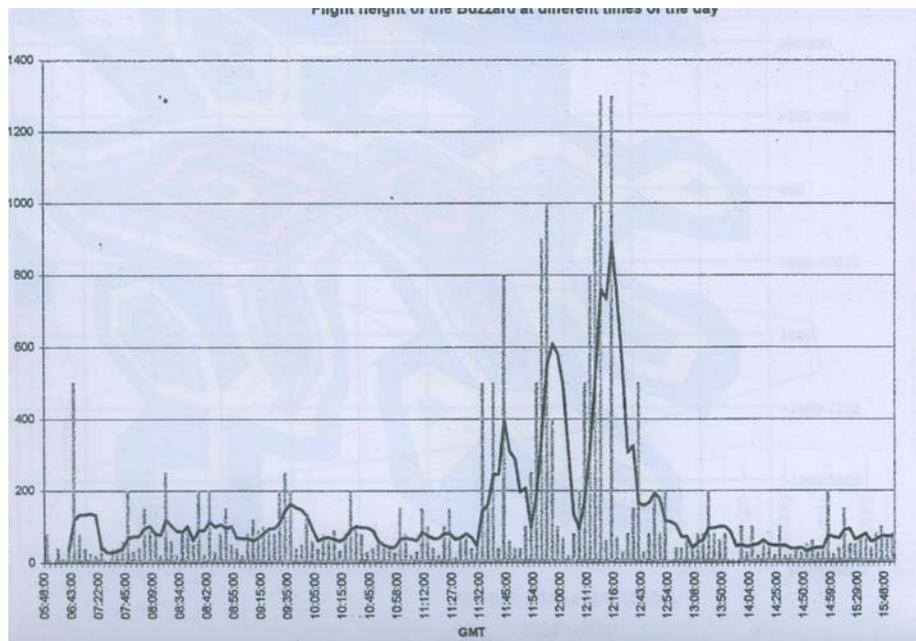


Figure 3 – Flight height of the Buzzard (*Buteo buteo*). Temporal variation during the day

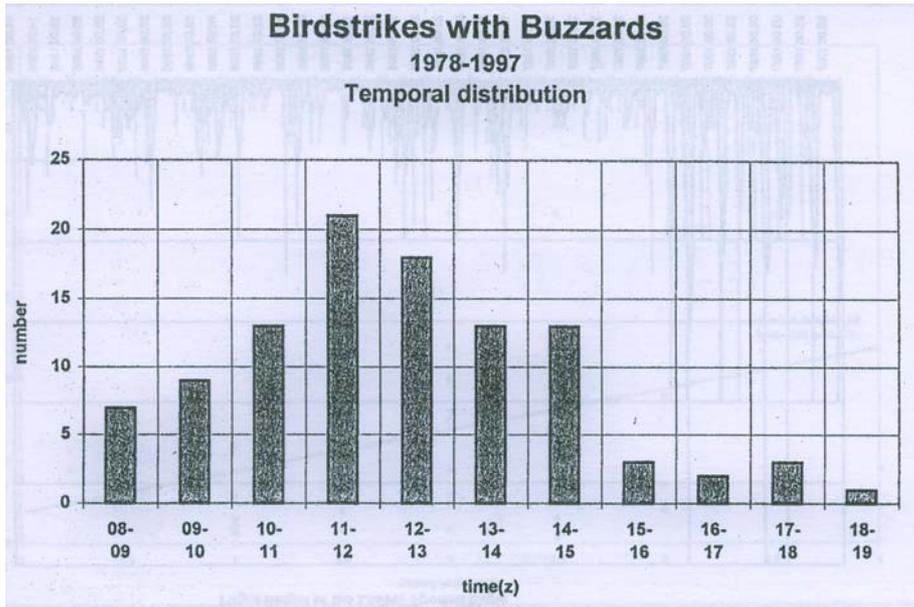


Figure 4 – Birdstrikes with the Buzzard (*Buteo buteo*). Temporal distribution

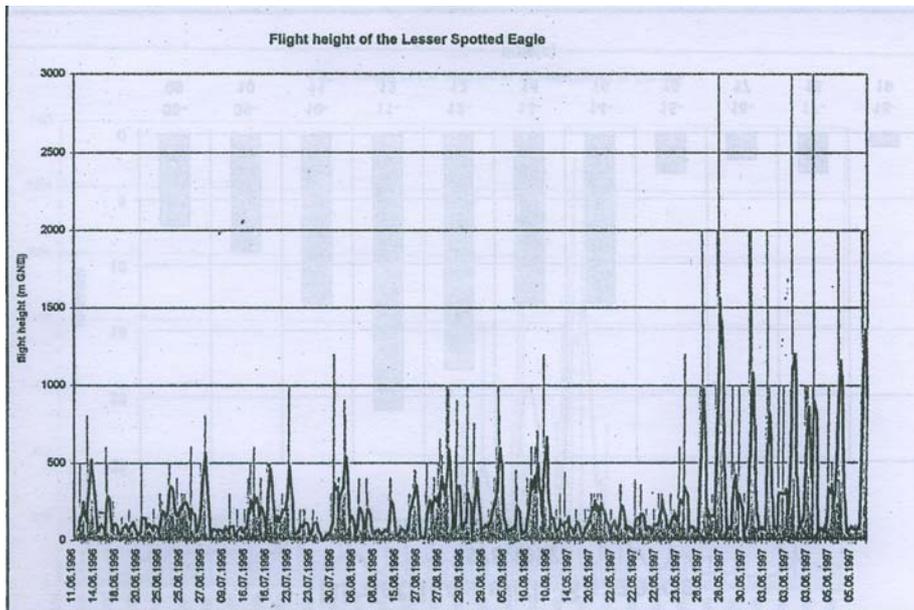


Figure 5 – Flight height of the Lesser Spotted Eagle (*Aquila pomarina*). Variation during the year.

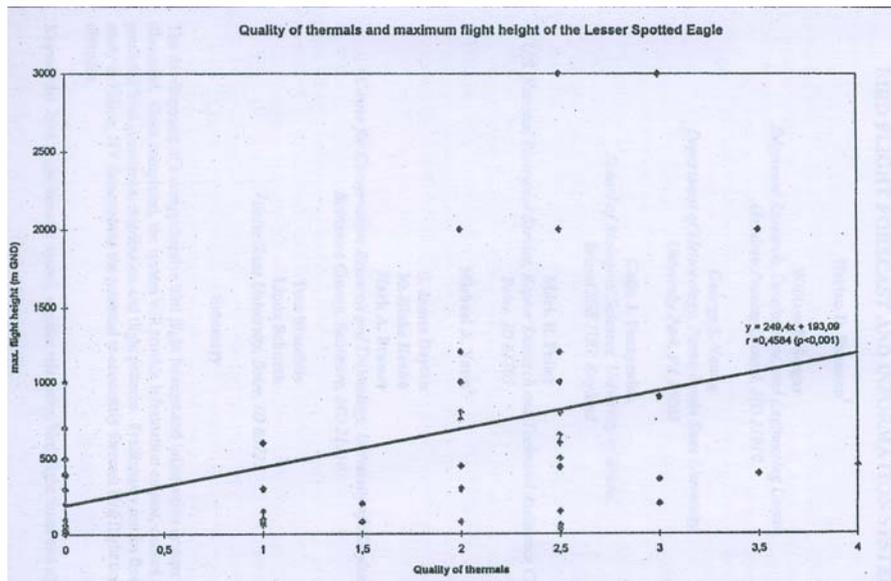


Figure 6 – Correlation between flight height of the Lesser Spotted Eagle (*Aquila pomarina*) and quality of thermals.