AVIATION ACCIDENT REPORT

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Type of Project: LOGD using Fuseki

1. INTRODUCTION

The National Transportation Safety Board (NTSB) reviews the Civil Aviation Accidents in the US. Civil aviation comprises of light sport aircrafts flown by novice pilots to large transport aircraft providing scheduled passenger service i.e., Commercial Air Carrier Operators and General Aviation Operators.

This report focuses on the accidents caused by the commercial air carrier operators using the NTSB's review data. These operators are regulated by the Title 14 Code of Federal Regulations (CFR) Parts 121 and 135. Part 121 usually refers to operators who fly large transport-category aircraft in controlled airspace and controlled airports that have available specific weather, navigational, operational, and maintenance support. Part 135 regulates commercial air carriers flying smaller aircraft with nine or fewer passenger seats, often into smaller airports that do not provide the services required to support Part 121 operations. This report covers the accident rates, passenger fatalities, total fatality rates and accident severity classification for operators regulated by CFR 121 and contrasts the total accident rates and total fatality rate with operator regulated by CRF 135.

2. TARGET AUDIENCE

This report is aimed to be useful for the US commercial aircraft manufacturers, aircraft engineers, Emergency medical services, US government departments such as Federal Aviation Administration (FAA) and US Department of Transportation, other organizations such as International Air Transport Association (IATA) and researchers who intend to further study the causes of the accidents. Since this report gives a comprehensive statistics of the aviation accident rates for the commercial air carriers for the years 2000-2009, the passenger fatalities, the total number of accidents that had fatalities and the different accident severity, this data can be used by the different departments to reduce the number of accidents, improve the quality and design of the aircraft parts, plan for the necessity to have an alternate mode of transport, improve aviation experience and analyze the causes for the accidents.

3. DESCRIPTION OF DATA SOURCES

This report uses five datasets (Datasets 1567, 1568, 1569, 1570 and 1573) from the LOGD website.

3.1 Dataset 1567:

- This dataset provides the different categories of accident severity classification and the number of accidents in each category for the years 1999-2009.
- This dataset 146 triples.
- The different accident categories are as follows:

Severity	Description
Major	The aircraft was destroyed (Hull Loss) , multiple fatalities or one fatality and substantial damage to the aircraft
Serious	One fatality without substantial damage to the aircraft or at-least one serious injury with substantial damage to the aircraft
Damage	No person was killed or seriously injured, but the aircraft was substantially damaged
Injury	Non-fatal accident with at least one serious injury but no substantial damage to the aircraft

Table 3.1. NTSB severity classification for Part 121

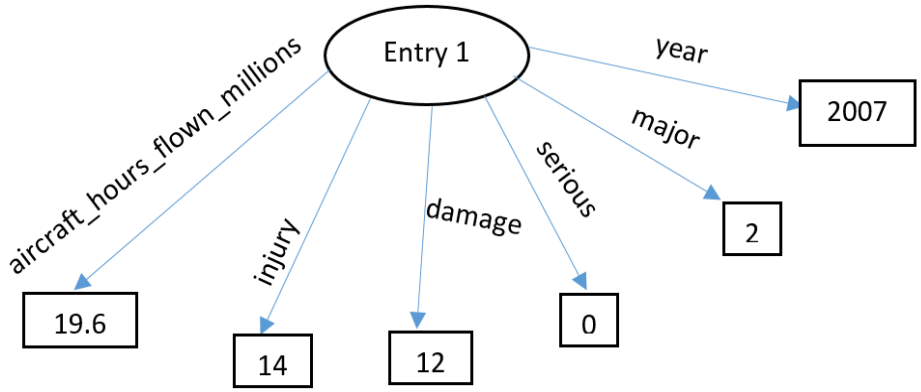

Figure 3.1: Dataset 1567 description

3.2 Dataset 1568:

- This dataset provides the statistics of passenger injuries and injury rates for the years 1999-2009, for U.S. Air Carriers operating under 14 CFR 121.
- This dataset has 106 triples.

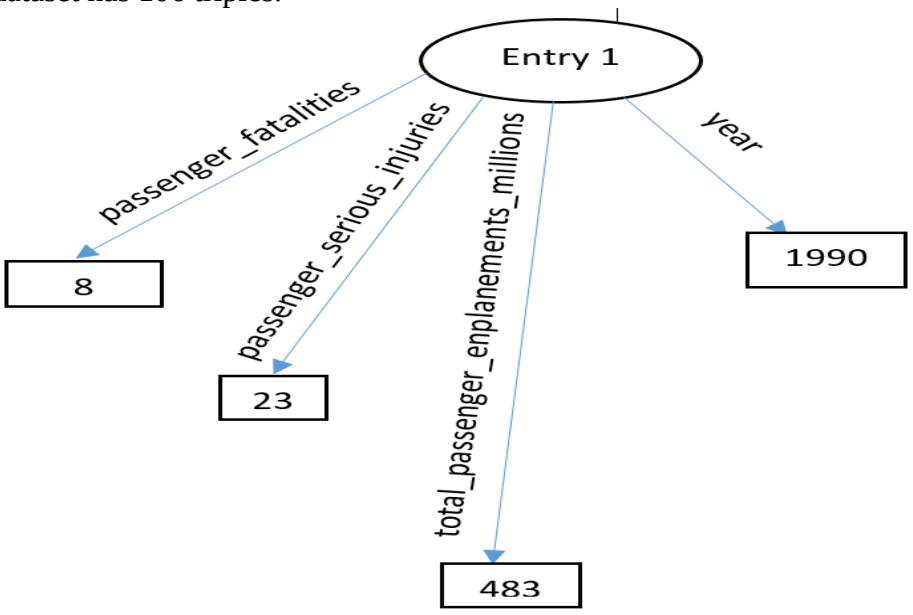

Figure 3.2. Dataset 1568 description

3.3 Dataset 1569:

- This dataset provides the statistics of the number and rate of Destroyed Aircraft for the years 1999 - 2009, for U.S. Air Carriers Operating under 14 CFR 121.
- This dataset has 86 triples.

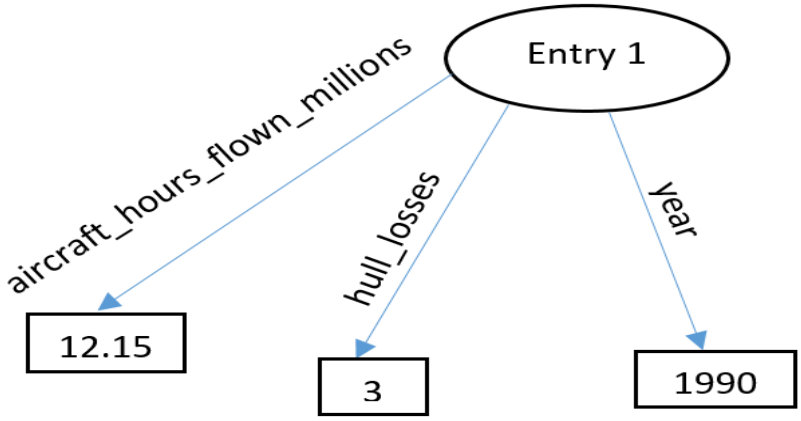

Figure 3.3. Dataset 1569 description

3.4 Dataset 1570:

- This dataset provides the data of the accidents, fatalities, and rates for the years 1999 - 2009, for U.S. Air Carriers Operating under 14 CFR 121, Scheduled and Nonscheduled Service (Airlines).
- This dataset has 186 triples.

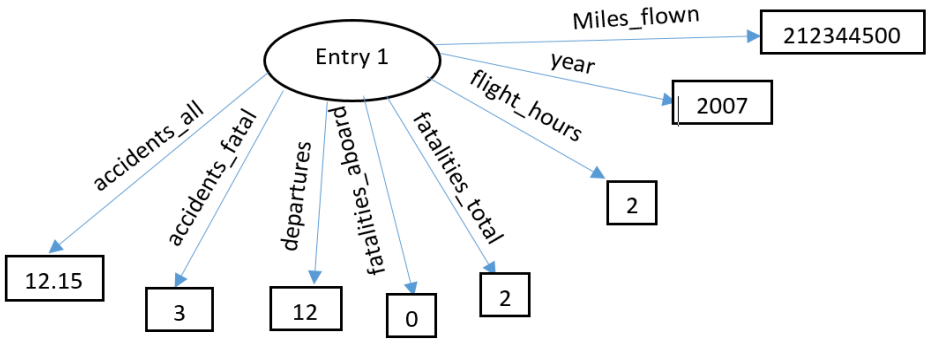

Figure 3.4. Dataset 1570 description

3.5 Dataset 1573:

- This dataset provides the of the accidents, fatalities, and rates for the years 1999 - 2009, for U.S. Air Carriers Operating under 14 CFR 135, Scheduled Service.
- This dataset has 186 triples.

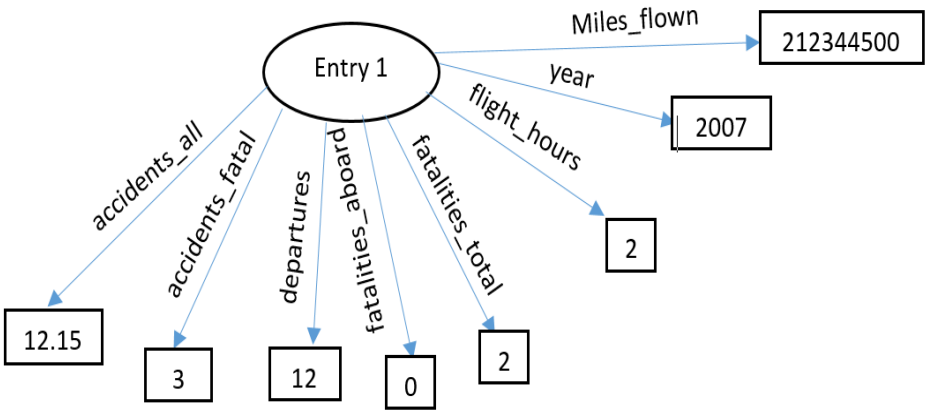

Figure 3.5. Dataset 1573 description

4. DATA INTEGRATION

4.1 Accident Severity Categories from 2000-2009

- Dataset 1567 is queried using sparql language in Fuseki server to display the accidents in each severity category mentioned in section 3.1.
- The query used is as follows:

```
SELECT distinct ?year ?major ?serious ?damage ?injury
WHERE {
GRAPH  <http://localhost:3030/project/data/data67>{
?s1 <http://data-gov.tw.rpi.edu/vocab/p/1566/year> ?year;
<http://data-gov.tw.rpi.edu/vocab/p/1566/major> ?major;
<http://data-gov.tw.rpi.edu/vocab/p/1566/serious> ?serious;
<http://data-gov.tw.rpi.edu/vocab/p/1566/damage> ?damage;
<http://data-gov.tw.rpi.edu/vocab/p/1566/injury> ?injury.
FILTER (?year>'1999')
}
}
order by (?year)
```

4.2 Classification of Accidents and Passenger Fatalities from 2000-2009

- Datasets 1567, 1568 and 1569 using sparql language in Fuseki server are integrated using the ‘year’ attribute.
- The following query is executed to retrieve the data.

```
SELECT distinct ?year ?major ?serious ?damage ?injury ?accidents_fatal ?hull_losses
WHERE {
 GRAPH  <http://localhost:3030/project/data/data67>{
   ?s1 <http://data-gov.tw.rpi.edu/vocab/p/1566/year> ?year;
    <http://data-gov.tw.rpi.edu/vocab/p/1566/major> ?major;
    <http://data-gov.tw.rpi.edu/vocab/p/1566/serious> ?serious;
     <http://data-gov.tw.rpi.edu/vocab/p/1566/damage> ?damage;
    <http://data-gov.tw.rpi.edu/vocab/p/1566/injury> ?injury.
  }
 GRAPH  <http://localhost:3030/project/data/data69>{
```

```
   ?s3 <http://data-gov.tw.rpi.edu/vocab/p/1566/year> ?year;
    <http://data-gov.tw.rpi.edu/vocab/p/1566/hull_losses> ?hull_losses;
   }
GRAPH  <http://localhost:3030/project/data/data70>{
   ?s4 <http://data-gov.tw.rpi.edu/vocab/p/1566/year> ?year;
    <http://data-gov.tw.rpi.edu/vocab/p/1566/accidents_fatal> ?accidents_fatal;
   }
}
order by desc (?year)
limit 10
```

4.3 Type of Fatalities for Aviation Accidents from 2000-2009

- Datasets 1568 and 1570 using sparql language in Fuseki server are integrated to display the mentioned data using the attribute ‘year’.
- The following query is executed to retrieve the data.

```
SELECT distinct ?year ?passenger_fatalities ?passenger_injuries ?fatalities_aboard
?fatalities_total
WHERE
{
 GRAPH  <http://localhost:3030/project/data/data70>{
   ?s1 <http://data-gov.tw.rpi.edu/vocab/p/1566/year> ?year;
    <http://data-gov.tw.rpi.edu/vocab/p/1566/fatalities_aboard> ?fatalities_aboard;
    <http://data-gov.tw.rpi.edu/vocab/p/1566/fatalities_total> ?fatalities_total
}
 GRAPH  <http://localhost:3030/project/data/data68>{
   ?s2 <http://data-gov.tw.rpi.edu/vocab/p/1566/year> ?year;
    <http://data-gov.tw.rpi.edu/vocab/p/1566/passenger_fatalities> ?passenger_fatalities;
    <http://data-gov.tw.rpi.edu/vocab/p/1566/passenger_serious_injuries>
?passenger_injuries ;
   }
}
order by desc (?year)
limit 10
```

4.4 Accident per Million Departures

- Dataset 1570 and 1573 using sparql language in Fuseki server are integrated to compare the number of accidents per million departures between air carriers under CFR 121 and under CFR 135 using the attribute ‘year’.
- The following query is executed to retrieve the data.

```
SELECT distinct ?year ?accidents_all1 ?fatalities_total1 ?departures1 ?accidents_all2
?fatalities_total2 ?departures2
WHERE {
 GRAPH  <http://localhost:3030/project/data/data70>{
   ?s1 <http://data-gov.tw.rpi.edu/vocab/p/1566/year> ?year;
    <http://data-gov.tw.rpi.edu/vocab/p/1566/accidents_all> ?accidents_all1;
    <http://data-gov.tw.rpi.edu/vocab/p/1566/departures> ?departures1;
     <http://data-gov.tw.rpi.edu/vocab/p/1566/fatalities_total> ?fatalities_total1 .
   }
 GRAPH  <http://localhost:3030/project/data/data73>{
   ?s2 <http://data-gov.tw.rpi.edu/vocab/p/1566/year> ?year;
    <http://data-gov.tw.rpi.edu/vocab/p/1566/accidents_all> ?accidents_all2;
```

```
    <http://data-gov.tw.rpi.edu/vocab/p/1566/departures> ?departures2 ;
     <http://data-gov.tw.rpi.edu/vocab/p/1566/fatalities_total> ?fatalities_total2 .
   }
  filter (?year >= "2000")
}
order by (?year)
```

4.5 Fatality per Accident

- Dataset 1570 and 1573 using sparql language in Fuseki server are integrated to compare the average number of fatalities per accident between air carriers under CFR 121 and under CFR 135 using the attribute 'year'.
- The query mentioned in 4.4 is used to get the fatality rates per year.

5. DATA PRODUCT RESULTS

5.1 Accident Severity Categories from 2000-2009

- By executing the query mentioned in section 4.1, we get the number of accidents under each classification for the years 2000-2009.
- The output is displayed using a line graph for each category using Google Visualization.
- From this we can infer that accidents involving aircraft damage have been the most through the years but has substantially decreased

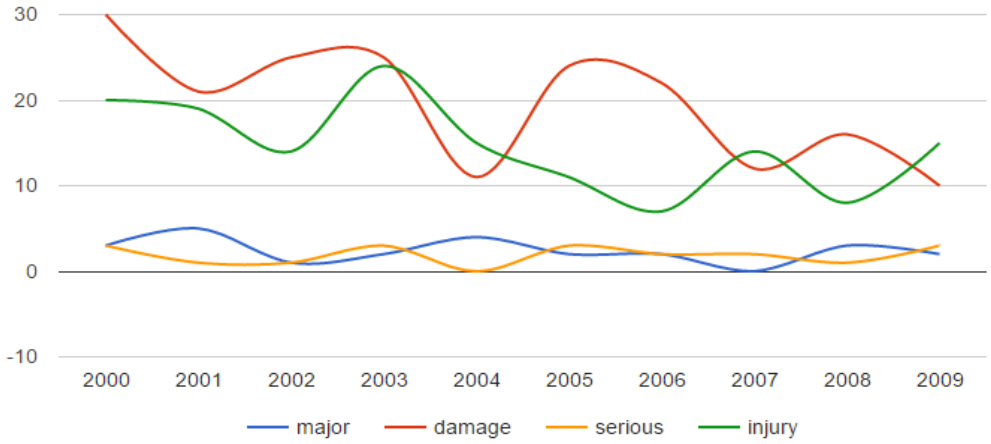

Figure 5.1. Severity classification of Accident

5.2 Classification of Effects of Aviation Accidents from 2000-2009

- By executing the query mentioned in section 4.2, we get the number of accidents classified according to severity, the passenger fatalities, the passenger injuries and the hull losses for the years 2000-2009.
- The values retrieved are computed to display the classification of total accidents into aircraft destruction (hull loss), total accidents that caused fatalities, accidents involving passenger injuries and aircraft damages.
- The output is displayed using a pie chart by indicating the number of accidents for each classification using Google Visualization.
- From this we could infer that the aircraft damages have been the most.

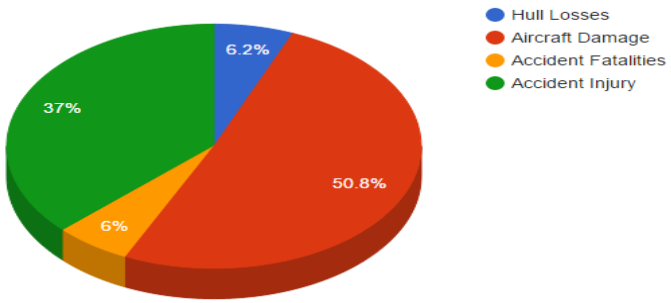

Figure 5.2. Classification of effects of Aviation Accidents

5.3 Type of Fatalities for Aviation Accidents from 2000-2009

- By executing the query mentioned in section 4.3, we get the number of passenger fatalities, the passenger injuries for the years 2000-2009.
- The output is displayed using a bar chart by indicating the type of fatalities for each classification using Google Visualization.
- From this we can infer that the fatalities have been most in 2001 and has reduced over the years.

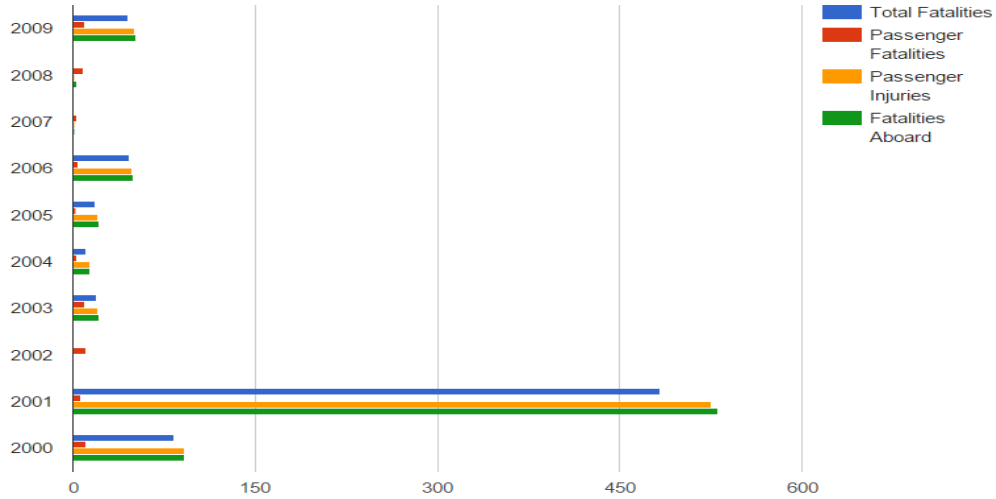

Figure 5.3. Type of fatalities for aviation accidents

5.4 Accidents per Million Departures for CFR part 121 and part 135 operators

- By executing the query mentioned in section 4.4, we get the number of accidents per million departures for the years 2000-2009 under CFR 121 and under 135.
- The output is displayed using a line chart by indicating the accident rate using Google Visualization.
- From this we can say that Accident rates for air carriers under part 135 are comparatively higher.

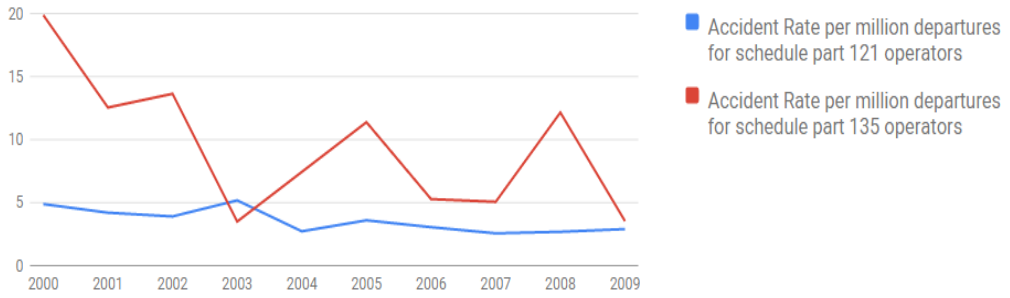

Figure 5.4. Accidents per million departures for CFR part 121 and part 135 operator

5.5 Fatalities per Accident for CFR part 121 and part 135 operators

- By executing the query mentioned in section 4.4, we get the average number of fatalities per accident for the years 2000-2009 under CFR 121 and under 135.
- The output is displayed using a bar chart by indicating the fatality rate comparing CFR 121 and CFR 135 using Google Visualization
- From this we can infer that the fatality rate for operators under part 121 are higher on an average.

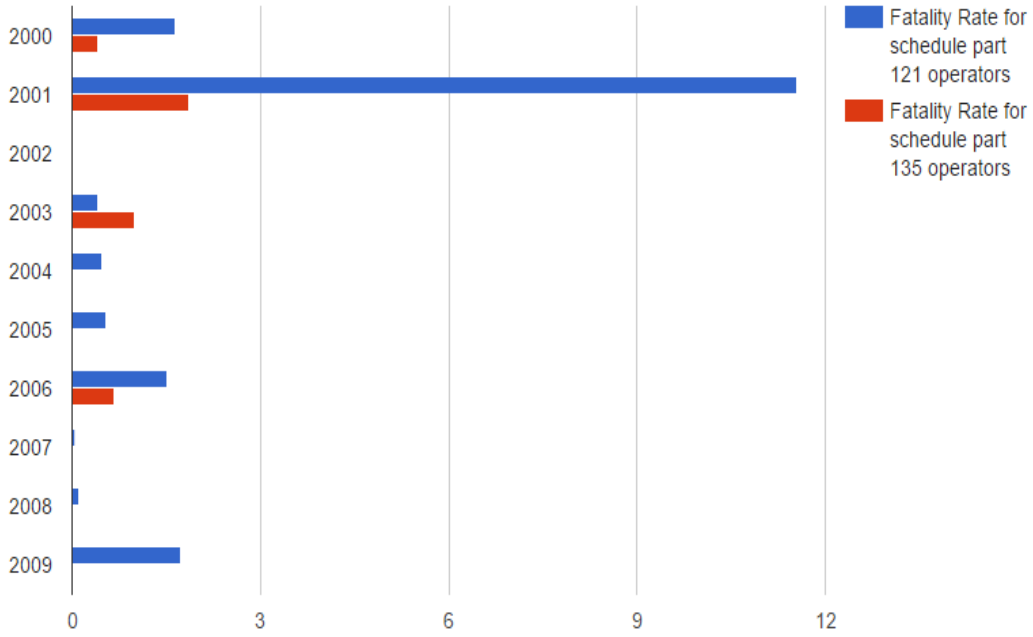

Figure 5.5. Fatality per accident rate for CFR part 121 and part 135 operators

6. SUMMARY

Aircraft are widely used for activities ranging from travelling, entertainment sports to carrying cargo. It is important for one to analyze the aviation accidents occurring in commercial aircrafts. This report details the aviation accidents occurring in commercial air carriers from 2000-2009. This report enables understanding of the rate of change of different accident severities, the passenger fatalities and type of fatalities occurring due to aircraft accidents. We can also infer the accident rate and the fatality rate for operators under CFR part121 and CFR part 135. We have learnt that the aircraft damages have been the most significant result due to aviation accidents and CFR part 135 has lower fatalities but higher accident rates when compared to CFR part 121.

The report can be furthered improved to detail the causes for the accidents, names of aircraft operators with most accidents and locations the accidents occurred in order to give a better understanding of the aviation accidents to prevent future accidents and improve the flight experience.