Phase 1
Aviation-Risk-Analysis

Phase 1:
Uncovering Insights through Data-Driven Aviation Risk Analysis

Introduction

- Topic: The presentation is about **Aviation Risk Analysis**.

  It’s an important aspect of the aviation industry, focusing on understanding and mitigating the risks associated with different aircraft makes.

- Context:

  The company is looking to diversify its portfolio by venturing into the aviation industry. This involves purchasing and operating airplanes for commercial and private enterprises. However, the potential risks associated with different aircraft makes are not well understood.

Introduction

- Importance:

  Understanding accident frequencies and fatality distributions among different aircraft makes is crucial. It helps in making informed decisions about which aircraft to purchase and operate, ensuring safety and efficiency in your new business endeavor.

- Approach:

  To address this, I have been working on a project that involves data cleaning, imputation, analysis, and visualization of aviation accident data. The goal is to generate insights that can guide the decision-making process in the company's new aviation division.

Problem Statement

- Challenge:

  The company is expanding into new industries to diversify its portfolio. Specifically, it's interested in purchasing and operating airplanes for commercial and private enterprises. However, the company lacks knowledge about the potential risks associated with different aircraft makes.

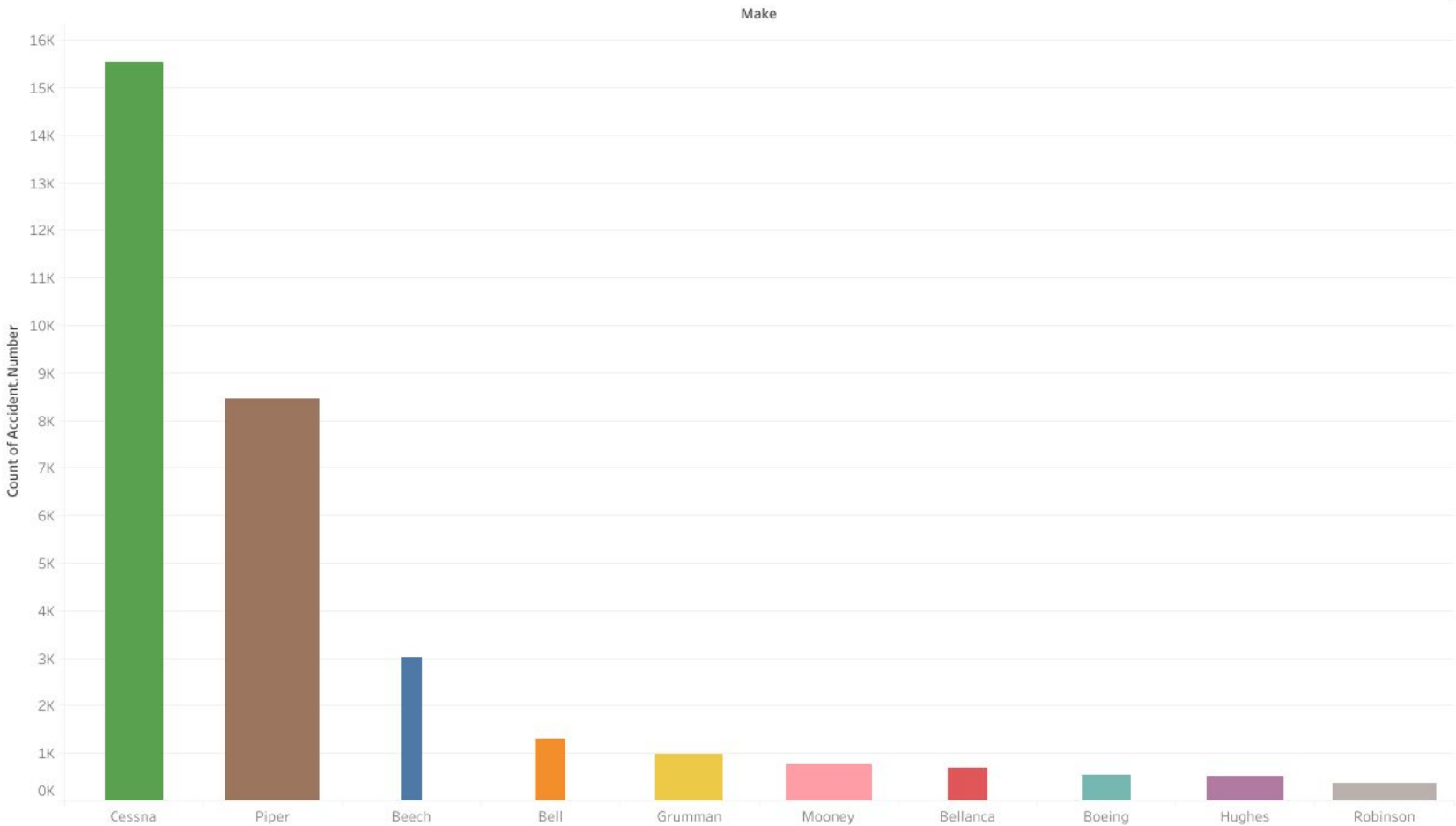
- Need:

  There's a need to understand the accident frequencies and fatality distributions among different aircraft makes. This information is crucial in determining which aircraft are the lowest risk for the company as it embarks on this new business endeavor.

- Task:

  Analyzing aviation accident data to generate insights that can guide the decision-making process. These insights will help the head of the new aviation division decide which aircraft to purchase. The challenge is to translate the findings from the data into actionable insights that can be easily understood and used by the business stakeholders.

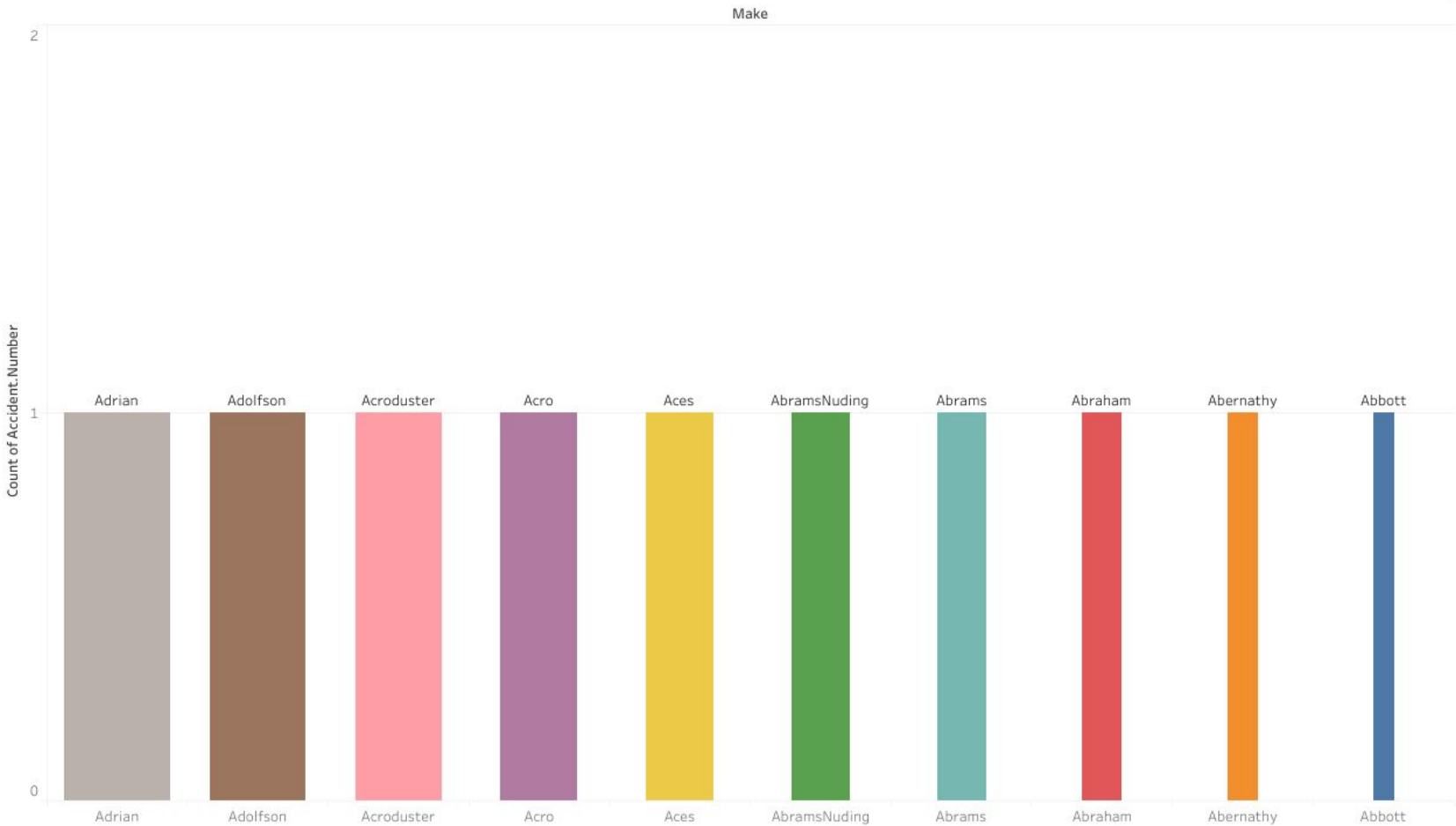
Top 10 Aeroplane Makes With Highest Accident Frequency



Top 10 Aircraft Makes with the Highest Accident Frequencies

1. **Cessna** leads the list with a significant 15.5K accidents.
2. **Piper** follows with approximately 8.5K accidents.
3. **Beech** is next with around 3K accidents.
4. **Bell** has recorded about 1.5K accidents.
5. **Grumman** has reported 1K accidents.
6. The remaining makes, **Mooney**, **Bellanca**, **Boeing**, **Hughes**, and **Robinson**, each have under 1K accidents.

Top 10 Aeroplane Makes With Lowest Accident Frequency



Top 10 Aeroplane Makes With Lowest Accident Frequency

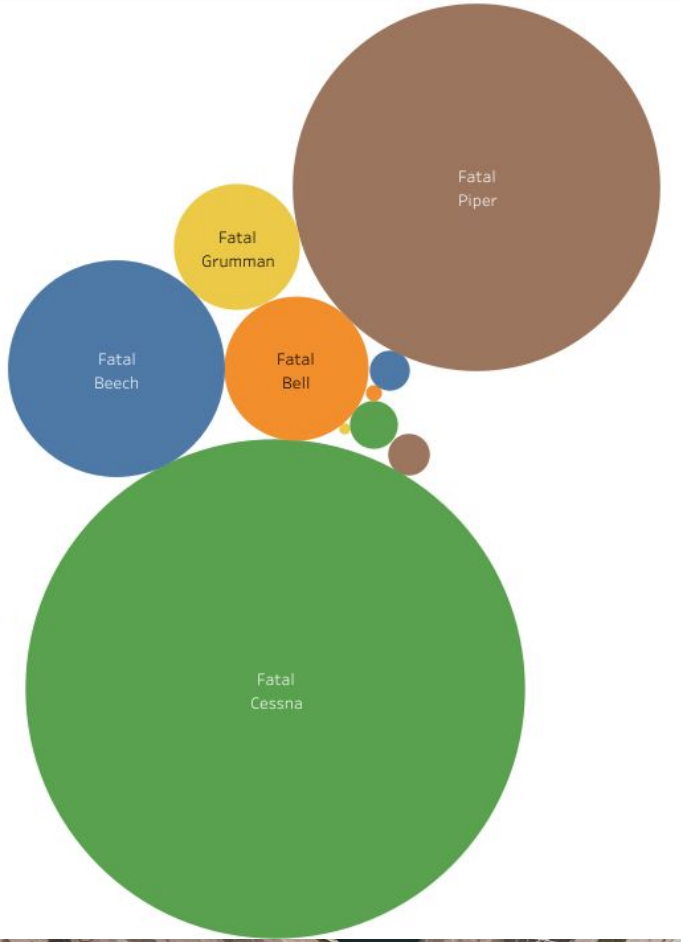
1. Prioritize Safety:

   Consider aircraft makes with the lowest accident frequencies. In this case, Adrian, Adolfson, Acroduster, Acro, Aces, AbramsNuding, Abrams, Abraham, Abernathhy, and Abbot all have only one recorded accident, making them potentially safer options.

2. Consider Fleet Size:

   The size of the aircraft make can impact operational efficiency and maintenance costs. It appears that the size of the make follows this descending order: Adrian, Adolfson, Acroduster, Acro, Aces, AbramsNuding, Abrams, Abraham, Abernathhy. Larger makes may offer more resources and support for maintenance and operations.

Fatality Distribution Among the Top 5 Makes with Most Accidents



Make
- Beech
- Bell
- Cessna
- Grumman
- Piper

Fatality Distribution Among the Top 5 Makes with Most Accident

Fatal - Cessna, Piper, Beech, Bell, Grumman,
Non-Fatal - Cessna, Piper, Beech, Bell, Grumman

1. Safety Measures:

   Given that these makes have same record of both fatal and non-fatal accidents, it's essential to invest in robust safety measures. This could include advanced pilot training, regular aircraft maintenance, and the implementation of safety management systems.

2. Insurance:

   Ensure adequate insurance coverage is in place. Given the accident data, insurance costs may be higher for these makes.

Fatality Distribution Among the Top 5 Makes with Least Accidents

Make
- Abbott
- Abernathy
- Abraham
- Abrams
- AbramsNuding

Fatality Distribution Among the Top 5 Makes with Least Accidents.

1. Aircraft Selection:

   The aircraft makes with the least accidents are Abrams, Abraham, Abbot, Abernathy, and AbramsNudding. These makes could be considered safer options due to their lower accident rates. However, it's important to note that all reported accidents for these makes were fatal.

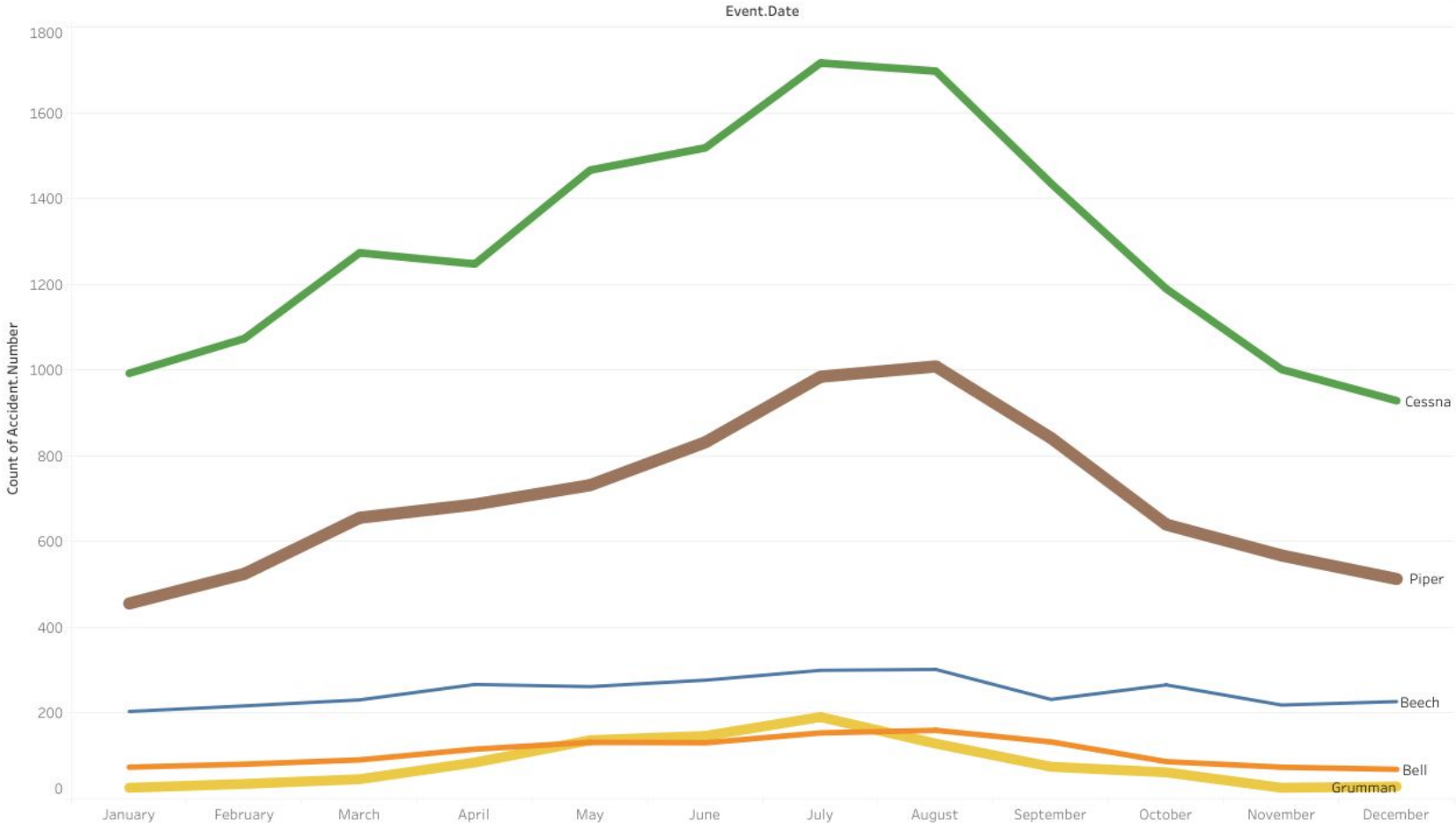
2. Risk Assessment:

   This should include factors such as the age of the aircraft, its maintenance history, and its suitability for the intended routes and operations.

3. Insurance:

   Adequate insurance coverage is crucial. While these makes have lower accident rates, the fact that all accidents were fatal may impact insurance costs. It's advisable to compare insurance deals and potentially use the accident data in negotiations.

Distribution of Accidents by Month for Top 5 Make



Distribution of Accidents by Month for Top 5 Make

1. Aircraft Selection:

   The top 5 makes with the highest number of accidents are Cessna, Piper, Beech, Bell, and Grumman. This could be related to factors like weather conditions or increased usage.

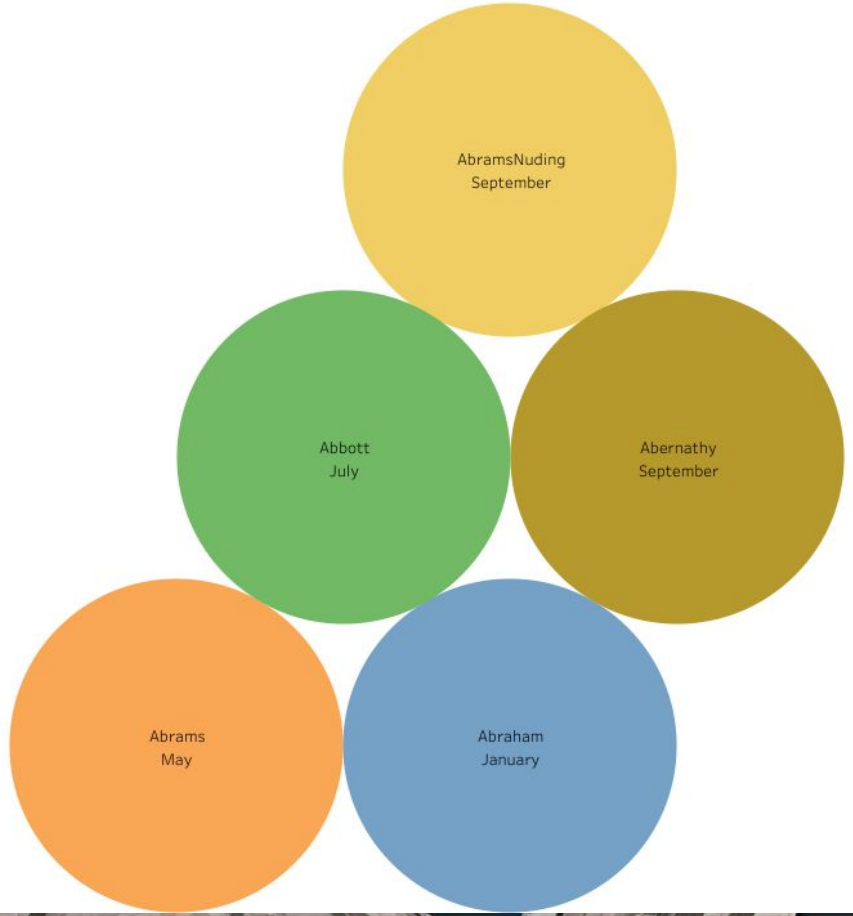
2. Safety Measures:

   Invest in robust safety measures. This includes advanced pilot training, regular aircraft maintenance, and the implementation of safety management systems.

3. Fleet Size:

   Consider the size of each make in the count of accident numbers. A larger fleet size may contribute to a higher number of accidents simply due to the larger number of aircraft in operation.

Distribution of Accidents by Month for Bottom 5 Make



Month of Event.Date, Make
- January, Abraham
- May, Abrams
- July, Abbott
- September, Abernathy
- September, AbramsNuding

Distribution of Accidents by Month for Bottom 5 Make.

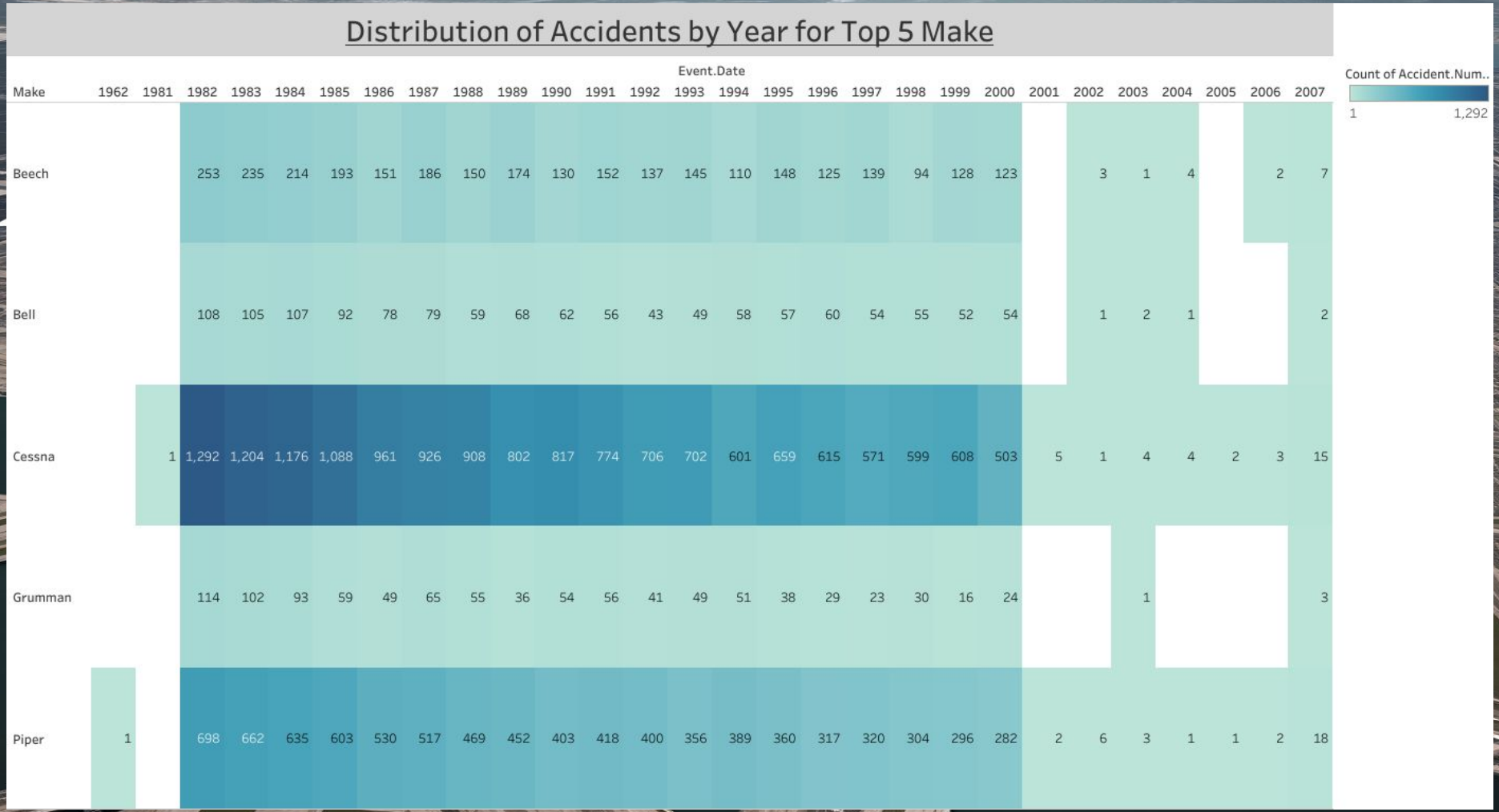
1. Aircraft Selection:

   The bottom 5 makes with the least number of accidents are Abraham, Abrams, Abbot, Abernathy, and AbramsNuding. These makes could be considered safer options due to their lower accident rates. However, it's important to note that each make had one accident in different months.

2. Seasonal Considerations:

   The accidents occurred in different months for each make. This could indicate seasonal factors at play, such as weather conditions or increased usage during certain times of the year. It's worth considering these factors when planning flight schedules and maintenance routines.

Distribution of Accidents by Year for Top 5 Make



Make	1962	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Beech			253	235	214	193	151	186	150	174	130	152	137	145	110	148	125	139	94	128	123		3	1	4		2	7
Bell			108	105	107	92	78	79	59	68	62	56	43	49	58	57	60	54	55	52	54		1	2	1			2
Cessna		1	1,292	1,204	1,176	1,088	961	926	908	802	817	774	706	702	601	659	615	571	599	608	503	5	1	4	4	2	3	15
Grumman			114	102	93	59	49	65	55	36	54	56	41	49	51	38	29	23	30	16	24			1				3
Piper	1		698	662	635	603	530	517	469	452	403	418	400	356	389	360	317	320	304	296	282	2	6	3	1	1	2	18

Distribution of Accidents by Month for Bottom 5 Make.

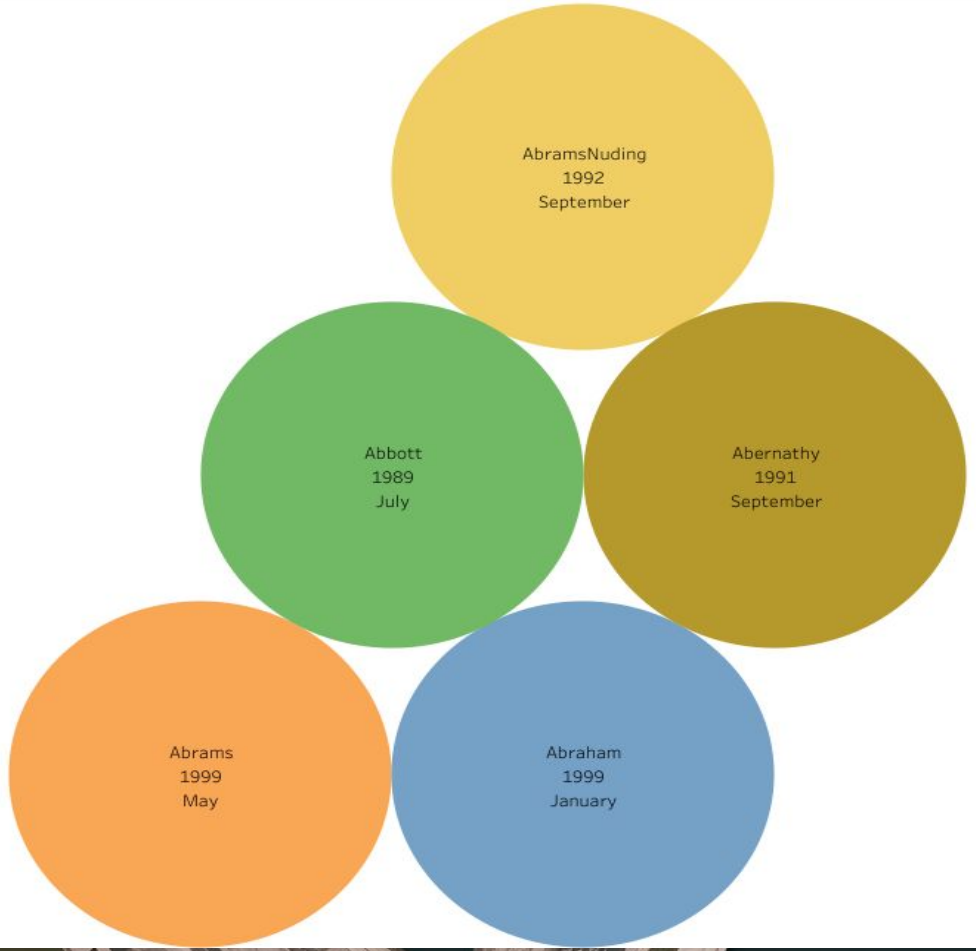
1. Aircraft Selection:

   The top 5 makes with the most accidents from 1982 to 2007 are Cessna, Piper, Beech, Bell, and Grumman. Cessna has the highest accident frequency and Grumman has the lowest. When selecting aircraft for your fleet, consider these accident frequencies as they provide insight into the historical safety records of these makes.

2. Risk Assessment:

   Conduct a comprehensive risk assessment for each make and model under consideration. This should take into account not just the accident data, but also factors like the age of the aircraft, its maintenance history, and its suitability for the intended routes and operations.

Distribution of Accidents by Year for Bottom 5 Make



Distribution of Accidents by Year for Bottom 5 Make

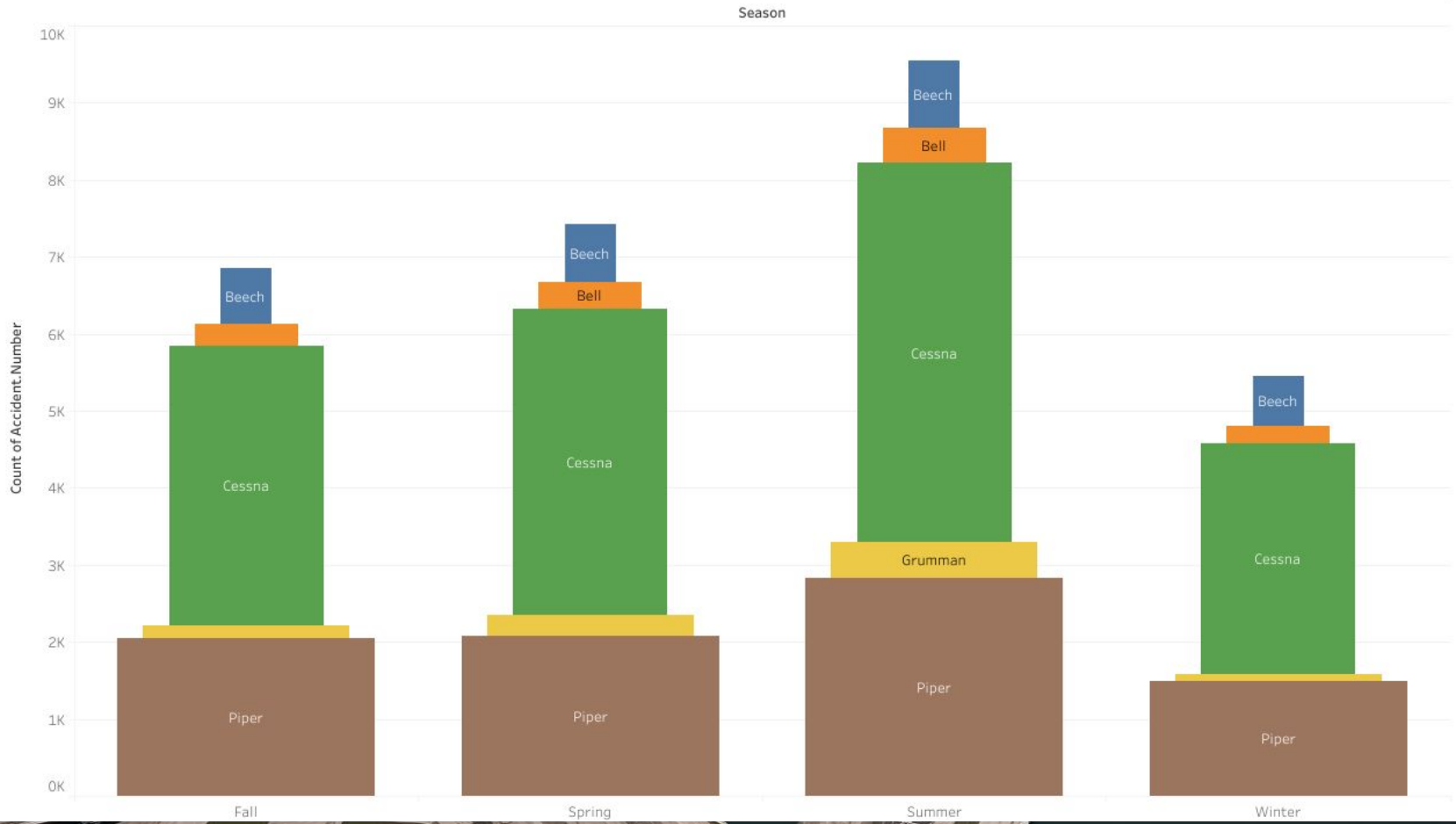
1. Aircraft Selection:

   The bottom 5 makes with the least number of accidents are Abrams, Abraham, Abbott, Abernathy, and AbramsNuding. Each of these makes had only one accident, which occurred in different years and months. These makes could be considered safer options due to their lower accident rates.

2. Historical Data:

   Considering the historical data of accidents. The accidents for these makes occurred in different years and months, which could indicate certain patterns or trends. It’s worth considering these factors when planning flight schedules and maintenance routines.

Distribution of Accidents by Season for Top 5 Make



Distribution of Accidents by Season for Top 5 Make

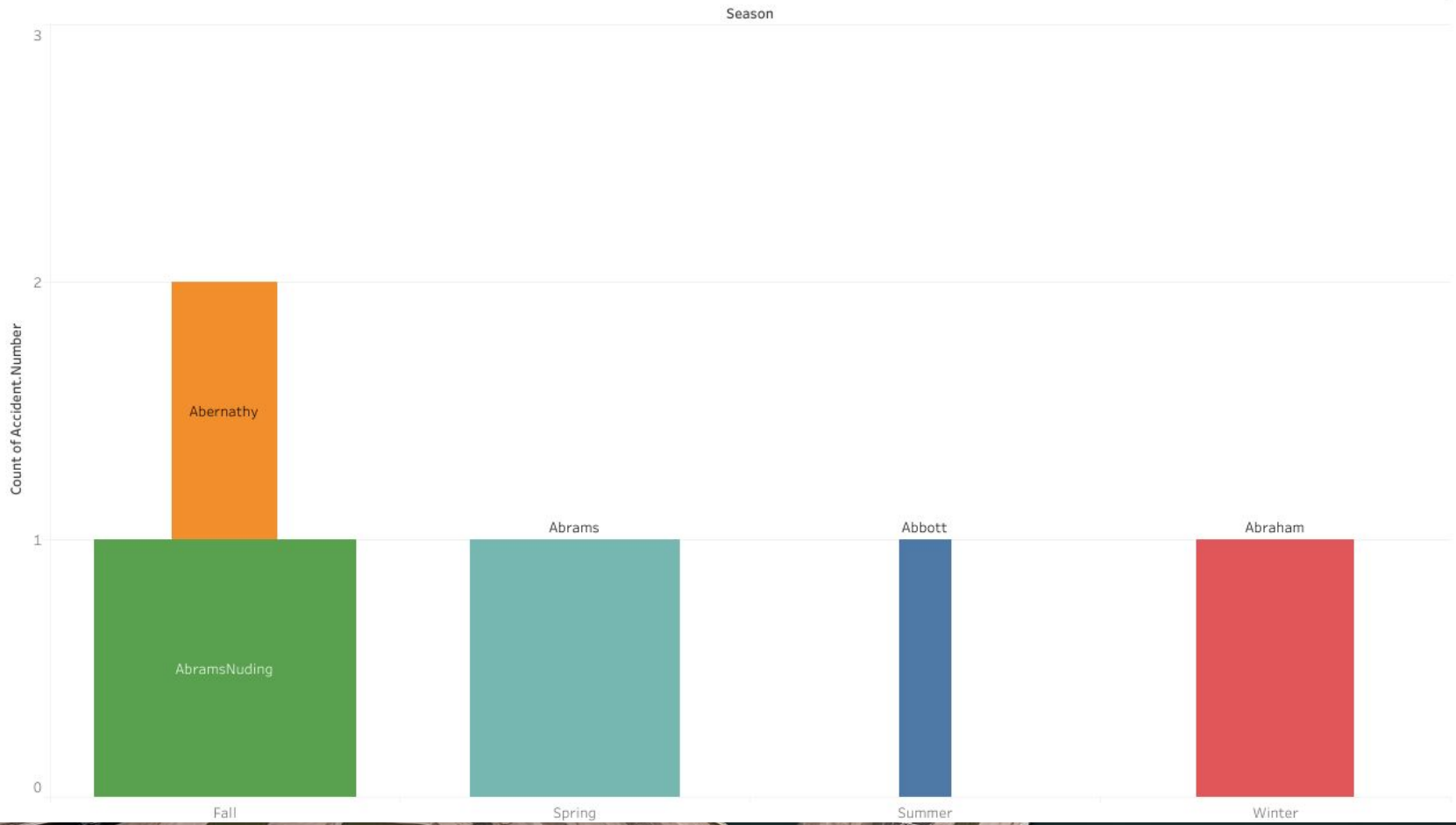
1. Aircraft Selection:

   The top 5 makes with the most accidents are Cessna, Piper, Beech, Bell, and Grumman, in that order. This order is consistent across all seasons - Fall, Spring, Summer, and Winter. When selecting aircraft for your fleet, consider these accident frequencies as they provide insight into the historical safety records of these makes.

2. Seasonal Safety Measures:

   Given that Summer has the highest number of accidents, followed by Spring, Fall, and Winter, it’s essential to implement robust safety measures that are tailored to each season. This could include additional pilot training for dealing with seasonal weather conditions, and increased aircraft maintenance checks during the high-risk seasons.

Distribution of Accidents by Season for Bottom 5 Make



During fall: Abernathy has high accident and AbramsNuding has low accident

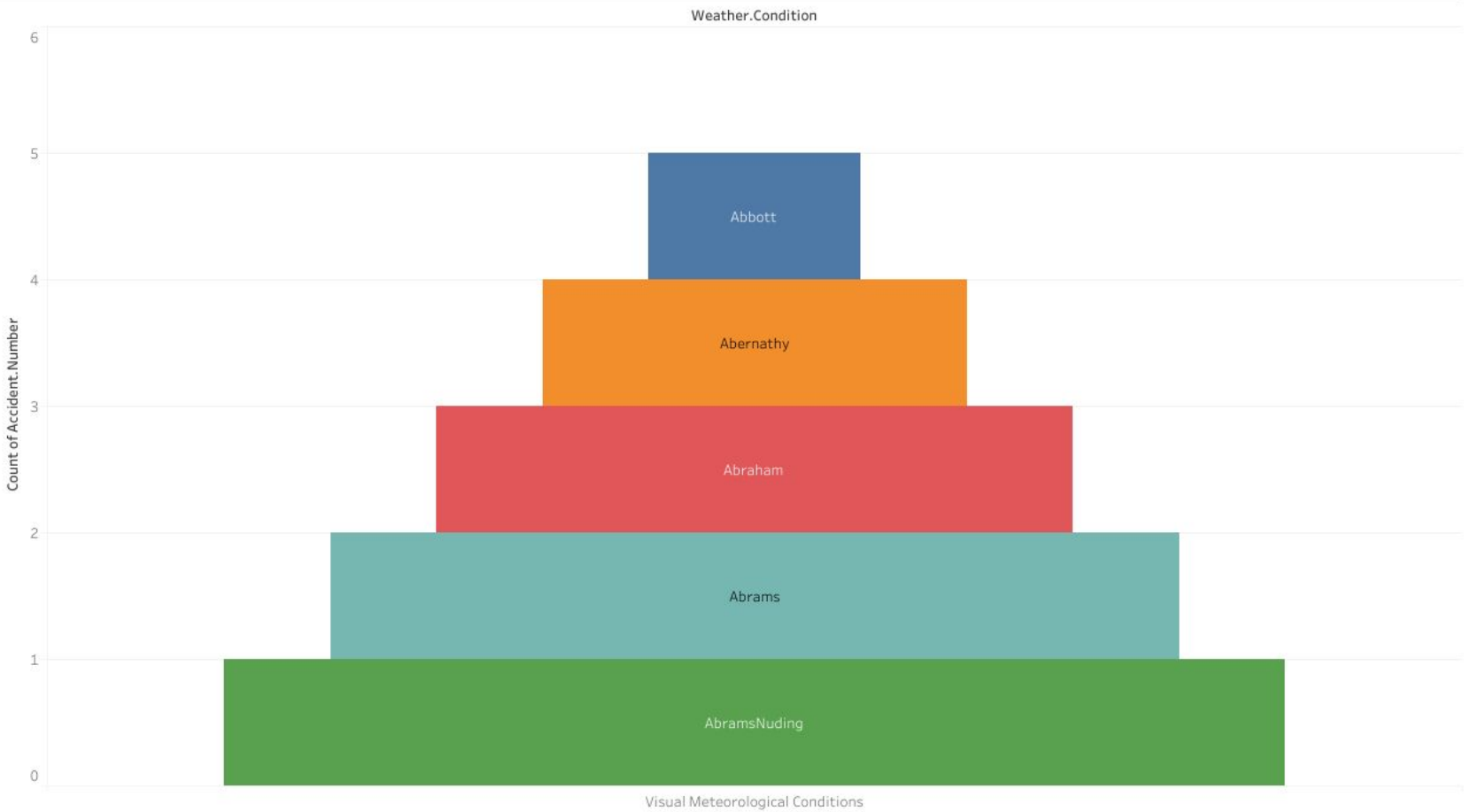
1. Aircraft Selection:

   The makes with varying accident rates across seasons are Abernathy, AbramsNuding, Abrams, Abbott, and Abraham. Abernathy has a high accident rate in Fall, while AbramsNuding has a low accident rate in the same season. Abrams, Abbott, and Abraham each have one accident in Spring, Summer, and Winter respectively. These patterns should be considered when selecting aircraft for your fleet.

2. Seasonal Safety Measures:

   Given that Fall has the highest number of accidents, followed by Spring, Winter, and Summer, it's essential to implement robust safety measures that are tailored to each season. This could include additional pilot training for dealing with seasonal weather conditions, and increased aircraft maintenance checks during the high-risk seasons.

Distribution of Accidents by Weather Condition for Bottom 5 Make



Distribution of Accidents by Weather Condition for Bottom 5 Make

1. Aircraft Selection:

   The bottom 5 makes with the least number of accidents under Visual Meteorological Conditions (VMC) are AbramsNuding, Abrams, Abraham, Abernathy, and Abbot, in that order. These makes could be considered safer options due to their lower accident rates under VMC.

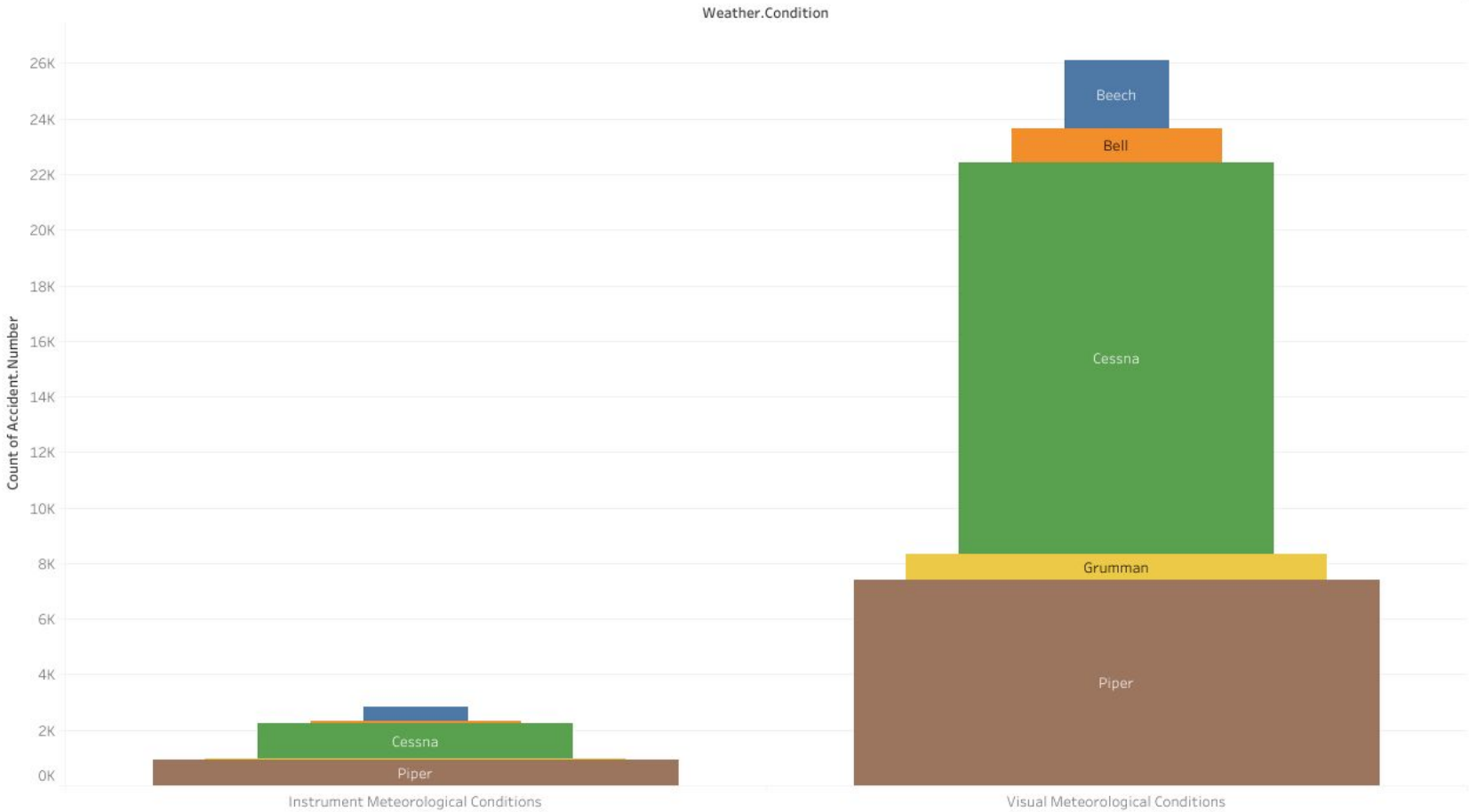
2. Weather Considerations:

   Given that all accidents for these makes occurred under VMC and none under Instrument Meteorological Conditions (IMC), it's essential to consider weather conditions when planning flight schedules. It might be worth reducing operations during poor visibility or adverse weather conditions.

3. Pilot Training:

   Invest in comprehensive pilot training that includes a strong focus on flying under various weather conditions. This can help reduce the risk of accidents, particularly under VMC where the majority of accidents for these makes have occurred.

Distribution of Accidents by Weather Conditions for Top 5 Make



Distribution of Accidents by Weather Conditions for Top 5 Make

1. Aircraft Selection:

   The top 5 makes with the most accidents under both Visual Meteorological Conditions (VMC) and Instrument Meteorological Conditions (IMC) are Cessna, Piper, Beech, Bell, and Grumman, in that order. When selecting aircraft for your fleet, consider these accident frequencies as they provide insight into the historical safety records of these makes.

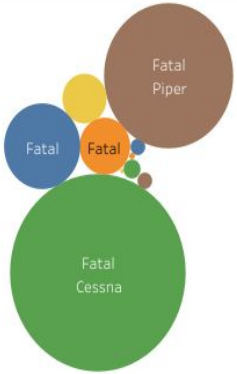
2. Weather Considerations:

   Given that VMC has a higher number of accidents than IMC, it's essential to consider weather conditions when planning flight schedules. It might be worth reducing operations during poor visibility or adverse weather conditions, even if they fall under VMC.

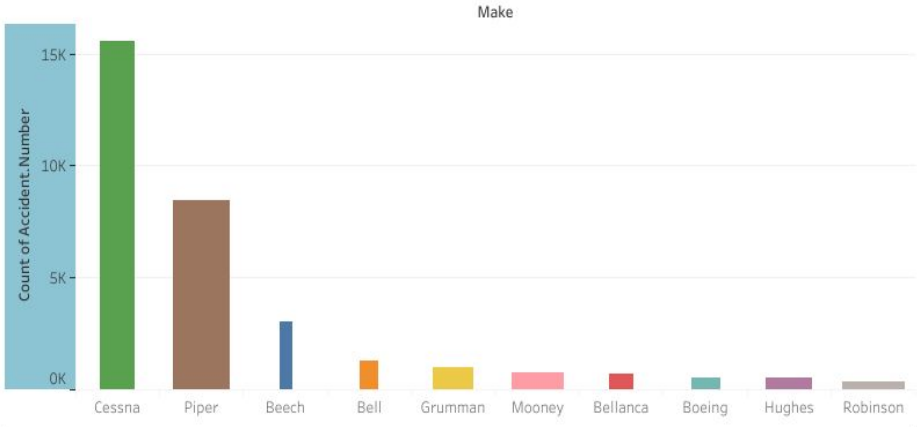
3. Pilot Training:

   Invest in comprehensive pilot training that includes a strong focus on flying under various weather conditions. This can help reduce the risk of accidents, particularly under VMC where the majority of accidents for these makes have occurred.

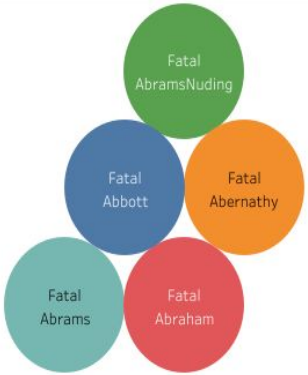
Fatality Distribution Among the Top 5 Makes with Most Accidents



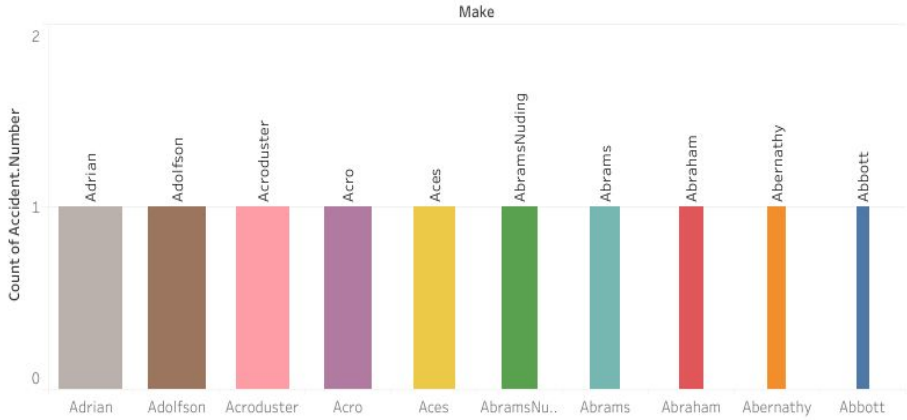
Top 10 Aeroplane Makes With Highest Accident Frequency



Fatality Distribution Among the Top 5 Makes with Least Accidents

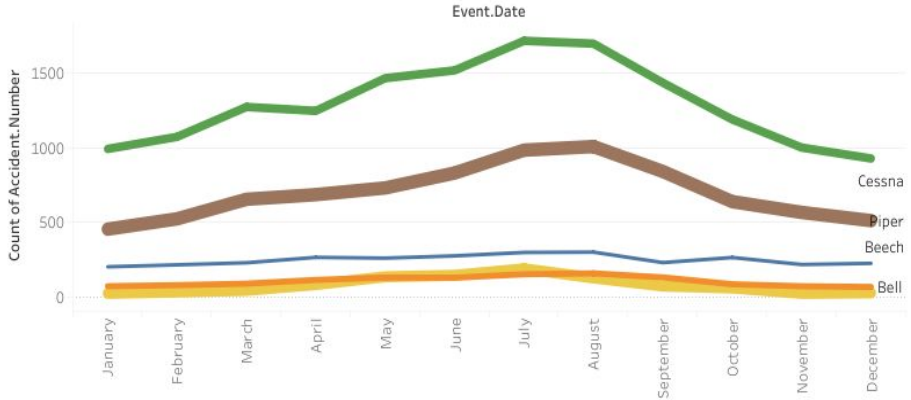


Top 10 Aeroplane Makes With Lowest Accident Frequency

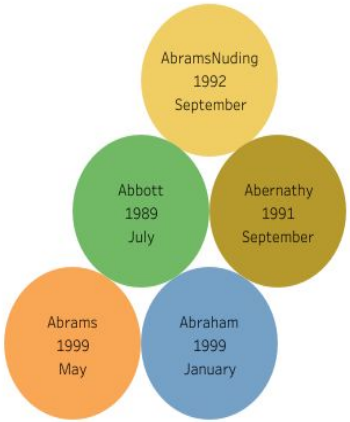


Distribution of Accidents by Month for Bottom 5 Make

Distribution of Accidents by Month for Top 5 Make



Distribution of Accidents by Year for Bottom 5 Make

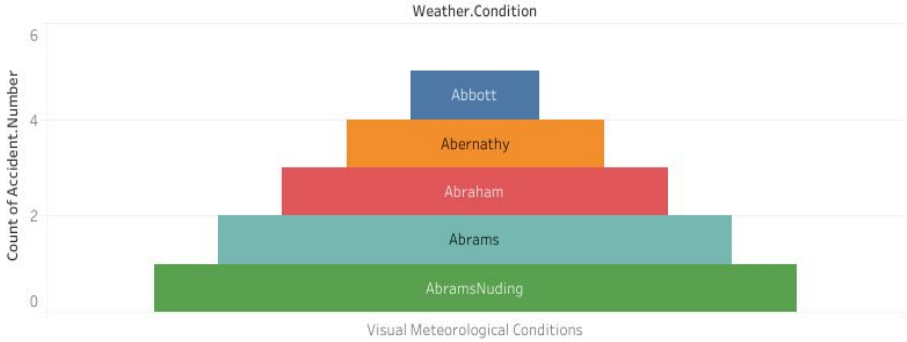


Distribution of Accidents by Year for Top 5 Make

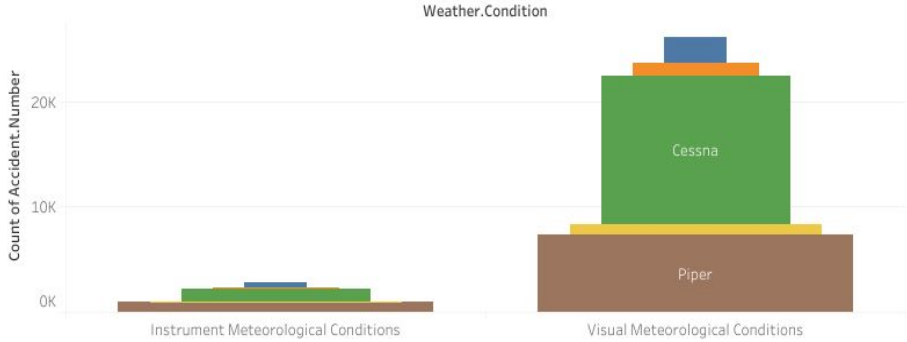
Event.Date

Make	19..	19..	19..	19..	19..	19..	19..	19..	19..	19..	19..	19..	19..	19..	19..	19..	19..	19..	20..	20..	20..	20..	20..	20..	20..
Beech			##	##	##	##	##	##	##	##	##	##	##	##	##	##	##	94	##	##	3	1	4		2	7
Bell			##	##	##	92	78	79	59	68	62	56	43	49	58	57	60	54	55	52	54		1	2	1		2
Cessna		1	##	##	##	##	##	##	##	##	##	##	##	##	##	##	##	##	##	##	##	5	1	4	4	2	3	15
Grumman			##	##	93	59	49	65	55	36	54	56	41	49	51	38	29	23	30	16	24			1				3
Piper	1		##	##	##	##	##	##	##	##	##	##	##	##	##	##	##	##	##	##	##	2	6	3	1	1	2	18

Distribution of Accidents by Weather Condition for Bottom 5 Make



Distribution of Accidents by Weather Conditions for Top 5 Make



Distribution of Accidents by Season for Bottom 5 Make

Distribution of Accidents by Season for Top 5 Make

Solution

Data Analysis Process:

It has undertaken a comprehensive data analysis process to address the problem. This involves:

1. **Data Cleaning and Imputation**: Preparing the data for analysis by cleaning and filling in missing values.
2. **Analysis**: Analyzing accident frequency by make, model, year, season, and weather conditions.
3. **Visualization**: Creating visual representations of the data to better understand the patterns and trends.

Solution

Key Findings: The analysis has yielded several key findings:

1. **Top Aircraft Makes with Highest and Lowest Accident Frequencies**: Cessna, Piper, Beech, Bell, and Grumman have the highest accident frequencies, while Adrian, Adolfson, Acroduster, Acro, Aces, AbramsNuding, Abrams, Abraham, Abernathhy, and Abbot have the lowest.
2. **Fatality Distribution**: The same makes have records of both fatal and non-fatal accidents, indicating the need for robust safety measures.
3. **Distribution of Accidents**: The distribution of accidents by month, year, season, and weather conditions for these makes provides insights into when and under what conditions most accidents occur.

RECOMMENDATIONS

Actionable Insights: Based on these findings, it provided several actionable insights:

1. **Aircraft Selection**: Consider the accident frequencies of different makes when selecting aircraft for your fleet.
2. **Safety Measures**: Invest in robust safety measures, including advanced pilot training and regular aircraft maintenance.
3. **Risk Assessment**: Conduct a comprehensive risk assessment for each make and model under consideration, taking into account not just the accident data, but also factors like the age of the aircraft, its maintenance history, and its suitability for the intended routes and operations.
4. **Insurance**: Ensure adequate insurance coverage is in place, considering the accident data when comparing insurance deals.

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