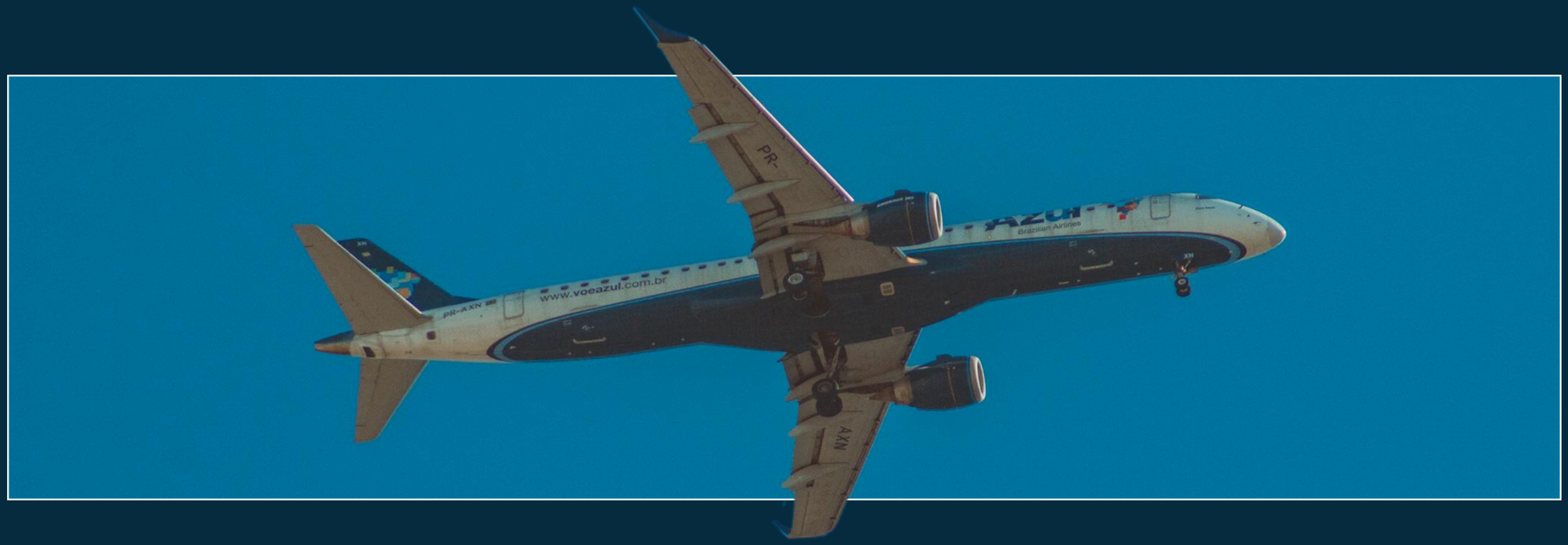
Aviation Accident Risk Analysis

Safer Skies. Smarter Investments.

Greetings, and thank you for being here.
Today I'm going to walk you through an analysis that helps answer one essential question:
"Which aircraft types are safest to invest in?"
This project combines decades of aviation accident data and business intelligence to support data-informed decision-making in the aviation sector.
Let's dive in.

WELCOME TO THE PRESENTATION

I’m William Arasirwa, and I'll be sharing with you my exciting findings, insights and recommendations .



Executive Summary

Strategic Safety Insights for Aircraft Investment

- **Business Goal**: Identify low-risk aircraft for investment using historical accident data
- **Data**: 50k+ FAA & NTSB accident records from 1982–2021
- **Key Insights**:
  - Business & commercial aircraft are safest
  - FAR 121 & 135 operations have lower accident rates
  - Summer months show significantly higher accident frequency
- **Recommendations**:
  - Invest in newer commercial aircraft under FAR 121/135
  - Avoid small, personal-use aircraft
  - Minimize flights in high-risk weather/seasons
- **Impact**: Reduces liability, increases regulatory compliance, boosts ROI

The Business Problem

Entering Aviation Without Crashing the Investment

- **Company Objective**: Expand into the aviation sector with safe, profitable aircraft investments
- **Challenge**: Limited aviation expertise — high uncertainty about accident risk, aircraft performance, and regulatory safety
- **Need**: Data-driven insights to evaluate risk across aircraft models, flight types, and conditions
- **Goal**: Identify aircraft with **low accident risk** to guide procurement and operations strategy

The Dataset

Decades of Aviation Accident History at Our Fingertips

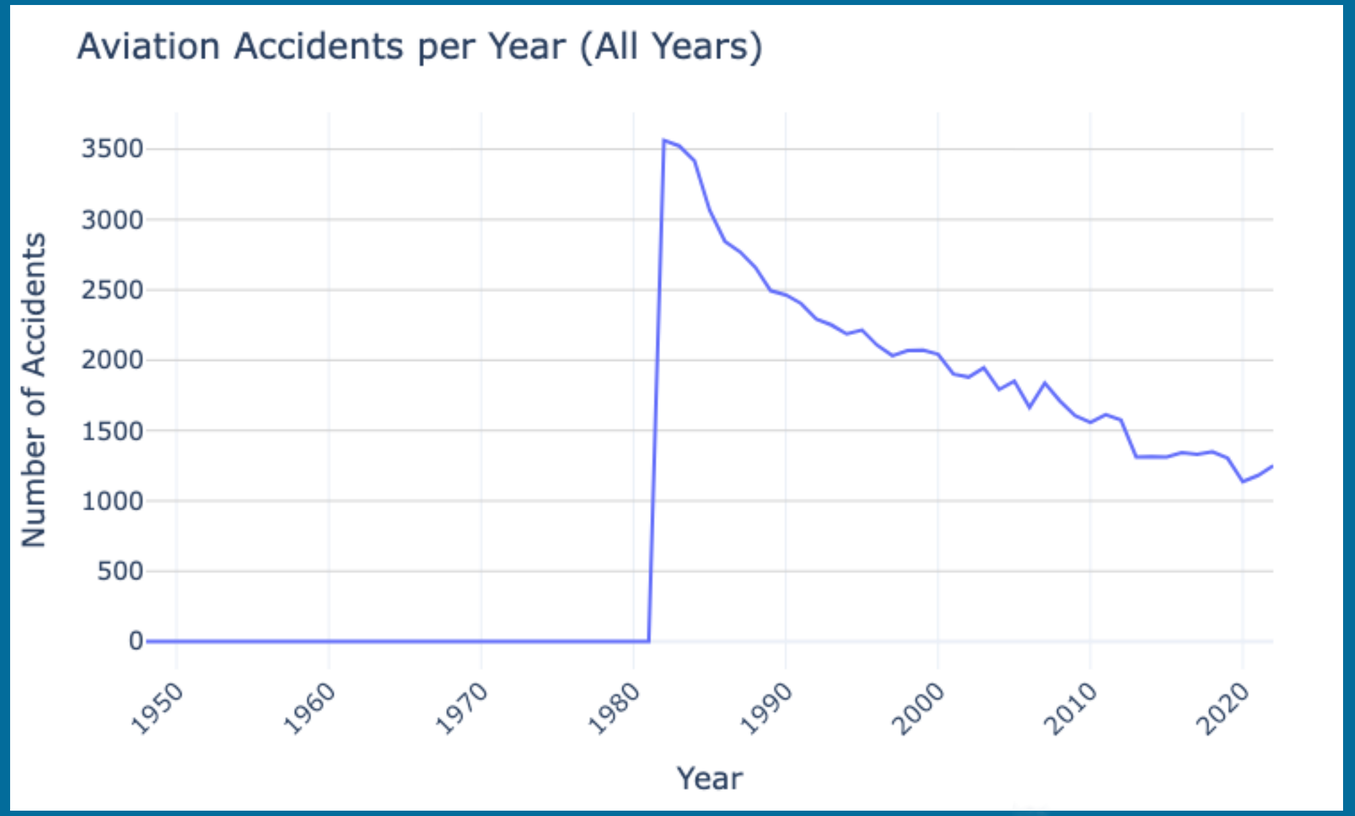
The dataset i analyzed is a rich, publicly available Kaggel dataset with reference from FAA + NTSB database of aviation accident synopses.
It includes over 50,000 incidents spanning 4 decades, giving us the ability to spot long-term trends in aircraft safety.
I focused on attributes relevant to real-world operations — such as injury severity, regulatory class, weather, and flight purpose — to give us a comprehensive risk profile.
With this, we're not guessing. We're grounding our insights in real accident history.

Source: Kaggle - Aviation Accident Database Synopses (FAA + NTSB records)

Scope: ~50,000+ accidents from **1982 to 2021**, covering all U.S. states

Key Columns Used:

- event_year, aircraft_make, aircraft_model
- injury_severity_clean, aircraft_damage, weather_condition
- far_description_explained, schedule_type, purpose_of_flight



Analytical Approach

From Raw Records to Risk-Driven Recommendations

I followed simple data science cleaning methods in the dataset, like statistical methods and engineering useful features, and conducting exploratory analysis.
I focused heavily on visualizing risk patterns:
which aircraft are involved in the most severe accidents?
What times of year are riskiest? How do regulatory categories compare?
All findings were compiled into a user-friendly
Tableau dashboard so stakeholders can explore the data for themselves.

Data Cleaning & Preprocessing

- Removed missing/irrelevant entries
- Standardized date formats, cleaned model names

Feature Engineering

- Created variables like make_model, event_decade, injury_severity_clean, total_individuals_affected

Exploratory Data Analysis (EDA)

- Visualized trends by aircraft type, season, weather, regulation (FAR)

Risk Pattern Discovery

- Identified models and categories with consistently higher/lower incident rates

Insight Synthesis & Dash-boarding

- Created interactive Tableau

Purchase Newer Aircraft

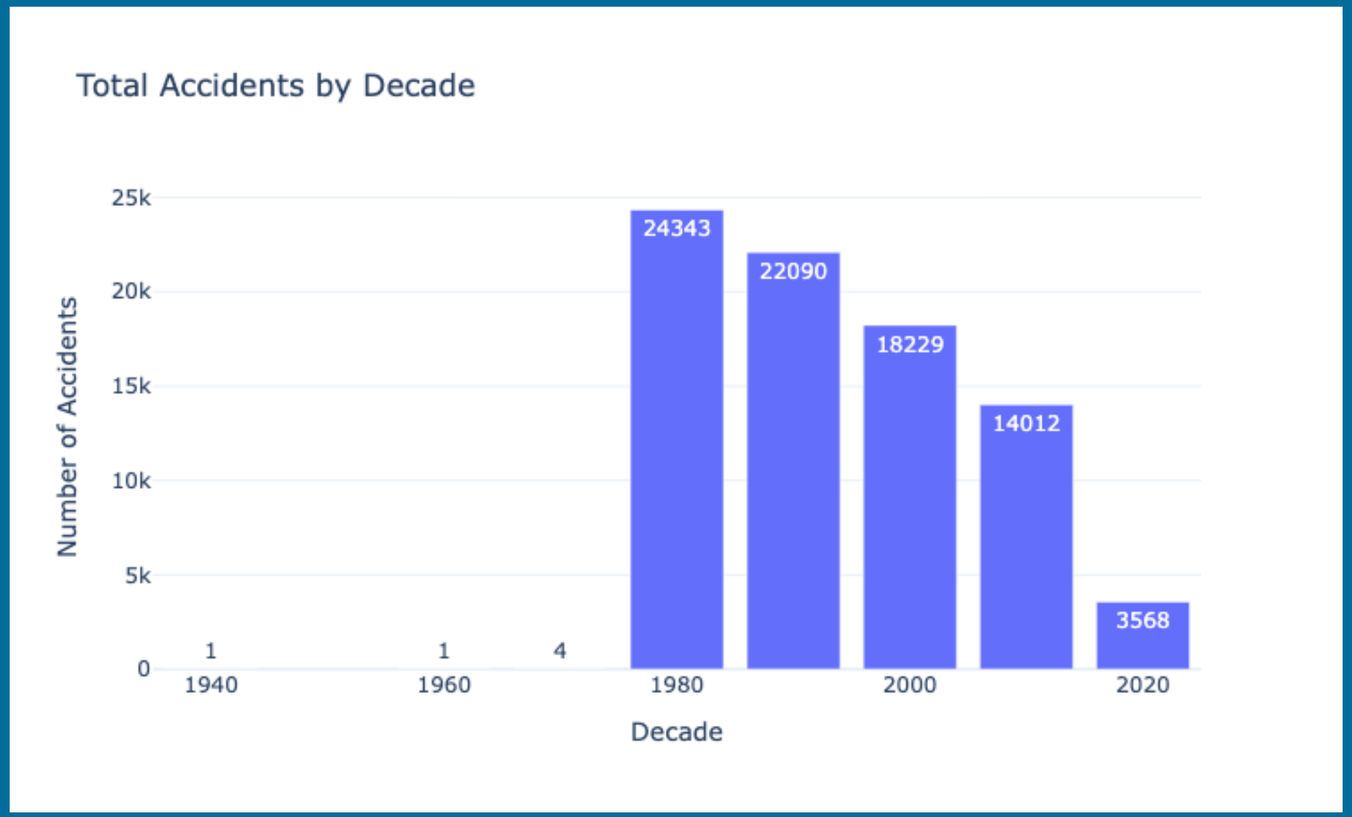
Newer aircraft, safer skies..

Fewer Accidents in Recent Decades
Data shows a **steady decline in accident rates over time** — a trend driven largely by **advancements in aircraft design, engineering, and automation**.

Modern Aircraft = Fewer Fatalities
Newer models are built with **redundant safety systems**, **improved materials**, and **smarter cockpit interfaces** — drastically reducing the likelihood and severity of crashes.

Efficiency Gains
New aircraft are **easier to maintain**, **more fuel efficient**, and **compliance-ready** with current FAA regulations — reducing long-term operational risk and cost.

A Smarter Investment
Buying older planes may save money upfront, but newer aircraft offer **greater ROI** through fewer delays, fewer accidents, and stronger customer trust.



Schedule Flights During Lower-Risk Periods

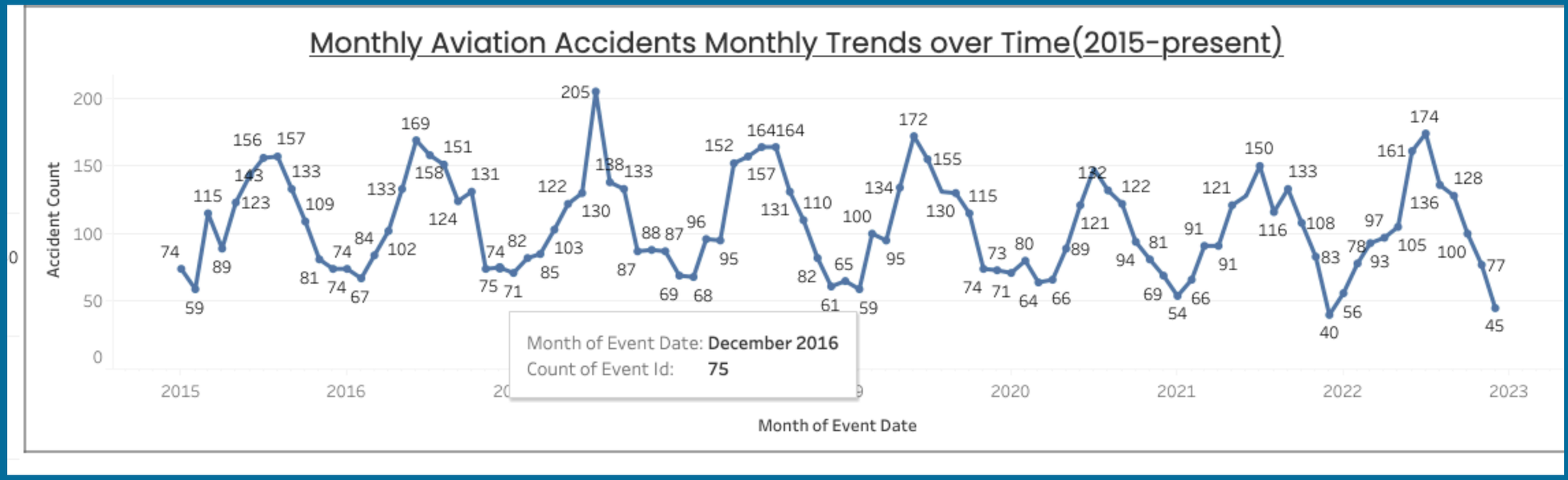
Use historical patterns to avoid accident-heavy months.

Peak Danger Months:
Your Tableau analysis shows a **clear spike in accidents during June–August** — driven by more personal flights, high temperatures, and increased air traffic.

Winter Watch-outs:
Weather-related accidents rise again in December–February (ice, poor visibility).

Strategic Scheduling Windows:
March–May and **September–November** emerge as the **safest months** to concentrate operations.

Business Benefit:
Smarter scheduling = fewer risks, **lower costs**, and **stronger operational reliability**.



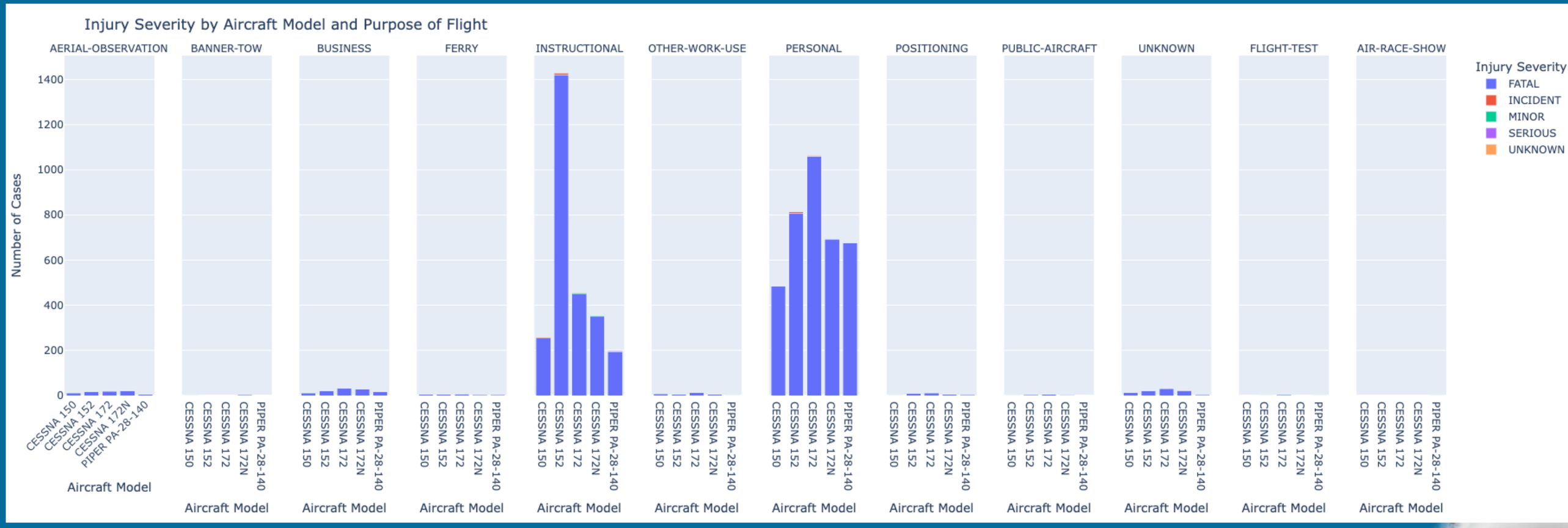
Invest in Commercial & Business-Class Aircraft

Highly Regulated = Highly Reliable
Commercial and business-class aircraft operate under **FAR 121 and 135**, which enforce rigorous maintenance, crew training, and safety inspections.

Fewer Accidents, Fewer Losses
These aircraft types account for a **significantly smaller percentage of total incidents** compared to personal and instructional flights — especially in **fatal and severe injuries**.

Scalable, Sustainable, Profitable
Designed for frequent, high-capacity use, these aircraft are **better suited for long-term commercial growth**, fleet management, and customer trust.

Risk Mitigation in Motion
Investing in this class of aircraft minimizes legal liability, operational disruptions, and reputation damage — **a critical factor in aviation ROI.**



Avoid High-Risk Small Aircraft

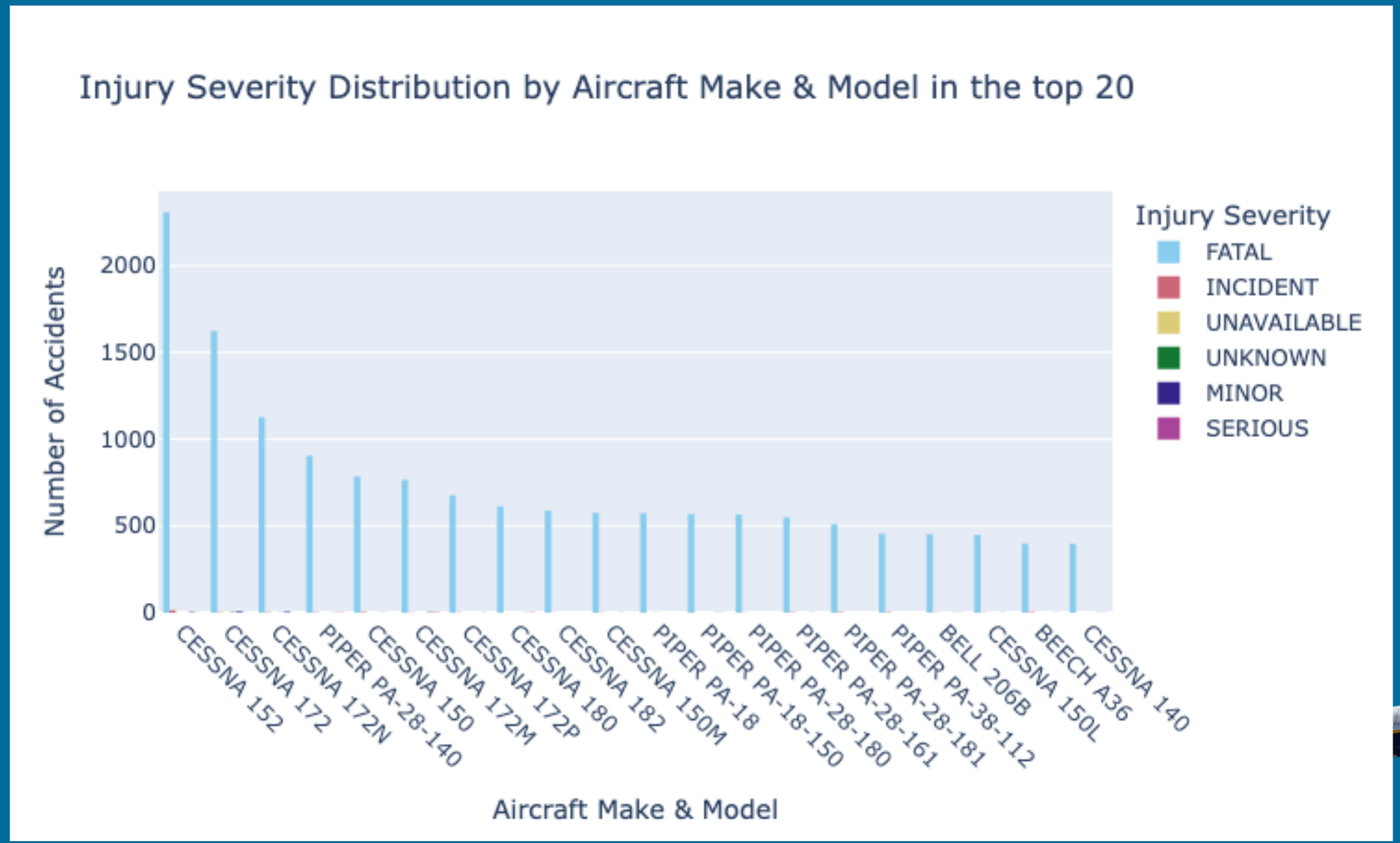
Low cost, high consequence.

Frequent Flyers... for the Wrong Reason
Models like the **Cessna 172** and **Piper PA-28** appear repeatedly in accident records — not just minor incidents, but those with **serious injuries and fatalities**.

High Exposure, Low Oversight
These aircraft are commonly used for **flight training and recreational purposes**. They're often piloted by less experienced flyers under **FAR 91**, which has **minimal regulatory enforcement** compared to commercial categories.

Disproportionate Risk Profile
Despite making up a small percentage of total flights, these aircraft are involved in **a large share of severe accidents** — making them a poor investment choice from a safety and liability standpoint.

Unsuitable for Scaling Operations
Their design, limited seating, and lack of redundant safety systems make them **unsustainable for commercial or high-frequency use**.



Leverage FAR 121 & 135 Operations

Safety thrives under strong regulation..

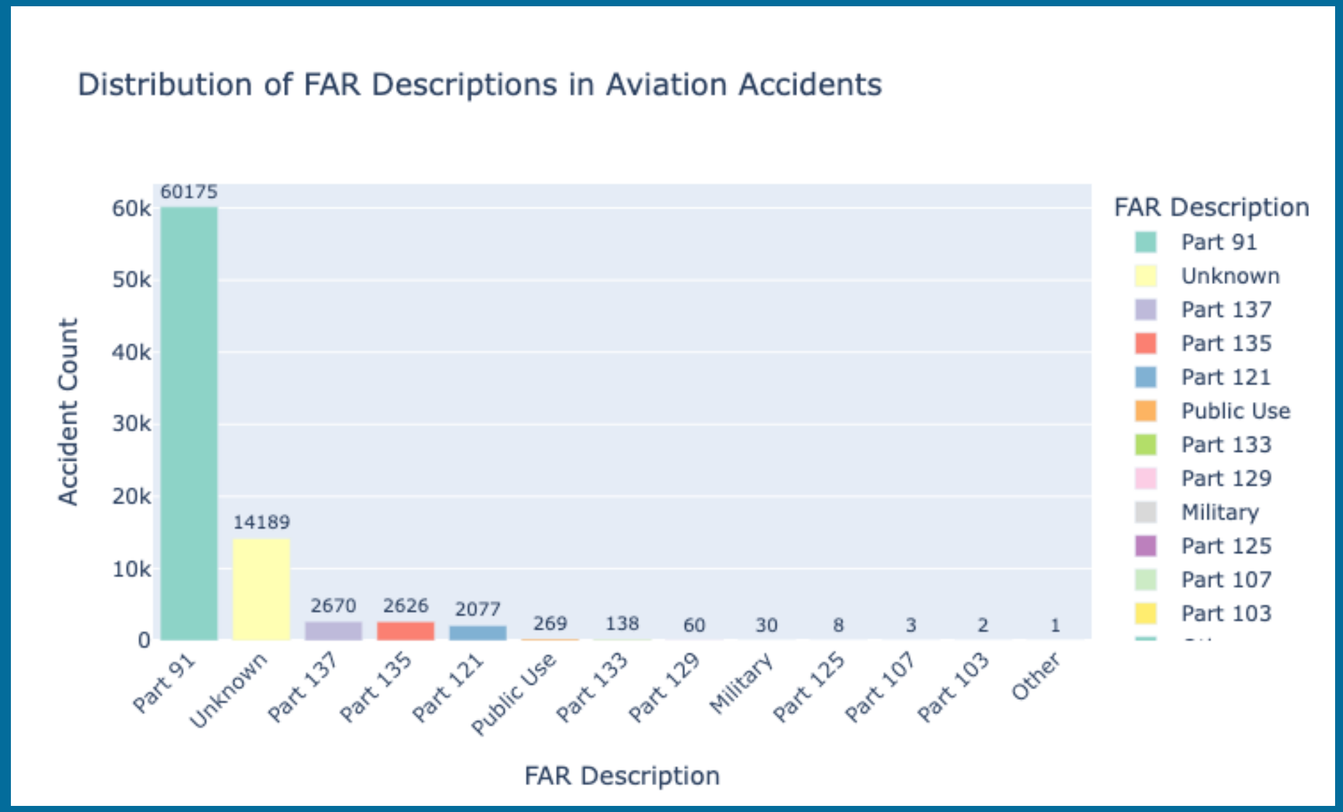
What Are FAR 121 & 135?

- **FAR 121**: Covers large commercial airlines — requires rigorous training, inspections, and equipment standards
- **FAR 135**: Regulates smaller commuter and charter operations — still highly controlled

Why It Matters:
Planes operating under FAR 121 & 135 have **much lower accident rates** compared to FAR 91 (used for private and instructional flights), due to **mandatory oversight, professional crew training maintenance cycles**.

Data Insight:
Your analysis shows that **FAR 91 flights account for the majority of incidents**, while **FAR 121 & 135 have consistently safer outcomes**.

Business Implication:
Investing in aircraft that fall under these classifications reduces risk **not just in safety, but also legal exposure, insurance premiums, and operational disruptions**.



Summary: Safer Skies, Smarter Investments

Data-Driven Safety Insights

Through analysis of decades of aviation accidents we can here by make decisions backed up with data.

Key Findings Led to 5 Strategic Recommendations

1. Invest in **Commercial/Business-class aircraft**
2. Avoid **accident-prone small planes**
3. Prefer **newer aircraft generations**
4. Operate under **FAR 121 & 135** for regulatory safety
5. **Schedule flights** during **lower-risk months**

Business Value

These recommendations reduce risk exposure, cut costs, and position the company for **safe and profitable aviation expansion**.

Strategic Actions

Review High-Risk Models
Flag models with frequent or severe incidents (e.g., *Cessna 172*, *Piper PA-28*)

Explore Safer Aircraft Models
Consider investing in:

- **Boeing 737**
- **Boeng 757-232**
- **MCDONNELL-DOUGLAS DC-9-82**

Procure FAR 121/135-Certified Aircraft
These regulatory categories demonstrate **stronger safety records** due to stricter oversight.

Integrate Dashboard into Internal Workflow
Use Tableau to monitor aircraft trends, filter risks, and drive procurement choices dynamically.

Adjust Scheduling Based on Risk Seasonality
Reduce exposure during **June–August**, where accidents historically spike.

Initiate Phase 2 Research
Include predictive modeling, maintenance logs, pilot experience, and international data for deeper insights.

Questions? Let’s Talk Aviation Strategy

Thank you for your time and attention

I am open to questions, feedback, and further discussion, and

Let’s collaborate on the next phase of smarter, safer aviation investment

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