Bird Strike Risk & Safety Impact Analysis Report (2000–2011)

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1. Installation and Setup

1.1 Tools Used

- **PostgreSQL**: Manual creation of a bird strike relational database and insertion of real data.
- **Power BI Desktop**: Built a multi-page interactive dashboard using DAX for KPI calculations.
- **CSV Dataset**: ~7MB original dataset processed and normalized using SQL queries.

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2. Database Structure and SQL Implementation

2.1 Key Table: `bird_strikes`

Manually created and loaded with data having 25K+ records across key fields:

```
CREATE TABLE bird_strikes (
    record_id INT PRIMARY KEY,
    aircraft_type VARCHAR(50),
    airport_name VARCHAR(100),
    altitude_bin VARCHAR(50),
    aircraft_model VARCHAR(100),
    wildlife_number_struck_actual INT,
    wildlife_number_struck_label VARCHAR(50),
    effect_impact_to_flight VARCHAR(100),
    flight_date DATE,
    effect_indicated_damage VARCHAR(50),
    number_of_engines INT,
    airline_operator VARCHAR(100),
    origin_state VARCHAR(50),
    phase_of_flight VARCHAR(50),
    precipitation_condition VARCHAR(50),
    remains_collected BOOLEAN,
    remains_sent_to_smithsonian BOOLEAN,
    wildlife_size VARCHAR(20),
    sky_condition VARCHAR(50),
    wildlife_species VARCHAR(100),
    pilot_warned VARCHAR(1),
    total_cost INT,
    feet_above_ground INT,
    number_injured INT,
    is_aircraft_large BOOLEAN
);
```

2.2 Sample Insertion

```
INSERT INTO bird_strikes VALUES (
    202152, 'Airplane', 'LAGUARDIA NY', '> 1000 ft', 'B-737-400', 859, 'Over
100',
    'Engine Shut Down', '2000-11-23', 'Caused damage', 2, 'US AIRWAYS', 'New
York',
    'Climb', 'None', FALSE, FALSE, 'Medium', 'No Cloud', 'Unknown bird -
medium',
    'N', 30736, 1500, 0, TRUE
);
```

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3. DAX Calculations Used

3.1 %StrikesWithDamage

```
%StrikesWithDamage =
DIVIDE(
    COUNTROWS(FILTER('Bird Strikes', 'Bird Strikes'[Effect: Indicated Damage]
= "Caused damage")),
    COUNTROWS('Bird Strikes')
) * 100
```

3.2 %StrikesWithWarning

```
%StrikesWithWarning =
DIVIDE(
    COUNTROWS(FILTER('Bird Strikes', 'Bird Strikes'[Pilot warned of birds or
wildlife?] = "Y")),
    COUNTROWS('Bird Strikes')
) * 100
```

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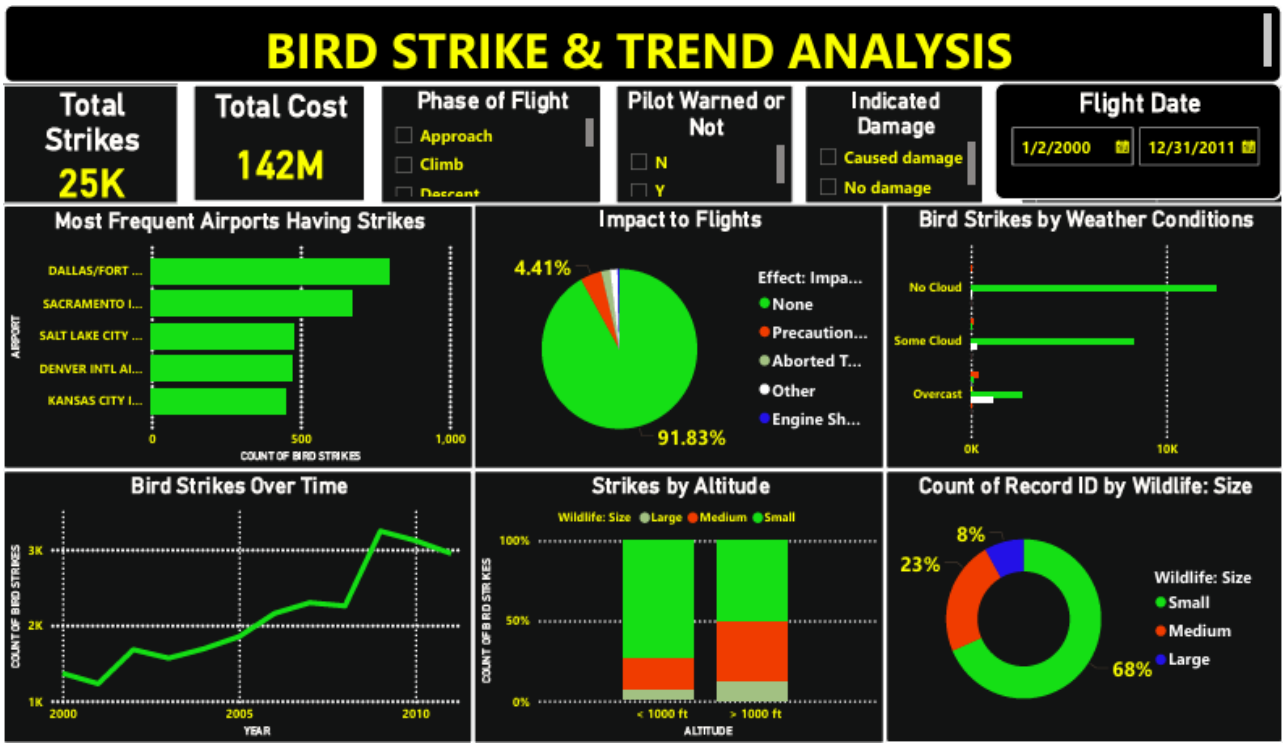
4. Dashboard Analysis and Recommendations

Dashboard 1: Bird Strikes & Trend Overview

Key Metrics:

- **Total Strikes**: 25K+
- **Total Cost**: $142 million
- **Top Impact Types**: 91.83% had no impact, 4.41% precautionary landing or engine shutdown
- **Altitude Distribution**: Majority occurred **< 1000 ft**
- **Wildlife Size**: 68% Small, 23% Medium, 8% Large



Insights:

- Vast majority of strikes occur at low altitudes, particularly during **landing or climb** phases.
- Smaller wildlife species dominate total incidents.
- Most common affected airports: Dallas/Fort Worth, Sacramento Intl, Salt Lake City, Denver.
- Cloudy weather slightly increases frequency.

Recommendations:

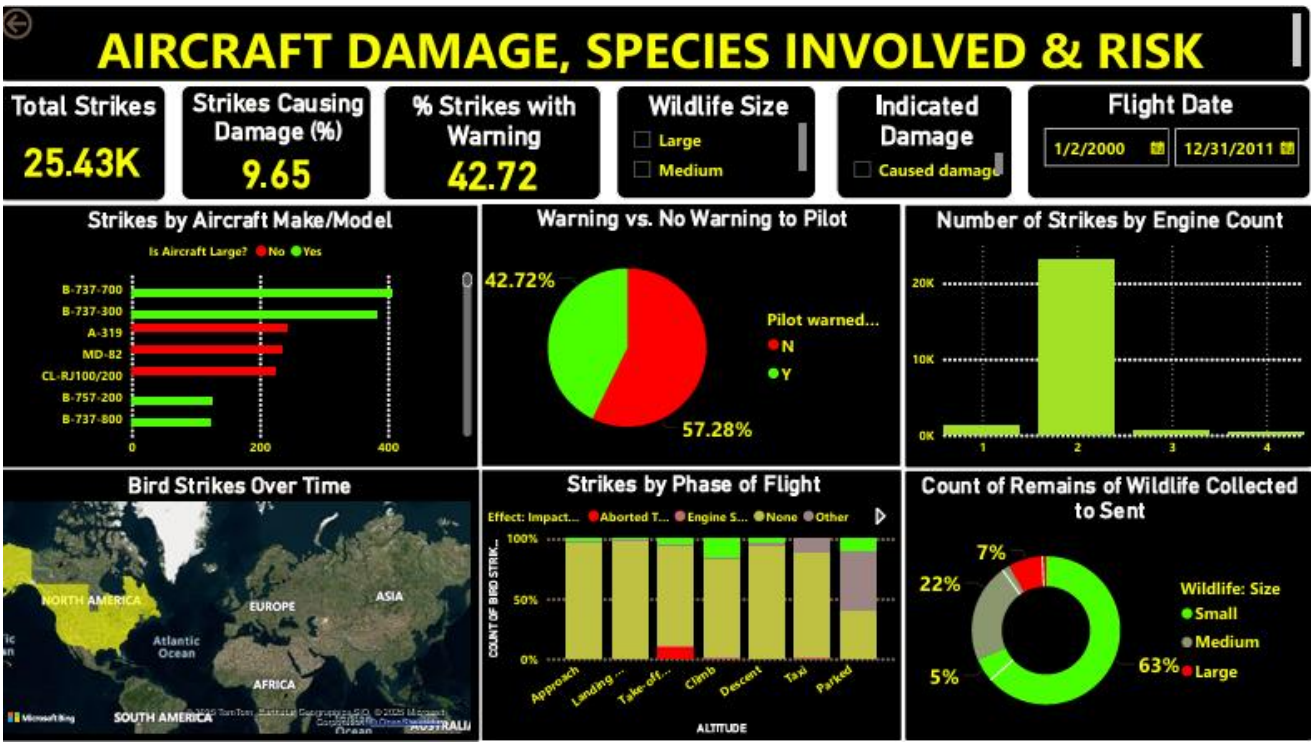
1. Enhance radar or avian detection systems during climb/landing below 1000 ft.
2. Focus mitigation on smaller species through targeted deterrents.
3. Install wildlife warning systems in top 5 affected airports.
4. Review airside bird-control operations during cloud coverage.
5. Create altitude-based response protocols for pilot warnings.

Dashboard 2: Aircraft Damage, Species & Operational Risk

Key Metrics:

- **% Strikes Causing Damage**: 9.65%
- **% With Pilot Warning**: 42.72%

- **Frequent Models Affected**: B-737, MD-82, A-319
- **Damage Types**: Engine shutdown and aborted takeoffs noted
- **Aircraft Type**: 61% of large aircraft reported strikes
- **Engine Counts**: 2-engine planes were most affected



Insights:

- Less than half the pilots received bird/wildlife warnings pre-strike.
- Higher damage is associated with engine-heavy commercial aircraft.
- Remains collection rate is low (~22% sent to Smithsonian), impacting species study.
- Bird sizes correlate with severity (larger → more likely to damage).

Recommendations:

1. Increase real-time alerts to pilots about wildlife presence.
2. Improve engine shielding or maintenance protocols for twin-engine jets.
3. Ensure systematic remains collection for accurate species risk profiling.
4. Train ATC staff on species-related risk and behavioral triggers.
5. Implement reporting mandates for failed or bypassed wildlife alerts.

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5. Strategic Risk Review and KPIs

Metric	Value
Total Strikes	25,430
% With Indicated Damage	9.65%
% With Pilot Warning	42.72%
Wildlife Size (Small)	68%
Avg Cost per Incident	~$5,580
Most Common Phase	Climb & Landing
Most Impacted Aircraft	B-737 Series
High-Risk Locations	Texas, California, Utah

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6. Conclusion

The bird strike data spanning 2000–2011 highlights critical gaps in real-time wildlife detection and aircraft risk exposure. The Power BI dashboard reveals high incident volumes at low altitudes and during flight transitions. While most strikes cause no direct damage, costly exceptions (e.g., engine shutdowns) pose serious risk.

The insights support targeted investment in radar systems, improved flight protocols, and wildlife deterrence mechanisms. Cross-agency collaboration is vital for optimizing safety outcomes, especially in frequently impacted airports.

Future improvements could involve AI-based bird prediction systems, automated aircraft zone monitoring, and integration with meteorological alerts to proactively avoid bird-rich airspace.