Ruth Maina

DSC 680 - Applied Data Science

Professor Amirfarrokh Iranitalab

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Airline Safety

Final White Paper

Topic: Airline Safety

Background/Business Problem:

The media has been promoting statistics stating air is no longer a safe way to travel. The aim of this project is to provide information and trends on airlines as the safest way to travel, especially when compared to automobiles. Using curated visualizations and storytelling techniques, the project will help multiple groups in the organization combat this negative publicity and help tell the airline's side of the story.

Data Explanation:

I chose several datasets which are presented in csv format from the sources. Below is some information and areas of focus for each dataset:

- Source: Aviation Safety Network (ASN)
    - This is an online database that stores numerous searchable archives of airline data
    - Airline accidents by airline data from 1985 to 2014 - represents the number of accidents occurring during the time given period
    - Fatalities from 1946 – 2022 - represents the fatalities from accidents occurring during the given period
- Source: National Transportation Safety Board (NTSB)
    - This also provides data like ASN except that it is a US federal agency
    - Airline Fatalities from 2009 – 2018 - represents the number of accidents occurring during given period
    - Airline Accident phases – represents the exact stage during flight when the accident occurred
- Source: AirSafe.com
    - This too is an online database for airline statistics.
    - Accidents by plane type over the years   - represents the number of accidents by the make and model of the plane in question.

Methods:

My role is a data analyst for the airline and this project helps spread the word on the truth about airlines to multiple groups within the organization as well as externally. It is divided into multiple deliverables/sections, each curated for different audience types as follows:

- The first delivery is a power BI dashboard directed at the airline internal teams to demonstrate what the data is saying - several visualizations are presented to help them see the statistics, the trends, and overall, the picture of what is happening. This is likely to spark discussions within the teams which is very good in dealing with the issue at hand. Any feedback will be incorporated into the next iterative step.

- The second delivery is an executive summary of findings thus far and is directed at the airline senior leaders. They have a deeply vested interest in their airline as well as the portrayal of the industry. They're likely to scrutinize the facts to ensure accuracy, ethics, and proper tone of what is to be shared externally. Recommendations to them and from them would be valuable and their input would drive the next steps since they are the industry experts and are key stakeholders, and they answer key stakeholders as well. They're likely to be interested in stats, trends, predictions, impact on sales, and so on.

- The third delivery is a blogpost directed at the general audience/public and is aimed at mitigating the issue via social network platforms.

- The last delivery is an infographic also directed at the public and is intended to mitigate the issue by advertising the airline's products and services.

Data preparation steps:

- For the dashboards targeted at the internal airline team, I followed the following steps:
    - I loaded the csv datasets directly into Power BI and viewed the basic stats to get an understanding of the Accidents and Fatalities Per Year
    - I chose a simple blue theme with different shades of the same color to enhance consistency in all the charts and table presented. Blue is also very appealing and has a professional look overall.

- o Data labels were included within the donut chart for neatness, instead of outside the visual

- o Eliminated axis labels and instead gave descriptive titles for each visual to lessen clutter

- For the executive summary, I followed similar themes as the above dashboards and it was inclusive of all the above, as the audience targeted was leaders of the company

- The blogpost was straightforward rationale to the public and it contained simple graphics created using Power BI – a calendar for marketing the airline's low fares, a map showing the airline's numerous destination coverages, and lastly a donut chart highlighting the small percentage of commercial airline accidents compared to general aviation.

- For the infographic:
  - o I continued with the 'pro-airline's stance and used a blue and yellow theme to match Southwest airline's real-world theme.

  - o I included a spatial map of their destinations to make it easy on the customer and to capture their attention to the many possibilities. To this I added a screenshot with the number 120+ in the middle of the map to capture the user's attention with the magnitude of choices available.

  - o Next I tackle the budget issue with a graphic of $140 average ticket price in big letters as a selling point

  - o Next I add customer satisfaction rating to show the user what the industry average is and where Southwest ranks as a selling point. A smiling face visual is included to drive the point home

  - o The issue of safety is briefly discussed last on purpose, to first show the user the benefits as a selling point. It's still brought to the table to win the user with real statistics of how low accidents are and how regulation helps maintain this status thus should not be a showstopper for travel.

- All visualizations are given in the Appendix section.

Analysis:

- In examining the Airline Dataset containing Accidents and Fatalities Per Year:
    - We find the total count of the highest recorded accidents to be at 4096 from 1946 – 2022. Thus, in a span of 76 years:
        - This is approximately 54 accidents per year / ~5 per month
    - Fatalities in the same time come to about 87,377:
        - approximately 1150 per year / ~96 per month / 3 per day
- Compared to motor vehicles data from NHTSA, in 2016 the number of deaths was about 100 people per day. By a huge margin, this fails to compare to the ~3 daily average discovered for airlines.

Conclusion:

- As aforementioned, the motor vehicles data from NHTSA indicates 100 deaths occur per day in 2016 – this does not compare to ~3 deaths for airlines daily average. This is an indication that commercial airlines are the safest methods of transportation and thus the public should not be concerned about the negative media which has tried to paint the opposite. The data speaks for itself, and commercial airlines continue to be heavily regulated by the Federal Aviation Agency laws to ensure quality and due diligence continues to be observed.

Assumptions:

- Data accuracy is assumed based on the sources being well respected and credible

Limitations:

- Curating and tailoring information for different audiences can be a limiting factor. Wisdom must be observed in how information is presented to each audience.

Challenges:

- Influencing and being able to combat negative media is itself a challenge. Once the bad information is already out there, being able to direct people to see airlines in a different light will be a challenge. However, with data and proper visualizations we can be able to combat the issue.

Future Uses/Additional Applications:

- The data can be used in many ways to continually inform the public in general. A potential future use could be to predict how the numbers could look like in the future, say in the next 50 years. Travelers could use such for informational and reassurance purposes. Airlines could use such for targeted marketing, sales improvement, and so on.

Recommendations:

- I would propose to the airline executives to market the analysis outcomes via major outlets such as the news media, to spread the positive news to bigger audiences. This will not only combat the issue but will also be a marketing strategy.

Implementation Plan:

- The project will first be presented to the immediate manager for review and for first line of defense approval. Thereafter, additional department stakeholders will be engaged for review, with their feedback incorporated and final approval documented. An official project kick off meeting will be held with representation from various teams. An implementation plan will be formulated and signed off upon by key managers and stakeholders.

Ethical Assessment:

- The main aim is to empower each audience with the information they're able to understand. I also ensured transparency in disclosing the source of the data as well as intent. Another key is maintaining accuracy and presenting data visualizations that are a true portrayal of each airline, and without any bias. This is so critical to ensure reliability of the information.

GitHub Project3 Link:

https://github.com/ruthmaina2022/Data-Science-Portfolio/tree/main/Applied%20Data%20Science%20Projects/Project%203

Questions:

1. How was the data acquired? *The data came from Aviation Safety Network (ASN), National Transportation Safety Board (NTSB) and from AirSafe.com*

2. Is this real data or is it synthetic for educational purposes? *This is real data collected from aviation events over the years*

3. Did the data owners approve of data use? *No owners we're consulted, the data is publicly available*

4. What evidence exists regarding the media's stance on airlines? *There is no evidence as this is a hypothetical situation for educational purposes.*

5. Which news networks presented the mentioned airline negative news? *None since this is a hypothetical situation for educational purposes.*

6. Was the information presented investigated further? *No because this is a hypothetical situation for educational purposes.*

7. What next steps will be taken to help the public synthesize the historical information better? *A phone line and virtual chat will be made available to address any questions arising.*

8. How can we ensure airlines are not taking any security measures for granted? *The Federal Aviation Administration (FAA) strictly and actively imposes and regulates security measures*

9. The airlines with the highest accidents, what steps have been taken to reduce those? *The Federal Aviation Administration (FAA) is closely working with them on the root causes and measures taken to avoid recurrences*

10. What has been done by airlines to curb cancellations and other known travel disruptions? *Any non-weather-related causes are monitored to ensure the customers get compensated accordingly.*

Reference Links:

National Transportation Safety Board (n.d.). Accident Data.

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IATA (2023, March 7). IATA Releases 2022 Airline Safety Performance:

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PilotInstitute (2023, February 26). Why Do Aircraft Crash? – Aviation Accident Statistics Revealed.

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Panish Law (n.d). Aviation Crash Statistics.
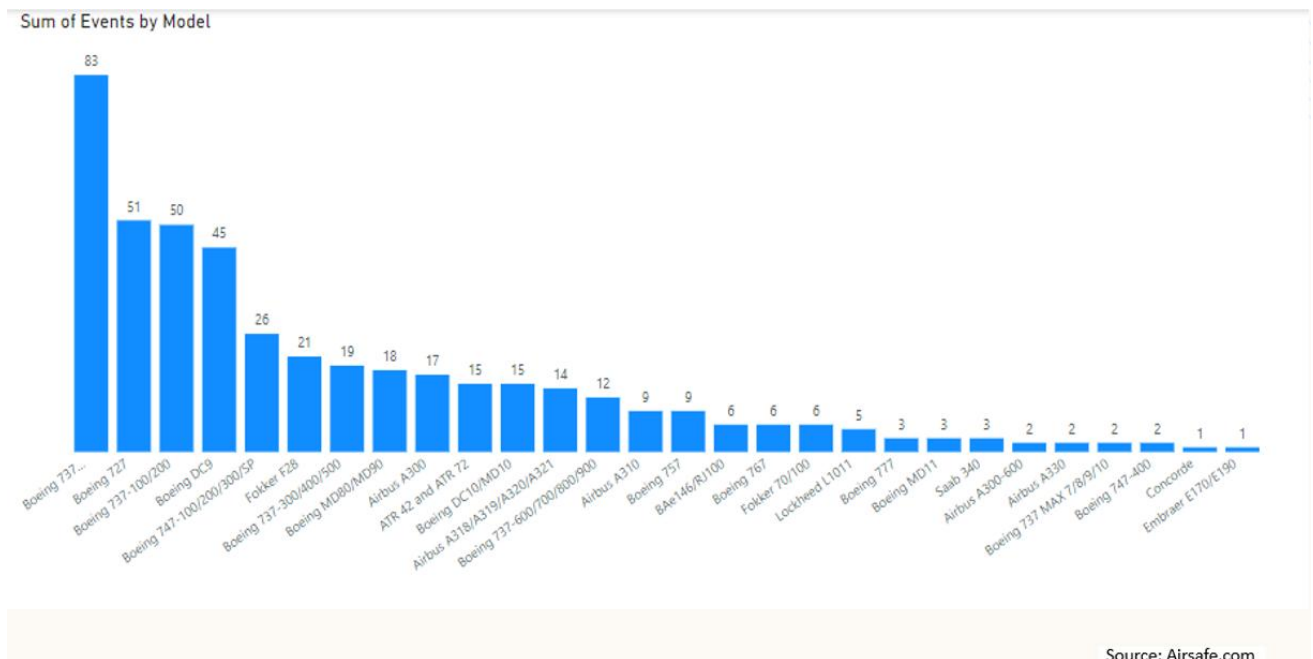
https://www.psbr.law/aviation_accident_statistics.html

Appendix:

- The dashboard, Blogpost, Infographic, and Executive Summary Presentations will be included in the final white paper
- Incidents sorted by airline appear to be occurring the most Aeroflot at 82 accidents followed by Delta at 48 and American at 38


Accidents by airline from 1985-2014

- Accidents by plane type/model

Sum of Events by Model

Source: Airsafe.com

- Fatalities:

Sum of Fatalities 1946 – 2022

Source: Aviation Safety Network
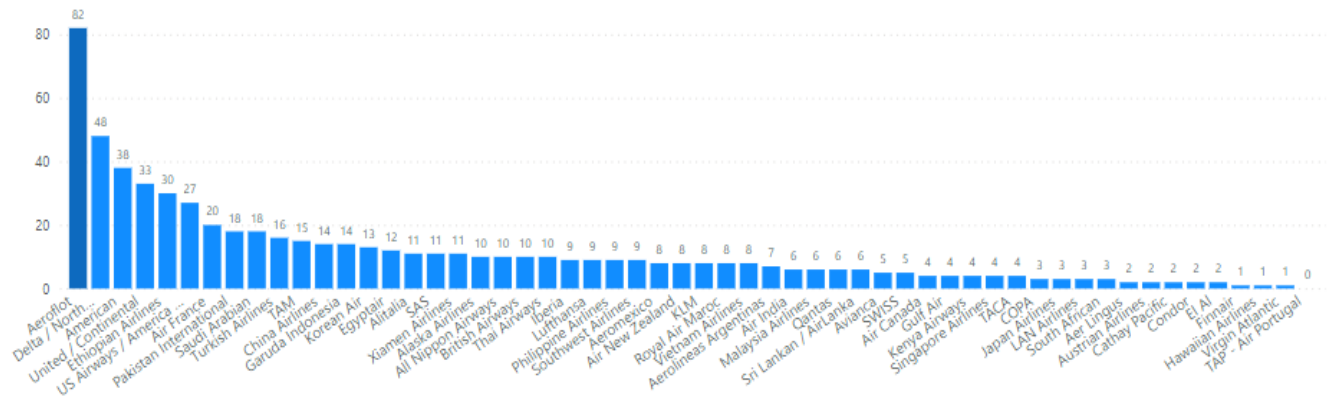
- Overall, commercial flights are considered safer than general aviation flights which account for 78% of aviation accidents; A potential explanation is due to commercial flights are more regulated than general aviation
- Below are fatality rates for general aviation flights
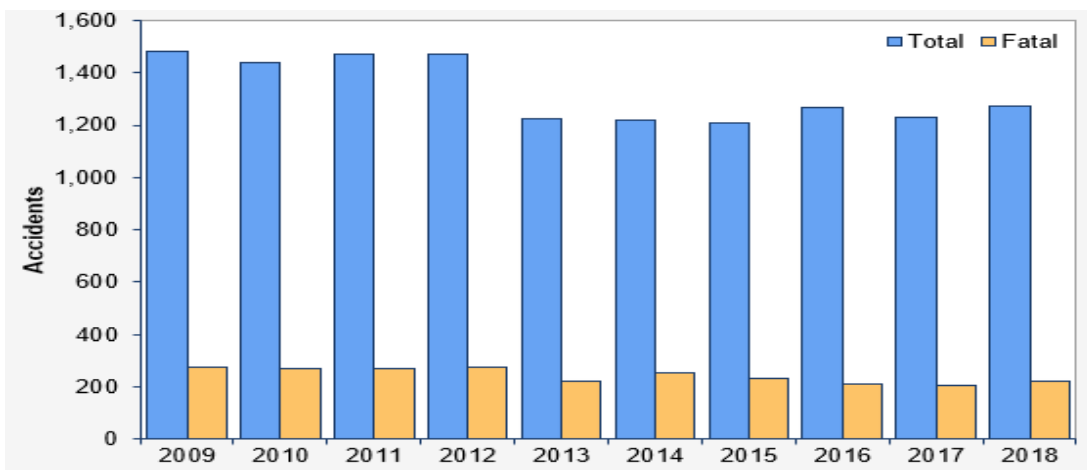
- Accident Phases and Fatalities:
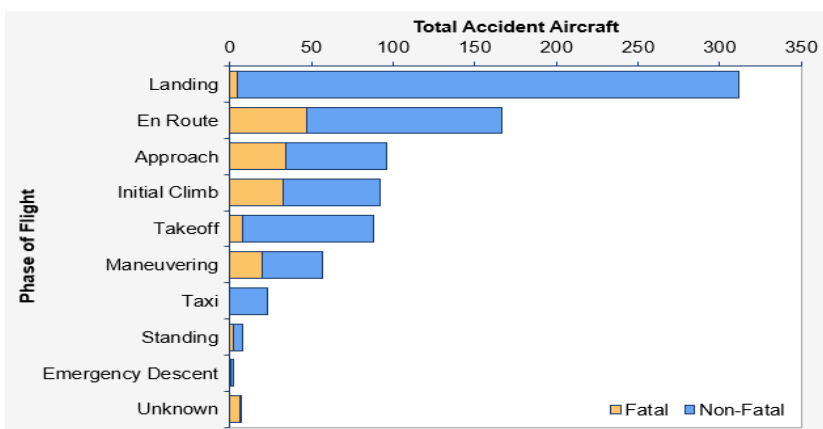
Ruth Maina - BLOGPOST:

Are you ready for a memorable vacation you so much deserve? Look no further. Southwest airlines has you covered in all aspects!

If you are a busy parent like me, there's just not enough hours on that clock in a day. Between working a full-time job, attending college in the evenings, going to children's events, and getting dinner on the table, there's little energy and time left to spend surfing the internet for a family vacation deal. Furthermore, negative news on airline safety, along with corona virus and increased inflation has made it impossible to take vacations. However, where there is a will there is a way! That is why Southwest Airlines is committed to bringing vacations back to the table.

As a frequent Southwest flyer, I have done some research on all airlines and have discovered 5 reasons why you should choose them over other airlines.

- ✓ You will get **121 destinations** to choose from, including international services to Aruba, Montego Bay, Hawaii, Jamaica, Bahamas, and so on. Domestic travel includes favorite destinations to 11 cities in Florida, 13 in California, 6 in New York, 10 in Texas, and the list goes on all over continental US:
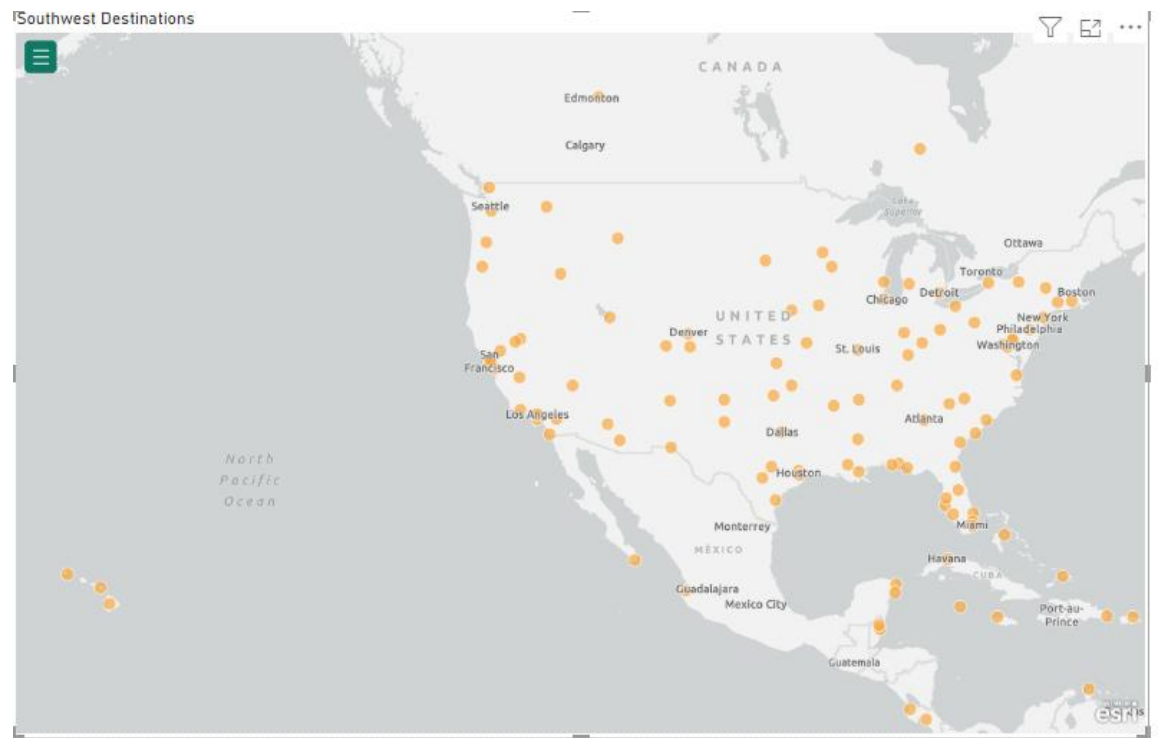
✓ If you're on a budget, look no further. Southwest's **low fare calendar** lets you leverage lower prices for low season dates. In 2021, their average ticket price of **$140 is unbeatable,** and it always comes with one free carry on and 2 free check-in bags. I often pack so much for the children thus the free baggage is a huge saving! Furthermore, in the event of last-minute unforeseen circumstances, they allow you to cancel and apply the value of the ticket in future travel. What a benefit we all have needed from time to time! See for yourself below snippet displaying Columbus to Atlanta fare prices for February with **tickets as low as $119**:

Low Fare Calendar: CMH ✈ ATL Modify $ Points

Now accepting reservations through October 2, 2024. **All fares are rounded up to the nearest dollar.**

Departs Columbus, OH - CMH to Atlanta, GA - ATL	✈	**Returns** Atlanta, GA - ATL to Columbus, OH - CMH

2024 FEB	2024 MAR	2024 APR	2024 MAY	2024 JUN	2024 JUL	2024 AUG	2024 SEP	2024 OCT		2024 FEB	2024 MAR	2024 APR	2024 MAY	2024 JUN	2024 JUL	2024 AUG	2024 SEP	2024 OCT

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday		Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
				1	2	3						1	2	3
4 $263	5 $263	6 $263	7 $263	8 $263	9 $263	10 $263		4 $263	5 $263	6 $263	7 $263	8 $263	9 $263	10 $263
11 $245	12 $245	13 $245	14 $245	15 $245	16 $245	17 $211		11 $245	12 $245	13 $245	14 $245	15 $245	16 $245	17 $211
18 $162	19 $162	20 $162	21 $162	22 $171	23 $162	24 $136		18 $162	19 $240	20 $162	21 $162	22 $162	23 $162	24 $136
25 $151	26 $129	27 $119	28 $119	29 $129				25 $151	26 $129	27 $119	28 $119	29 $129		

✓ Lastly, airline safety has recently been a topic of discussion in the media. However, this should not worry you because **commercial airlines are the safest methods of transportation**. Compared to motor vehicles accidents which cause about 100 deaths per day, the airline average is ~3 per day. Despite this statistic, we brave on and drive our cars daily to work. It's also important to note that general aviation flights (such as small/personal single engine planes) account for 80% of aviation accidents per NTSB; A potential explanation is due to commercial flights are heavily regulated than general aviation:

Airline Accidents 2002 - 2021

■ General Aviation ■ Commercial
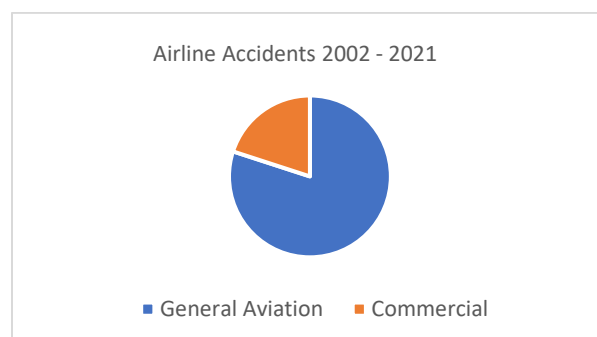
- ✓ All in all, the numbers here speak for themselves thus negative media should not stop you from flying, vacationing, or continuing to enjoy life while you can. You deserve a memorable vacation. **Click here** to book your ticket with Southwest Airlines. Their top-notch live agent customer service representatives are available to assist you 24/7.

References:

Wikipedia (2024, Jan 1). *List of Southwest Airlines destinations.*

https://en.wikipedia.org/wiki/List_of_Southwest_Airlines_destinations

SWA (n.d). Low Fare Calendar.

https://www.southwest.com/air/low-fare-calendar/select-dates.html?adultPassengersCount=1&currencyCode=USD&departureDate=2024-02-04&destinationAirportCode=ATL&originationAirportCode=CMH&passengerType=ADULT&promoCode=&returnAirportCode=&returnDate=2024-02-04&tripType=roundtrip

SWA (n.d). Southwest Airlines Route List.

https://www.southwest.com/route-map-list-view/?clk=RTMAPLIST

FLY SOUTHWEST

120+
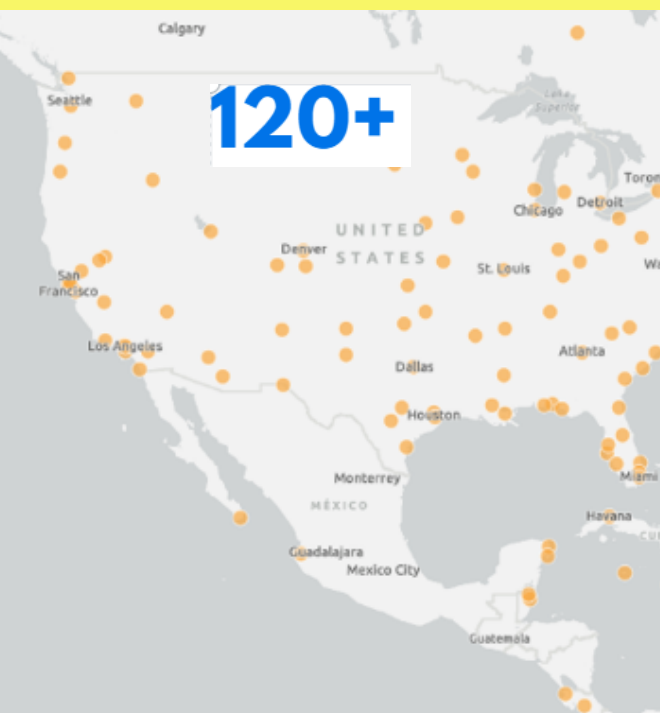
Travel Destinations

Including international services to Aruba, Montego Bay, Hawaii, Jamaica, Bahamas, and so on. Domestic travel includes favorite destinations to 11 cities in Florida, 13 in California, 6 in New York, 10 in Texas, and the list goes on all over continental US

Budget Friendly

- Average ticket price of $140 is unbeatable
- No baggage fees - one free carry on and 2 free check-in bags.
- Southwest's low fare calendar lets you leverage even much lower prices during low season dates

$140

Best Service

- Southwest's high customer satisfaction rating is 78, above industry average by 2 points.
- Refundable tickets option allows customers to cancel and apply the value of the ticket to future travel
- Live agent customer service representatives are available to assist you 24/7.
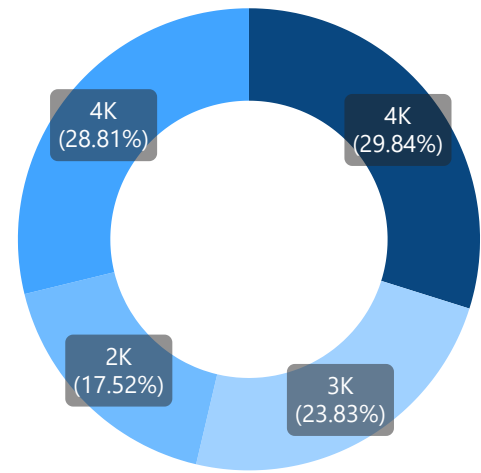
Safest Travel

- Commercial airlines are the safest method of transportation and are heavily regulated
- In 2018-2022, the 5 year average was one accident every 0.81 million flights! This number here speaks for itself.
- Go ahead and book your ticket with Southwest Airlines.

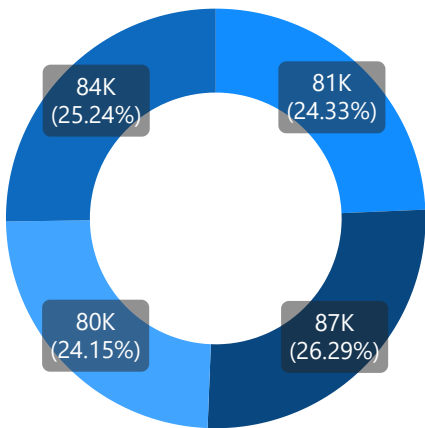### Ready for an adventure of a lifetime?

Visit us at southwest.com

Airline accidents 1946 – 2022

- ● Sum of Accidents incl s...
- ● Sum of Accidents ...
- ● Sum of Accident...
- ● Sum of Accid...

Donut chart segments:
- 4K (29.84%)
- 4K (28.81%)
- 2K (17.52%)
- 3K (23.83%)

Airline fatalities 1946 – 2022

- ● Sum of Fatalities excl...
- ● Sum of Fatalities i...
- ● Sum of Fataliti...
- ● Sum of Fataliti...

Donut chart segments:
- 84K (25.24%)
- 81K (24.33%)
- 80K (24.15%)
- 87K (26.29%)

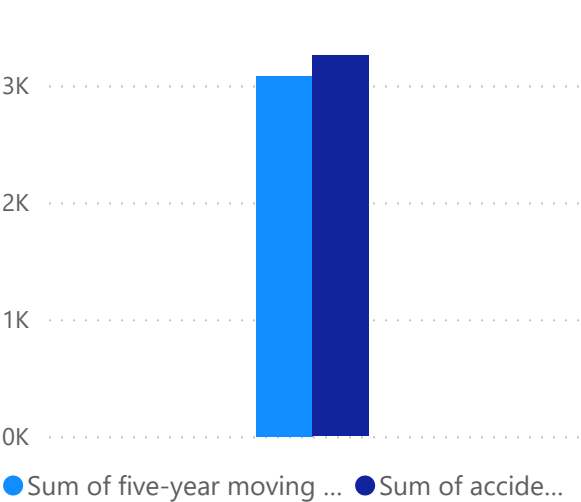## Sum of Accidents incl sabot by Year
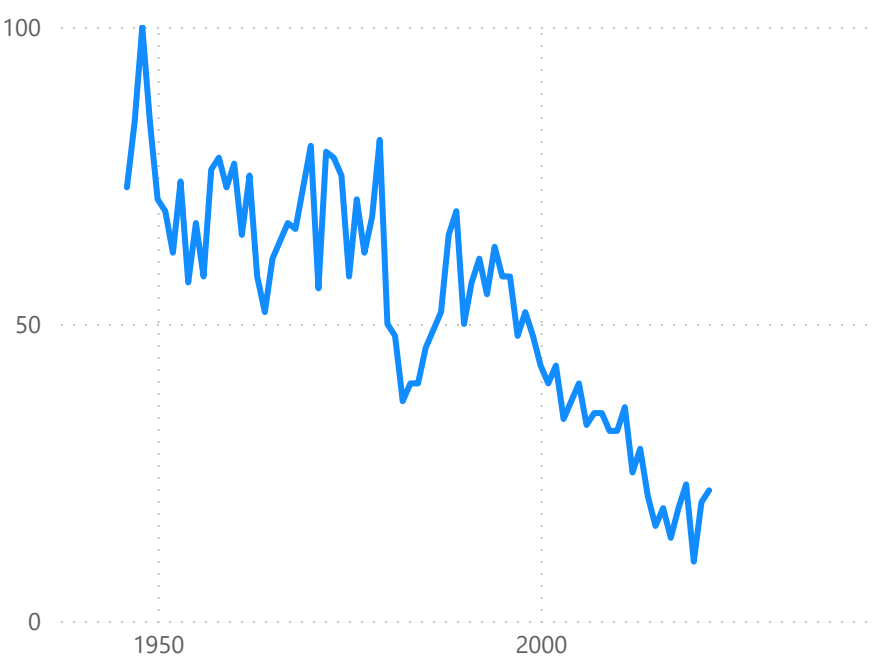
Sum of Fatalities incl sabot by Year
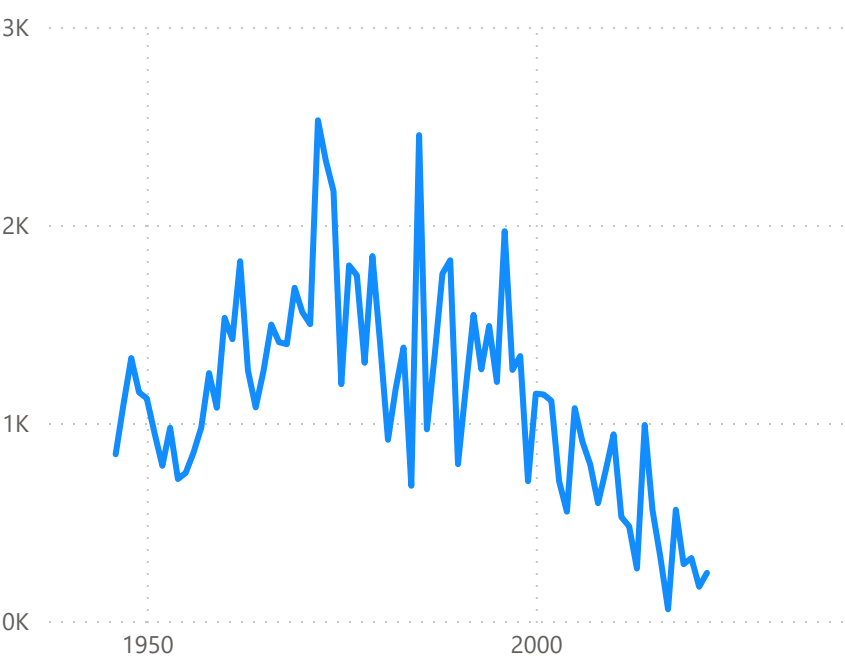
Five-year moving average over previous 5 years

- ● Sum of five-year moving ...
- ● Sum of accide...

Accidents from 1985-2014

airline	Sum of incidents total
Aeroflot	82
Delta / Northwest	48
American	38
United / Continental	33
Ethiopian Airlines	30
US Airways / America West	27
Air France	20
Pakistan International	18
Saudi Arabian	18
Turkish Airlines	16
TAM	15
China Airlines	14
Total	**633**