Use of Aircraft fleet Data Analytics to model Bird Strike threat

Aviation Wildlife Management Conference
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COMMERCIAL AIRCRAFT

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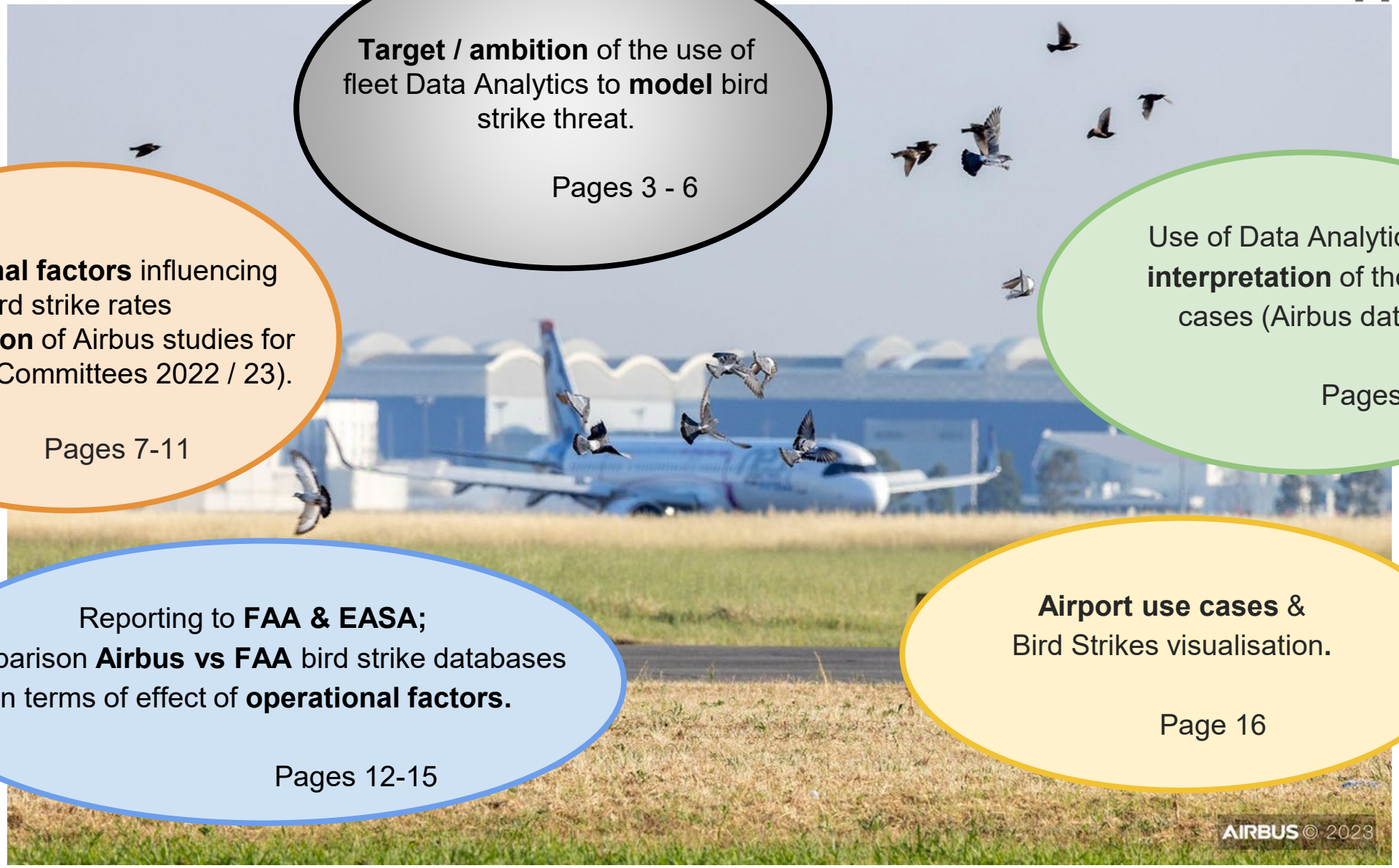

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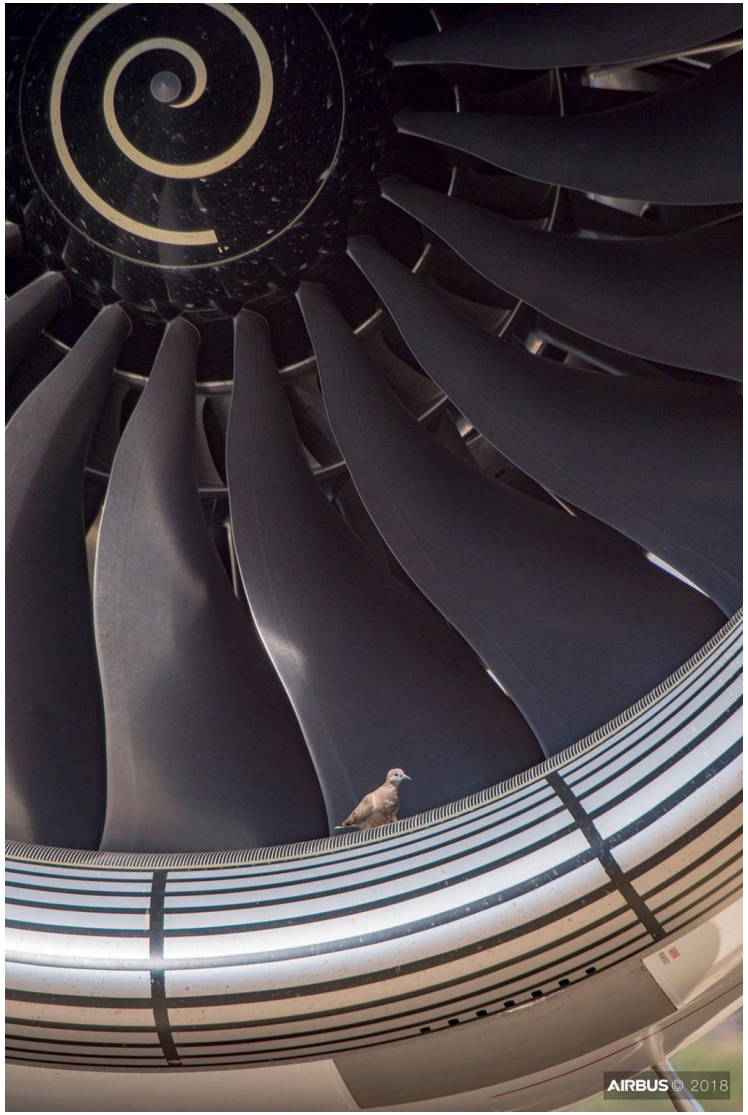
Target / ambition

- To be able to answer the questions:

  Why do some **customers** report **significantly higher bird strike rates than others** when operating in the **same airport**?

  Why do some **airports** located in the **same geographical / migratory area** report **significantly different bird strike rates**?

- To be able to provide **targeted operational recommendations** to customers / airports and to influence regulations in order to prevent bird strikes.



Target / ambition: use case examples (Europe)

country String	airport String	airport_latitu... Double	airport_longitud... Double	airport_alt... Long	airport_tz String	operator_co... String	strike_count Long	movements Long ▼	strike_rate_100k Double	airport_region String
Spain	LEBL	41.296	2.081	14	Europe/Madrid	[redacted]	1186	480220	246.970138686435380	Europe
Spain	LEBL	41.296	2.081	14	Europe/Madrid		29	60514	47.922794725187560	Europe
Spain	LEBL	41.296	2.081	14	Europe/Madrid		23	31069	74.028774662847210	Europe
Spain	LEBL	41.296	2.081	14	Europe/Madrid		45	22633	198.824724959130500	Europe
Spain	LEBL	41.296	2.081	14	Europe/Madrid		13	9530	136.411332633788050	Europe
Spain	LEBL	41.296	2.081	14	Europe/Madrid		25	8538	292.808620285781200	Europe

country String	airport String	airport_latitu... Double	airport_longitud... Double	airport_alt... Long	airport_tz String	operator_co... String	strike_count Long	movements Long ▼	strike_rate_100k Double	airport_region String
Italy	LIRF	41.798	12.247	14	Europe/Rome	[redacted]	69	171403	40.256004854057394	Europe
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Italy	LIRF	41.798	12.247	14	Europe/Rome		7	12084	57.927838464084740	Europe
Italy	LIRF	41.798	12.247	14	Europe/Rome		12	11295	106.241699867197870	Europe

Source: Airbus platform Skywise © Airbus

Note: possible bias whenever bird strike is reported upon arrival, although happened unnoticed at departure.

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Target / ambition: effect of reporting biases and data limitations

Regarding **reporting biases:**

- ➢ Biases in reporting to authorities may be **different** to biases in reporting to **aircraft or engine manufacturers**. The latter are likely to underreport minor strikes with either no damage or damage covered by **in-service manuals** (aircraft Structural Repair Manual for instance), in spite of the fact that damage might have been more significant if engine or other sensitive area had been impacted by same bird.

- ➢ The kind of **contract** in place with each aircraft or engine manufacturer may also affect the nature of the bias.

Data limitations in Airbus platform “Skywise”:

- Limited in **coverage**: only a certain percent of our customers have contractual agreements to share operational and logbook data with Airbus.
- Within this fleet coverage there are reporting biases per flight.
- **No information on bird species / weight**.

Operator	Datetime	Aircraft registration	Flight number	Defect description
OP1	01-01-2022 11:00:00	XX-XXX	XXX	BIRDSTRIKE DURING T/O RUN (LOWER RADOME) RH SIDE
OP2	01-01-2022 11:00:00	XX-XXX	XXX	BIRD STRIKE AT LANDING
OP3	01-01-2022 11:00:00	XX-XXX	XXX	BIRD STRIKE. FULL INGESTION OF BIRD IN LEFT ENGINE. CHICKEN SMELL IN FLIGHT DECK WITH NORMAL ENGINE INDICATIONS, CARCUS FOUND ON RUNWAY.
OP4	01-01-2022 11:00:00	XX-XXX	XXX	SMALL BIRD STRIKE ON ENG #2

Target / ambition: effect of reporting biases and data limitations

Data visible through Airbus platform “Skywise”:

2023 Results

- Timeframe: Jan 2019 to May 2023
- A320 & A321 aircraft type
- 2390 MSNs belonging to 13 airlines (representative sample).
- 20.6 million movements
- 25.4k bird strike instances

2024 Results

- Timeframe: Jan 2019 to Jan 2024
- A318, A319, A320 & A321 (all A320 family aircraft types)
- 7190 MSNs belonging to ~220 airlines which consistently share Logbook data with Airbus (about 71% of the fleet flight cycles).
- 70.8 million movements
- 86.4k bird strike instances

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Some Operational factors influencing Bird Strike rates

a) Time since **last runway movement.**

a) **Local time** of the day.

a) **Time of the year** (migratory habitudes).

a) **Geographical location** (migratory routes).

a) Use of aircraft mounted devices to prevent bird strikes?

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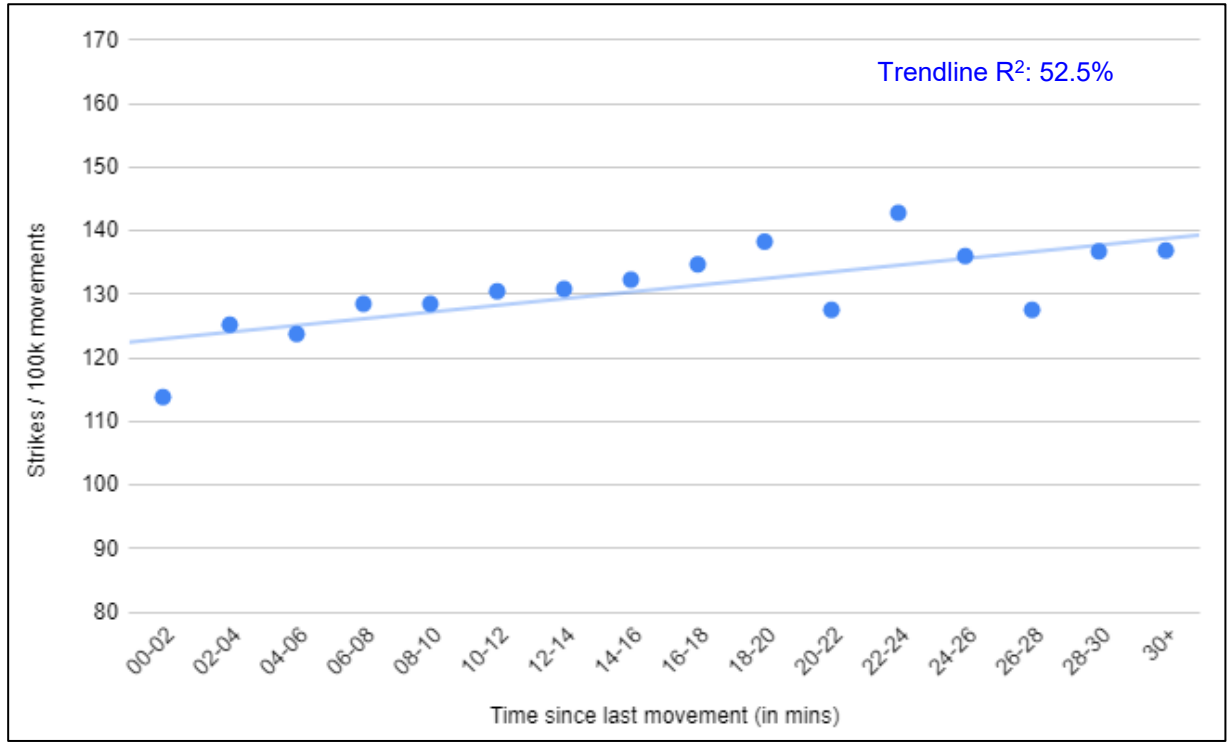
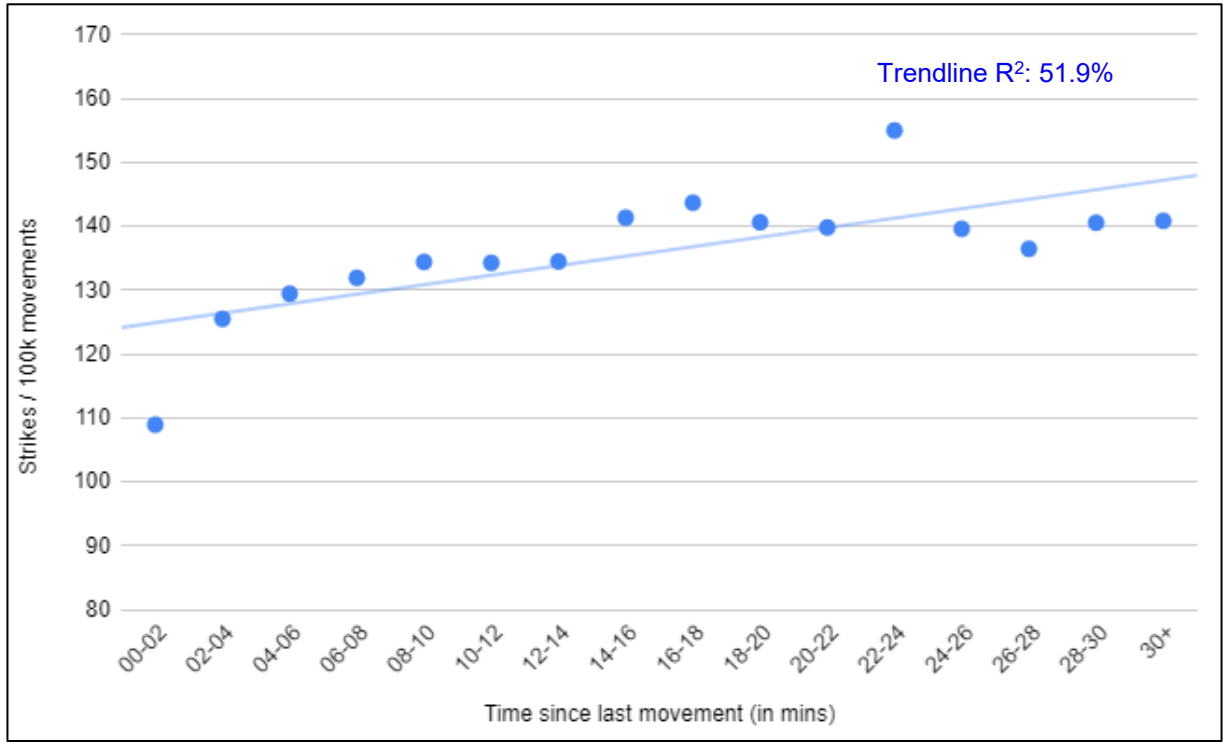
Operational factors influencing Bird Strike rates: a) Time since last runway movement

Graphs refer to Airbus study conducted on worldwide A320 family from Jan 19 to Jan 24.

Bird strike rate Vs Time since last **airport** movement (71% A320 fleet)



Bird strike rate Vs Time since last **runway** movement (55% A320 fleet)



Source: Airbus platform Skywise © Airbus

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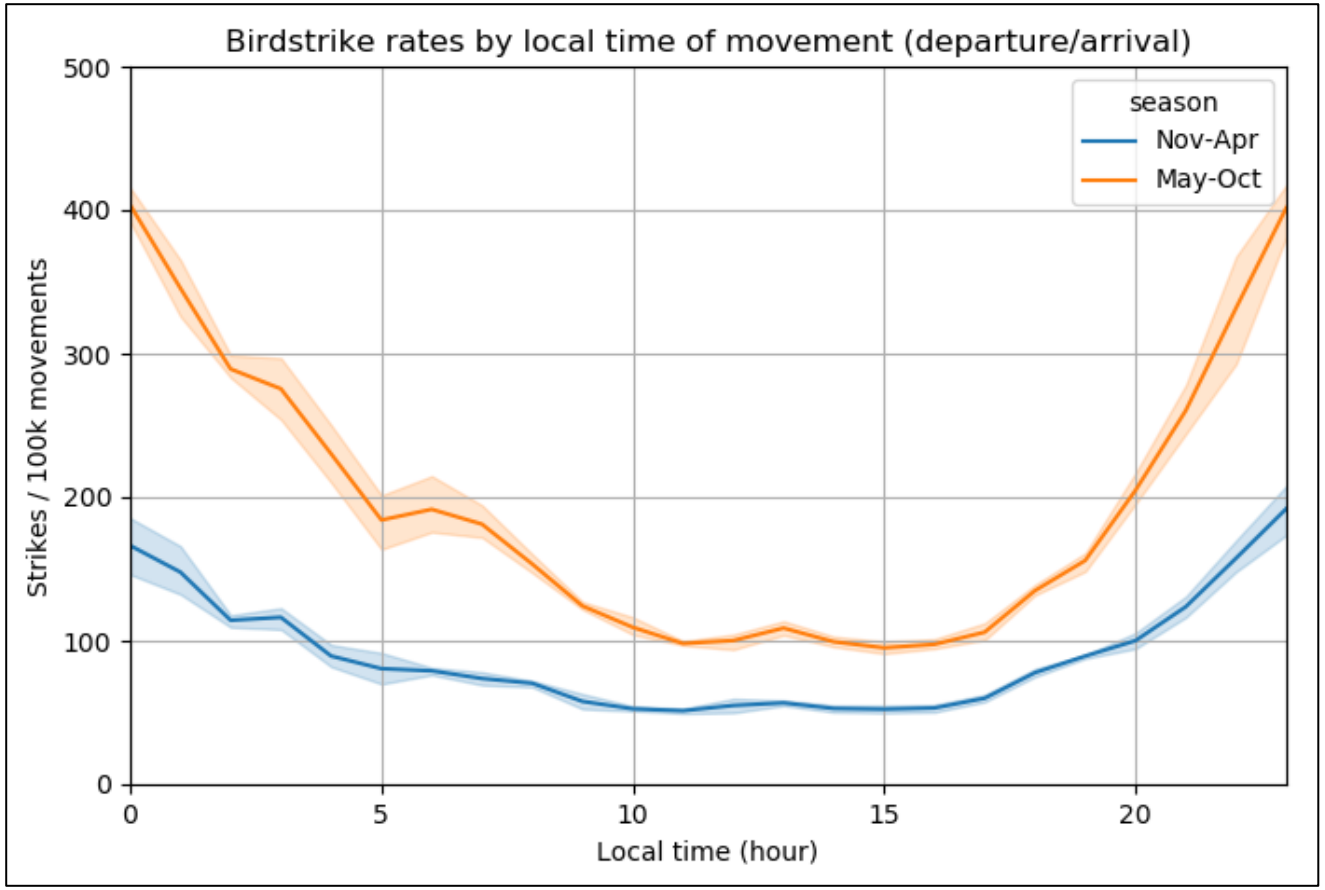
Operational factors influencing Bird Strike rates:
b) Local time of the day

Graph refers to Airbus study conducted on worldwide A320 family (about 71% of the fleet flight cycles) from Jan 19 to Jan 24.

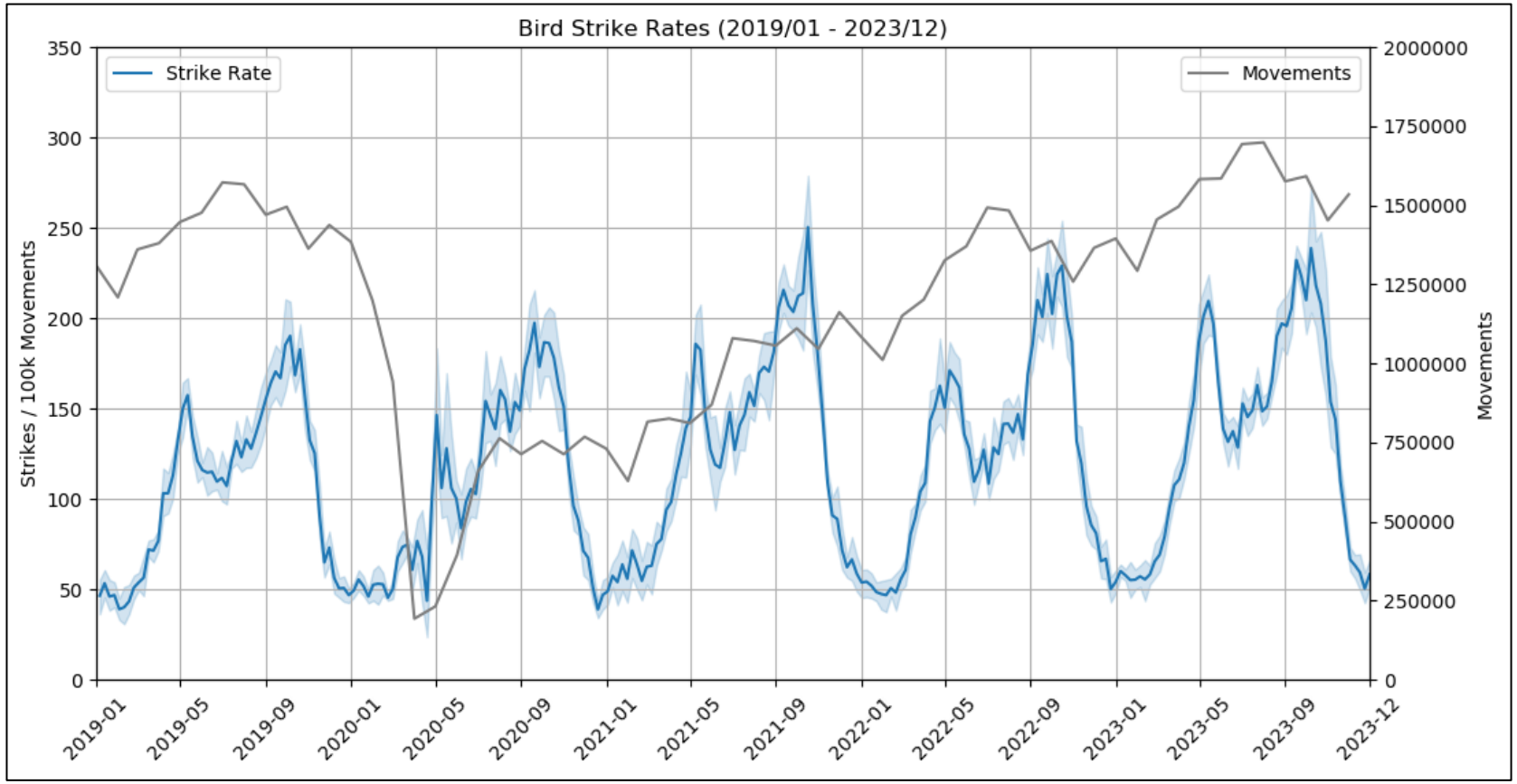


During the summer months (higher bird activity), sunrise and night slots have about x4 risk of strike vs midday slots (x3 in winter months).

Source: Airbus platform Skywise © Airbus

Operational factors influencing Bird Strike rates:
c) Time of the year

Graph refers to Airbus study conducted on worldwide A320 family (about 71% of the fleet flight cycles) from Jan 19 to Jan 24.



Source: Airbus platform Skywise © Airbus

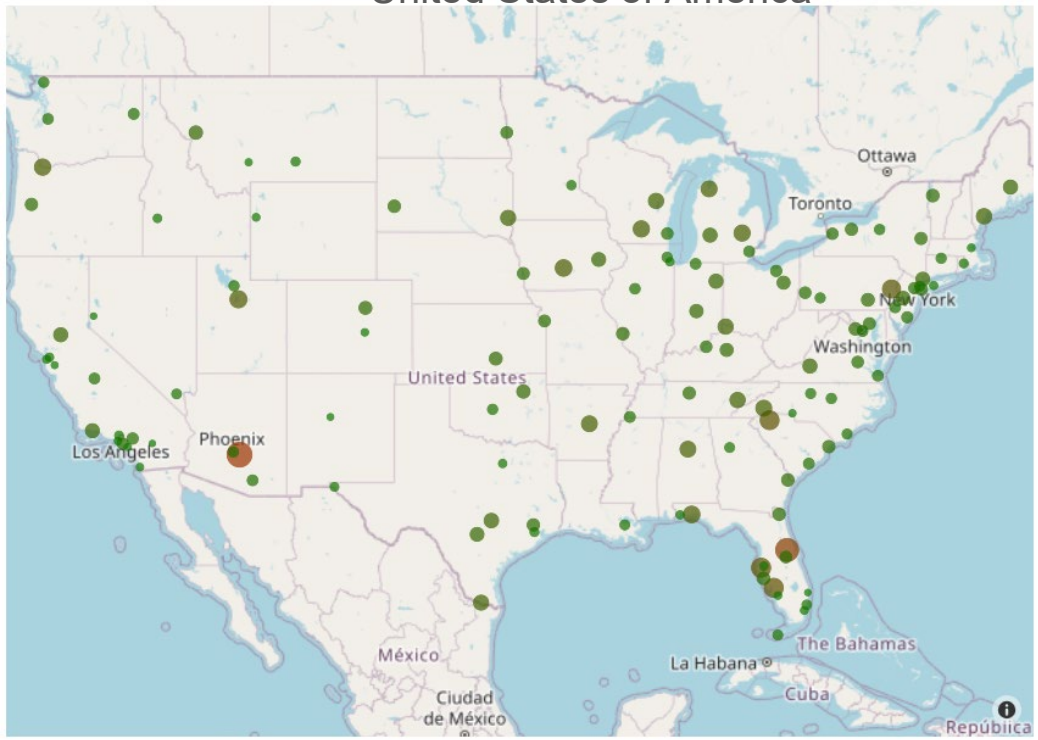
Operational factors influencing Bird Strike rates: d) Geographical location

Graphs refer to Airbus study conducted on A320 family (200 operators, about 71% of the fleet) from Jan 19 to Jan 24.

Note: Only airports with >1000 movements & >10 bird strikes are considered for the plot below.

Europe

United States of America



Source: Airbus platform Skywise © Airbus

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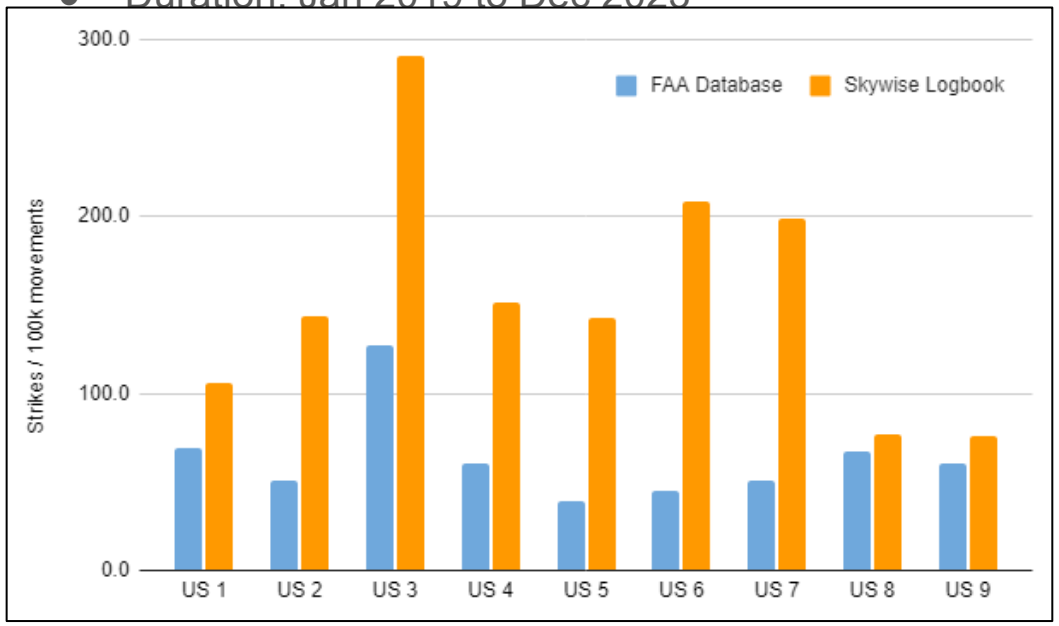
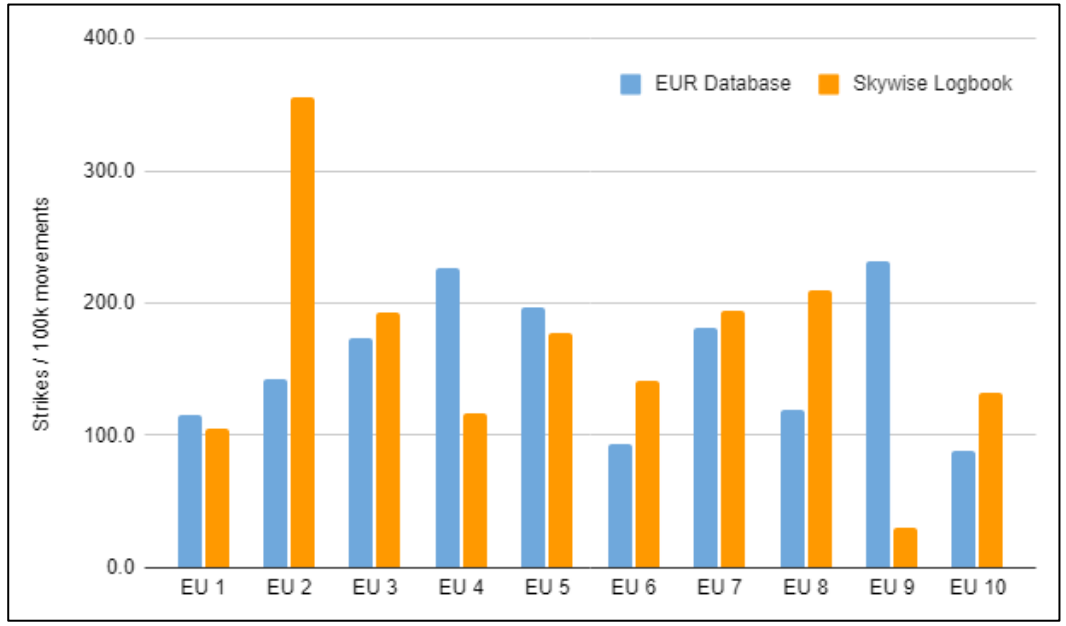
Bird strike Reporting: Airbus Skywise Logbook Vs FAA database Vs EUR database

- Population: A320 family A/C from 9 US based airlines with movements in the United States
- Duration: Jan 2019 to Dec 2023



Overall Strikes / 100k Movements: 60.7 (FAA) Vs 153.6 (Skywise)

- Population: A320 family A/C from 10 EU based airlines
- Duration: Jan 2022 to Dec 2023



Overall Strikes / 100k Movements: 140.1 (EUR) Vs 174.7 (Skywise)

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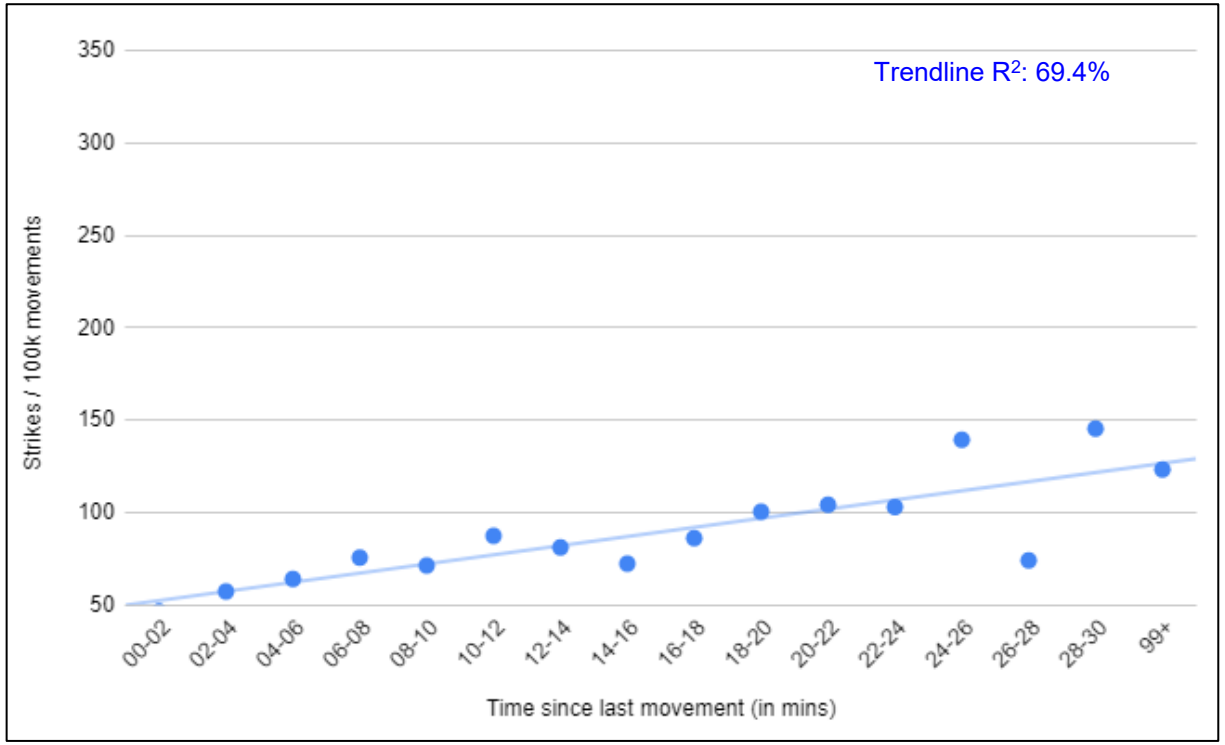
Comparison Airbus vs FAA databases in terms of effect of Time since last runway movement.

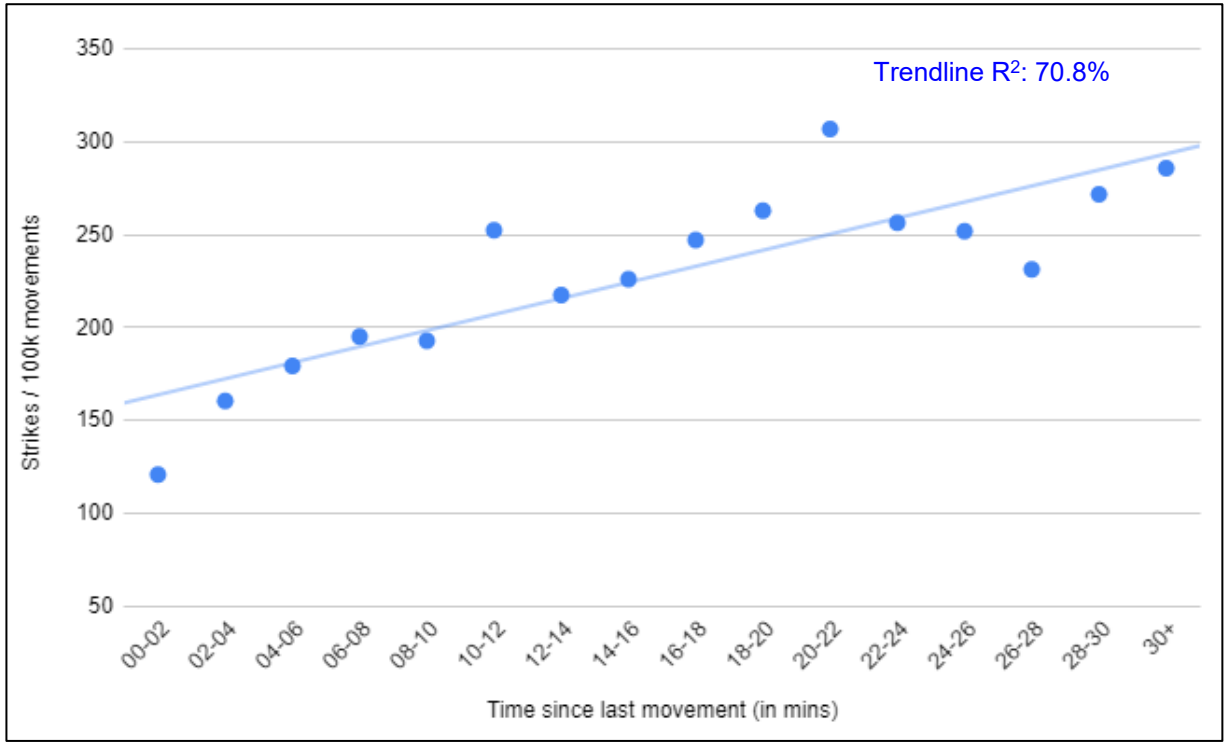
Graphs refer to Airbus study conducted on **top 9-bird strike reporting operators to FAA (A320 family** from Jan 19 to Jan 24, **US movements)**.

FAA Database



Source: https://wildlife.faa.gov/home

Airbus Skywise Logbook



Source: Airbus platform Skywise © Airbus

Tendency is visible also through analysis of FAA data, in spite of reporting differences.
Bird strike risk doubles after 20 min without runway movement.

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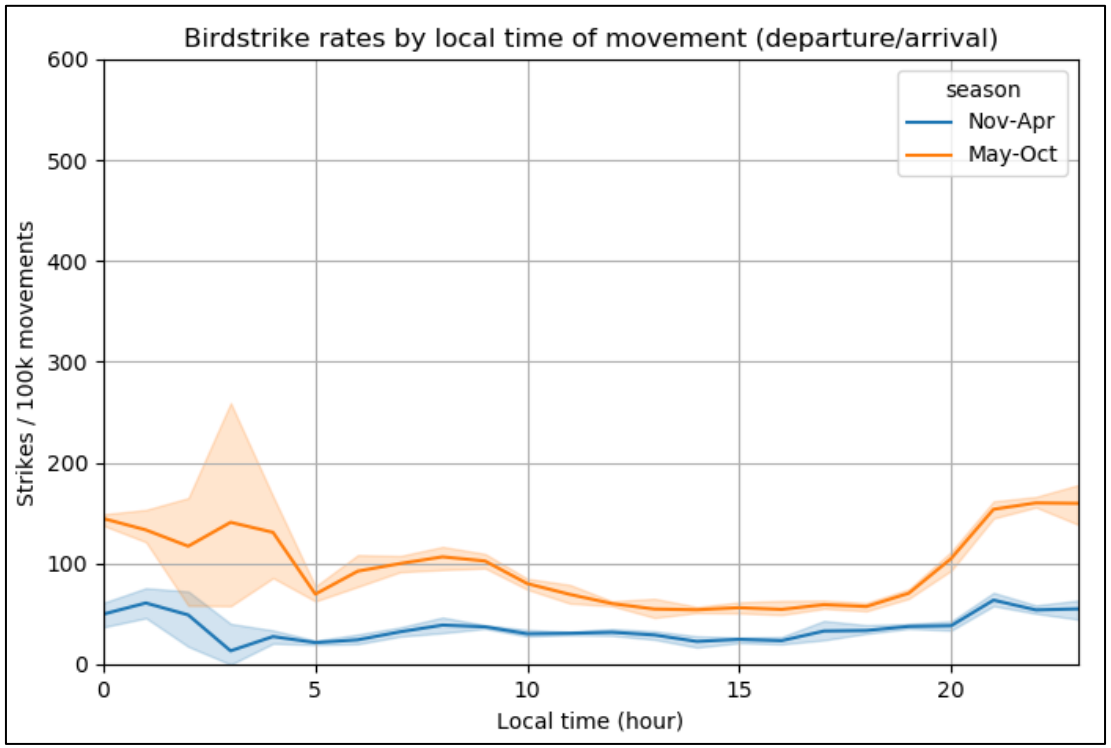
Comparison Airbus vs FAA databases in terms of effect of Local time of the day.

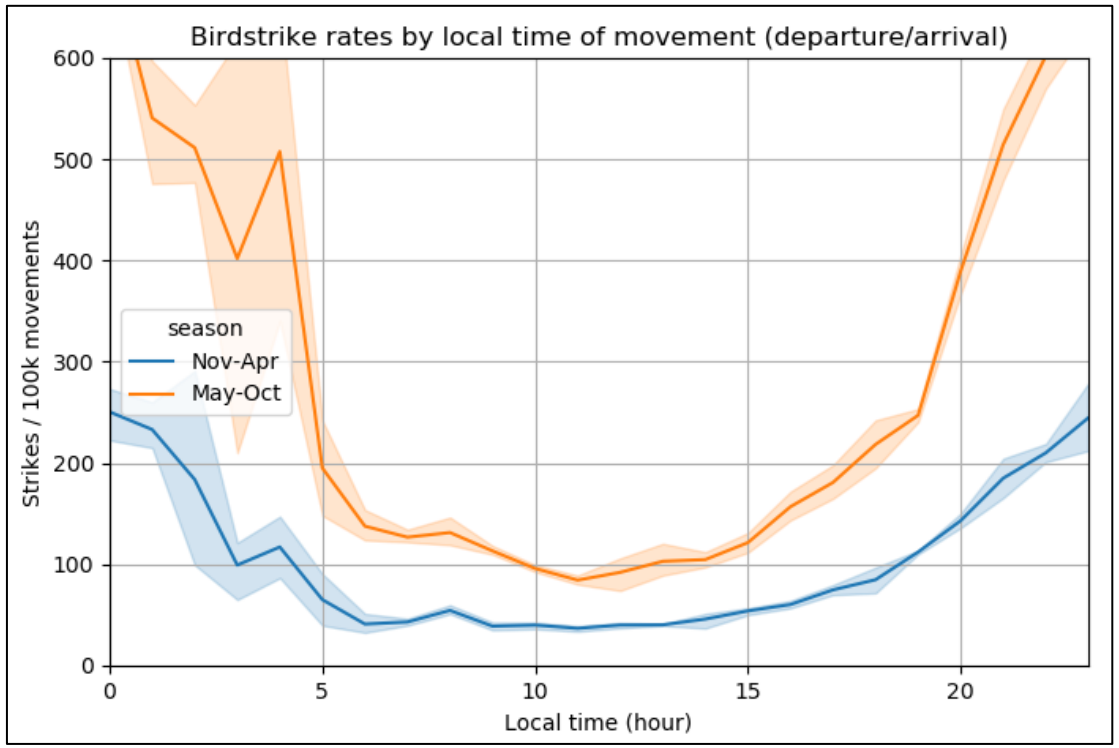
Graphs refer to Airbus study conducted on **top 9-bird strike reporting operators to FAA (A320 family** from Jan 19 to Jan 24, **US movements)**.

FAA Database



Source: https://wildlife.faa.gov/home

Airbus Skywise Logbook



Source: Airbus platform Skywise © Airbus

Tendency is visible also through analysis of FAA data, in spite of reporting differences.
Specially in summer months, bird strike risk is significantly higher in the sunrise / night slots versus midday slots.

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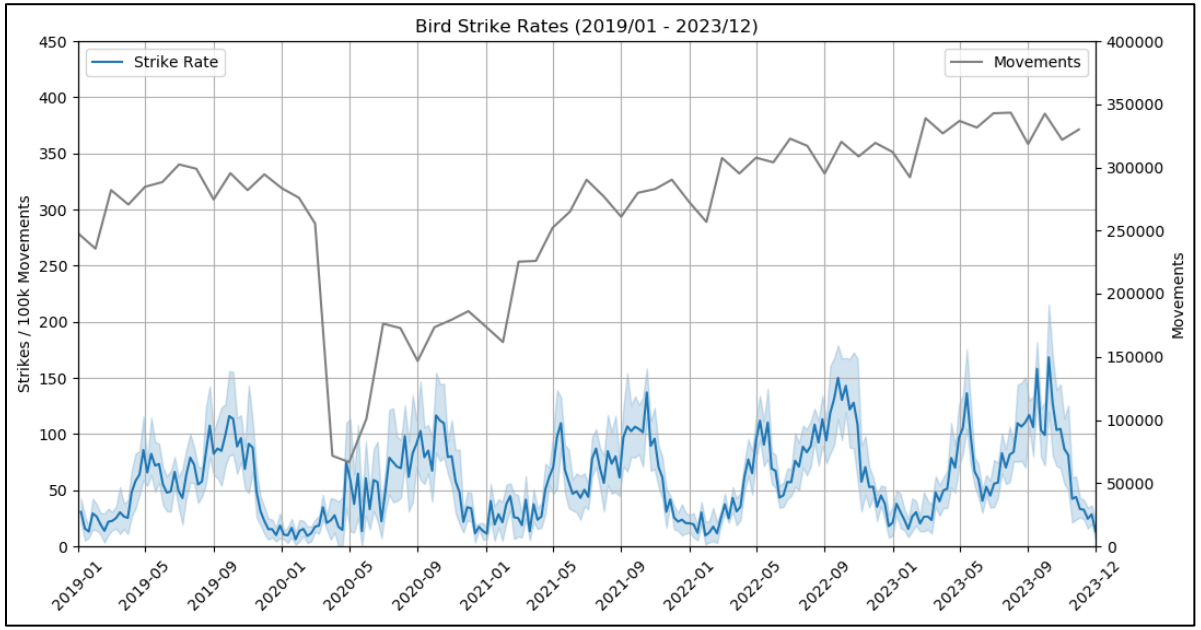
Comparison Airbus vs FAA databases in terms of effect of Time of the year.

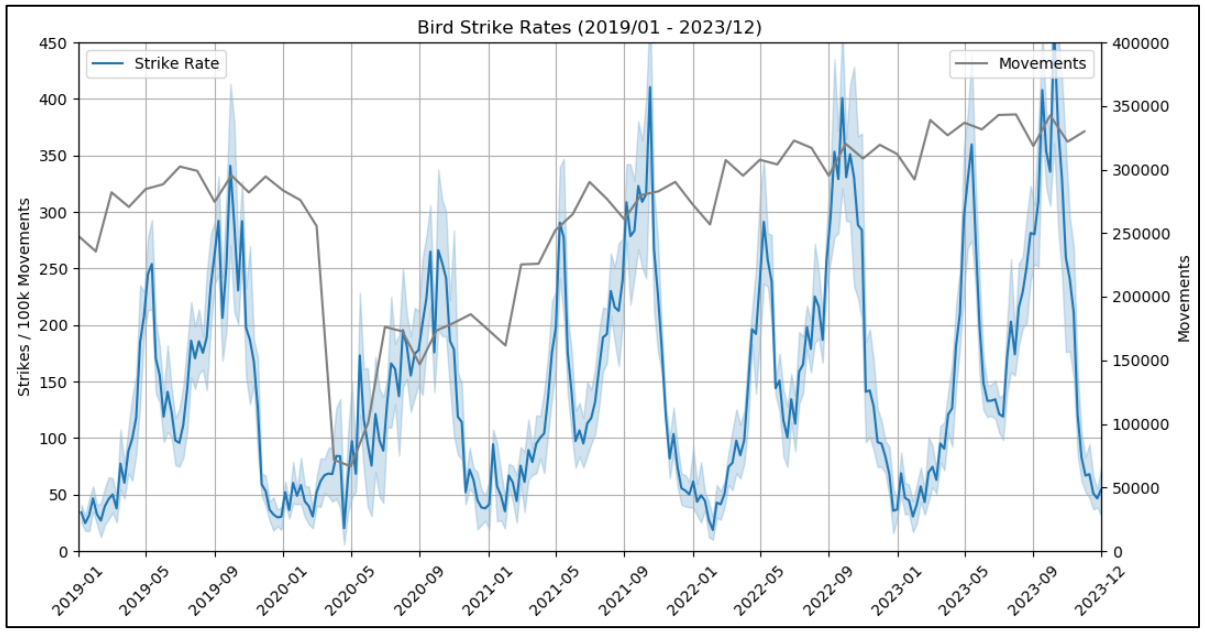
Graphs refer to Airbus study conducted on **top 9-bird strike reporting operators to FAA (A320 family** from Jan 19 to Jan 24, **US movements)**.

FAA Database



Source: https://wildlife.faa.gov/home

Airbus Skywise Logbook



Source: Airbus platform Skywise © Airbus

Tendency is visible also through analysis of FAA data, in spite of reporting differences.
In summer months, bird strike risk is significantly higher vs winter months.

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Airport use cases

- **CFM** bird strikes visualisation tool: subject of dedicated slides by **General Electric and Safran** after this presentation.

Airport use cases visible through Airbus data ("Skywise" platform), in Europe and in North America:

Country	Airport (ICAO)	Airline	Strike Count	Movements	Strikes / 100k movements
USA	KATL	A	114	95953	118.8
USA	KATL	B	160	63093	253.6

Country	Airport (ICAO)	Airline	Strike Count	Movements	Strikes / 100k movements
Spain	LEBL	A	24	31069	77.2
Spain	LEBL	B	46	22633	203.2

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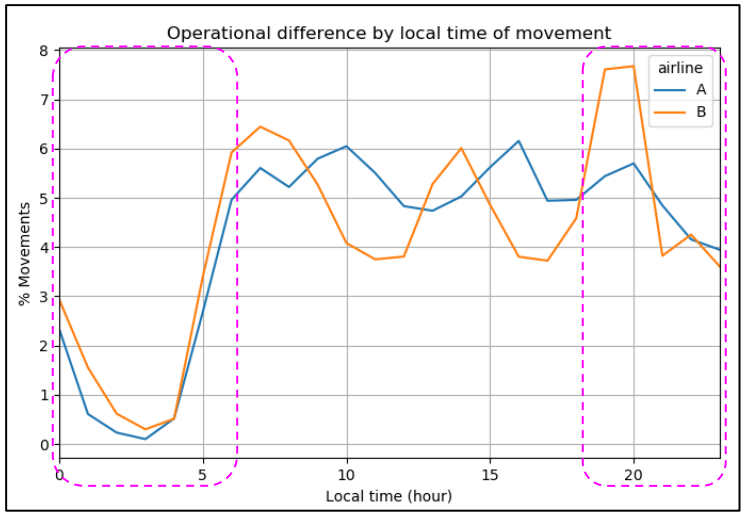
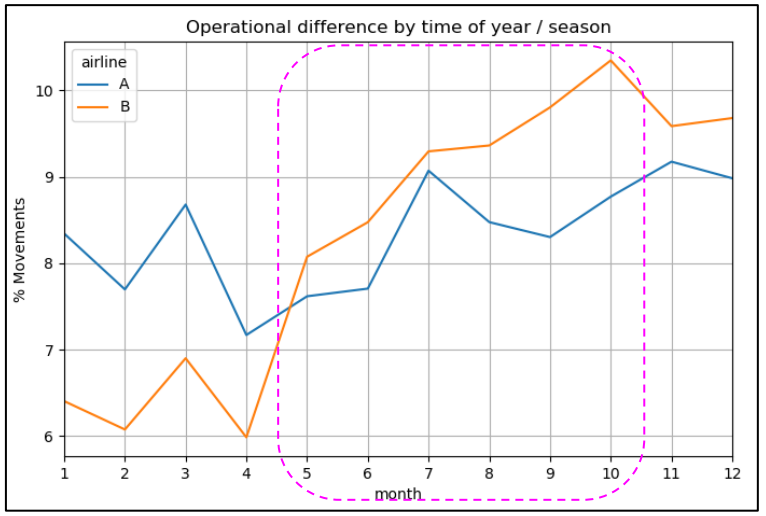
Use of Data Analytics for interpretation of the use cases: USA / KATL airport

Country	Airport (ICAO)	Airline	Strike Count	Movements	Strikes / 100k movements
USA	KATL	A	114	95953	118.8
USA	KATL	B	160	63093	253.6





Source: Airbus platform Skywise © Airbus

Airline B, with a bird strike rate double than Airline A in the same airport, is performing a higher percent of its operations during early morning / late evening time & summer months (higher risk slots & period).
Early morning operations include first operation of the day (effect of time since last runway movement).

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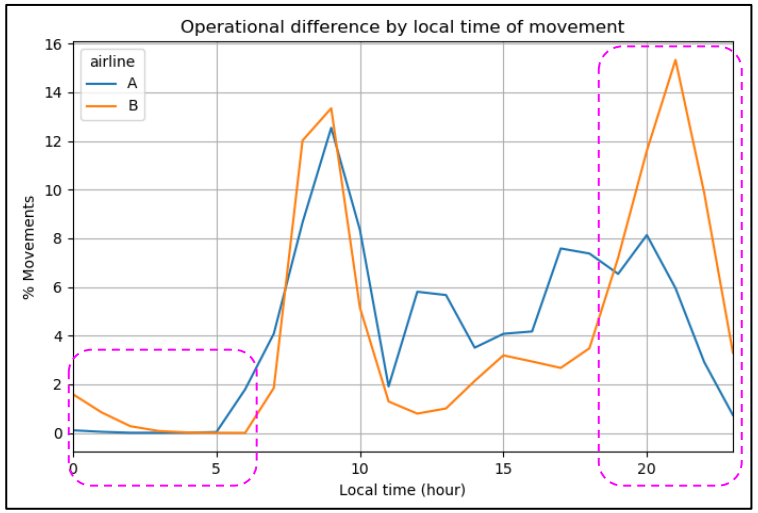
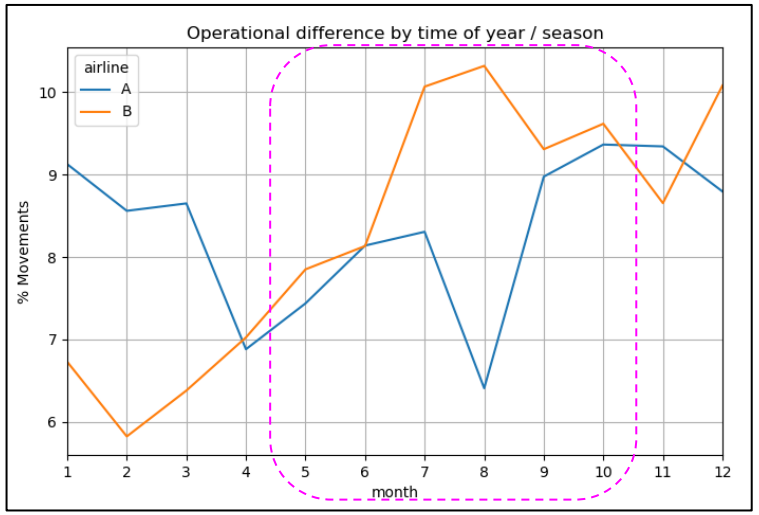
Use of Data Analytics for interpretation of the use cases: Europe / LEBL airport

Country	Airport (ICAO)	Airline	Strike Count	Movements	Strikes / 100k movements
Spain	LEBL	A	24	31069	77.2
Spain	LEBL	B	46	22633	203.2





Source: Airbus platform Skywise © Airbus

Airline B, with a bird strike rate more than double than Airline A in the same airport, is performing a higher percent of its operations during early morning / late evening time & summer months (higher risk slots / period).
Early morning operations include first operation of the day (effect of time since last runway movement).

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KEY MESSAGES / CONCLUSIONS

- From 2019, the amount of available field data allows aircraft and engine manufacturers (in addition to authorities) to perform representative **Big Data Analysis of bird strike trends**, in spite of reporting biases.

- Such Big Data Analysis show a **quantifiable influence of operational factors** on bird strike rates, notably the **Time since last runway movement**, the **Local time of the day** and the **Time of the year**.

- The question *"Why do some **customers** report **significantly higher bird strike rates than others** when operating in the **same airport**?"* may partially be answered sometimes, based on Data Analysis, in terms of: "Because these customers **operate differently** in the airport".

- Based on the above, the future of Bird Strike Data Analysis might be oriented to the **development of operational recommendations** to reduce strike rates.

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We pioneer sustainable aerospace for a safe and united world

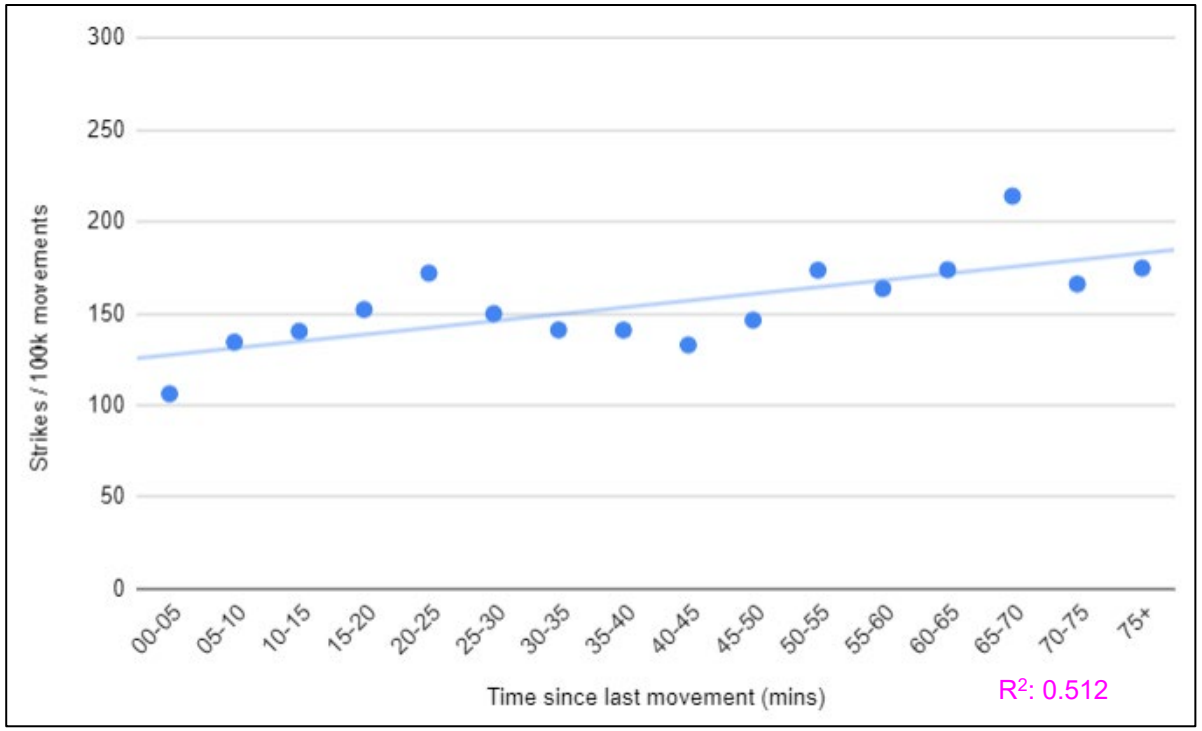
Thank you

Bird Strike risk: effect of time since last movement

Post-covid air traffic recovery: **time since last runway movement** is a **measurable key risk factor**.
Reactivation of smaller regional airports with low density of movements + big airport hubs still not at full occupation of slots may contribute to this parameter.

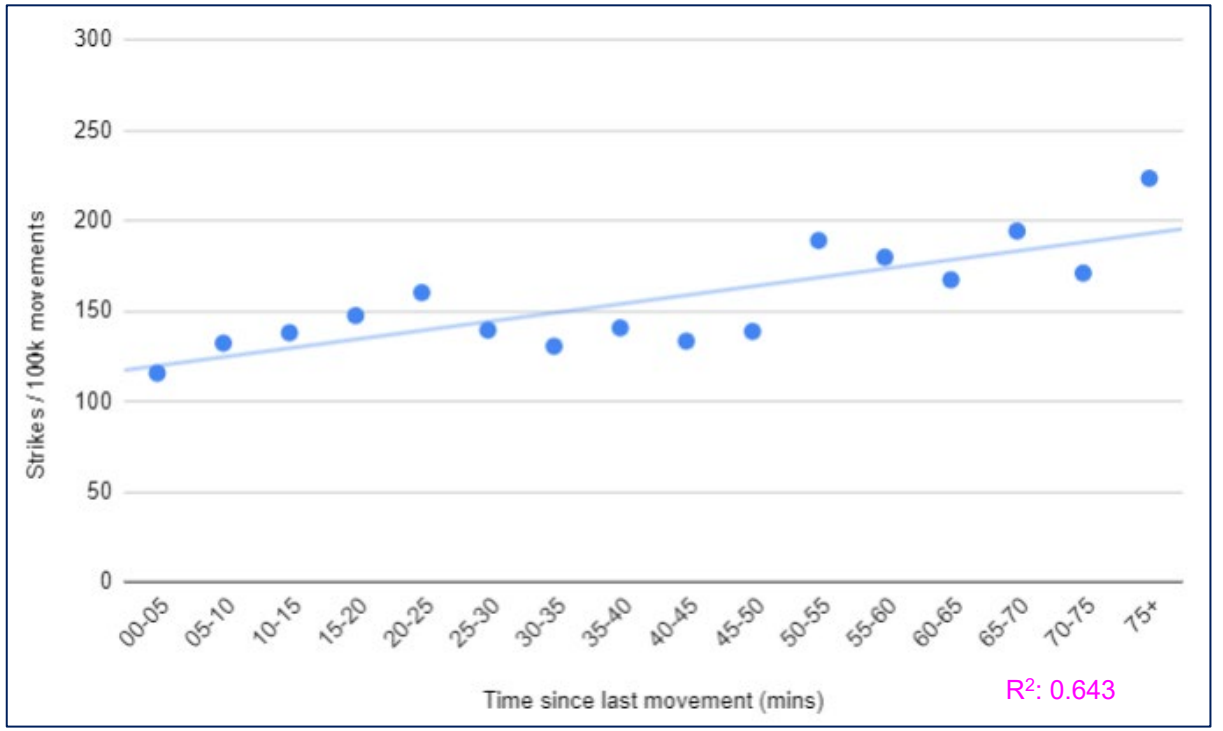
Graphs refer to Airbus study conducted on A320 and A321 fleets for 13 worldwide operators from Jan 19 to May 23.

Bird strike rates vs time since last **runway** movement



Source: Airbus platform Skywise © Airbus

Bird strike rates vs time since last **airport** movement



Source: Airbus platform Skywise © Airbus

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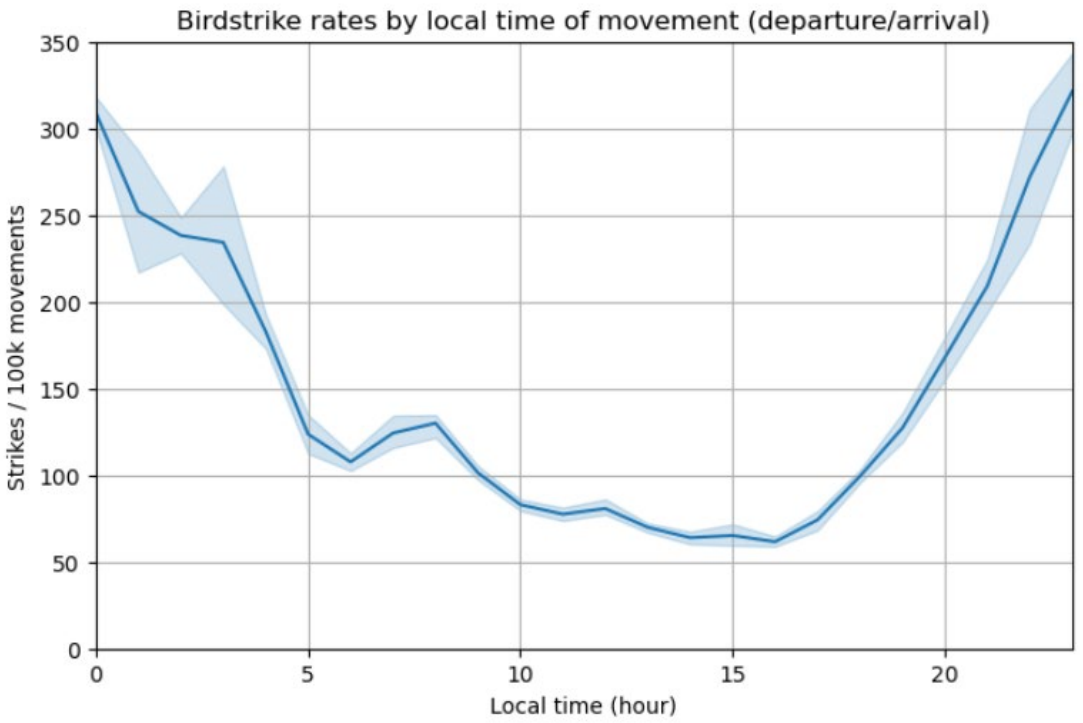
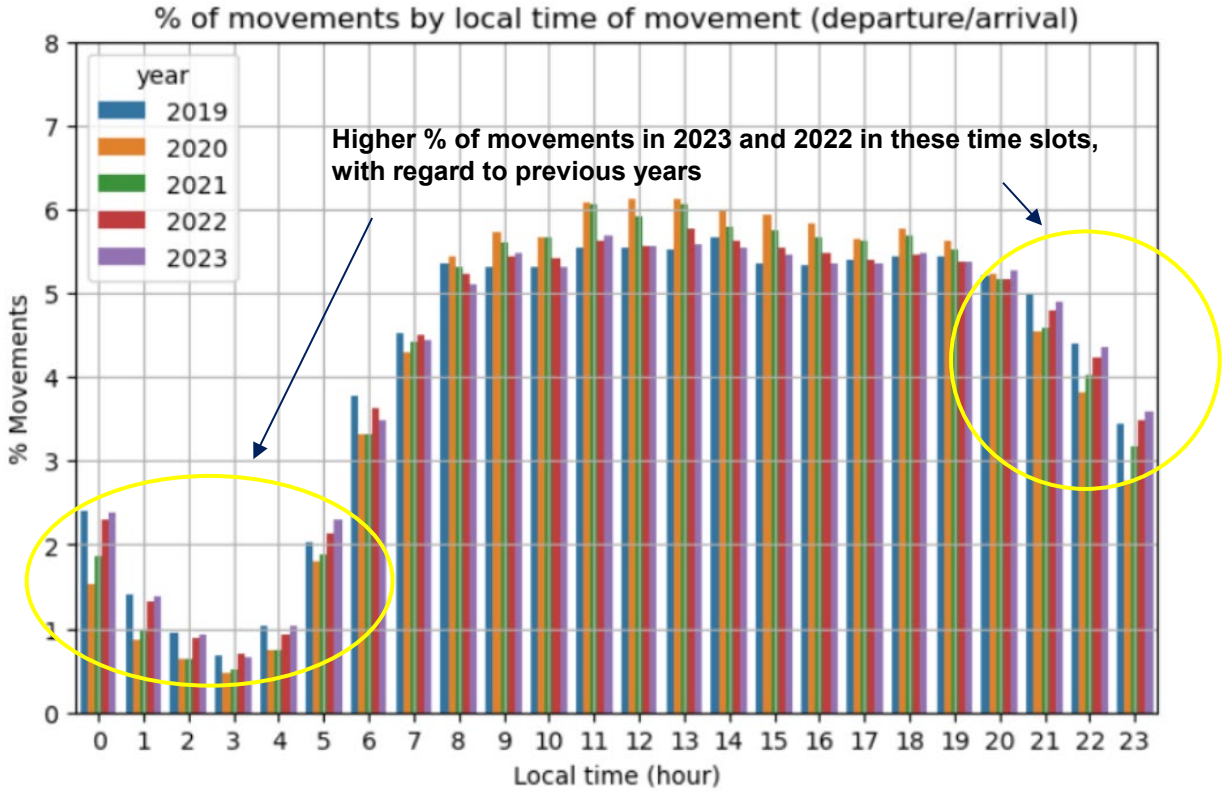
Bird Strike risk: effect of time of the day

Post-covid air traffic recovery: **time of the day** has also been identified as a **measurable key risk factor**.
Repopulation of airport slots after covid extends operations towards the sunrise/night slots, which have a higher risk of bird strike (less visibility / movement around airports, peak of birds activity just before sunrise).

Graphs refers to Airbus study conducted on A320 and A321 fleets for 13 worldwide operators from Jan 19 to May 23.



Source: Airbus platform Skywise © Airbus



Source: Airbus platform Skywise © Airbus

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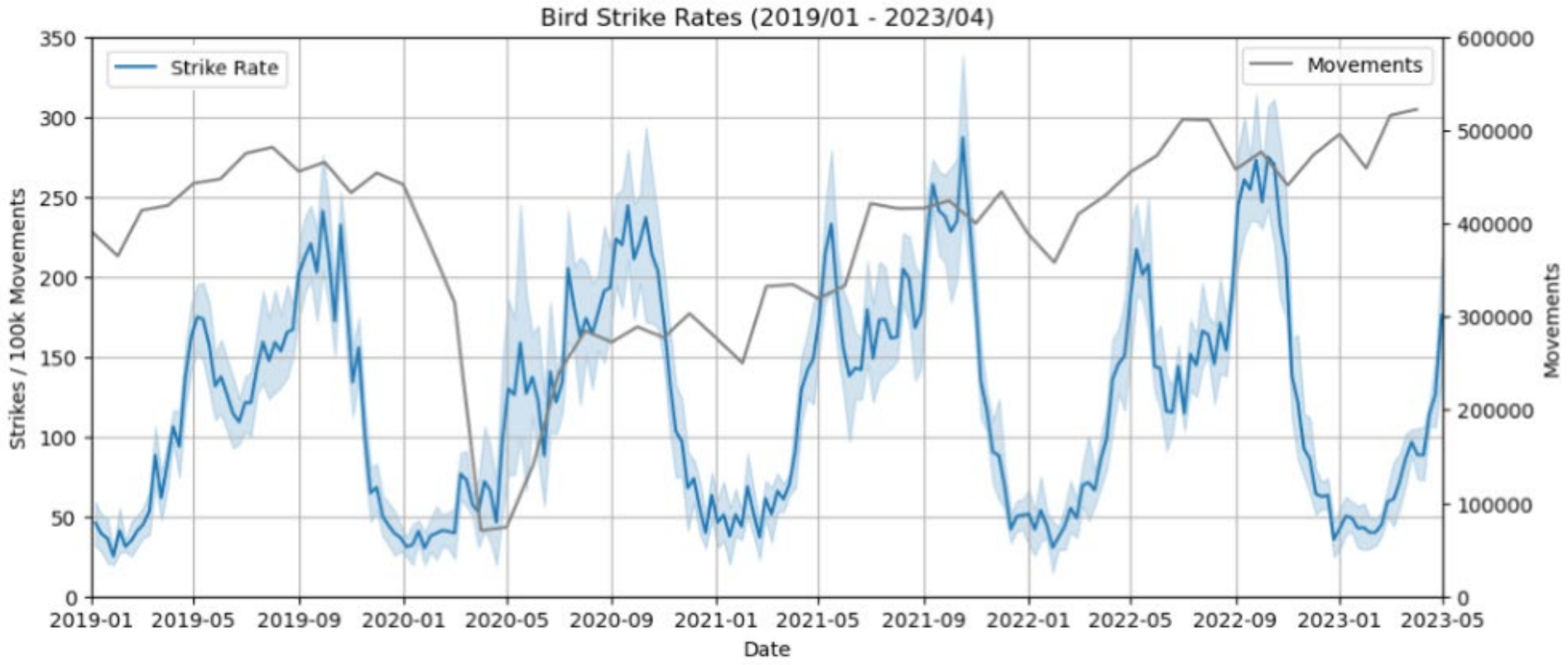
Bird Strike risk: climate change and migratory habitudes

Climate change aspects: date of the year is **one of the main measurable factors** influencing bird strike rates.
Modification of migratory **habitudes** (moment of migration start) may expose to higher risk airports unprepared for it.

Graphs refer to Airbus study conducted on A320 and A321 fleets for 13 worldwide operators from Jan 19 to May 2023.



Source: Airbus platform Skywise © Airbus

Bird Strike risk: climate change and aircraft exposure

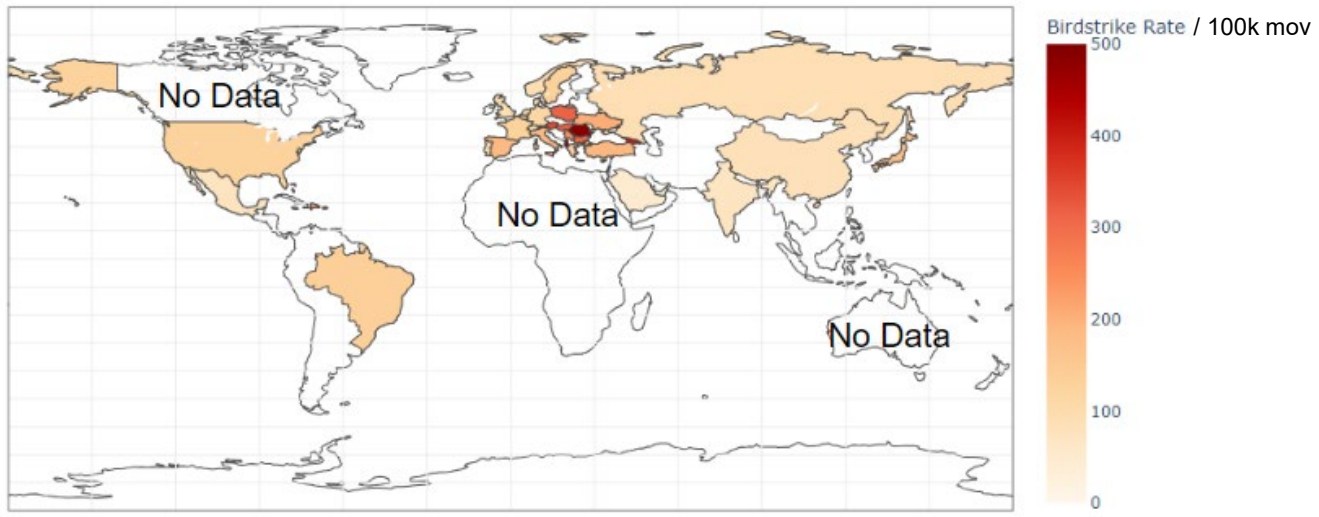
Climate change aspects: Aviar species of **bigger size** are in better position against climate challenge.

Graphs refer to Airbus study conducted on A320 and A321 fleets for 13 worldwide operators from Jan 19 to May 23.

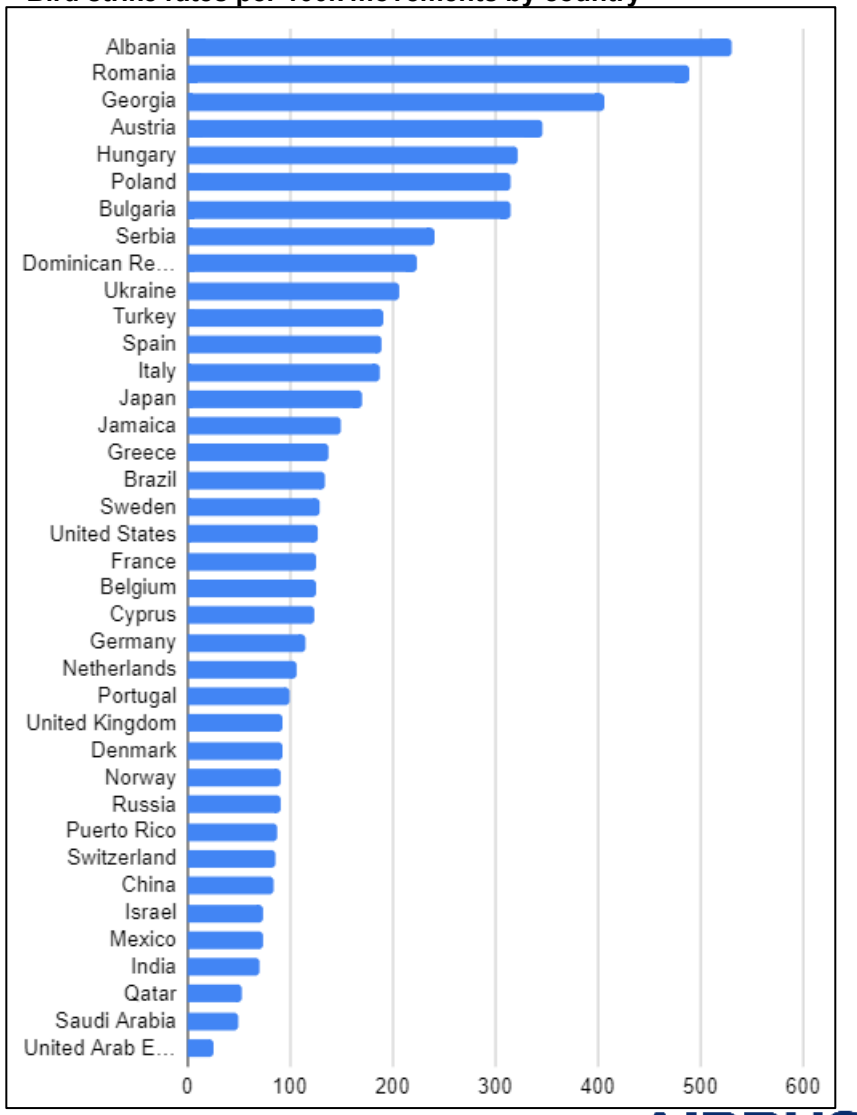
Geographical aspects: Eastern Europe, on one of the main migratory routes between Scandinavia and Africa, presents the highest strike rates.

Note: Data in Eastern Europe limited to one operator, using small regional airports with limited wildlife prevention means.

Source: Airbus platform Skywise © Airbus



Bird strike rates per 100k movements by country



Source: Airbus platform Skywise © Airbus

Use of fleet Data Analytics to model Bird Strike threat, August 2024 © Airbus Operations

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