A STUDY OF ERRORS
IN PREDICTING ARRIVAL FIX TIMES
IN AIR TRAFFIC CONTROL

BY

Ming-Cheng Chiang

Submitted to the Department of Aeronautics and Astronautics
in Partial Fulfillment of the Requirements for the
Degree of

Master of Science in Aeronautics and Astronautics
at the

Massachusetts Institute of Technology

June 1993

© Massachusetts Institute of Technology 1993
All rights reserved

Signature of Author ____________________________

Department of Aeronautics and Astronautics
May 14, 1993

Certified by ____________________________

Professor Robert W. Simpson
Department of Aeronautics and Astronautics
Thesis Advisor

Accepted by ____________________________

Professor Harold Y. Wachman
Chairman, Department Graduate Committee
A Study of Errors in Predicting Arrival Fix Times in Air Traffic Control

by

Ming-Cheng Chiang

Submitted to the Department of Aeronautics and Astronautics
on May 14, 1993 in partial fulfillment of the
requirement for the Degree of Master of Science in
Aeronautics and Astronautics

ABSTRACT

As the US air line industry experienced remarkable growth during the economic expansion of the 1980's and air traffic increased drastically, terminal airspace around busy airport became more and more crowded. The accompanying effects were the occurrence of congestion and delay. To alleviate the effects of this delay, it has become necessary to introduce Traffic Flow Management processes which depend critically on the accurate prediction of arrival rates of traffic at busy airports. The objective of this thesis is to provide statistical evidence about the accuracy of Estimated Fix Time Arrivals (EFTAs) at terminal area entry fixes for airborne aircraft as a function of "Time-to-go" (T). This is needed to assess the accuracies of the expected arrival rates at a congested airport. The accuracies of the EFTAs are expressed as a mean error, a standard deviation $\sigma$, and there is a variation of $\sigma$ with "Time-to-go" (T). Furthermore, we also investigate the effects of initial climb on $\sigma(T)$. The results of these studies are quite important for properly executing Traffic Flow Management, and affect the possibility of developing new concepts.

Thesis Supervisor: Robert W. Simpson
Title: Director, Flight Transportation Lab, MIT
Acknowledgments

My sincerest thanks to Professor Robert W. Simpson who has supervised and supported the research leading to this thesis. I have benefited a great deal from his kind help and expert advice in the course of this research. It is a tremendous privilege for me to have this opportunity to work with Professor Simpson.

I would also like to thank my good friends here in MIT: Kuang-Han Chen, Nai-Hsin Ting for their valuable suggestions upon the thesis. I am grateful to Elizabeth Zotos, Catherine E. Carter, and Clare Williman for their kind helps.

Lastly, I would like to thank my parents, Shui-Li Chiang and Mei-Ying Yang Chiang, for their unconditional love and financial support.
## Contents

1 Introduction 5  
   1.1 Motivation of the Thesis 5  
   1.2 Structure of the Thesis 6  

2 Introduction 7  
   2.1 Enhanced Traffic Management System (ETMS) 7  
   2.2 Background Information 8  
      2.2.1 NAS Messages 8  
      2.2.2 Time Type (TTP) 9  
      2.2.3 Flight Time Modeling 10  
         2.2.3.1 Departure Time Modeling 10  
         2.2.3.2 En Route Traffic Modeling 11  
         2.2.3.3 Position Update Processing 12  

3 Methodology Analysis 13  
   3.1 Introduction 13  
   3.2 ETA Errors versus Time-to-go (T) 13  
      3.2.1 Denver(DEN) 13  
      3.2.2 Orlando(MCO) 14  
      3.2.3 Minneapolis(MSP) 14
Chapter 1

Introduction

1.1 Motivation of the Thesis

As the US air line industry experienced remarkable growth during the economic expansion of the 1980's and air traffic increased drastically, terminal airspace around busy airport became more and more crowded. The accompanying effects were the occurrence of congestion and delay. To alleviate the effects of this delay, it has become necessary to introduce Traffic Flow Management processes which depend critically on the accurate prediction of arrival rates of traffic at busy airports. The objective of this thesis is to provide statistical evidence about the accuracy of Estimated Fix Time Arrivals (EFTAs) at terminal area entry fixes for airborne aircraft as a function of "Time-to-go" (T). This is needed to assess the accuracies of the expected arrival rates at a congested airport. The accuracies of the EFTAs are expressed as a mean error, a standard deviation σ, and there is a variation of σ with "Time-to-go" (T). Furthermore, we also investigate the effects of initial climb on σ(T). The results of these studies are quite important for properly executing Traffic Flow Management, and affect the possibility of developing new concepts.
1.2 Structure of the Thesis

The remainder of this thesis is divided into five chapters. Chapter 2 contains a brief description of the current Estimated Traffic Management System (ETMS), and some background information referring to its National Airspace System (NAS) messages, Time Type (TPP), and Flight Time Modeling. Those are needed for us to understand the following chapters' statistical analysis.

Chapter 3 addresses the methodology used in the statistical analysis. It explains how to pick up the sample points from air flights in four cities (Denver, Orlando, Minneapolis-St. Paul, and Phoenix), and also shows some example plots of EFTA errors versus Time-to-go, the distribution of EFTA errors for different discrete time-to-go values (T=30,60,90,120 mins, etc.), and the trend of σ(T) with time-to-go.

Chapter 4 gives the aggregate analysis of the results we obtained in chapter 3 for four cities and all cities, and compares the different cities with one another.

Chapter 5 provides the conclusion about the thesis and an overview of further research in this topic.
Chapter 2

Introduction

2.1 Enhanced Traffic Management System (ETMS)

The Enhanced Traffic Management System (ETMS) assists the FAA in the performance of air traffic management. Air traffic management is the strategic control of traffic flow; its purpose is to reduce airborne delays and congestion, and to increase the overall output of the National Airspace System (NAS).

Air traffic management is performed through a hierarchical organization. At the top is the Air Traffic Control System Command Center (ATCSCC) which is concerned with the management of the nationwide traffic problems. The next stage consists of Traffic management Units (TMUs) at the contiguous U.S. Air Route Traffic Control Centers (ARTCCs). The final stage of the hierarchy is the TMUs at the Terminal Radar Approach Control (TRACON) facilities.

The ETMS is associated with the Advanced Traffic Management System (ATM) of which goal is to develop and evaluate new concepts for traffic management automation. The ETMS implementation currently represents the first two of the five ETMS
development phases. The first phase was the development of the Aircraft Situation Display (ASD), which can graphically display current aircraft positions. The second phase is the development of the monitor and alert function. Monitor/Alert can provide a forecast of traffic demands for all airports, sectors, and fixes of interest in U.S. and alerts for the situation where these forecasts exceed any desired set of alert thresholds.

### 2.2 Background Information

To conduct Traffic Flow Management, the ATC computer in each of the ARTCCs of the NAS sends recurrent messages on the position of all its aircraft (and other information) to the ATM system at 5 minutes intervals. This allows the display of the nation's air traffic on a single display called the ASD (Aircraft Situation Display). From these messages, it is possible to determine the current groundspeed of each aircraft, and using its flight planned route to estimate arrival times at future waypoints. Each flight plan is analyzed to identify a set of "events" which are important during the flight (e.g. sector or Center boundary crossing, enroute waypoints, crossing into TRACONs at "Arrival" or "Entry" fixes, etc.).

#### 2.2.1 NAS Messages

There are seven NAS messages received by ETMS. We provide a brief description about each message:

- **Flight schedule (FS):** It provides information on scheduled flights before a flight plan is filed.

- **Flight plan (FZ):** Its purpose is to transmit the intentions of a flight as filed with the NAS. It provides the routing, altitude, and airspeed.
• Amendment (AF): its purpose is to amend a flight's intentions that were previously filed with the NAS.

• Cancellation (RZ): its purpose is to cancel the a flight plan previously filed with the NAS.

• Departure (DZ): signifies the activation of a proposed flight, whenever the radar surveillance establishes that the flight is airborne and establishes a track file for that aircraft.

• ARTCC Boundary Crossing (UZ): transmits the time at which an aircraft has left the airspace of an Air Route Traffic Control Center and enters new airspace.

• Position Update (TZ): Transmits the current position, altitude, and groundspeed of a flight as tracked by the NAS

• Arrival (AZ): signifies the termination of an active flight after it enters the airspace of its destination TRACON (Terminal Radar Control Center).

2.2.2 Time Type (TTP)

There are three types of information concerning time values in the above messages as follows:

TTP=4 - updated directly from TZ

---

1A position update is generated for each flight at least once every 5 minutes. A single TZ may contain position update for multiple flights.
TTP=5 - interpolated from other TZ events

TTP=6 - predicted times

Either 4 or 5 corresponds to our best estimate of the actual time at any Entry fix.

2.2.3 Flight Time Modeling

The description of the ETMS flight time modeling is divided into three sections. Section 2.2.3.1 describes how the ETMS models departure times. 2.2.3.2 describes how the ETMS predicts time for the other events in a flight's event list. Section 2.2.3.3 describes how the ETMS updates event times based on the data received in position update (TZ) messages.

2.2.3.1 Departure Time Modeling

The ETMS receives departure times from incoming flight plan data messages and initially expresses all departure event times as wheels-up times\(^1\). The ETMS converts gate pushback times\(^2\) to wheel-up times by adding a taxi time estimate which is determined from historical data for each airline operating at an airport. It is expected that an actual departure message (DZ) will be received within 5 minutes of wheels-up times, and it will activate the flight plan.

The ETMS also tracks observed departure delays. When it observes that a flight has not been activated five minutes after its expected departure time, it adds five minutes

---

\(^1\) Wheels-up times refer to the time that the flight actually takes off.
\(^2\) Gate pushback times refer to the time that a flight expects to push back from the gate at a terminal after loading passengers.
to the modeled departure time. (i.e. it is waiting to see when the flight will be activated without any knowledge of why it is being delayed)

2.2.3.2 En Route Time Modeling

The computations for estimated event times while an aircraft is airborne are based on the latest groundspeed and the distance to the future event. Before takeoff, ETMS uses flight plan data using the forecasted wind vector for the nearest location and combines aircraft airspeed vector with wind vector to predict the speed over ground at each enroute event. The ETMS then uses the groundspeed with the distances between events to compute the next event times.

![TZ Position Diagram](image)

**Fig. 2.2.1 Examples of TZ Processing**
2.2.3.3 Position Update Processing

The position update messages (TZ) contain the tracked position and groundspeed for an active flight. The ETMS uses the TZ data to extrapolate the predicted time and speed of future events and to interpolate the actual time of any immediate past events. (Since the data is received at 5 minute intervals, it is necessary to interpolate to estimate the "actual" time for each event after it has been passed.)

An example of TZ processing is shown in Fig. 2.2.1. We just take the TZ processing whenever the TZ position is within 15 miles to the flight path. The TZ processing finds the last actual event (closest previous event, event 3 in this case) and estimates the time of that event based on the distance from the TZ position to the event, the TZ speed over ground and the TZ time. Then the TZ processing uses the speed over ground to update cruising speed. Finally, the TZ processing re-computes the times for the predicted events in the manner described in section 2.2.3.2.
Chapter 3

Methodology Analysis

3.1 Introduction

This chapter explains the methodology used in the thesis. Section 3.2 describes how to use the position update (TZ) points we picked from the files: Den_srf, Mco_srf, Msp_srf, and Phx_srf to draw the plots between the EFTA errors with Time-to-go (T). Section 3.3 shows plots of EFTA errors, $\sigma(T)$, for different discrete time-to-go values $T$ (=30,60,90 mins, etc.) from respective city. Section 3.4 draws the plots of $\sigma(T)$'s variation with time to go $T$. We consider flights by jet aircraft as well as propeller aircraft in the above analysis.

3.2 ETA Errors versus Time-to-go (T)

3.2.1 Denver(DEN)

In the Den_srf file (refer to the attached sample Table3.2.1), we just consider the TZ points and AZ point. We define
Time-to-go\( (T) = \text{EFTA(AZ)} - \text{Message Time(i)} \)

\[ \text{EFTA Error} = \text{EFTA(i)} - \text{EFTA(AZ)} \]

\( i = \) all the sample points we chose (it is necessary to eliminate all messages which are not TZ points)

These calculations mean that a positive EFTA Error indicates that the estimate at T was later than the actual time; a negative value indicates that the estimate at T was earlier than the actual time.

There are 114 jet flights and 28 prop flights we chose from the Den_srf file. Figs. 3.2.1a to 3.2.1f are samples of the plots for the EFTA errors versus Time-to-go T.

### 3.2.2 Orlando(MCO)

In the Mco_srf file (refer to the attached sample Table3.2.2), there are 65 jet flights and 16 prop flights we chose from the Den_srf file. Figs. 3.2.2a to 3.2.2c are samples of the plots for the EFTA errors versus Time-to-go T.

### 3.2.3 Minneapolis(MSP)

In the Msp_srf file (refer to the attached sample Table3.3), there are 81 jet flights and 40 prop flights we chose from the Den_srf file. Figs. 3.2.3a to 3.2.3e are samples of the plots for the EFTA errors versus Time-to-go T.
3.2.4 Phoenix(PHX)

In the Phx_srf file (refer to the attached sample Table3.4), there are 60 jet flights and 7 prop flights we chose from the Den_srf file. Figs.3.2.4a to 3.2.4d are samples of the plots for the EFTA errors versus Time-to-go T.

3.3 Distribution of EFTA Errors at Different Time-to-go

We use the data from section 3.2. We choose EFTA error values from the TZ points closest to T (=30, 60, 90 mins, etc.) The following definitions are needed for plotting the distribution of ETA error in different time periods.

Sample Mean=$\bar{x} = \frac{\sum_{i=1}^{N} N_i X_i}{N_i}$

Ni=Number

Xi=EFTA Value

Sample Variance=$\bar{S} = \frac{\sum_{i=1}^{n} (X_i - \bar{x})^2}{n}$

(Eqn3.2)

Standard Deviation=$\sigma^2 = E \left[ (X - \bar{x})^2 \right]$  

(Eqn3.3)

3.3.1 Denver(DEN)

We use the methodology mentioned in section 3.2, section 3.3, and Eqns. 3.1 to 3.3 to evaluate all the data we got in section 3.1. Tables 3.3.1a to 3.3.1h and Figs. 3.3.1a
to 3.3.1h are the chosen sample EFTA error points and Weight versus EFTA error plots, respectively.

3.3.2 Orlando (MCO)

Tables 3.3.2a to 3.3.2e and Figs. 3.3.2a to 3.3.2e are the chosen sample EFTA error points and Weight versus EFTA error plots, respectively.

3.3.3 Minneapolis (MSP)

Tables 3.3.3a to 3.3.3g and Figs. 3.3.3a to 3.3.3g are the chosen sample EFTA error points and Weight versus EFTA error plots, respectively.

3.3.4 Phoenix (PHX)

Tables 3.3.4a to 3.3.4e and Figs. 3.3.4a to 3.3.4e are the chosen sample EFTA error points and Weight versus EFTA error plots, respectively.

3.3.5 All Cities

Tables 3.3.5a to 3.3.5g and Fig 3.3.5a to 3.3.5g are the chosen sample EFTA error points and Weight versus EFTA error plots, respectively.
3.4 Standard Deviation versus Time-to-go

In this section, we use the results we got in section 3.3. Tables 3.4a to 3.4b and Figs.3.4a to 3.4b are the σ's variation with Time to Go (T=30, 60, 90 mins, etc.) for Jets as well as Props. As it can be seen, there is a slight downward trend in uncertainty for estimating Arrival Fix times as Time-to-go decreases.
<table>
<thead>
<tr>
<th>Flight No</th>
<th>Origin</th>
<th>Destination</th>
<th>Message Time</th>
<th>NAS Message</th>
<th>Arrival Fix</th>
<th>EFTA</th>
<th>TTP</th>
<th>ETD</th>
<th>ETA</th>
<th>A/C</th>
<th>Class</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAL169</td>
<td>DFW</td>
<td>DEN</td>
<td>11:46</td>
<td>FZ</td>
<td>RAMAH</td>
<td>14:28</td>
<td>6</td>
<td>13:11</td>
<td>14:42</td>
<td>MD80</td>
<td>LARG</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL169</td>
<td>DFW</td>
<td>DEN</td>
<td>13:22</td>
<td>TZ</td>
<td>RAMAH</td>
<td>14:35</td>
<td>6</td>
<td>13:22</td>
<td>14:49</td>
<td>MD80</td>
<td>LARG</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL169</td>
<td>DFW</td>
<td>DEN</td>
<td>13:30</td>
<td>FA</td>
<td>RAMAH</td>
<td>14:39</td>
<td>6</td>
<td>13:22</td>
<td>14:53</td>
<td>MD80</td>
<td>LARG</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL169</td>
<td>DFW</td>
<td>DEN</td>
<td>13:37</td>
<td>TZ</td>
<td>RAMAH</td>
<td>14:36</td>
<td>6</td>
<td>13:22</td>
<td>14:50</td>
<td>MD80</td>
<td>LARG</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL169</td>
<td>DFW</td>
<td>DEN</td>
<td>13:40</td>
<td>TZ</td>
<td>RAMAH</td>
<td>14:40</td>
<td>6</td>
<td>13:22</td>
<td>14:54</td>
<td>MD80</td>
<td>LARG</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL169</td>
<td>DFW</td>
<td>DEN</td>
<td>13:42</td>
<td>TZ</td>
<td>RAMAH</td>
<td>14:38</td>
<td>6</td>
<td>13:22</td>
<td>14:52</td>
<td>MD80</td>
<td>LARG</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL169</td>
<td>DFW</td>
<td>DEN</td>
<td>13:49</td>
<td>UZ</td>
<td>RAMAH</td>
<td>14:38</td>
<td>6</td>
<td>13:22</td>
<td>14:52</td>
<td>MD80</td>
<td>LARG</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL169</td>
<td>DFW</td>
<td>DEN</td>
<td>13:56</td>
<td>TZ</td>
<td>RAMAH</td>
<td>14:41</td>
<td>6</td>
<td>13:22</td>
<td>14:55</td>
<td>MD80</td>
<td>LARG</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL169</td>
<td>DFW</td>
<td>DEN</td>
<td>14:01</td>
<td>TZ</td>
<td>RAMAH</td>
<td>14:39</td>
<td>6</td>
<td>13:22</td>
<td>14:53</td>
<td>MD80</td>
<td>LARG</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL169</td>
<td>DFW</td>
<td>DEN</td>
<td>14:06</td>
<td>TZ</td>
<td>RAMAH</td>
<td>14:39</td>
<td>6</td>
<td>13:22</td>
<td>14:53</td>
<td>MD80</td>
<td>LARG</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL169</td>
<td>DFW</td>
<td>DEN</td>
<td>14:09</td>
<td>FA</td>
<td>RAMAH</td>
<td>14:39</td>
<td>6</td>
<td>13:22</td>
<td>14:53</td>
<td>MD80</td>
<td>LARG</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL169</td>
<td>DFW</td>
<td>DEN</td>
<td>14:11</td>
<td>TZ</td>
<td>RAMAH</td>
<td>14:39</td>
<td>6</td>
<td>13:22</td>
<td>14:54</td>
<td>MD80</td>
<td>LARG</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL169</td>
<td>DFW</td>
<td>DEN</td>
<td>14:15</td>
<td>TZ</td>
<td>RAMAH</td>
<td>14:37</td>
<td>6</td>
<td>13:22</td>
<td>14:51</td>
<td>MD80</td>
<td>LARG</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL169</td>
<td>DFW</td>
<td>DEN</td>
<td>14:16</td>
<td>TZ</td>
<td>RAMAH</td>
<td>14:38</td>
<td>6</td>
<td>13:22</td>
<td>14:52</td>
<td>MD80</td>
<td>LARG</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL169</td>
<td>DFW</td>
<td>DEN</td>
<td>14:18</td>
<td>UZ</td>
<td>RAMAH</td>
<td>14:37</td>
<td>6</td>
<td>13:22</td>
<td>14:51</td>
<td>MD80</td>
<td>LARG</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL169</td>
<td>DFW</td>
<td>DEN</td>
<td>14:20</td>
<td>TZ</td>
<td>RAMAH</td>
<td>14:36</td>
<td>6</td>
<td>13:22</td>
<td>14:50</td>
<td>MD80</td>
<td>LARG</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL169</td>
<td>DFW</td>
<td>DEN</td>
<td>14:25</td>
<td>TZ</td>
<td>RAMAH</td>
<td>14:39</td>
<td>6</td>
<td>13:22</td>
<td>14:53</td>
<td>MD80</td>
<td>LARG</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL169</td>
<td>DFW</td>
<td>DEN</td>
<td>14:30</td>
<td>TZ</td>
<td>RAMAH</td>
<td>14:39</td>
<td>6</td>
<td>13:22</td>
<td>14:53</td>
<td>MD80</td>
<td>LARG</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL169</td>
<td>DFW</td>
<td>DEN</td>
<td>14:35</td>
<td>TZ</td>
<td>RAMAH</td>
<td>14:39</td>
<td>6</td>
<td>13:22</td>
<td>14:53</td>
<td>MD80</td>
<td>LARG</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL169</td>
<td>DFW</td>
<td>DEN</td>
<td>14:40</td>
<td>TZ</td>
<td>RAMAH</td>
<td>14:41</td>
<td>6</td>
<td>13:22</td>
<td>14:55</td>
<td>MD80</td>
<td>LARG</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL169</td>
<td>DFW</td>
<td>DEN</td>
<td>14:45</td>
<td>TZ</td>
<td>RAMAH</td>
<td>14:43</td>
<td>4</td>
<td>13:22</td>
<td>14:57</td>
<td>MD80</td>
<td>LARG</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL169</td>
<td>DFW</td>
<td>DEN</td>
<td>14:50</td>
<td>TZ</td>
<td>RAMAH</td>
<td>14:43</td>
<td>4</td>
<td>13:22</td>
<td>14:59</td>
<td>MD80</td>
<td>LARG</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL169</td>
<td>DFW</td>
<td>DEN</td>
<td>14:55</td>
<td>TZ</td>
<td>RAMAH</td>
<td>14:43</td>
<td>4</td>
<td>13:22</td>
<td>14:59</td>
<td>MD80</td>
<td>LARG</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL169</td>
<td>DFW</td>
<td>DEN</td>
<td>14:58</td>
<td>AZ</td>
<td>RAMAH</td>
<td>14:43</td>
<td>4</td>
<td>13:22</td>
<td>14:45</td>
<td>MD80</td>
<td>LARG</td>
<td>CIV/JET</td>
</tr>
</tbody>
</table>

Table 3.2.1 Data Sample-DEN Flights
<table>
<thead>
<tr>
<th>Flight No</th>
<th>Origin</th>
<th>Destination</th>
<th>Message Time</th>
<th>NAS Message</th>
<th>Arrival Fix</th>
<th>EFTA</th>
<th>TTP</th>
<th>ETD</th>
<th>ETA</th>
<th>A/C</th>
<th>Class</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAL174</td>
<td>RDU</td>
<td>MCO</td>
<td>13:56</td>
<td>FZ</td>
<td>LAMMA</td>
<td>16:27</td>
<td>6</td>
<td>15:18</td>
<td>16:38</td>
<td>DC1</td>
<td>HEAV</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL174</td>
<td>RDU</td>
<td>MCO</td>
<td>15:39</td>
<td>DZ</td>
<td>LAMMA</td>
<td>16:49</td>
<td>6</td>
<td>15:40</td>
<td>17:00</td>
<td>DC1</td>
<td>HEAV</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL174</td>
<td>RDU</td>
<td>MCO</td>
<td>15:41</td>
<td>TZ</td>
<td>LAMMA</td>
<td>16:45</td>
<td>6</td>
<td>15:40</td>
<td>16:56</td>
<td>DC1</td>
<td>HEAV</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL174</td>
<td>RDU</td>
<td>MCO</td>
<td>15:47</td>
<td>TZ</td>
<td>LAMMA</td>
<td>16:46</td>
<td>6</td>
<td>15:40</td>
<td>16:57</td>
<td>DC1</td>
<td>HEAV</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL174</td>
<td>RDU</td>
<td>MCO</td>
<td>15:52</td>
<td>UZ</td>
<td>LAMMA</td>
<td>16:39</td>
<td>6</td>
<td>15:40</td>
<td>16:50</td>
<td>DC1</td>
<td>HEAV</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL174</td>
<td>RDU</td>
<td>MCO</td>
<td>15:54</td>
<td>TZ</td>
<td>LAMMA</td>
<td>16:47</td>
<td>6</td>
<td>15:40</td>
<td>16:58</td>
<td>DC1</td>
<td>HEAV</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL174</td>
<td>RDU</td>
<td>MCO</td>
<td>15:59</td>
<td>TZ</td>
<td>LAMMA</td>
<td>16:43</td>
<td>6</td>
<td>15:40</td>
<td>16:54</td>
<td>DC1</td>
<td>HEAV</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL174</td>
<td>RDU</td>
<td>MCO</td>
<td>16:04</td>
<td>TZ</td>
<td>LAMMA</td>
<td>16:45</td>
<td>6</td>
<td>15:40</td>
<td>16:56</td>
<td>DC1</td>
<td>HEAV</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL174</td>
<td>RDU</td>
<td>MCO</td>
<td>16:09</td>
<td>TZ</td>
<td>LAMMA</td>
<td>16:44</td>
<td>6</td>
<td>15:40</td>
<td>16:55</td>
<td>DC1</td>
<td>HEAV</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL174</td>
<td>RDU</td>
<td>MCO</td>
<td>16:14</td>
<td>TZ</td>
<td>LAMMA</td>
<td>16:44</td>
<td>6</td>
<td>15:40</td>
<td>16:55</td>
<td>DC1</td>
<td>HEAV</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL174</td>
<td>RDU</td>
<td>MCO</td>
<td>16:20</td>
<td>TZ</td>
<td>LAMMA</td>
<td>16:45</td>
<td>6</td>
<td>15:40</td>
<td>16:56</td>
<td>DC1</td>
<td>HEAV</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL174</td>
<td>RDU</td>
<td>MCO</td>
<td>16:24</td>
<td>TZ</td>
<td>LAMMA</td>
<td>16:45</td>
<td>6</td>
<td>15:40</td>
<td>16:56</td>
<td>DC1</td>
<td>HEAV</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL174</td>
<td>RDU</td>
<td>MCO</td>
<td>16:29</td>
<td>TZ</td>
<td>LAMMA</td>
<td>16:43</td>
<td>6</td>
<td>15:38</td>
<td>16:54</td>
<td>DC1</td>
<td>HEAV</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL174</td>
<td>RDU</td>
<td>MCO</td>
<td>16:35</td>
<td>TZ</td>
<td>LAMMA</td>
<td>16:44</td>
<td>6</td>
<td>15:38</td>
<td>16:55</td>
<td>DC1</td>
<td>HEAV</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL174</td>
<td>RDU</td>
<td>MCO</td>
<td>16:39</td>
<td>TZ</td>
<td>LAMMA</td>
<td>16:44</td>
<td>6</td>
<td>15:38</td>
<td>16:55</td>
<td>DC1</td>
<td>HEAV</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL174</td>
<td>RDU</td>
<td>MCO</td>
<td>16:45</td>
<td>TZ</td>
<td>LAMMA</td>
<td>16:46</td>
<td>6</td>
<td>15:38</td>
<td>16:57</td>
<td>DC1</td>
<td>HEAV</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL174</td>
<td>RDU</td>
<td>MCO</td>
<td>16:54</td>
<td>TZ</td>
<td>LAMMA</td>
<td>17:01</td>
<td>4</td>
<td>15:38</td>
<td>17:12</td>
<td>DC1</td>
<td>HEAV</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL174</td>
<td>RDU</td>
<td>MCO</td>
<td>17:02</td>
<td>AZ</td>
<td>LAMMA</td>
<td>17:01</td>
<td>4</td>
<td>15:38</td>
<td>16:53</td>
<td>DC1</td>
<td>HEAV</td>
<td>CIV/JET</td>
</tr>
</tbody>
</table>

Table 3.2.2 Data Sample-MCO Flights
<table>
<thead>
<tr>
<th>Flight N</th>
<th>Origin</th>
<th>Destination</th>
<th>Message Time</th>
<th>NAS Message</th>
<th>Arrival Fix</th>
<th>EFTA</th>
<th>TTP</th>
<th>ETD</th>
<th>ETA</th>
<th>A/C</th>
<th>Class</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAL832</td>
<td>DFW</td>
<td>MSP</td>
<td>12:51</td>
<td>FZ</td>
<td>MEINZ</td>
<td>15:56</td>
<td>6</td>
<td>14:17</td>
<td>16:10</td>
<td>MD8</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL832</td>
<td>DFW</td>
<td>MSP</td>
<td>14:26</td>
<td>DZ</td>
<td>MEINZ</td>
<td>16:06</td>
<td>6</td>
<td>14:27</td>
<td>16:20</td>
<td>MD8</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL832</td>
<td>DFW</td>
<td>MSP</td>
<td>14:36</td>
<td>E7</td>
<td>MEINZ</td>
<td>16:06</td>
<td>6</td>
<td>14:27</td>
<td>16:20</td>
<td>MD8</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL832</td>
<td>DFW</td>
<td>MSP</td>
<td>14:36</td>
<td>TZ</td>
<td>MEINZ</td>
<td>16:05</td>
<td>6</td>
<td>14:27</td>
<td>16:17</td>
<td>MD8</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL832</td>
<td>DFW</td>
<td>MSP</td>
<td>14:41</td>
<td>TZ</td>
<td>MEINZ</td>
<td>16:02</td>
<td>6</td>
<td>14:27</td>
<td>16:15</td>
<td>MD8</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL832</td>
<td>DFW</td>
<td>MSP</td>
<td>14:46</td>
<td>TZ</td>
<td>MEINZ</td>
<td>16:02</td>
<td>6</td>
<td>14:27</td>
<td>16:15</td>
<td>MD8</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL832</td>
<td>DFW</td>
<td>MSP</td>
<td>14:47</td>
<td>T4</td>
<td>MEINZ</td>
<td>16:02</td>
<td>6</td>
<td>14:27</td>
<td>16:16</td>
<td>MD8</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL832</td>
<td>DFW</td>
<td>MSP</td>
<td>14:50</td>
<td>T7</td>
<td>MEINZ</td>
<td>16:03</td>
<td>6</td>
<td>14:27</td>
<td>16:15</td>
<td>MD8</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL832</td>
<td>DFW</td>
<td>MSP</td>
<td>14:55</td>
<td>T7</td>
<td>MEINZ</td>
<td>16:03</td>
<td>6</td>
<td>14:27</td>
<td>16:15</td>
<td>MD8</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL832</td>
<td>DFW</td>
<td>MSP</td>
<td>15:00</td>
<td>T7</td>
<td>MEINZ</td>
<td>16:03</td>
<td>6</td>
<td>14:27</td>
<td>16:15</td>
<td>MD8</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL832</td>
<td>DFW</td>
<td>MSP</td>
<td>15:05</td>
<td>T7</td>
<td>MEINZ</td>
<td>16:03</td>
<td>6</td>
<td>14:27</td>
<td>16:15</td>
<td>MD8</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL832</td>
<td>DFW</td>
<td>MSP</td>
<td>15:10</td>
<td>T7</td>
<td>MEINZ</td>
<td>16:03</td>
<td>6</td>
<td>14:27</td>
<td>16:15</td>
<td>MD8</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL832</td>
<td>DFW</td>
<td>MSP</td>
<td>15:15</td>
<td>T7</td>
<td>MEINZ</td>
<td>16:03</td>
<td>6</td>
<td>14:27</td>
<td>16:15</td>
<td>MD8</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL832</td>
<td>DFW</td>
<td>MSP</td>
<td>15:20</td>
<td>T7</td>
<td>MEINZ</td>
<td>16:03</td>
<td>6</td>
<td>14:27</td>
<td>16:15</td>
<td>MD8</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL832</td>
<td>DFW</td>
<td>MSP</td>
<td>15:25</td>
<td>T7</td>
<td>MEINZ</td>
<td>16:03</td>
<td>6</td>
<td>14:27</td>
<td>16:15</td>
<td>MD8</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL832</td>
<td>DFW</td>
<td>MSP</td>
<td>15:26</td>
<td>U7</td>
<td>MEINZ</td>
<td>16:03</td>
<td>6</td>
<td>14:27</td>
<td>16:17</td>
<td>MD8</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL832</td>
<td>DFW</td>
<td>MSP</td>
<td>15:27</td>
<td>T7</td>
<td>MEINZ</td>
<td>16:03</td>
<td>6</td>
<td>14:27</td>
<td>16:17</td>
<td>MD8</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL832</td>
<td>DFW</td>
<td>MSP</td>
<td>15:32</td>
<td>T7</td>
<td>MEINZ</td>
<td>16:03</td>
<td>6</td>
<td>14:27</td>
<td>16:17</td>
<td>MD8</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL832</td>
<td>DFW</td>
<td>MSP</td>
<td>15:37</td>
<td>T7</td>
<td>MEINZ</td>
<td>16:03</td>
<td>6</td>
<td>14:27</td>
<td>16:17</td>
<td>MD8</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL832</td>
<td>DFW</td>
<td>MSP</td>
<td>15:42</td>
<td>T7</td>
<td>MEINZ</td>
<td>16:01</td>
<td>6</td>
<td>14:27</td>
<td>16:14</td>
<td>MD8</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL832</td>
<td>DFW</td>
<td>MSP</td>
<td>15:47</td>
<td>T7</td>
<td>MEINZ</td>
<td>16:03</td>
<td>6</td>
<td>14:27</td>
<td>16:15</td>
<td>MD8</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL832</td>
<td>DFW</td>
<td>MSP</td>
<td>15:52</td>
<td>T7</td>
<td>MEINZ</td>
<td>16:03</td>
<td>6</td>
<td>14:27</td>
<td>16:15</td>
<td>MD8</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL832</td>
<td>DFW</td>
<td>MSP</td>
<td>15:57</td>
<td>T7</td>
<td>MEINZ</td>
<td>16:03</td>
<td>6</td>
<td>14:27</td>
<td>16:15</td>
<td>MD8</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL832</td>
<td>DFW</td>
<td>MSP</td>
<td>16:02</td>
<td>T7</td>
<td>MEINZ</td>
<td>16:04</td>
<td>6</td>
<td>14:27</td>
<td>16:16</td>
<td>MD8</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL832</td>
<td>DFW</td>
<td>MSP</td>
<td>16:07</td>
<td>T7</td>
<td>MEINZ</td>
<td>16:05</td>
<td>5</td>
<td>14:27</td>
<td>16:17</td>
<td>MD8</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL832</td>
<td>DFW</td>
<td>MSP</td>
<td>16:12</td>
<td>T7</td>
<td>MEINZ</td>
<td>16:05</td>
<td>5</td>
<td>14:27</td>
<td>16:17</td>
<td>MD8</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL832</td>
<td>DFW</td>
<td>MSP</td>
<td>16:18</td>
<td>AZ</td>
<td>MEINZ</td>
<td>16:05</td>
<td>5</td>
<td>14:27</td>
<td>16:09</td>
<td>MD8</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
</tbody>
</table>

Table 3.2.3 Data Sample-MSP Flights
<table>
<thead>
<tr>
<th>Flight No</th>
<th>Origin</th>
<th>Destination</th>
<th>Message Time</th>
<th>NAS Message</th>
<th>Arrival Fix</th>
<th>EFTA</th>
<th>TTP</th>
<th>ETD</th>
<th>ETA</th>
<th>A/C</th>
<th>Class</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAL475</td>
<td>DFW</td>
<td>PHX</td>
<td>14:13</td>
<td>FZ</td>
<td>TOTEC</td>
<td>17:33</td>
<td>6</td>
<td>15:39</td>
<td>17:45</td>
<td>MD80</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL475</td>
<td>DFW</td>
<td>PHX</td>
<td>15:51</td>
<td>DZ</td>
<td>TOTEC</td>
<td>17:46</td>
<td>6</td>
<td>15:52</td>
<td>17:58</td>
<td>MD80</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL475</td>
<td>DFW</td>
<td>PHX</td>
<td>15:55</td>
<td>TZ</td>
<td>TOTEC</td>
<td>17:44</td>
<td>6</td>
<td>15:52</td>
<td>17:53</td>
<td>MD80</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL475</td>
<td>DFW</td>
<td>PHX</td>
<td>16:00</td>
<td>TZ</td>
<td>TOTEC</td>
<td>17:44</td>
<td>6</td>
<td>15:52</td>
<td>17:54</td>
<td>MD80</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL475</td>
<td>DFW</td>
<td>PHX</td>
<td>16:05</td>
<td>TZ</td>
<td>TOTEC</td>
<td>17:57</td>
<td>6</td>
<td>15:52</td>
<td>18:07</td>
<td>MD80</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL475</td>
<td>DFW</td>
<td>PHX</td>
<td>16:10</td>
<td>TZ</td>
<td>TOTEC</td>
<td>17:49</td>
<td>6</td>
<td>15:52</td>
<td>17:59</td>
<td>MD80</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL475</td>
<td>DFW</td>
<td>PHX</td>
<td>16:15</td>
<td>TZ</td>
<td>TOTEC</td>
<td>17:50</td>
<td>6</td>
<td>15:52</td>
<td>18:00</td>
<td>MD80</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL475</td>
<td>DFW</td>
<td>PHX</td>
<td>16:20</td>
<td>TZ</td>
<td>TOTEC</td>
<td>17:48</td>
<td>6</td>
<td>15:52</td>
<td>17:58</td>
<td>MD80</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL475</td>
<td>DFW</td>
<td>PHX</td>
<td>16:25</td>
<td>TZ</td>
<td>TOTEC</td>
<td>17:47</td>
<td>6</td>
<td>15:52</td>
<td>17:57</td>
<td>MD80</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL475</td>
<td>DFW</td>
<td>PHX</td>
<td>16:30</td>
<td>TZ</td>
<td>TOTEC</td>
<td>17:46</td>
<td>6</td>
<td>15:52</td>
<td>17:56</td>
<td>MD80</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL475</td>
<td>DFW</td>
<td>PHX</td>
<td>16:35</td>
<td>TZ</td>
<td>TOTEC</td>
<td>17:46</td>
<td>6</td>
<td>15:52</td>
<td>17:56</td>
<td>MD80</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL475</td>
<td>DFW</td>
<td>PHX</td>
<td>16:40</td>
<td>TZ</td>
<td>TOTEC</td>
<td>17:46</td>
<td>6</td>
<td>15:52</td>
<td>17:56</td>
<td>MD80</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL475</td>
<td>DFW</td>
<td>PHX</td>
<td>16:42</td>
<td>UZ</td>
<td>TOTEC</td>
<td>17:45</td>
<td>6</td>
<td>15:52</td>
<td>17:57</td>
<td>MD80</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL475</td>
<td>DFW</td>
<td>PHX</td>
<td>16:45</td>
<td>FA</td>
<td>TOTEC</td>
<td>17:46</td>
<td>6</td>
<td>15:52</td>
<td>17:58</td>
<td>MD80</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL475</td>
<td>DFW</td>
<td>PHX</td>
<td>16:45</td>
<td>TZ</td>
<td>TOTEC</td>
<td>17:46</td>
<td>6</td>
<td>15:52</td>
<td>17:56</td>
<td>MD80</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL475</td>
<td>DFW</td>
<td>PHX</td>
<td>16:50</td>
<td>TZ</td>
<td>TOTEC</td>
<td>17:45</td>
<td>6</td>
<td>15:52</td>
<td>17:56</td>
<td>MD80</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL475</td>
<td>DFW</td>
<td>PHX</td>
<td>16:55</td>
<td>TZ</td>
<td>TOTEC</td>
<td>17:46</td>
<td>6</td>
<td>15:52</td>
<td>17:57</td>
<td>MD80</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL475</td>
<td>DFW</td>
<td>PHX</td>
<td>17:00</td>
<td>TZ</td>
<td>TOTEC</td>
<td>17:46</td>
<td>6</td>
<td>15:52</td>
<td>17:57</td>
<td>MD80</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL475</td>
<td>DFW</td>
<td>PHX</td>
<td>17:05</td>
<td>TZ</td>
<td>TOTEC</td>
<td>17:44</td>
<td>6</td>
<td>15:52</td>
<td>17:54</td>
<td>MD80</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL475</td>
<td>DFW</td>
<td>PHX</td>
<td>17:10</td>
<td>TZ</td>
<td>TOTEC</td>
<td>17:43</td>
<td>6</td>
<td>15:52</td>
<td>17:54</td>
<td>MD80</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL475</td>
<td>DFW</td>
<td>PHX</td>
<td>17:15</td>
<td>TZ</td>
<td>TOTEC</td>
<td>17:43</td>
<td>6</td>
<td>15:52</td>
<td>17:54</td>
<td>MD80</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL475</td>
<td>DFW</td>
<td>PHX</td>
<td>17:20</td>
<td>TZ</td>
<td>TOTEC</td>
<td>17:43</td>
<td>6</td>
<td>15:52</td>
<td>17:54</td>
<td>MD80</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL475</td>
<td>DFW</td>
<td>PHX</td>
<td>17:25</td>
<td>TZ</td>
<td>TOTEC</td>
<td>17:43</td>
<td>6</td>
<td>15:52</td>
<td>17:54</td>
<td>MD80</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL475</td>
<td>DFW</td>
<td>PHX</td>
<td>17:30</td>
<td>TZ</td>
<td>TOTEC</td>
<td>17:44</td>
<td>6</td>
<td>15:52</td>
<td>17:54</td>
<td>MD80</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL475</td>
<td>DFW</td>
<td>PHX</td>
<td>17:35</td>
<td>TZ</td>
<td>TOTEC</td>
<td>17:44</td>
<td>6</td>
<td>15:52</td>
<td>17:55</td>
<td>MD80</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL475</td>
<td>DFW</td>
<td>PHX</td>
<td>17:40</td>
<td>TZ</td>
<td>TOTEC</td>
<td>17:43</td>
<td>6</td>
<td>15:52</td>
<td>17:54</td>
<td>MD80</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
<tr>
<td>AAL475</td>
<td>DFW</td>
<td>PHX</td>
<td>17:56</td>
<td>AZ</td>
<td>TOTEC</td>
<td>17:41</td>
<td>5</td>
<td>15:52</td>
<td>17:50</td>
<td>MD80</td>
<td>LARGE</td>
<td>CIV/JET</td>
</tr>
</tbody>
</table>

Table 3.2.4 Data Sample-PHX Flights
<table>
<thead>
<tr>
<th>Number</th>
<th>Item</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-16</td>
<td>0.00877193</td>
</tr>
<tr>
<td>0</td>
<td>-15</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>-14</td>
<td>0.00877193</td>
</tr>
<tr>
<td>1</td>
<td>-13</td>
<td>0.00877193</td>
</tr>
<tr>
<td>0</td>
<td>-12</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>-11</td>
<td>0.00877193</td>
</tr>
<tr>
<td>4</td>
<td>-10</td>
<td>0.035087719</td>
</tr>
<tr>
<td>1</td>
<td>-9</td>
<td>0.00877193</td>
</tr>
<tr>
<td>3</td>
<td>-8</td>
<td>0.026315789</td>
</tr>
<tr>
<td>1</td>
<td>-7</td>
<td>0.00877193</td>
</tr>
<tr>
<td>3</td>
<td>-6</td>
<td>0.026315789</td>
</tr>
<tr>
<td>0</td>
<td>-5</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>-4</td>
<td>0.043859649</td>
</tr>
<tr>
<td>2</td>
<td>-3</td>
<td>0.01754386</td>
</tr>
<tr>
<td>6</td>
<td>-2</td>
<td>0.052631579</td>
</tr>
<tr>
<td>13</td>
<td>-1</td>
<td>0.114035088</td>
</tr>
<tr>
<td>31</td>
<td>0</td>
<td>0.271929825</td>
</tr>
<tr>
<td>22</td>
<td>1</td>
<td>0.192982456</td>
</tr>
<tr>
<td>9</td>
<td>2</td>
<td>0.078947368</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>0.026315789</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>0.026315789</td>
</tr>
<tr>
<td>0</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>7</td>
<td>0.01754386</td>
</tr>
<tr>
<td>0</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>9</td>
<td>0.00877193</td>
</tr>
<tr>
<td>0</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>13</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>14</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>16</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>17</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>18</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>19</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>21</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>22</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>23</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>24</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>25</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>26</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>27</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>28</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>29</td>
<td>0.00877193</td>
</tr>
</tbody>
</table>

Mean: -0.7895
Standard Deviation: 4.946150933
Variance: 24.46440905
Total#: 114

Table 3.3.1a Distribution of Errors in EFTA at 30min-DEN Flights
<table>
<thead>
<tr>
<th>Number</th>
<th>Item</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-15</td>
<td>0.009803922</td>
</tr>
<tr>
<td>1</td>
<td>-14</td>
<td>0.009803922</td>
</tr>
<tr>
<td>1</td>
<td>-13</td>
<td>0.009803922</td>
</tr>
<tr>
<td>0</td>
<td>-12</td>
<td>0.009803922</td>
</tr>
<tr>
<td>1</td>
<td>-11</td>
<td>0.009803922</td>
</tr>
<tr>
<td>1</td>
<td>-10</td>
<td>0.009803922</td>
</tr>
<tr>
<td>2</td>
<td>-9</td>
<td>0.019607843</td>
</tr>
<tr>
<td>2</td>
<td>-8</td>
<td>0.019607843</td>
</tr>
<tr>
<td>4</td>
<td>-7</td>
<td>0.039215686</td>
</tr>
<tr>
<td>6</td>
<td>-6</td>
<td>0.058823529</td>
</tr>
<tr>
<td>1</td>
<td>-5</td>
<td>0.009803922</td>
</tr>
<tr>
<td>2</td>
<td>-4</td>
<td>0.019607843</td>
</tr>
<tr>
<td>4</td>
<td>-3</td>
<td>0.039215686</td>
</tr>
<tr>
<td>9</td>
<td>-2</td>
<td>0.088235294</td>
</tr>
<tr>
<td>6</td>
<td>-1</td>
<td>0.058823529</td>
</tr>
<tr>
<td>18</td>
<td>0</td>
<td>0.176470588</td>
</tr>
<tr>
<td>11</td>
<td>1</td>
<td>0.107843137</td>
</tr>
<tr>
<td>12</td>
<td>2</td>
<td>0.117647059</td>
</tr>
<tr>
<td>5</td>
<td>3</td>
<td>0.049019608</td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td>0.009803922</td>
</tr>
<tr>
<td>6</td>
<td>5</td>
<td>0.058823529</td>
</tr>
<tr>
<td>1</td>
<td>6</td>
<td>0.009803922</td>
</tr>
<tr>
<td>3</td>
<td>7</td>
<td>0.029411765</td>
</tr>
<tr>
<td>1</td>
<td>8</td>
<td>0.009803922</td>
</tr>
<tr>
<td>1</td>
<td>9</td>
<td>0.009803922</td>
</tr>
<tr>
<td>0</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>13</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>14</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>16</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>17</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>18</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>19</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>21</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>22</td>
<td>0.009803922</td>
</tr>
<tr>
<td>0</td>
<td>23</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>24</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>25</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>26</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>27</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>28</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>29</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>30</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>31</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>32</td>
<td>0.009803922</td>
</tr>
</tbody>
</table>

Mean: -0.2745
Standard Deviation: 6.060410161
Variance: 36.72857132
Total#: 102

Table 3.3.1b Distribution of Errors in EFTA at 60min-DEN Flights
<table>
<thead>
<tr>
<th>Number</th>
<th>Item</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-16</td>
<td>0.016666667</td>
</tr>
<tr>
<td>0</td>
<td>-15</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-14</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-13</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-12</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>-11</td>
<td>0.016666667</td>
</tr>
<tr>
<td>1</td>
<td>-10</td>
<td>0.016666667</td>
</tr>
<tr>
<td>1</td>
<td>-9</td>
<td>0.016666667</td>
</tr>
<tr>
<td>4</td>
<td>-8</td>
<td>0.066666667</td>
</tr>
<tr>
<td>0</td>
<td>-7</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>-6</td>
<td>0.066666667</td>
</tr>
<tr>
<td>0</td>
<td>-5</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>-4</td>
<td>0.116666667</td>
</tr>
<tr>
<td>5</td>
<td>-3</td>
<td>0.0833333333</td>
</tr>
<tr>
<td>3</td>
<td>-2</td>
<td>0.05</td>
</tr>
<tr>
<td>7</td>
<td>-1</td>
<td>0.116666667</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>0.05</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>0.066666667</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>0.05</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>0.05</td>
</tr>
<tr>
<td>5</td>
<td>4</td>
<td>0.0833333333</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>0.066666667</td>
</tr>
<tr>
<td>0</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>8</td>
<td>0.016666667</td>
</tr>
<tr>
<td>2</td>
<td>9</td>
<td>0.0333333333</td>
</tr>
<tr>
<td>0</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>13</td>
<td>0.016666667</td>
</tr>
</tbody>
</table>

Mean -1
Standard Deviation 5.310367219
Variance 28.2
Total# 60

Table3.3.1c Distribution of Errors in EFTA at 90min-DEN Flights
<table>
<thead>
<tr>
<th>Number</th>
<th>Item</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-19</td>
<td>0.03030303</td>
</tr>
<tr>
<td>0</td>
<td>-18</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>-17</td>
<td>0.03030303</td>
</tr>
<tr>
<td>0</td>
<td>-16</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>-15</td>
<td>0.03030303</td>
</tr>
<tr>
<td>0</td>
<td>-14</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-13</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-12</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-11</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-10</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>-9</td>
<td>0.03030303</td>
</tr>
<tr>
<td>2</td>
<td>-8</td>
<td>0.060606061</td>
</tr>
<tr>
<td>1</td>
<td>-7</td>
<td>0.03030303</td>
</tr>
<tr>
<td>0</td>
<td>-6</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>-5</td>
<td>0.060606061</td>
</tr>
<tr>
<td>2</td>
<td>-4</td>
<td>0.060606061</td>
</tr>
<tr>
<td>3</td>
<td>-3</td>
<td>0.090909091</td>
</tr>
<tr>
<td>2</td>
<td>-2</td>
<td>0.060606061</td>
</tr>
<tr>
<td>2</td>
<td>-1</td>
<td>0.060606061</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0.03030303</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>0.090909091</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>0.060606061</td>
</tr>
<tr>
<td>1</td>
<td>3</td>
<td>0.03030303</td>
</tr>
<tr>
<td>0</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>6</td>
<td>0.03030303</td>
</tr>
<tr>
<td>0</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
<td>0.060606061</td>
</tr>
<tr>
<td>0</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>11</td>
<td>0.090909091</td>
</tr>
<tr>
<td>0</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>13</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>14</td>
<td>0.03030303</td>
</tr>
<tr>
<td>0</td>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>16</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>17</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>18</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>19</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>21</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>22</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>23</td>
<td>0.03030303</td>
</tr>
</tbody>
</table>

Mean: -0.424
Standard Deviation: 8.73527747
Variance: 76.30507248
Total#: 33

Table 3.3.1d Distribution of Errors in EFTA at 120min-DEN Flights
<table>
<thead>
<tr>
<th>Number</th>
<th>Item</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-10</td>
<td>0.047619048</td>
</tr>
<tr>
<td>0</td>
<td>-9</td>
<td>0.047619048</td>
</tr>
<tr>
<td>0</td>
<td>-8</td>
<td>0.047619048</td>
</tr>
<tr>
<td>0</td>
<td>-7</td>
<td>0.047619048</td>
</tr>
<tr>
<td>0</td>
<td>-6</td>
<td>0.047619048</td>
</tr>
<tr>
<td>0</td>
<td>-5</td>
<td>0.047619048</td>
</tr>
<tr>
<td>1</td>
<td>-4</td>
<td>0.047619048</td>
</tr>
<tr>
<td>1</td>
<td>-3</td>
<td>0.047619048</td>
</tr>
<tr>
<td>1</td>
<td>-2</td>
<td>0.047619048</td>
</tr>
<tr>
<td>2</td>
<td>-1</td>
<td>0.095238095</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0.047619048</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0.047619048</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>0.047619048</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>0.095238095</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>0.095238095</td>
</tr>
<tr>
<td>0</td>
<td>5</td>
<td>0.047619048</td>
</tr>
<tr>
<td>1</td>
<td>6</td>
<td>0.047619048</td>
</tr>
<tr>
<td>1</td>
<td>7</td>
<td>0.047619048</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
<td>0.095238095</td>
</tr>
<tr>
<td>0</td>
<td>9</td>
<td>0.047619048</td>
</tr>
<tr>
<td>0</td>
<td>10</td>
<td>0.047619048</td>
</tr>
<tr>
<td>3</td>
<td>11</td>
<td>0.142857143</td>
</tr>
<tr>
<td>0</td>
<td>12</td>
<td>0.047619048</td>
</tr>
<tr>
<td>0</td>
<td>13</td>
<td>0.047619048</td>
</tr>
<tr>
<td>1</td>
<td>14</td>
<td>0.047619048</td>
</tr>
<tr>
<td>0</td>
<td>15</td>
<td>0.047619048</td>
</tr>
<tr>
<td>0</td>
<td>16</td>
<td>0.047619048</td>
</tr>
<tr>
<td>0</td>
<td>17</td>
<td>0.047619048</td>
</tr>
<tr>
<td>0</td>
<td>18</td>
<td>0.047619048</td>
</tr>
<tr>
<td>1</td>
<td>19</td>
<td>0.047619048</td>
</tr>
</tbody>
</table>

Mean 4.33  
Standard deviation 6.635642096  
Variance 44.03174603  
TOTAL# 21

Table 3.3.1e Distribution of Errors in EFTA at 150min-DEN Flights
<table>
<thead>
<tr>
<th>Number</th>
<th>Item</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-24</td>
<td>0.0625</td>
</tr>
<tr>
<td>0</td>
<td>-23</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-22</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-21</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-20</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-19</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>-18</td>
<td>0.0625</td>
</tr>
<tr>
<td>0</td>
<td>-17</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-16</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-15</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-14</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-13</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-12</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-11</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>-10</td>
<td>0.0625</td>
</tr>
<tr>
<td>1</td>
<td>-9</td>
<td>0.0625</td>
</tr>
<tr>
<td>1</td>
<td>-8</td>
<td>0.0625</td>
</tr>
<tr>
<td>0</td>
<td>-7</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-6</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>-5</td>
<td>0.0625</td>
</tr>
<tr>
<td>0</td>
<td>-4</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>-3</td>
<td>0.0625</td>
</tr>
<tr>
<td>0</td>
<td>-2</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-1</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>0.125</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>0.0625</td>
</tr>
<tr>
<td>1</td>
<td>3</td>
<td>0.0625</td>
</tr>
<tr>
<td>0</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>5</td>
<td>0.0625</td>
</tr>
<tr>
<td>0</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>8</td>
<td>0.0625</td>
</tr>
<tr>
<td>0</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>13</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>14</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>15</td>
<td>0.0625</td>
</tr>
<tr>
<td>0</td>
<td>16</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>17</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>18</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>19</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>21</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>22</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>23</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>24</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>25</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>26</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>27</td>
<td>0.0625</td>
</tr>
<tr>
<td>0</td>
<td>28</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>29</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>30</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>31</td>
<td>0.0625</td>
</tr>
</tbody>
</table>

Mean 0.875  
Standard Deviation 14.10618216  
Variance 198.984375

Table 3.3.1f Distribution of Errors in EFTA at 180min-DEN Flights
<table>
<thead>
<tr>
<th>Num#</th>
<th>Item</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-8</td>
<td>0.035714286</td>
</tr>
<tr>
<td>0</td>
<td>-7</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-6</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>-5</td>
<td>0.035714286</td>
</tr>
<tr>
<td>3</td>
<td>-4</td>
<td>0.107142857</td>
</tr>
<tr>
<td>1</td>
<td>-3</td>
<td>0.035714286</td>
</tr>
<tr>
<td>2</td>
<td>-2</td>
<td>0.071428571</td>
</tr>
<tr>
<td>2</td>
<td>-1</td>
<td>0.071428571</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>0.107142857</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>0.142857143</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>0.071428571</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>0.107142857</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>0.071428571</td>
</tr>
<tr>
<td>1</td>
<td>5</td>
<td>0.035714286</td>
</tr>
<tr>
<td>0</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>7</td>
<td>0.035714286</td>
</tr>
<tr>
<td>0</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>10</td>
<td>0.035714286</td>
</tr>
<tr>
<td>0</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>12</td>
<td>0.035714286</td>
</tr>
</tbody>
</table>

Mean 0.2928  
Standard Deviation 4.40210789  
Variance 19.37855387  
Total# 28

Table 3.3.1g Distribution of Errors in EFTA at 30min-DEN Flights(Prop)
<table>
<thead>
<tr>
<th>Num#</th>
<th>Item</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-14</td>
<td>0.1</td>
</tr>
<tr>
<td>0</td>
<td>-13</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-12</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-11</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-10</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-9</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-8</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-7</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-6</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>-5</td>
<td>0.2</td>
</tr>
<tr>
<td>1</td>
<td>-4</td>
<td>0.1</td>
</tr>
<tr>
<td>0</td>
<td>-3</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-2</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-1</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0.1</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>0.1</td>
</tr>
<tr>
<td>1</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>10</td>
<td>0.1</td>
</tr>
<tr>
<td>0</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>13</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>14</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>16</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>17</td>
<td>0.1</td>
</tr>
<tr>
<td>0</td>
<td>18</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>19</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>20</td>
<td>0.1</td>
</tr>
<tr>
<td>1</td>
<td>21</td>
<td>0.1</td>
</tr>
</tbody>
</table>

Table 3.3.1h Distribution of Errors in EFTA at 60min-DEN Flights(Prop)

Mean 4.3
Standard Deviation 11.45469336
Variance 131.21
Total# 10
<table>
<thead>
<tr>
<th>Num#</th>
<th>Item</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-18</td>
<td>0.015625</td>
</tr>
<tr>
<td>0</td>
<td>-17</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>-16</td>
<td>0.015625</td>
</tr>
<tr>
<td>3</td>
<td>-15</td>
<td>0.046875</td>
</tr>
<tr>
<td>2</td>
<td>-14</td>
<td>0.03125</td>
</tr>
<tr>
<td>0</td>
<td>-13</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-12</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-11</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-10</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-9</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-8</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-7</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-6</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>-5</td>
<td>0.015625</td>
</tr>
<tr>
<td>0</td>
<td>-4</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>-3</td>
<td>0.015625</td>
</tr>
<tr>
<td>3</td>
<td>-2</td>
<td>0.046875</td>
</tr>
<tr>
<td>5</td>
<td>-1</td>
<td>0.078125</td>
</tr>
<tr>
<td>6</td>
<td>0</td>
<td>0.09375</td>
</tr>
<tr>
<td>11</td>
<td>1</td>
<td>0.171875</td>
</tr>
<tr>
<td>12</td>
<td>2</td>
<td>0.1875</td>
</tr>
<tr>
<td>10</td>
<td>3</td>
<td>0.15625</td>
</tr>
<tr>
<td>5</td>
<td>4</td>
<td>0.078125</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>0.03125</td>
</tr>
<tr>
<td>0</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>7</td>
<td>0.015625</td>
</tr>
</tbody>
</table>

Mean: -0.375
Standard Deviation: 5.613877893
Variance: 31.515625
Total: 64

Table 3.3.2a Distribution of Errors in EFTA at 30min-MCO Flights
<table>
<thead>
<tr>
<th>Num#</th>
<th>Item</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-18</td>
<td>0.017857143</td>
</tr>
<tr>
<td>0</td>
<td>-17</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>-16</td>
<td>0.035714286</td>
</tr>
<tr>
<td>1</td>
<td>-15</td>
<td>0.017857143</td>
</tr>
<tr>
<td>1</td>
<td>-14</td>
<td>0.017857143</td>
</tr>
<tr>
<td>3</td>
<td>-13</td>
<td>0.053571429</td>
</tr>
<tr>
<td>0</td>
<td>-12</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-11</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>-10</td>
<td>0.017857143</td>
</tr>
<tr>
<td>1</td>
<td>-9</td>
<td>0.017857143</td>
</tr>
<tr>
<td>0</td>
<td>-8</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>-7</td>
<td>0.017857143</td>
</tr>
<tr>
<td>0</td>
<td>-6</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-5</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-4</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>-3</td>
<td>0.053571429</td>
</tr>
<tr>
<td>1</td>
<td>-2</td>
<td>0.017857143</td>
</tr>
<tr>
<td>7</td>
<td>-1</td>
<td>0.125</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td>0.089285714</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>0.125</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>0.071428571</td>
</tr>
<tr>
<td>8</td>
<td>3</td>
<td>0.142857143</td>
</tr>
<tr>
<td>5</td>
<td>4</td>
<td>0.089285714</td>
</tr>
<tr>
<td>1</td>
<td>5</td>
<td>0.017857143</td>
</tr>
<tr>
<td>1</td>
<td>6</td>
<td>0.017857143</td>
</tr>
<tr>
<td>3</td>
<td>7</td>
<td>0.053571429</td>
</tr>
</tbody>
</table>

**Mean**: -1.268

**Standard Deviation**: 6.443382342

**Variance**: 41.517176

**Total#**: 56

Table 3.3.2b Distribution of Errors in EFTA at 60min-MCO Flights
<table>
<thead>
<tr>
<th>Num#</th>
<th>Item</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-16</td>
<td>0.022222222</td>
</tr>
<tr>
<td>0</td>
<td>-15</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-14</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>-13</td>
<td>0.022222222</td>
</tr>
<tr>
<td>0</td>
<td>-12</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>-11</td>
<td>0.022222222</td>
</tr>
<tr>
<td>1</td>
<td>-10</td>
<td>0.022222222</td>
</tr>
<tr>
<td>0</td>
<td>-9</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>-8</td>
<td>0.022222222</td>
</tr>
<tr>
<td>1</td>
<td>-7</td>
<td>0.022222222</td>
</tr>
<tr>
<td>3</td>
<td>-6</td>
<td>0.066666667</td>
</tr>
<tr>
<td>0</td>
<td>-5</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>-4</td>
<td>0.022222222</td>
</tr>
<tr>
<td>0</td>
<td>-3</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>-2</td>
<td>0.022222222</td>
</tr>
<tr>
<td>2</td>
<td>-1</td>
<td>0.044444444</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>0.066666667</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0.022222222</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>0.022222222</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>0.066666667</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>0.088888889</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>0.066666667</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
<td>0.088888889</td>
</tr>
<tr>
<td>4</td>
<td>7</td>
<td>0.088888889</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
<td>0.044444444</td>
</tr>
<tr>
<td>2</td>
<td>9</td>
<td>0.044444444</td>
</tr>
<tr>
<td>1</td>
<td>10</td>
<td>0.022222222</td>
</tr>
<tr>
<td>0</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>12</td>
<td>0.022222222</td>
</tr>
<tr>
<td>1</td>
<td>13</td>
<td>0.022222222</td>
</tr>
<tr>
<td>0</td>
<td>14</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>15</td>
<td>0.022222222</td>
</tr>
<tr>
<td>0</td>
<td>16</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>17</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>18</td>
<td>0.022222222</td>
</tr>
</tbody>
</table>

Mean: 2.355
Standard Deviation: 7.306661915
Variance: 53.38730833
Total #: 45

Table 3.3.2c Distribution of Errors in EFTA at 90min-MCO Flights
<table>
<thead>
<tr>
<th>Num#</th>
<th>Item</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-19</td>
<td>0.04</td>
</tr>
<tr>
<td>3</td>
<td>-18</td>
<td>0.12</td>
</tr>
<tr>
<td>1</td>
<td>-17</td>
<td>0.04</td>
</tr>
<tr>
<td>0</td>
<td>-16</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>-15</td>
<td>0.04</td>
</tr>
<tr>
<td>2</td>
<td>-14</td>
<td>0.08</td>
</tr>
<tr>
<td>1</td>
<td>-13</td>
<td>0.04</td>
</tr>
<tr>
<td>1</td>
<td>-12</td>
<td>0.04</td>
</tr>
<tr>
<td>2</td>
<td>-11</td>
<td>0.08</td>
</tr>
<tr>
<td>0</td>
<td>-10</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-9</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>-8</td>
<td>0.08</td>
</tr>
<tr>
<td>2</td>
<td>-7</td>
<td>0.08</td>
</tr>
<tr>
<td>2</td>
<td>-6</td>
<td>0.08</td>
</tr>
<tr>
<td>0</td>
<td>-5</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>-4</td>
<td>0.04</td>
</tr>
<tr>
<td>1</td>
<td>-3</td>
<td>0.04</td>
</tr>
<tr>
<td>0</td>
<td>-2</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>-1</td>
<td>0.04</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0.04</td>
</tr>
<tr>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td>0.04</td>
</tr>
<tr>
<td>0</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>6</td>
<td>0.04</td>
</tr>
<tr>
<td>0</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>9</td>
<td>0.04</td>
</tr>
</tbody>
</table>

Mean: -8.4
Standard deviation: 7.714920609
Variance: 59.52
Total#: 25

Table 3.3.2d Distribution of Errors in EFTA at 120min-MCO Flights
<table>
<thead>
<tr>
<th>Num#</th>
<th>Item</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-5</td>
<td>0.047619048</td>
</tr>
<tr>
<td>0</td>
<td>-4</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>-3</td>
<td>0.047619048</td>
</tr>
<tr>
<td>4</td>
<td>-2</td>
<td>0.19047619</td>
</tr>
<tr>
<td>2</td>
<td>-1</td>
<td>0.095238095</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>0.19047619</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0.047619048</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
<td>0.238095238</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>0.142857143</td>
</tr>
</tbody>
</table>

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>0.095</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>2.180110034</td>
</tr>
<tr>
<td>Variance</td>
<td>4.752879762</td>
</tr>
<tr>
<td>Total#</td>
<td>21</td>
</tr>
</tbody>
</table>

Table 3.3.2e Distribution of Errors in EFTA at 30min-MCO Flights(Prop)
<table>
<thead>
<tr>
<th>Number#</th>
<th>Item</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-8</td>
<td>0.0125</td>
</tr>
<tr>
<td>0</td>
<td>-7</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>-6</td>
<td>0.025</td>
</tr>
<tr>
<td>7</td>
<td>-5</td>
<td>0.0875</td>
</tr>
<tr>
<td>4</td>
<td>-4</td>
<td>0.05</td>
</tr>
<tr>
<td>9</td>
<td>-3</td>
<td>0.1125</td>
</tr>
<tr>
<td>15</td>
<td>-2</td>
<td>0.1875</td>
</tr>
<tr>
<td>14</td>
<td>-1</td>
<td>0.175</td>
</tr>
<tr>
<td>11</td>
<td>0</td>
<td>0.1375</td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>0.1</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>0.05</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>0.025</td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td>0.0125</td>
</tr>
<tr>
<td>0</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>0.025</td>
</tr>
</tbody>
</table>

Mean: -1.3

Standard Deviation: 2.561249695
Variances: 6.56

Total #: 80

Table 3.3.3a Distribution of Errors in EFTA at 30min-MSP Flights
<table>
<thead>
<tr>
<th>Number#</th>
<th>Item</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>-7</td>
<td>0.037735849</td>
</tr>
<tr>
<td>2</td>
<td>-6</td>
<td>0.037735849</td>
</tr>
<tr>
<td>4</td>
<td>-5</td>
<td>0.075471698</td>
</tr>
<tr>
<td>4</td>
<td>-4</td>
<td>0.075471698</td>
</tr>
<tr>
<td>6</td>
<td>-3</td>
<td>0.113207547</td>
</tr>
<tr>
<td>13</td>
<td>-2</td>
<td>0.245283019</td>
</tr>
<tr>
<td>4</td>
<td>-1</td>
<td>0.075471698</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td>0.094339623</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>0.094339623</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>0.056603774</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>0.075471698</td>
</tr>
<tr>
<td>0</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>5</td>
<td>0.094339623</td>
</tr>
</tbody>
</table>

Mean: -1.169811321  
Standard Deviation: 3.219843246  
Variance: 10.36739053  
Total #: 53

Table 3.3.3b Distribution of Errors in EFTA at 60min-MSP Flights
<table>
<thead>
<tr>
<th>Number#</th>
<th>Item</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-8</td>
<td>0.035714286</td>
</tr>
<tr>
<td>1</td>
<td>-7</td>
<td>0.035714286</td>
</tr>
<tr>
<td>1</td>
<td>-6</td>
<td>0.035714286</td>
</tr>
<tr>
<td>0</td>
<td>-5</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>-4</td>
<td>0.035714286</td>
</tr>
<tr>
<td>1</td>
<td>-3</td>
<td>0.035714286</td>
</tr>
<tr>
<td>1</td>
<td>-2</td>
<td>0.035714286</td>
</tr>
<tr>
<td>1</td>
<td>-1</td>
<td>0.035714286</td>
</tr>
<tr>
<td>6</td>
<td>0</td>
<td>0.214285714</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>0.107142857</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>0.035714286</td>
</tr>
<tr>
<td>0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>0.071428571</td>
</tr>
<tr>
<td>0</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>6</td>
<td>0.035714286</td>
</tr>
<tr>
<td>1</td>
<td>7</td>
<td>0.035714286</td>
</tr>
<tr>
<td>1</td>
<td>8</td>
<td>0.035714286</td>
</tr>
<tr>
<td>1</td>
<td>9</td>
<td>0.035714286</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td>0.071428571</td>
</tr>
<tr>
<td>1</td>
<td>11</td>
<td>0.035714286</td>
</tr>
<tr>
<td>0</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>13</td>
<td>0.035714286</td>
</tr>
<tr>
<td>0</td>
<td>14</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>16</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>17</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>18</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>19</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>20</td>
<td>0.035714286</td>
</tr>
</tbody>
</table>

Mean 2.714285714
Standard Deviation 6.357544129
Variance 40.41836735
Total# 28

Table 3.3.3c Distribution of Errors in EFTA at 90min-MSP Flights
<table>
<thead>
<tr>
<th>Number#</th>
<th>Item</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-13</td>
<td>0.055555556</td>
</tr>
<tr>
<td>2</td>
<td>-12</td>
<td>0.111111111</td>
</tr>
<tr>
<td>0</td>
<td>-11</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-10</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-9</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-8</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-7</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>-6</td>
<td>0.055555556</td>
</tr>
<tr>
<td>1</td>
<td>-5</td>
<td>0.055555556</td>
</tr>
<tr>
<td>0</td>
<td>-4</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>-3</td>
<td>0.055555556</td>
</tr>
<tr>
<td>0</td>
<td>-2</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>-1</td>
<td>0.111111111</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>0.166666667</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0.055555556</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>0.055555556</td>
</tr>
<tr>
<td>0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>6</td>
<td>0.055555556</td>
</tr>
<tr>
<td>1</td>
<td>7</td>
<td>0.055555556</td>
</tr>
<tr>
<td>0</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>13</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>14</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>16</td>
<td>0.055555556</td>
</tr>
<tr>
<td>0</td>
<td>17</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>18</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>19</td>
<td>0.055555556</td>
</tr>
<tr>
<td>1</td>
<td>20</td>
<td>0.055555556</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>1</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>9.480975102</td>
</tr>
<tr>
<td>Variance</td>
<td>89.888888889</td>
</tr>
<tr>
<td>Total#</td>
<td>18</td>
</tr>
</tbody>
</table>

Table 3.3.3d Distribution of Errors in EFTA at 120min-MSP Flights
<table>
<thead>
<tr>
<th>Number#</th>
<th>Item</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-10</td>
<td>0.142857143</td>
</tr>
<tr>
<td>0</td>
<td>-9</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-8</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-7</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>-6</td>
<td>0.142857143</td>
</tr>
<tr>
<td>0</td>
<td>-5</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-4</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-3</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>-2</td>
<td>0.285714286</td>
</tr>
<tr>
<td>0</td>
<td>-1</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>0.142857143</td>
</tr>
<tr>
<td>0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>7</td>
<td>0.142857143</td>
</tr>
<tr>
<td>0</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>10</td>
<td>0.142857143</td>
</tr>
</tbody>
</table>

Mean  
Standard Deviation  
Variance  
Total#  

Table 3.3.3e Distribution of Errors in EFTA at 150min-MSP Flights
<table>
<thead>
<tr>
<th>Number#</th>
<th>Item</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-17</td>
<td>0.024390244</td>
</tr>
<tr>
<td>0</td>
<td>-16</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-15</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-14</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-13</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-12</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-11</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-10</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>-9</td>
<td>0.024390244</td>
</tr>
<tr>
<td>0</td>
<td>-8</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-7</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>-6</td>
<td>0.073170732</td>
</tr>
<tr>
<td>1</td>
<td>-5</td>
<td>0.024390244</td>
</tr>
<tr>
<td>1</td>
<td>-4</td>
<td>0.024390244</td>
</tr>
<tr>
<td>3</td>
<td>-3</td>
<td>0.073170732</td>
</tr>
<tr>
<td>3</td>
<td>-2</td>
<td>0.073170732</td>
</tr>
<tr>
<td>4</td>
<td>-1</td>
<td>0.097560976</td>
</tr>
<tr>
<td>7</td>
<td>0</td>
<td>0.170731707</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>0.0976</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>0.0732</td>
</tr>
<tr>
<td>1</td>
<td>3</td>
<td>0.0244</td>
</tr>
<tr>
<td>5</td>
<td>4</td>
<td>0.1220</td>
</tr>
<tr>
<td>1</td>
<td>5</td>
<td>0.0244</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>0.0488</td>
</tr>
<tr>
<td>0</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>9</td>
<td>0.0244</td>
</tr>
</tbody>
</table>

Mean: -0.317073171
Standard Deviation: 4.528710711
Variance: 20.5092207
Total#: 41

Table 3.3.3f Distribution of Errors in EFTA at 30min-MSP Flights (Prop)
<table>
<thead>
<tr>
<th>Number#</th>
<th>Item</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-15</td>
<td>0.142857143</td>
</tr>
<tr>
<td>0</td>
<td>-14</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-13</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>-12</td>
<td>0.142857143</td>
</tr>
<tr>
<td>0</td>
<td>-11</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-10</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-9</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-8</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-7</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-6</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>-5</td>
<td>0.142857143</td>
</tr>
<tr>
<td>0</td>
<td>-4</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-3</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>-2</td>
<td>0.142857143</td>
</tr>
<tr>
<td>0</td>
<td>-1</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0.142857143</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>0.142857143</td>
</tr>
<tr>
<td>0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>9</td>
<td>0.142857143</td>
</tr>
</tbody>
</table>

Mean: -3.285714286  
Standard Deviation: 7.629159956  
Variance: 58.20408163  
Total#: 7

Table 3.3.3g Distribution of Errors in EFTA at 60min-MSP Flights (Prop)
<table>
<thead>
<tr>
<th>Number#</th>
<th>Item</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>-3</td>
<td>0.0339</td>
</tr>
<tr>
<td>2</td>
<td>-2</td>
<td>0.0339</td>
</tr>
<tr>
<td>4</td>
<td>-1</td>
<td>0.0678</td>
</tr>
<tr>
<td>11</td>
<td>0</td>
<td>0.1864</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>0.1186</td>
</tr>
<tr>
<td>10</td>
<td>2</td>
<td>0.1695</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>0.0678</td>
</tr>
<tr>
<td>6</td>
<td>4</td>
<td>0.1017</td>
</tr>
<tr>
<td>6</td>
<td>5</td>
<td>0.1017</td>
</tr>
<tr>
<td>0</td>
<td>6</td>
<td>0.0000</td>
</tr>
<tr>
<td>0</td>
<td>7</td>
<td>0.0000</td>
</tr>
<tr>
<td>0</td>
<td>8</td>
<td>0.0000</td>
</tr>
<tr>
<td>1</td>
<td>9</td>
<td>0.0169</td>
</tr>
<tr>
<td>0</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>11</td>
<td>0.0339</td>
</tr>
<tr>
<td>1</td>
<td>12</td>
<td>0.0169</td>
</tr>
<tr>
<td>0</td>
<td>13</td>
<td>0.0000</td>
</tr>
<tr>
<td>0</td>
<td>14</td>
<td>0.0000</td>
</tr>
<tr>
<td>1</td>
<td>15</td>
<td>0.0169</td>
</tr>
<tr>
<td>0</td>
<td>16</td>
<td>0.0000</td>
</tr>
<tr>
<td>1</td>
<td>17</td>
<td>0.0169</td>
</tr>
<tr>
<td>0</td>
<td>18</td>
<td>0.0000</td>
</tr>
<tr>
<td>1</td>
<td>19</td>
<td>0.0169</td>
</tr>
</tbody>
</table>

| Mean    | 2.9322|
| Standard Deviation | 4.50 |
| Variance     | 20.2327|
| Total#       | 59 |

Table 3.3.4a Distribution of Errors in EFTA at 30min-PHX Flights
<table>
<thead>
<tr>
<th>Number</th>
<th>Item</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>-3</td>
<td>0.1176</td>
</tr>
<tr>
<td>0</td>
<td>-2</td>
<td>0.0000</td>
</tr>
<tr>
<td>1</td>
<td>-1</td>
<td>0.0588</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>0.1765</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0.0588</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>0.1176</td>
</tr>
<tr>
<td>1</td>
<td>3</td>
<td>0.0588</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>0.1765</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>0.1176</td>
</tr>
<tr>
<td>0</td>
<td>6</td>
<td>0.0000</td>
</tr>
<tr>
<td>0</td>
<td>7</td>
<td>0.0000</td>
</tr>
<tr>
<td>1</td>
<td>8</td>
<td>0.0588</td>
</tr>
<tr>
<td>0</td>
<td>9</td>
<td>0.0000</td>
</tr>
<tr>
<td>0</td>
<td>10</td>
<td>0.0000</td>
</tr>
<tr>
<td>1</td>
<td>11</td>
<td>0.0588</td>
</tr>
</tbody>
</table>

Mean 2.4706  
Standard Deviation 3.566463942  
Variance 12.71966505  
Total# 17

Table 3.3.4b Distribution of Errors in EFTA at 60min-PHX Flights
<table>
<thead>
<tr>
<th>Number</th>
<th>Item</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-5</td>
<td>0.0909</td>
</tr>
<tr>
<td>1</td>
<td>-4</td>
<td>0.0909</td>
</tr>
<tr>
<td>0</td>
<td>-3</td>
<td>0.0000</td>
</tr>
<tr>
<td>0</td>
<td>-2</td>
<td>0.0000</td>
</tr>
<tr>
<td>0</td>
<td>-1</td>
<td>0.0000</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0.0000</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0.0000</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>0.0909</td>
</tr>
<tr>
<td>0</td>
<td>3</td>
<td>0.0000</td>
</tr>
<tr>
<td>0</td>
<td>4</td>
<td>0.0000</td>
</tr>
<tr>
<td>0</td>
<td>5</td>
<td>0.0000</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>0.1818</td>
</tr>
<tr>
<td>0</td>
<td>7</td>
<td>0.0000</td>
</tr>
<tr>
<td>1</td>
<td>8</td>
<td>0.0909</td>
</tr>
<tr>
<td>1</td>
<td>9</td>
<td>0.0909</td>
</tr>
<tr>
<td>0</td>
<td>10</td>
<td>0.0000</td>
</tr>
<tr>
<td>1</td>
<td>11</td>
<td>0.0909</td>
</tr>
<tr>
<td>1</td>
<td>12</td>
<td>0.0909</td>
</tr>
<tr>
<td>0</td>
<td>13</td>
<td>0.0000</td>
</tr>
<tr>
<td>0</td>
<td>14</td>
<td>0.0000</td>
</tr>
<tr>
<td>0</td>
<td>15</td>
<td>0.0000</td>
</tr>
<tr>
<td>0</td>
<td>16</td>
<td>0.0000</td>
</tr>
<tr>
<td>0</td>
<td>17</td>
<td>0.0000</td>
</tr>
<tr>
<td>0</td>
<td>18</td>
<td>0.0000</td>
</tr>
<tr>
<td>1</td>
<td>19</td>
<td>0.0909</td>
</tr>
<tr>
<td>0</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>21</td>
<td>0.0909</td>
</tr>
</tbody>
</table>

Mean 7.7273
Standard Deviation 7.8171
Variance 61.1070
Total# 11

Table 3.3.4c Distribution of Errors in EFTA at 90min-PHX Flights
<table>
<thead>
<tr>
<th>Number#</th>
<th>Item</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7</td>
<td>0.125</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
<td>0.25</td>
</tr>
<tr>
<td>1</td>
<td>9</td>
<td>0.125</td>
</tr>
<tr>
<td>1</td>
<td>10</td>
<td>0.125</td>
</tr>
<tr>
<td>0</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>13</td>
<td>0.125</td>
</tr>
<tr>
<td>0</td>
<td>14</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>16</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>17</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>18</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>19</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>21</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>22</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>23</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>24</td>
<td>0.125</td>
</tr>
<tr>
<td>0</td>
<td>25</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>26</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>27</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>28</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>29</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>30</td>
<td>0.125</td>
</tr>
</tbody>
</table>

Mean 13.625
Standard Deviation 8.045767521
Variance 64.734375
Total# 8

Table3.3.4d Distribution of Errors in EFTA at 120min-PHX Flights
<table>
<thead>
<tr>
<th>Number</th>
<th>Item</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-3</td>
<td>0.16666667</td>
</tr>
<tr>
<td>0</td>
<td>-2</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>-1</td>
<td>0.33333333</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0.16666667</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>0.16666667</td>
</tr>
<tr>
<td>0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>5</td>
<td>0.16666667</td>
</tr>
</tbody>
</table>

Mean 0.333333
Standard Deviation 3.049759938
Variance 9.301035678
Total# 6

Table 3.3.4e Distribution of Errors in EFTA at 30min-PHX Flights (Prop)
<table>
<thead>
<tr>
<th>Number#</th>
<th>Item</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-18</td>
<td>0.003154574</td>
</tr>
<tr>
<td>0</td>
<td>-17</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>-16</td>
<td>0.006309148</td>
</tr>
<tr>
<td>3</td>
<td>-15</td>
<td>0.009463722</td>
</tr>
<tr>
<td>3</td>
<td>-14</td>
<td>0.009463722</td>
</tr>
<tr>
<td>1</td>
<td>-13</td>
<td>0.003154574</td>
</tr>
<tr>
<td>0</td>
<td>-12</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>-11</td>
<td>0.003154574</td>
</tr>
<tr>
<td>4</td>
<td>-10</td>
<td>0.012618297</td>
</tr>
<tr>
<td>1</td>
<td>-9</td>
<td>0.003154574</td>
</tr>
<tr>
<td>4</td>
<td>-8</td>
<td>0.012618297</td>
</tr>
<tr>
<td>1</td>
<td>-7</td>
<td>0.003154574</td>
</tr>
<tr>
<td>5</td>
<td>-6</td>
<td>0.015772871</td>
</tr>
<tr>
<td>8</td>
<td>-5</td>
<td>0.025236593</td>
</tr>
<tr>
<td>9</td>
<td>-4</td>
<td>0.028391167</td>
</tr>
<tr>
<td>14</td>
<td>-3</td>
<td>0.044164038</td>
</tr>
<tr>
<td>26</td>
<td>-2</td>
<td>0.082018927</td>
</tr>
<tr>
<td>36</td>
<td>-1</td>
<td>0.113564669</td>
</tr>
<tr>
<td>59</td>
<td>0</td>
<td>0.186119874</td>
</tr>
<tr>
<td>48</td>
<td>1</td>
<td>0.151419558</td>
</tr>
<tr>
<td>35</td>
<td>2</td>
<td>0.110410995</td>
</tr>
<tr>
<td>19</td>
<td>3</td>
<td>0.05936909</td>
</tr>
<tr>
<td>15</td>
<td>4</td>
<td>0.047318612</td>
</tr>
<tr>
<td>8</td>
<td>5</td>
<td>0.025236593</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>0.006309148</td>
</tr>
<tr>
<td>3</td>
<td>7</td>
<td>0.009463722</td>
</tr>
<tr>
<td>0</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>9</td>
<td>0.006309148</td>
</tr>
<tr>
<td>0</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>11</td>
<td>0.006309148</td>
</tr>
<tr>
<td>1</td>
<td>12</td>
<td>0.003154574</td>
</tr>
<tr>
<td>0</td>
<td>13</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>14</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>15</td>
<td>0.003154574</td>
</tr>
<tr>
<td>0</td>
<td>16</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>17</td>
<td>0.003154574</td>
</tr>
<tr>
<td>0</td>
<td>18</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>19</td>
<td>0.003154574</td>
</tr>
<tr>
<td>0</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>21</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>22</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>23</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>24</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>25</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>26</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>27</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>28</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>29</td>
<td>0.003154574</td>
</tr>
</tbody>
</table>

Mean = -0.142
Standard Deviation = 4.779229513
Variance = 22.84103474
Total# = 317

Table 3.3.5a Distribution of Errors in EFTA at 30min-All Cities Flights
<table>
<thead>
<tr>
<th>Number#</th>
<th>Item</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-18</td>
<td>0.004385965</td>
</tr>
<tr>
<td>0</td>
<td>-17</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>-16</td>
<td>0.00877193</td>
</tr>
<tr>
<td>2</td>
<td>-15</td>
<td>0.00877193</td>
</tr>
<tr>
<td>2</td>
<td>-14</td>
<td>0.00877193</td>
</tr>
<tr>
<td>4</td>
<td>-13</td>
<td>0.01754386</td>
</tr>
<tr>
<td>0</td>
<td>-12</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>-11</td>
<td>0.004385965</td>
</tr>
<tr>
<td>2</td>
<td>-10</td>
<td>0.00877193</td>
</tr>
<tr>
<td>3</td>
<td>-9</td>
<td>0.013157895</td>
</tr>
<tr>
<td>2</td>
<td>-8</td>
<td>0.00877193</td>
</tr>
<tr>
<td>7</td>
<td>-7</td>
<td>0.030701754</td>
</tr>
<tr>
<td>8</td>
<td>-6</td>
<td>0.035087719</td>
</tr>
<tr>
<td>5</td>
<td>-5</td>
<td>0.021929825</td>
</tr>
<tr>
<td>6</td>
<td>-4</td>
<td>0.026315789</td>
</tr>
<tr>
<td>15</td>
<td>-3</td>
<td>0.065789474</td>
</tr>
<tr>
<td>23</td>
<td>-2</td>
<td>0.100877193</td>
</tr>
<tr>
<td>18</td>
<td>-1</td>
<td>0.078947368</td>
</tr>
<tr>
<td>31</td>
<td>0</td>
<td>0.135964912</td>
</tr>
<tr>
<td>24</td>
<td>1</td>
<td>0.105263158</td>
</tr>
<tr>
<td>21</td>
<td>2</td>
<td>0.092105263</td>
</tr>
<tr>
<td>18</td>
<td>3</td>
<td>0.078947368</td>
</tr>
<tr>
<td>9</td>
<td>4</td>
<td>0.039473684</td>
</tr>
<tr>
<td>10</td>
<td>5</td>
<td>0.043859649</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>0.00877193</td>
</tr>
<tr>
<td>6</td>
<td>7</td>
<td>0.026315789</td>
</tr>
<tr>
<td>8</td>
<td>8</td>
<td>0.00877193</td>
</tr>
<tr>
<td>1</td>
<td>9</td>
<td>0.004385965</td>
</tr>
<tr>
<td>0</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>11</td>
<td>0.004385965</td>
</tr>
<tr>
<td>0</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>13</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>14</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>16</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>17</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>18</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>19</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>21</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>22</td>
<td>0.004385965</td>
</tr>
<tr>
<td>0</td>
<td>23</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>24</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>25</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>26</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>27</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>28</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>29</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>30</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>31</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>32</td>
<td>0.004385965</td>
</tr>
</tbody>
</table>

Mean: -0.609
Standard Deviation: 5.511725592
Variance: 30.379119
Total #: 228

Table 3.3.5b Distribution of Errors in EFTA at 60min-All Cities Flights
<table>
<thead>
<tr>
<th>Number#</th>
<th>Item</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>-16</td>
<td>0.01388889</td>
</tr>
<tr>
<td>0</td>
<td>-15</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-14</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>-13</td>
<td>0.006944444</td>
</tr>
<tr>
<td>0</td>
<td>-12</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>-11</td>
<td>0.01388889</td>
</tr>
<tr>
<td>2</td>
<td>-10</td>
<td>0.01388889</td>
</tr>
<tr>
<td>1</td>
<td>-9</td>
<td>0.006944444</td>
</tr>
<tr>
<td>6</td>
<td>-8</td>
<td>0.04166667</td>
</tr>
<tr>
<td>2</td>
<td>-7</td>
<td>0.01388889</td>
</tr>
<tr>
<td>8</td>
<td>-6</td>
<td>0.05555556</td>
</tr>
<tr>
<td>1</td>
<td>-5</td>
<td>0.006944444</td>
</tr>
<tr>
<td>10</td>
<td>-4</td>
<td>0.069444444</td>
</tr>
<tr>
<td>6</td>
<td>-3</td>
<td>0.04166667</td>
</tr>
<tr>
<td>5</td>
<td>-2</td>
<td>0.034722222</td>
</tr>
<tr>
<td>10</td>
<td>-1</td>
<td>0.069444444</td>
</tr>
<tr>
<td>12</td>
<td>0</td>
<td>0.083333333</td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>0.05555556</td>
</tr>
<tr>
<td>6</td>
<td>2</td>
<td>0.04166667</td>
</tr>
<tr>
<td>6</td>
<td>3</td>
<td>0.04166667</td>
</tr>
<tr>
<td>11</td>
<td>4</td>
<td>0.076388889</td>
</tr>
<tr>
<td>7</td>
<td>5</td>
<td>0.048611111</td>
</tr>
<tr>
<td>7</td>
<td>6</td>
<td>0.048611111</td>
</tr>
<tr>
<td>5</td>
<td>7</td>
<td>0.034722222</td>
</tr>
<tr>
<td>5</td>
<td>8</td>
<td>0.034722222</td>
</tr>
<tr>
<td>6</td>
<td>9</td>
<td>0.04166667</td>
</tr>
<tr>
<td>3</td>
<td>10</td>
<td>0.020833333</td>
</tr>
<tr>
<td>2</td>
<td>11</td>
<td>0.01388889</td>
</tr>
<tr>
<td>2</td>
<td>12</td>
<td>0.01388889</td>
</tr>
<tr>
<td>3</td>
<td>13</td>
<td>0.020833333</td>
</tr>
<tr>
<td>0</td>
<td>14</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>15</td>
<td>0.006944444</td>
</tr>
<tr>
<td>0</td>
<td>16</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>17</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>18</td>
<td>0.006944444</td>
</tr>
<tr>
<td>1</td>
<td>19</td>
<td>0.006944444</td>
</tr>
<tr>
<td>1</td>
<td>20</td>
<td>0.006944444</td>
</tr>
<tr>
<td>1</td>
<td>21</td>
<td>0.006944444</td>
</tr>
</tbody>
</table>

**Mean** 1.4375
**Standard Deviation** 6.858408009
**Variance** 47.03776042
**Total#** 144

Table 3.3.5c Distribution of Errors in EFTA at 90min-All Cities Flights
<table>
<thead>
<tr>
<th>Number#</th>
<th>Item</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>-19</td>
<td>0.023809524</td>
</tr>
<tr>
<td>3</td>
<td>-18</td>
<td>0.035714286</td>
</tr>
<tr>
<td>2</td>
<td>-17</td>
<td>0.023809524</td>
</tr>
<tr>
<td>0</td>
<td>-16</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>-15</td>
<td>0.023809524</td>
</tr>
<tr>
<td>2</td>
<td>-14</td>
<td>0.023809524</td>
</tr>
<tr>
<td>2</td>
<td>-13</td>
<td>0.023809524</td>
</tr>
<tr>
<td>3</td>
<td>-12</td>
<td>0.035714286</td>
</tr>
<tr>
<td>2</td>
<td>-11</td>
<td>0.023809524</td>
</tr>
<tr>
<td>0</td>
<td>-10</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>-9</td>
<td>0.011904762</td>
</tr>
<tr>
<td>4</td>
<td>-8</td>
<td>0.047619048</td>
</tr>
<tr>
<td>3</td>
<td>-7</td>
<td>0.035714286</td>
</tr>
<tr>
<td>3</td>
<td>-6</td>
<td>0.035714286</td>
</tr>
<tr>
<td>3</td>
<td>-5</td>
<td>0.035714286</td>
</tr>
<tr>
<td>3</td>
<td>-4</td>
<td>0.035714286</td>
</tr>
<tr>
<td>5</td>
<td>-3</td>
<td>0.05952381</td>
</tr>
<tr>
<td>2</td>
<td>-2</td>
<td>0.023809524</td>
</tr>
<tr>
<td>5</td>
<td>-1</td>
<td>0.05952381</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>0.047619048</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>0.05952381</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>0.035714286</td>
</tr>
<tr>
<td>1</td>
<td>3</td>
<td>0.011904762</td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td>0.011904762</td>
</tr>
<tr>
<td>0</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
<td>0.035714286</td>
</tr>
<tr>
<td>2</td>
<td>7</td>
<td>0.023809524</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
<td>0.047619048</td>
</tr>
<tr>
<td>2</td>
<td>9</td>
<td>0.023809524</td>
</tr>
<tr>
<td>1</td>
<td>10</td>
<td>0.011904762</td>
</tr>
<tr>
<td>3</td>
<td>11</td>
<td>0.035714286</td>
</tr>
<tr>
<td>0</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>13</td>
<td>0.011904762</td>
</tr>
<tr>
<td>1</td>
<td>14</td>
<td>0.011904762</td>
</tr>
<tr>
<td>0</td>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>16</td>
<td>0.011904762</td>
</tr>
<tr>
<td>0</td>
<td>17</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>18</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>19</td>
<td>0.011904762</td>
</tr>
<tr>
<td>1</td>
<td>20</td>
<td>0.011904762</td>
</tr>
<tr>
<td>0</td>
<td>21</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>22</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>23</td>
<td>0.011904762</td>
</tr>
<tr>
<td>1</td>
<td>24</td>
<td>0.011904762</td>
</tr>
<tr>
<td>0</td>
<td>25</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>26</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>27</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>28</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>29</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>30</td>
<td>0.011904762</td>
</tr>
</tbody>
</table>

Mean: -1.154
Standard Deviation: 10.52385943
Variance: 110.7516173
Total#: 84

Table 3.3.5d Distribution of Errors in EFTA at 120min-All Cities Flights
<table>
<thead>
<tr>
<th>Number#</th>
<th>Item</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>-10</td>
<td>0.071428571</td>
</tr>
<tr>
<td>0</td>
<td>-9</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-8</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-7</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>-6</td>
<td>0.035714286</td>
</tr>
<tr>
<td>0</td>
<td>-5</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>-4</td>
<td>0.035714286</td>
</tr>
<tr>
<td>1</td>
<td>-3</td>
<td>0.035714286</td>
</tr>
<tr>
<td>3</td>
<td>-2</td>
<td>0.107142857</td>
</tr>
<tr>
<td>2</td>
<td>-1</td>
<td>0.071428571</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0.035714286</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>0.071428571</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>0.071428571</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>0.071428571</td>
</tr>
<tr>
<td>0</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>6</td>
<td>0.035714286</td>
</tr>
<tr>
<td>2</td>
<td>7</td>
<td>0.071428571</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
<td>0.071428571</td>
</tr>
<tr>
<td>0</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>10</td>
<td>0.035714286</td>
</tr>
<tr>
<td>3</td>
<td>11</td>
<td>0.107142857</td>
</tr>
<tr>
<td>0</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>13</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>14</td>
<td>0.035714286</td>
</tr>
<tr>
<td>0</td>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>16</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>17</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>18</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>19</td>
<td>0.035714286</td>
</tr>
</tbody>
</table>

Mean 3.214
Standard Deviation 6.883639278
Variance 47.38448971
Total# 28

Table 3.3.5e Distribution of Errors in EFTA at 150min-All Cities Flights
<table>
<thead>
<tr>
<th>Num#</th>
<th>Item</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-17</td>
<td>0.010416667</td>
</tr>
<tr>
<td>0</td>
<td>-16</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-15</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-14</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-13</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-12</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-11</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-10</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>-9</td>
<td>0.010416667</td>
</tr>
<tr>
<td>1</td>
<td>-8</td>
<td>0.010416667</td>
</tr>
<tr>
<td>0</td>
<td>-7</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>-6</td>
<td>0.03125</td>
</tr>
<tr>
<td>3</td>
<td>-5</td>
<td>0.03125</td>
</tr>
<tr>
<td>4</td>
<td>-4</td>
<td>0.041666667</td>
</tr>
<tr>
<td>6</td>
<td>-3</td>
<td>0.0625</td>
</tr>
<tr>
<td>9</td>
<td>-2</td>
<td>0.09375</td>
</tr>
<tr>
<td>10</td>
<td>-1</td>
<td>0.104166667</td>
</tr>
<tr>
<td>15</td>
<td>0</td>
<td>0.15625</td>
</tr>
<tr>
<td>9</td>
<td>1</td>
<td>0.09375</td>
</tr>
<tr>
<td>11</td>
<td>2</td>
<td>0.114583333</td>
</tr>
<tr>
<td>7</td>
<td>3</td>
<td>0.072916667</td>
</tr>
<tr>
<td>7</td>
<td>4</td>
<td>0.072916667</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>0.03125</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>0.020833333</td>
</tr>
<tr>
<td>1</td>
<td>7</td>
<td>0.010416667</td>
</tr>
<tr>
<td>0</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>9</td>
<td>0.010416667</td>
</tr>
<tr>
<td>1</td>
<td>10</td>
<td>0.010416667</td>
</tr>
<tr>
<td>0</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>12</td>
<td>0.010416667</td>
</tr>
</tbody>
</table>

Mean 0.166
Standard Deviation 3.988727115
Variance 15.909944
Total# 96

Table 3.3.5f: Distribution of Errors in EFTA at 30min-All Cities Flights (Prop
<table>
<thead>
<tr>
<th>Num#</th>
<th>Item</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-15</td>
<td>0.058823529</td>
</tr>
<tr>
<td>1</td>
<td>-14</td>
<td>0.058823529</td>
</tr>
<tr>
<td>0</td>
<td>-13</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>-12</td>
<td>0.058823529</td>
</tr>
<tr>
<td>0</td>
<td>-11</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-10</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-9</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-8</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-7</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-6</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>-5</td>
<td>0.176470588</td>
</tr>
<tr>
<td>1</td>
<td>-4</td>
<td>0.058823529</td>
</tr>
<tr>
<td>0</td>
<td>-3</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>-2</td>
<td>0.058823529</td>
</tr>
<tr>
<td>0</td>
<td>-1</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0.058823529</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0.058823529</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>0.117647059</td>
</tr>
<tr>
<td>0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>9</td>
<td>0.058823529</td>
</tr>
<tr>
<td>1</td>
<td>10</td>
<td>0.058823529</td>
</tr>
<tr>
<td>0</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>13</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>14</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>16</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>17</td>
<td>0.058823529</td>
</tr>
<tr>
<td>0</td>
<td>18</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>19</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>20</td>
<td>0.058823529</td>
</tr>
<tr>
<td>1</td>
<td>21</td>
<td>0.058823529</td>
</tr>
</tbody>
</table>

Mean 1.176
Standard Deviation 10.72788946
Variance 115.0876122
Total# 17

Table3.3.5g Distribution of Errors in EFTA at 60min-All Cities Flights(Prop)
<table>
<thead>
<tr>
<th>min/city</th>
<th>All Cities</th>
<th>Denver</th>
<th>Orlando</th>
<th>Phoenix</th>
<th>Minneapolis</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>30</td>
<td>4.779</td>
<td>4.946</td>
<td>5.613</td>
<td>4.5</td>
<td>2.561</td>
</tr>
<tr>
<td>60</td>
<td>5.511</td>
<td>6.06</td>
<td>6.443</td>
<td>3.566</td>
<td>3.219</td>
</tr>
<tr>
<td>90</td>
<td>6.858</td>
<td>5.31</td>
<td>7.306</td>
<td>7.817</td>
<td>6.357</td>
</tr>
<tr>
<td>120</td>
<td>10.523</td>
<td>8.735</td>
<td>7.714</td>
<td>8.045</td>
<td>9.48</td>
</tr>
<tr>
<td>150</td>
<td>6.883</td>
<td>6.635</td>
<td></td>
<td></td>
<td>6.512</td>
</tr>
</tbody>
</table>

Table 3.4a Standard Deviation versus Time-to-go(Jet)
<table>
<thead>
<tr>
<th>min/city</th>
<th>All Cities</th>
<th>Denver</th>
<th>Orlando</th>
<th>Phoenix</th>
<th>Minneapolis</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>3.988</td>
<td>4.402</td>
<td>2.18</td>
<td>3.049</td>
<td>4.528</td>
</tr>
<tr>
<td>60</td>
<td>10.727</td>
<td>11.454</td>
<td></td>
<td></td>
<td>7.629</td>
</tr>
</tbody>
</table>

Table 3.4b Standard Deviation versus Time-to-go (Prop)
Fig 3.2.1a Sample Histories of Estimation Errors (Jet)
Fig3.2.1b Sample Histories of Estimation Errors(Jet)
Fig 3.2.1c Sample Histories of Estimation Errors (Jet)
Fig 3.2.1d Sample Histories of Estimation Errors (Jet)
Fig3.2.1e Sample Histories of Estimation Errors(Prop)
BTA2170 GJT-DEN 51min (estimated flight time)

Time to Go (min)

BTA2269 RAP-DEN 70min (estimated flight time)

Time to Go (min)

BTA2400 COD-DEN 85min (estimated flight time)

Time to Go (min)

Fig 3.2. If Sample Histories of Estimation Errors (Prop)
Fig 3.2.2a Sample Histories of Estimation Errors (Jet)
Fig3.2.2b Sample Histories of Estimation Errors (Jet)
Fig 3.2.2c Sample Histories of Estimation Errors (Prop)
Fig 3.2.3a Sample Histories of Estimation Errors (Jet)
Fig 3.2.3b Sample Histories of Estimation Errors (Jet)
Fig3.2.3c Sample Histories of Estimation Errors (Jet)
Fig 3.2.3d Sample Histories of Estimation Errors (Prop)
Fig 3.2.3e Sample Histories of Estimation Errors (Prop)
Fig. 3.2.4a Sample Histories of Estimation Errors (Jet)
Fig3.2.4b Sample Histories of Estimation Errors (Jet)
Fig 3.2.4c Sample Histories of Estimation Errors (Jet)
Fig 3.2.4d Sample Histories of Estimation Errors (Prop)
DEN30min
(Jet)
Sample Points=114
Mean=-0.7895
Standard Deviation=4.946

Fig. 3.3.1a Distribution of Errors in EFTA at 30 min-DEN Flights
DEN60min

(Jet)

Sample Points=102
Mean=-0.2745
Standard Deviation=6.06

Fig. 3.3.1b Distribution of Errors in EFTA at 60min-DEN Flights
Fig. 3.3.1c Distribution of Errors in EFTA at 90min-DEN Flights

Sample Points = 60
Mean = -1
Standard Deviation = 5.31
DEN120min (Jet)

Sample Points = 33
Mean = -0.424
Standard Deviation = 8.735

Fig. 3.3.1d Distribution of Errors in EFTA at 120min-DEN Flights
DEN 150min (Jet)

Sample Points = 21
Mean = 4.33
Standard Deviation = 6.635

Fig. 3.3.1e Distribution of Errors in EFTA at 120min-DEN Flights

Error in EFTA [min] (+ is late arrival)
DEN 180min
Sample Points=16
Mean=0.875
Standard Deviation=14.106

Fig. 3.3.1f Distribution of Errors in EFTA at 180min-DEN Flights
DEN30min
(Prop)

Sample Points = 28
Mean = 0.2928
Standard Deviation = 4.4

Fig. 3.3.1g Distribution of Errors in EFTA at 30min-DEN Flights
DEN60min (Prop)

Sample Points = 10
Mean = 4.3
Standard Deviation = 11.45

Fig. 3.3.1h Distribution of Errors in EFTA at 60min-DEN Flights

Error in EFTA [min] (+ is late arrival)
Fig. 3.3.2a Distribution of Errors in EFTA at 30min-MCO Flights
MCO60min
(Jet)

Sample Points = 56
Mean = -1.268
Standard Deviation = 6.44

Fig. 3.3.2b Distribution of Errors in EFTA at 60min-MCO Flights
MCO90min
(Jet)

Sample Points = 45
Mean = 2.355
Standard deviation = 7.30

Fig. 3.3.2c Distribution of Errors in EFTA at 90min-MCO Flights

Error in EFTA [min] (+ is late arrival)
MCO120min

(Jet)

Sample Points=25
Mean=-8.4
Standard Deviation=7.71

Fig.3.3.2d Distribution of Errors in EFTA at 120min-MCO
MCO30min
(Prop)

Sample Points=21
Mean=0.095
Standard Deviation=2.18

Fig.3.3.2e Distribution of Errors in EFTA at 30min-MCO Flights
Fig. 3.3.3a Distribution of Errors in EFTA at 30min-MSP Flights

MSP 30min (Jet)

Sample Points = 80
Mean = -1.3
Standard Deviation = 2.56

Error in EFTA [min] (+ is late arrival)
MSP60min (Jet)

Sample Points=53
Mean=-1.1698
Standard Deviation=3.22

Fig.3.3.3b Distribution of Errors in EFTA at 60min-MSP Flights

Error in EFTA [min](+ is late arrival)
MSP90min
(Jet)
Sample Points=28
Mean=2.714
Standard Deviation=6.3575

Fig. 3.3.3c Distribution of Errors in EFTA at 90min-MSP Flights
MSP120min
(Jet)

Sample points = 18
Mean = 1
Standard Deviation = 9.48

Fig. 3.3.3d Distribution of Errors in EFTA at 120min-MSP Flights

Error in EFTA [min] (+ is late arrival)
MSP150min (Jet)

Sample Points=7
Mean=-0.14285
Standard Deviation=6.512

Fig. 3.3.3e Distribution of Errors in EFTA at 150min-MSP Flights

Error in EFTA [min] (+ is late arrival)
MSP30min Sample Points=41
Mean=-0.3170
(Prop) Standard Deviation=4.5287

Fig. 3.3.3.f Distribution of Errors in EFTA at 30min-MSP Flights

Error in EFTA [min] (+ is late arrival)
MSP60min (Prop)  
Sample Points=7  
Mean=-3.2857  
Standard Deviation=7.629

Fig. 3.3.3g Distribution of Errors in EFTA at 60min-MSP Flights
Fig. 3.3.4a Distribution of Errors in EFTA at 30min-PHX Flights

PHX30min
(Jet)

Sample Points = 59
Mean = 2.9322
Standard Deviation = 4.5

Error in EFTA [min] (+ is late arrival)
PHX60min
(Jet)

Sample Points = 17
Mean = 2.4706
Standard Deviation = 3.566

Fig. 3.3.4b Distribution of Errors in EFTA at 60min-PHX Flights
PHX90min (Jet)

Sample Points=11
Mean=7.7273
Standard Deviation=7.817

Fig. 3.3.4c Distribution of Errors in EFTA at 90min-PHX Flights
PHX120min  
(Jet)  
Sample Points=8  
Mean=13.625  
Standard Deviation=8.045

Fig. 3.3.4d Distribution of Errors in EFTA at 120min-PHX Flights
PHX30min (Prop)

Sample Points = 6
Mean = 0.333
Standard Deviation = 3.05

Fig. 3.3.4e Distribution of Errors in EFTA at 30min-PHX Flights
All Cities 30min

Sample Points = 317
Mean = -0.142
Standard Deviation = 4.779

Fig. 3.3.5a Distribution of Errors in EFTA at 30min-All Cities Flights
All Cities 60min
(Jet)
Sample Points = 228
Mean = -0.609
Standard Deviation = 5.511

Fig. 3.3.5b Distribution of Errors in EFTA at 60min-All Cities Flights
All Cities 90min

Sample Points=144
Mean=1.4375
Standard Deviation=6.858

Fig. 3.3.5c Distribution of Errors in EFTA at 90min-All Cities Flights
All Cities 120min (Jet)

Sample Points = 84
Mean = -1.154
Standard deviation = 10.52

Error in EFTA [min] (+ is late arrival)

Fig. 3.3.5d Distribution of Errors in EFTA at 120min - All Cities Flights
All Cities 150min (Jet)

Sample Points=28
Mean=3.214
Standard Deviation=6.883

Fig. 3.3.5e Distribution of Errors in EFTA at 150min-All Cities Flights
Fig. 3.3.5f Distribution of Errors in EFTA at 30min-All Cities Flights

- All Cities 30min
- Sample Points = 96
- Mean = 0.166
- Standard Deviation = 3.988

Error in EFTA [min] (+ is late arrival)
All Cities 60min
(Prop)
Sample Points=17
Mean=1.176
Standard Deviation=10.727

Fig.3.3.5g Distribution of Errors in EFTA at 60min-All Cities Flights
Fig. 3.4a Standard Deviation versus Time-to-go

- All Cities
- Denver
- Orlando
- Phoenix
- Minneapolis
Fig 3.4b Standard Deviation versus Time-to-go
Chapter 4

Analysis of Results

4.1 Introduction

The objective of this chapter is to analyze the results which we got in chapter 3 to evaluate which factors such as the numbers of sample points, or the effect of climbing influences over the EFTA errors and σ (standard deviation). Section 4.2 forwards the plot trends about the EFTA errors versus time to go for both jet and prop cases. Section 4.3 presents which factor influences the distribution of EFTA in Different Time-to-go Values. Section 4.4 provides the comparison results to prove the climbing does not really influence the σ (standard deviation) of the EFTA errors.

4.2 EFTA Errors versus Time-to-go (T)

From the results we got in Section 3.2, most of the EFTA error versus Time-to-go plots will converge to zero as Time-to-go T decreases. However, there are no consistent patterns for the plots. Take Fig.4.2 for example, the EFTA errors jumps(or drops) sharply
during the flight time and then decreases later as $T$ decreases. Therefore, we conclude that there is no pattern for the EFTA error versus Time-to-go.

4.3 Distribution of EFTA Errors at Different Time-to-go

From Figs. 3.3.1a to 3.3.5g, we see the number of sample points do really influence the distribution of EFTA error in different time periods. For all study cases, we can clearly see that for $T=30, 60$ mins., since there are more sample points than other time periods, the distributions of ETA error are normally distributed. In contrast, for other time periods $T=90, 120, 150$ mins, etc., the distributions of the EFTA error are not as normal as what we expected. However, if we had more sample points for $T=90, 120$ mins, etc., we can expect that the EFTA error distributions for them should be similar as what we got for $T=30, 60$ mins.

4.4 The Initial Climbing Effect on EFTA Error

To consider whether initial climbing affects the EFTA error, we consider those sample points for $T=30$ and 60 mins which are in the first 5 points of the flight during the time, since we suppose that in the first 25 mins, the flight is climbing. The comparisons are listed as follows:

Case 1: $T=30$ mins

$\sigma=4.78$ mins

Mean=-0.142

for all sample points of any flight.
\( \sigma = 4.25 \text{ mins} \)
Mean = 0.96
for the points are in first five sample points of any flight.

\( \sigma = 4.78 \text{ mins} \)
Mean = -0.825
for the points are not in the first 5 sample points of any flight.

Case 2: \( T = 60 \text{ mins} \)

\( \sigma = 5.51 \text{ mins} \)
Mean = -0.609
for all sample points of any flight.

\( \sigma = 5.33 \text{ mins} \)
Mean = -0.846
for the points are in first five sample points of any flight.

\( \sigma = 4.95 \text{ mins} \)
Mean = -0.72
for the points are not in the first 5 sample points of any flight.

The plots for above study cases can be seen in Tables 4.4a to 4.4f and Figs. 4.4a to 4.4f. From the results, we conclude that the climbing does not really affect the mean value or uncertainty of the EFTA error. This is an important result from this thesis.
<table>
<thead>
<tr>
<th>Number#</th>
<th>Item</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-18</td>
<td>0.003154574</td>
</tr>
<tr>
<td>0</td>
<td>-17</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>-16</td>
<td>0.006309148</td>
</tr>
<tr>
<td>3</td>
<td>-15</td>
<td>0.009463722</td>
</tr>
<tr>
<td>3</td>
<td>-14</td>
<td>0.009463722</td>
</tr>
<tr>
<td>1</td>
<td>-13</td>
<td>0.003154574</td>
</tr>
<tr>
<td>0</td>
<td>-12</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>-11</td>
<td>0.003154574</td>
</tr>
<tr>
<td>4</td>
<td>-10</td>
<td>0.012618297</td>
</tr>
<tr>
<td>1</td>
<td>-9</td>
<td>0.003154574</td>
</tr>
<tr>
<td>4</td>
<td>-8</td>
<td>0.012618297</td>
</tr>
<tr>
<td>1</td>
<td>-7</td>
<td>0.003154574</td>
</tr>
<tr>
<td>5</td>
<td>-6</td>
<td>0.015772871</td>
</tr>
<tr>
<td>8</td>
<td>-5</td>
<td>0.025236593</td>
</tr>
<tr>
<td>9</td>
<td>-4</td>
<td>0.028391167</td>
</tr>
<tr>
<td>14</td>
<td>-3</td>
<td>0.044164038</td>
</tr>
<tr>
<td>26</td>
<td>-2</td>
<td>0.082018927</td>
</tr>
<tr>
<td>36</td>
<td>-1</td>
<td>0.113564669</td>
</tr>
<tr>
<td>59</td>
<td>0</td>
<td>0.186119874</td>
</tr>
<tr>
<td>48</td>
<td>1</td>
<td>0.151419558</td>
</tr>
<tr>
<td>35</td>
<td>2</td>
<td>0.110410095</td>
</tr>
<tr>
<td>19</td>
<td>3</td>
<td>0.059936909</td>
</tr>
<tr>
<td>15</td>
<td>4</td>
<td>0.047318612</td>
</tr>
<tr>
<td>8</td>
<td>5</td>
<td>0.025236593</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>0.006309148</td>
</tr>
<tr>
<td>3</td>
<td>7</td>
<td>0.009463722</td>
</tr>
<tr>
<td>0</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>9</td>
<td>0.006309148</td>
</tr>
<tr>
<td>0</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>12</td>
<td>0.003154574</td>
</tr>
<tr>
<td>0</td>
<td>13</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>14</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>15</td>
<td>0.003154574</td>
</tr>
<tr>
<td>0</td>
<td>16</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>17</td>
<td>0.003154574</td>
</tr>
<tr>
<td>0</td>
<td>18</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>19</td>
<td>0.003154574</td>
</tr>
<tr>
<td>0</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>21</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>22</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>23</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>24</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>25</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>26</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>27</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>28</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>29</td>
<td>0.003154574</td>
</tr>
</tbody>
</table>

Mean: 0.142
Standard Deviation: 4.779229513
Variance: 22.84103474
Total#: 317

Table 4.4a Distribution of Errors in EFTA at 30min-All Cities Flights
<table>
<thead>
<tr>
<th>Number#</th>
<th>Item</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-8</td>
<td>0.00952381</td>
</tr>
<tr>
<td>0</td>
<td>-7</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>-6</td>
<td>0.028571429</td>
</tr>
<tr>
<td>1</td>
<td>-6</td>
<td>0.028571429</td>
</tr>
<tr>
<td>9</td>
<td>-3</td>
<td>0.085714286</td>
</tr>
<tr>
<td>7</td>
<td>-2</td>
<td>0.066666667</td>
</tr>
<tr>
<td>12</td>
<td>-1</td>
<td>0.114285714</td>
</tr>
<tr>
<td>20</td>
<td>0</td>
<td>0.19047619</td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>0.076190476</td>
</tr>
<tr>
<td>13</td>
<td>2</td>
<td>0.123809524</td>
</tr>
<tr>
<td>7</td>
<td>3</td>
<td>0.066666667</td>
</tr>
<tr>
<td>6</td>
<td>4</td>
<td>0.057142857</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>0.047619048</td>
</tr>
<tr>
<td>1</td>
<td>6</td>
<td>0.00952381</td>
</tr>
<tr>
<td>2</td>
<td>7</td>
<td>0.019047619</td>
</tr>
<tr>
<td>0</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>9</td>
<td>0.00952381</td>
</tr>
<tr>
<td>0</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>11</td>
<td>0.019047619</td>
</tr>
<tr>
<td>1</td>
<td>12</td>
<td>0.00952381</td>
</tr>
<tr>
<td>0</td>
<td>13</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>14</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>16</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>17</td>
<td>0.00952381</td>
</tr>
<tr>
<td>0</td>
<td>18</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>19</td>
<td>0.00952381</td>
</tr>
</tbody>
</table>

Mean: 0.9619
Standard Deviation: 4.251440743
Variance: 18.07474839
Total#: 105

The chosen points are in the first 5 points

Table 4.4b Distribution of Errors in EFTA at 30min-All Cities Flights
<table>
<thead>
<tr>
<th>Number#</th>
<th>Item</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-18</td>
<td>0.004716981</td>
</tr>
<tr>
<td>0</td>
<td>-17</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>-16</td>
<td>0.009433962</td>
</tr>
<tr>
<td>3</td>
<td>-15</td>
<td>0.014150943</td>
</tr>
<tr>
<td>3</td>
<td>-14</td>
<td>0.014150943</td>
</tr>
<tr>
<td>1</td>
<td>-13</td>
<td>0.004716981</td>
</tr>
<tr>
<td>0</td>
<td>-12</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>-11</td>
<td>0.004716981</td>
</tr>
<tr>
<td>4</td>
<td>-10</td>
<td>0.018867925</td>
</tr>
<tr>
<td>1</td>
<td>-9</td>
<td>0.004716981</td>
</tr>
<tr>
<td>3</td>
<td>-8</td>
<td>0.014150943</td>
</tr>
<tr>
<td>1</td>
<td>-7</td>
<td>0.004716981</td>
</tr>
<tr>
<td>2</td>
<td>-6</td>
<td>0.009433962</td>
</tr>
<tr>
<td>5</td>
<td>-5</td>
<td>0.023584906</td>
</tr>
<tr>
<td>8</td>
<td>-4</td>
<td>0.037735849</td>
</tr>
<tr>
<td>5</td>
<td>-3</td>
<td>0.023584906</td>
</tr>
<tr>
<td>19</td>
<td>-2</td>
<td>0.089622642</td>
</tr>
<tr>
<td>24</td>
<td>-1</td>
<td>0.113207547</td>
</tr>
<tr>
<td>40</td>
<td>0</td>
<td>0.188679245</td>
</tr>
<tr>
<td>42</td>
<td>1</td>
<td>0.198113208</td>
</tr>
<tr>
<td>22</td>
<td>2</td>
<td>0.103773585</td>
</tr>
<tr>
<td>11</td>
<td>3</td>
<td>0.051886792</td>
</tr>
<tr>
<td>8</td>
<td>4</td>
<td>0.037735849</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>0.009433962</td>
</tr>
<tr>
<td>1</td>
<td>6</td>
<td>0.004716981</td>
</tr>
<tr>
<td>1</td>
<td>7</td>
<td>0.004716981</td>
</tr>
<tr>
<td>0</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>9</td>
<td>0.004716981</td>
</tr>
<tr>
<td>0</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>13</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>14</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>16</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>17</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>18</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>19</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>21</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>22</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>23</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>24</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>25</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>26</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>27</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>28</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>29</td>
<td>0.004716981</td>
</tr>
</tbody>
</table>

Mean: -0.825  
Standard Deviation: 4.783377024  
Variance: 22.88069575  
Total#: 212

The chosen points are not in the first 5 points

Table 4.4c Distribution of Errors in EFTA at 30min-All Cities Flight

113
<table>
<thead>
<tr>
<th>Number#</th>
<th>Item</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-18</td>
<td>0.004385965</td>
</tr>
<tr>
<td>0</td>
<td>-17</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>-16</td>
<td>0.00877193</td>
</tr>
<tr>
<td>2</td>
<td>-15</td>
<td>0.00877193</td>
</tr>
<tr>
<td>2</td>
<td>-14</td>
<td>0.00877193</td>
</tr>
<tr>
<td>4</td>
<td>-13</td>
<td>0.01754386</td>
</tr>
<tr>
<td>0</td>
<td>-12</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>-11</td>
<td>0.004385965</td>
</tr>
<tr>
<td>2</td>
<td>-10</td>
<td>0.00877193</td>
</tr>
<tr>
<td>3</td>
<td>-9</td>
<td>0.013157895</td>
</tr>
<tr>
<td>2</td>
<td>-8</td>
<td>0.00877193</td>
</tr>
<tr>
<td>7</td>
<td>-7</td>
<td>0.030701754</td>
</tr>
<tr>
<td>8</td>
<td>-6</td>
<td>0.035087719</td>
</tr>
<tr>
<td>5</td>
<td>-5</td>
<td>0.021929825</td>
</tr>
<tr>
<td>6</td>
<td>-4</td>
<td>0.026315789</td>
</tr>
<tr>
<td>15</td>
<td>-3</td>
<td>0.065789474</td>
</tr>
<tr>
<td>23</td>
<td>-2</td>
<td>0.100877193</td>
</tr>
<tr>
<td>18</td>
<td>-1</td>
<td>0.078947368</td>
</tr>
<tr>
<td>31</td>
<td>0</td>
<td>0.135964912</td>
</tr>
<tr>
<td>24</td>
<td>1</td>
<td>0.105263158</td>
</tr>
<tr>
<td>21</td>
<td>2</td>
<td>0.092105263</td>
</tr>
<tr>
<td>18</td>
<td>3</td>
<td>0.078947368</td>
</tr>
<tr>
<td>9</td>
<td>4</td>
<td>0.039473684</td>
</tr>
<tr>
<td>10</td>
<td>5</td>
<td>0.043859649</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>0.00877193</td>
</tr>
<tr>
<td>6</td>
<td>7</td>
<td>0.026315789</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
<td>0.00877193</td>
</tr>
<tr>
<td>1</td>
<td>9</td>
<td>0.004385965</td>
</tr>
<tr>
<td>0</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>11</td>
<td>0.004385965</td>
</tr>
<tr>
<td>0</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>13</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>14</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>16</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>17</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>18</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>19</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>21</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>22</td>
<td>0.004385965</td>
</tr>
<tr>
<td>0</td>
<td>23</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>24</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>25</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>26</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>27</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>28</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>29</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>30</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>31</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>32</td>
<td>0.004385965</td>
</tr>
</tbody>
</table>

Mean  
Standard Deviation  
Variance  
Total#  

Table 4.4d Distribution of Errors in EFTA at 60min-All Cities Flights
<table>
<thead>
<tr>
<th>Number#</th>
<th>Item</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-18</td>
<td>0.012820513</td>
</tr>
<tr>
<td>0</td>
<td>-17</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>-16</td>
<td>0.025641026</td>
</tr>
<tr>
<td>0</td>
<td>-15</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-14</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-13</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-12</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>-11</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>-10</td>
<td>0.012820513</td>
</tr>
<tr>
<td>0</td>
<td>-9</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>-8</td>
<td>0.012820513</td>
</tr>
<tr>
<td>3</td>
<td>-7</td>
<td>0.038461538</td>
</tr>
<tr>
<td>3</td>
<td>-6</td>
<td>0.038461538</td>
</tr>
<tr>
<td>2</td>
<td>-5</td>
<td>0.025641026</td>
</tr>
<tr>
<td>3</td>
<td>-4</td>
<td>0.038461538</td>
</tr>
<tr>
<td>8</td>
<td>-3</td>
<td>0.102564103</td>
</tr>
<tr>
<td>6</td>
<td>-2</td>
<td>0.076923077</td>
</tr>
<tr>
<td>6</td>
<td>-1</td>
<td>0.076923077</td>
</tr>
<tr>
<td>9</td>
<td>0</td>
<td>0.115384615</td>
</tr>
<tr>
<td>10</td>
<td>1</td>
<td>0.128205128</td>
</tr>
<tr>
<td>8</td>
<td>2</td>
<td>0.102564103</td>
</tr>
<tr>
<td>7</td>
<td>3</td>
<td>0.08974359</td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td>0.012820513</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>0.038461538</td>
</tr>
<tr>
<td>0</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>8</td>
<td>0.012820513</td>
</tr>
<tr>
<td>1</td>
<td>9</td>
<td>0.012820513</td>
</tr>
<tr>
<td>0</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>13</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>14</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>16</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>17</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>18</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>19</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>21</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>22</td>
<td>0.012820513</td>
</tr>
<tr>
<td>0</td>
<td>23</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>24</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>25</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>26</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>27</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>28</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>29</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>30</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>31</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>32</td>
<td>0.012820513</td>
</tr>
</tbody>
</table>

Mean: 0.846
Standard Deviation: 5.339948804
Variance: 28.51505323
Total #: 78

The chosen points are in the first 5 points.

Table 4.4e: Distribution of Errors in EFTA at 60min-All Cities Flight.
<table>
<thead>
<tr>
<th>Number#</th>
<th>Item</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
<td>-15 0.013333333</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>-14 0.013333333</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>-13 0.033333333</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>-12 0</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>-11 0.006666667</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>-10 0.006666667</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>-9 0.02</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>-8 0.006666667</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>-7 0.026666667</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>-6 0.02</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>-5 0.02</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>-4 0.02</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>-3 0.046666667</td>
</tr>
<tr>
<td></td>
<td>17</td>
<td>-2 0.113333333</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>-1 0.073333333</td>
</tr>
<tr>
<td></td>
<td>23</td>
<td>0 0.153333333</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>1 0.1</td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>2 0.086666667</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>3 0.08</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>4 0.053333333</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>5 0.046666667</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>6 0.013333333</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>7 0.033333333</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>8 0.006666667</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>9 0</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>10 0</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>11 0.006666667</td>
</tr>
</tbody>
</table>

Mean -0.72
Standard Deviation 4.957311099
Variance 24.57493333
Total# 150

The chosen points are not in the first 5 points

Table 4.4f Distribution of Errors in EFTA at 60min-All Cities Flights
Fig. 4.2 Sample Histories of Estimation Errors
All Cities 30min (Jet)

Sample Points = 317
Mean = -0.142
Standard Deviation = 4.779

Fig. 4.4a Distribution of Errors in EFTA at 30min - All Cities Flights
Fig. 4.4b Distribution of Errors in EFTA at 30min-All Cities Flights

All Cities 30min
(Jet)

Sample Points=105
Mean=0.96
Standard Deviation=4.25

The chosen points are in first 5 points
All Cities 30min (Jet)
Sample Points=212
Mean=-0.825
Standard Deviation=4.78

The chosen points are not in first 5 points

Fig. 4.4c Distribution of Errors in EFTA at 30min-All Cities Flights
Fig. 4.4d Distribution of Errors in EFTA at 60min-All Cities Flights

All Cities 60min

(Jet)

Sample Points = 228
Mean = -0.609
Standard Deviation = 5.511
The chosen points are in first 5 points

All Cities 60min (Jet)

Sample Points = 78
Mean = -0.846
Standard Deviation = 5.33

Fig. 4.4e Distribution of Errors in EFTA at 60min - All Cities Flights
All Cities 60min
(Jet)

Sample Points=150
Mean=-0.72
Standard Deviation=4.95

The chosen points are not in the first 5 points

Error in EFTA[min](+ is late arrival)

Fig.4.4f Distribution of Errors in EFTA at 60min-All Cities Flights
Chapter 5

Concluding Remarks

The objective of this study is to provide statistical evidence about the accuracy of Estimated Fix Time Arrivals (EFTAs) for airborne aircraft of terminal area entry fixes as a function of "Time to Go". This is needed to confirm the expected arrival rates at a congested airport.

First, a literature descriptions about Estimated Traffic Management System (ETMS) and some background referring to the National Airspace (NAS) messages, Time Type (TTP), and Flight Time Modeling are introduced.

Second, a study of the methodology used in the statistical analysis. It explains how to pick up sample points from flights into four cities (Denver, Orlando, Minneapolis, and Phoenix). And then using the data points we draw some example plots between EFTA errors versus Time to Go, the distribution of EFTA errors for different time period (T=30,60,90 mins, etc.), and the σ's variation with time.
Third, an analysis of the results we got in chapter 3, we reach three conclusions. The first is that there are no regular patterns for the EFTA errors versus Time-to-go. The second is if there are enough sample points considered in the plotting for the distribution of EFTA errors for different time periods, the shape of the distribution should be normally distributed. The last is that the climbing effect does not really affect the $\sigma$'s variation with time.

5.1 Future Topics in this Field

For this study, we picked the TZ and AZ points to do the distribution of EFTA Error, and its standard deviation versus Time-to-go. We expect more analysis on the distribution of EFTA errors for the initial FZ and FS points. It is desirable to try to obtain information on airspeed or groundspeed to see if we can identify the imposition of "miles-in-trail" during the flight. (This would cause a slow down and a sudden increase in EFTA-this can be seen in some of the EFTA profiles) There are also some EFTA profiles which indicate a delay in arrival over the last 10 or 15 minutes of the flight which might be explained by the imposition of airborne holding near the destination airport. It is desirable to see if such "holding" can be confirmed. This thesis has been on initial look at EFTA errors, and the results are perhaps limited by the number of sample points. For this reason, further research might be undertaken using more data particularly for the long haul flights.