Airline Flight Data Examination to Improve flight Performance Modeling – Final Report Project 35

Georgia Institute of Technology / Delta Air Lines, Inc.

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- P.I.(s): Professor John-Paul Clarke
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Investigation Team

James Brooks (GT: Data Analysis); Karén Melikov (GT: Analysis Support); Jesse Miers (Delta Air Lines: Subject Matter Expert); Vince Mestre (Landrum and Brown: Subject Matter Expert).

Project Overview

Currently, when modeling either aircraft noise or emissions with the Aviation Environment Design Tool (AEDT), there are simplifications associated with the methodology suggested for determining the aircraft gross takeoff weight [Ref. 1] that can create inaccurate results, along with the inability to model reduced thrust/power departures. The goal of this project is to develop a functional relationship between stage/trip length and weight that can improve the existing guidance provided for weight estimation; and subsequently to determine the percentage of departures that use reduced thrust and the level of reduced thrust that is used for the departure.

Task 1 Airline Flight Data Examination to Improve Flight Performance Modeling

Georgia Tech

Objective(s)

Analyze aircraft departure operating data for two wide-body and two narrow body commercial aircraft to develop a functional relationship between stage/trip length and weight that can replace the existing guidance provided for weight estimation; and potentially determine the percentage of departures that use reduced thrust as well as the level of reduced thrust that is used.

Research Approach

The Air Transportation Laboratory (ATL) at the Georgia Institute of Technology acquired two large independent databases containing operational information with regard to aircraft departures. One is a Flight Planning Database which was used for researching a relationship to improve the estimation of takeoff gross weight. The second is an Aircraft Communications Addressing and Reporting System (ACARS) that was used for researching reduced thrust usage while also serving as a test environment for the takeoff weight estimations. Both contain, among other data, actual departure weight and the departing and destination airports and both were edited to add airport standard elevation, runway length, and Great Circle Distance (GCD). Only the ACARS database contains actual reduced power/thrust used for the departure and the planned trip distance is only available in the Flight Planning Database. This data was used to develop a functional relationship between stage/trip length and weight that can replace the existing guidance provided for weight estimation; and subsequently to determine the percentage of departures that use reduced thrust and the level of reduced thrust that is used.

Takeoff Weight Determination

Although preliminary analysis has shown a strong functional relationship between aircraft weight and Great Circle Distance (GCD) flown there are known issues with using GCD for some specific airport pairs. An additional source of distance flown is the “planned distance” which is contained in the air carrier flight plan. Since one of the factors in determining the total fuel carried is the planned distance, it was anticipated that using this distance could result in a stronger correlation than using the GCD. With regard to modeler access to the planned distance, there are a number of websites that provide flight-tracking information and include the planned distance (i.e., www.Flightaware.com). This research has developed a number of functional relationship using both GCD and Planned Distance along with other parameters that influence aircraft departure gross weight. These results of these relationships have been compared with the existing AEDT Stage Length methodology.

Reduced Thrust (Usage and Level)

The operational database described above is straightforward with respect to the aircraft/engine type and the takeoff weight and amount of reduced thrust used for the departure. While thousands of departures are contained in the database, the task of deriving a relationship to predict the amount

of reduced thrust for any departure of a specific aircraft/engine type is complicated by the way in which the carriers implement the use of reduced thrust.

The performance analysis to certify the maximum reduced thrust that can be used for a departure from a specific runway, at a specific airport, for existing temperature and wind conditions is mandated in the FAA certified Aircraft Flight Manual (AFM). The AFM requirements for performance analysis is the same for each air carrier. What varies between the various air carriers is the presentation of the allowable reduced thrust departure information to the flight crew. The variation is essentially due to the pilot community and their historical views on using something less than maximum thrust available for conducting the critical departure phase of the operation. Although the performance analysis is in compliance with the AFM, as is the performance analysis of any departure, there are those in the pilot community that opt to reduce thrust less than the maximum certified to safely conduct the departure.

The flight crew is presented with takeoff performance information (by the air carrier) for each departure. Based on the agreed information format and the limitations, if any, on the amount of information that can be conveyed, a number of reduced thrust options can be presented. Even in situations where only one reduced thrust option is presented, this single option may be less than the maximum allowable reduced thrust (the existing case for some of the data contained in the ATL operational database).

As a result of the described pilot community reaction there exists a noticeable variation in reduced thrust applied for a given recorded takeoff weight, which complicates the task of developing a relationship describing the level of reduced thrust used. A number of statistical analyses have been performed and assessed with respect to defining the correct strategy for predicting the amount of reduced thrust applied as a function of variables that effect engine thrust. In each strategy, the implementation into the AEDT has been considered with regard to cost and complexity.

Originally, it was planned to work with the airframe manufacturers to provide sufficient data that would support the development of the equation coefficients for aero-profile modeling defined in SAE AIR1845. The interface with the manufacturers was to be the SAE A-21 Committee, but unfortunately, the only meeting scheduled within the research period was cancelled. Communicating directly with one of the manufacturers gave the impression that another course of action may be necessary for future AEDT modelling.

The results of the reduced power/thrust analyses will be presented in both an aggregate as well by individual routes contained in the database.

A total of six departure procedures meeting the requirements contained in AC 91-53A will be provided, three for close-in procedures or NADP1, and three for distant procedures or NADP2. The procedure will specify a takeoff flap setting and a range of operational weights.

The remainder of the report presents the results of the research for the following airframe/engine combinations:

- B757-200/PW2037
- B737-800/CFM56-7B26
- B767-400ER/CF680C2/B8F
- B767-300ER/CF680C2/B6F

Due to the volume of information produced by this report, it will be presented in two sections; Section I, will be the Takeoff Weight Determination and Section II will be the Reduced Thrust (Usage and Level) analysis.

SECTION I

B757-200/PW2037

Takeoff Weight Determination:

Specifics of the Flight Planning Database:

- 45,343 Flights
- 376 Routes Departing 97 Airports
- 7,602 “Tankered” Flights
    - 8102 lbs. Average
    - 691 NM Average Trip
- Added Airport Elevation, Runway Length, and GCD for each Airport/Flight

Multiple linear regressions on the database were conducted in a stepwise method using the following independent variables: runway length, airport elevation, and either GCD or Planned Distance. The regressions were applied to the total database of individual flights and repeated with an “average” database that contained the average data for each route and in the case of Planned Distance, the average planned distance.

The statistical summary of the GCD and Planned Distance regressions are as follows:

B757-200 Planned Distance with All Data:

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.810[a]	.657	.657	7842.3388878
2	.813[b]	.660	.660	7798.0242986
3	.813[c]	.662	.662	7785.2970748

a. Predictors: (Constant), PLN_DST

b. Predictors: (Constant), PLN_DST, RWYL

c. Predictors: (Constant), PLN_DST, RWYL, ELEV

d. Dependent Variable: GWT

B757-200 Planned Distance with Average/Route Data

Model Summary[c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.909[a]	.826	.825	5900.9364673
2	.910[b]	.828	.827	5874.0057751

a. Predictors: (Constant), AVG_PLND

b. Predictors: (Constant), AVG_PLND, RWYL

c. Dependent Variable: AVG-GWT

B757-200 GCD with All Data

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.810[a]	.657	.657	7842.1698175
2	.813[b]	.660	.660	7797.8917768
3	.813[c]	.662	.662	7785.1833801

a. Predictors: (Constant), GCD

b. Predictors: (Constant), GCD, RWYL

c. Predictors: (Constant), GCD, RWYL, ELEV

d. Dependent Variable: GWT

B757-200 GCD with Average/Route Data

Model Summary[c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.909[a]	.826	.825	5900.6880141
2	.910[b]	.828	.827	5873.6849681

a. Predictors: (Constant), GCD

b. Predictors: (Constant), GCD, RWYL

c. Dependent Variable: AVG-GWT

As can be seen with the regression model summaries above, the strength of the correlation using GCD is almost identical to using Planned Distance. This result is evident on all regressions made for this research project, the correlation strength using GCD has been equivalent to or slightly better than the correlation using Planned Distance. In addition, the correlation strength has been found to always be improved when regressing Average/Route data.

The regression coefficients for GCD and Average/Route data are as follows:

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	179794.148	601.772		298.775	.000
	GCD	19.253	.457	.909	42.102	.000
2	(Constant)	175571.496	2090.152		83.999	.000
	GCD	19.188	.456	.906	42.058	.000
	RWYL	.374	.177	.045	2.109	.036

a. Dependent Variable: AVG-GWT

The resulting B757-200 takeoff weight estimation equation is:

$$GWT = 175571.496 + 19.188(GCD) + .374(RUNWAY\ LEN)$$

(Reference Figure 3 below)

Testing of the Takeoff Weight Estimation

The resulting takeoff weight regression equations were compared with data from the ACARS database which has recorded data for 82,646 flights. The resulting data represented 376 routes from 101 airports.

Part of the test procedure was to determine if the presence of "tankered" fuel influenced the takeoff weight estimation. The presence of fuel tankering data in the Flight Plan database raised an issue about whether or not this strategic action would influence the results of the takeoff weight estimation. To resolve the issue, regressions were made using the database with the "tankered" flights removed and the resulting equation tested against the ACARS database. The absolute value of the difference in the estimated weights for the average/route data with both the "untankered" regression and the equation above are plotted in the frequency diagram below.

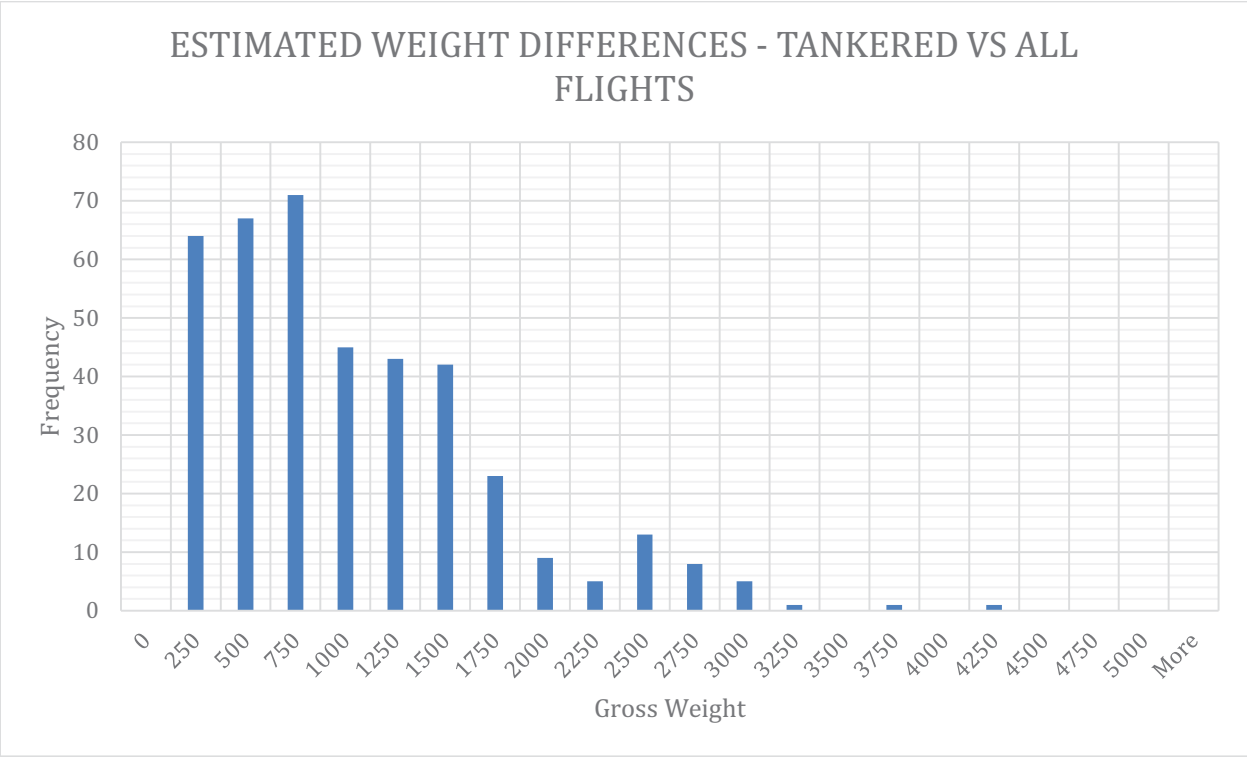


CHART 1

With the majority of the weight differences below 1750 lbs., the difference in the estimated weight between tankered and untankered flights is small compared to the average operating weight for the B757 of 208,000 lbs. and the maximum certified takeoff weight certified of 240,000 lbs. In addition, it would be difficult for a modeler to obtain "tankered" flight information from the air carriers. It should be noted here, that the ACARS data has no information regarding flight fuel loads, so therefore the test database includes all flights.

Test Results

Due to the size of the database, the results are initially presented in graphical form with the reqressed estimated weights plotted against the ACARS data actual recorded weight. The graphical representation also allows additional analysis of the results.

AEDT Stage Length Weights

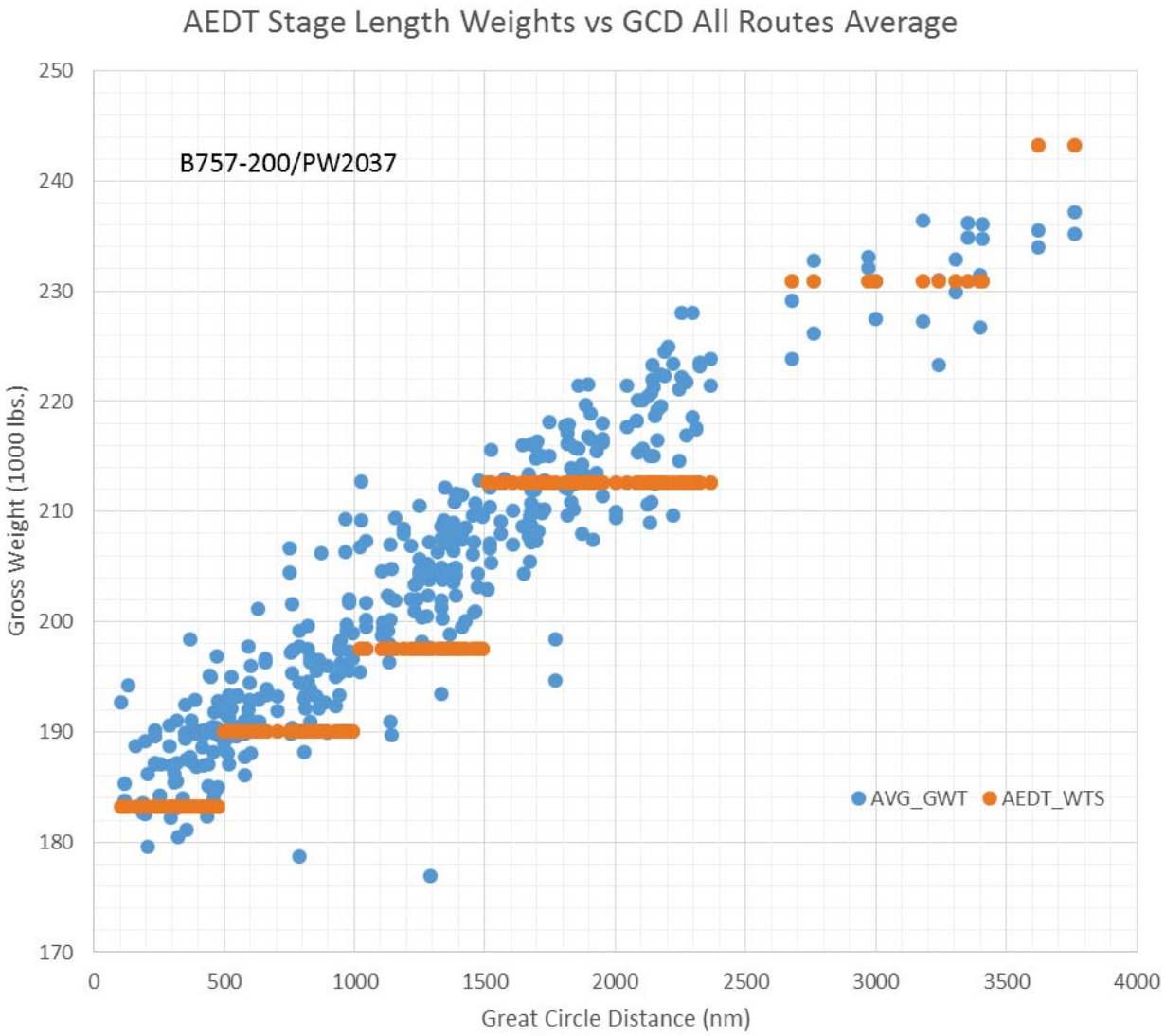


FIGURE 1

Regression Developed Using All Flights

$$GWT = 176599.317 + 18.253(GCD) + .586\ (RUNWAY\ LEN) - .346(ELEV)$$

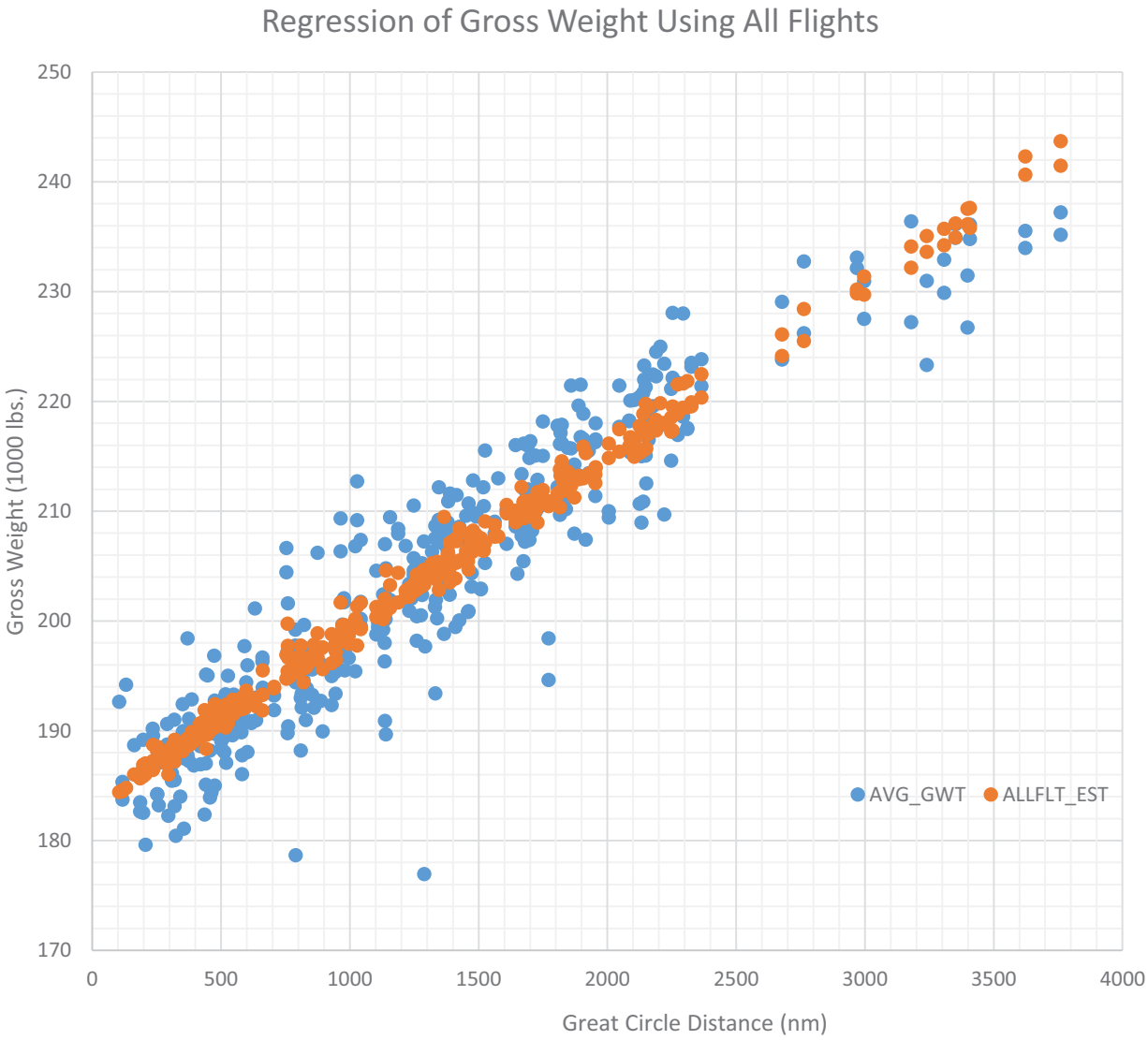


FIGURE 2

Regression Developed Using Average/Route Data of All Flights

$$GWT + 175571.496 + 19.188(GCD) + .374(\text{RUNWAY LEN})$$

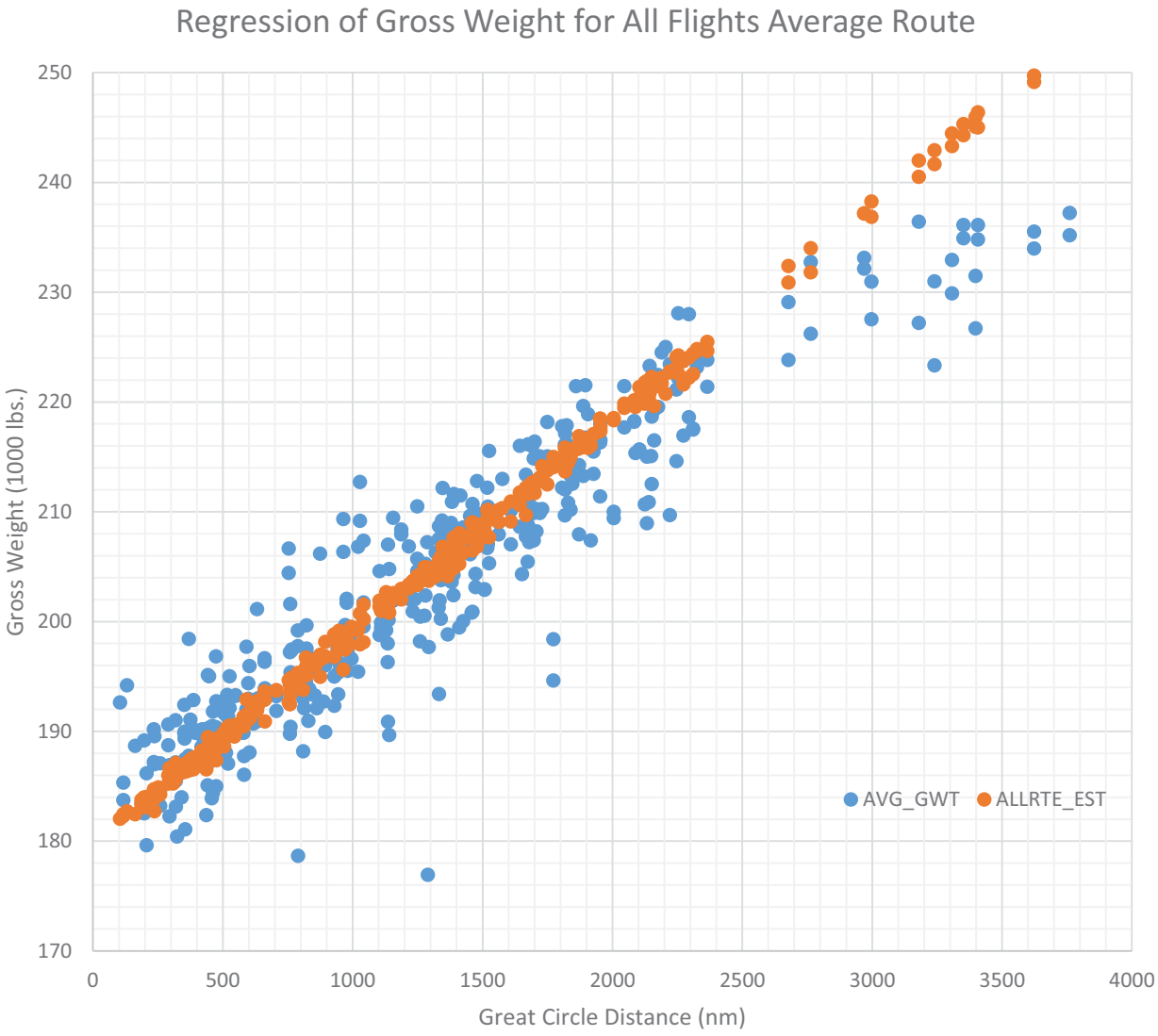


FIGURE 3

The graphical representation of the test results revealed a cluster of flights at distances of more than 3000 nautical miles that were not following the trend of increasing weight with distance even though the recorded weights were still below the maximum certified takeoff weight of 240,000 lbs. A closer examination of these flights revealed they were international flights and at that trip length, were performance or payload limited due to fuel capacity (fuel tanks filled to capacity).

The major air carriers began longer range international flights with the B757 several years ago, so to correctly model the weights associated with all B757 operations, a quadratic regression was developed using the database. The results of this regression are shown in Figure 4.

Quadratic Regression Developed Using Average/Route Data of All Flights

$$GWT = 175381.001 + 27.18(GCD) - .003(GCD)^2$$

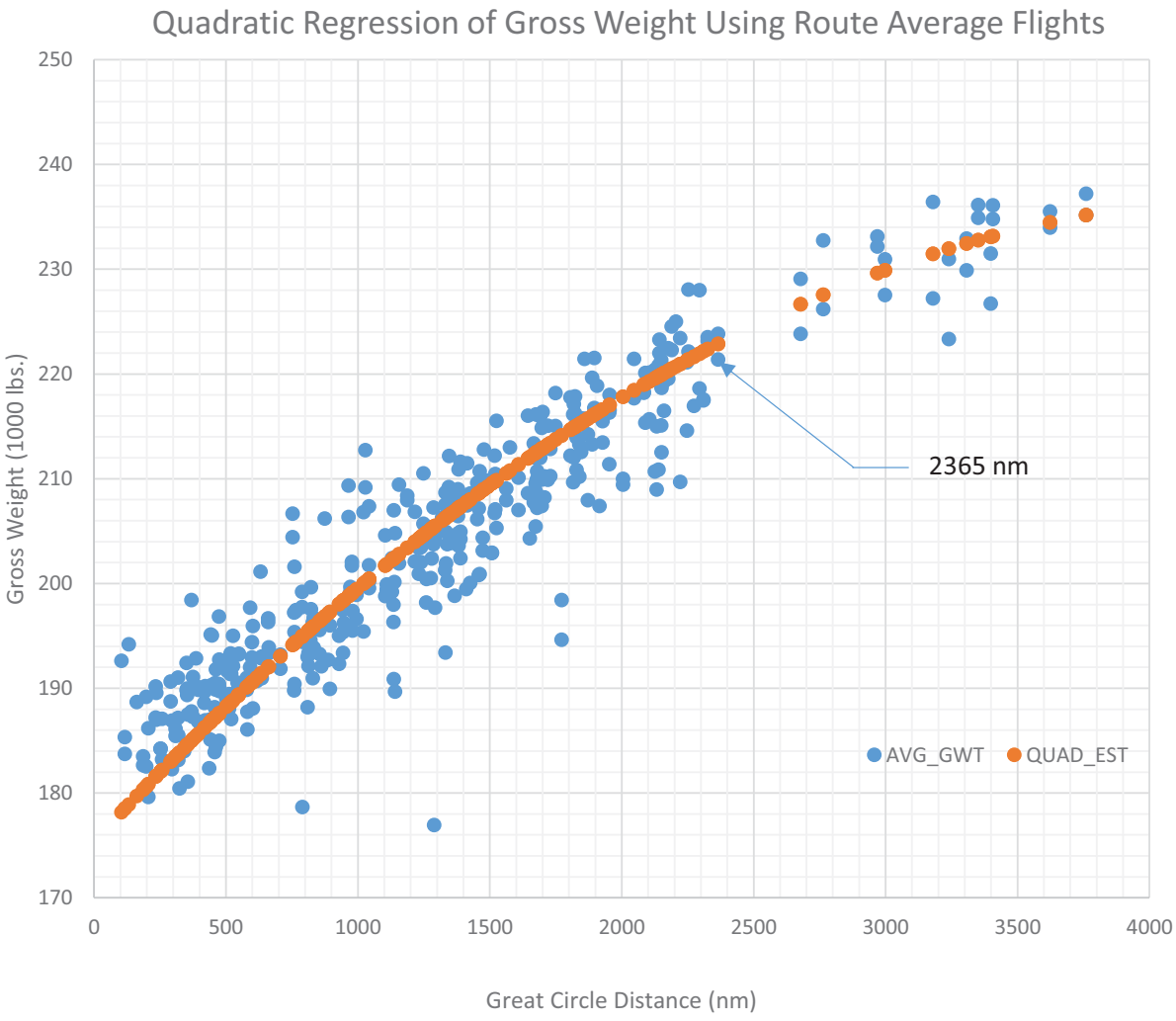


FIGURE 4

B757-200 Takeoff Weight Estimation Final Results

$GWT + 175571.496 + 19.188(GCD) + .374$(RUNWAY LEN) for GCD's < 2365 nm

$GWT = 175381.001 + 27.18(GCD) - .003(GCD)^2$ for GCD's ≥ 2365 nm

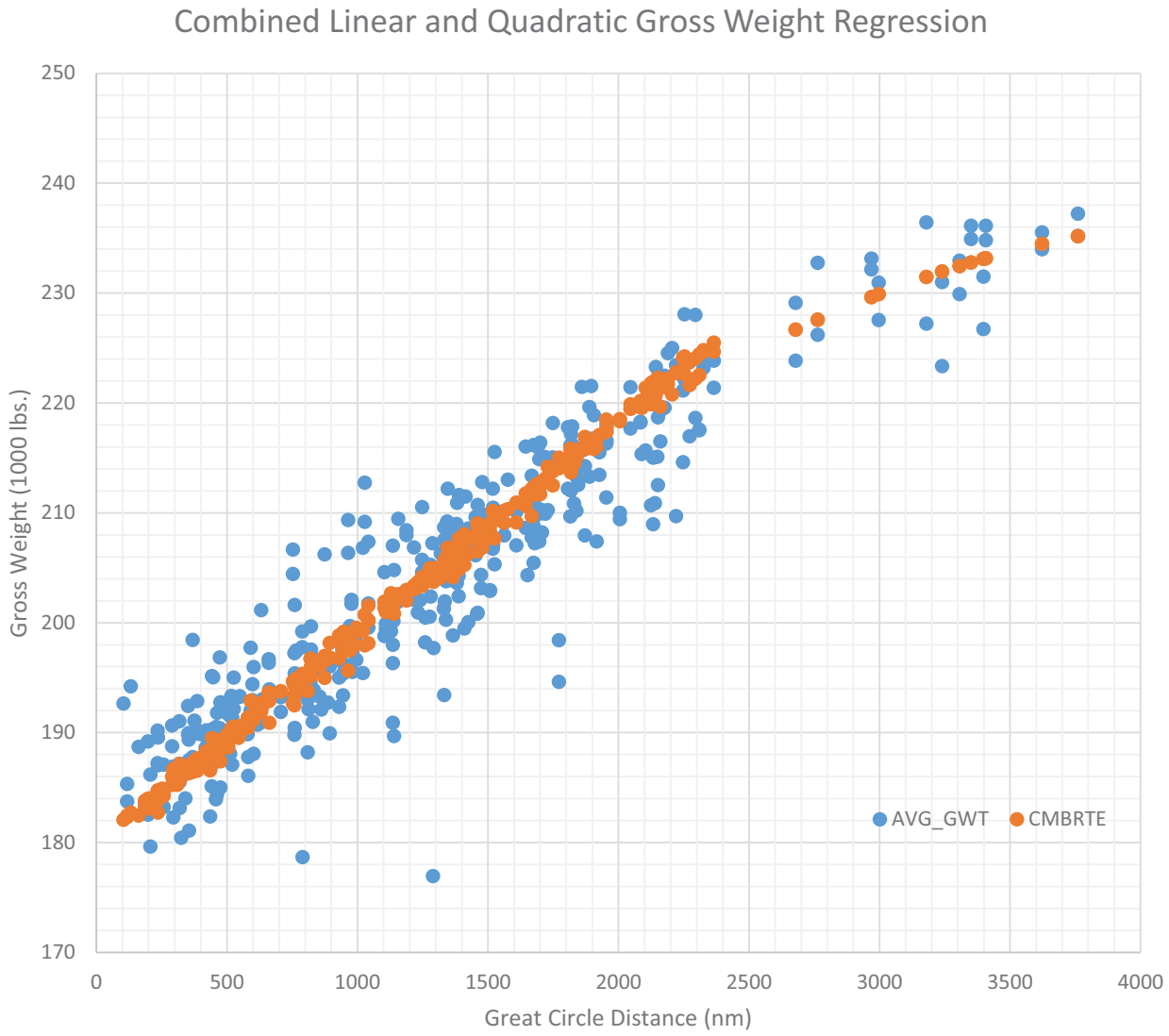


FIGURE 5

The estimated weight, the difference from the actual weight, and the percentage of that difference for both the regression and the current AEDT Stage Length methodology are tabulated in Tables 1 through 4 that follow. The tables represent the average weight for each of the routes contained in the test ACARS database.

The average route tabular data is contained in the following tables, showing the actual weight, and the differences in the regression and AEDT stage length weights.

B757-200 TABULAR RESULTS

APRTS	AVG_GWT	REG_EST	REG_DIF	REG_%DIF	AEDT_EST	AEDT_DIF	AEDT_%DIF
ABQATL	204.6	201.9	-2692	-1.3%	197.5	-7087	-3.4%
AGPJFK	227.2	231.5	4258	1.9%	230.9	3690	1.7%
ANCATL	232.2	229.6	-2522	-0.8%	230.9	-1255	-0.2%
ANCMSP	224.5	222.2	-2308	-0.9%	212.6	-11919	-5.2%
ANCSLC	212.6	215.6	3079	1.5%	212.6	49	0.1%
ARNJFK	236.1	233.2	-2951	-1.2%	230.9	-5211	-2.2%
ATLABQ	198.8	201.4	2582	1.3%	197.5	-1288	-0.6%
ATLANC	233.1	229.6	-3486	-1.5%	230.9	-2220	-0.9%
ATLAUA	209.8	208.8	-992	-0.4%	197.5	-12306	-5.8%
ATLAUS	191.9	193.8	1881	1.1%	190	-1871	-0.9%
ATLBHM	185.3	182.5	-2883	-1.4%	183.2	-2133	-1.0%
ATLBNA	183.5	183.8	274	0.3%	183.2	-300	-0.1%
ATLBOG	217.9	215.2	-2680	-1.2%	212.6	-5265	-2.4%
ATLBON	209.1	210.2	1124	0.7%	212.6	3547	1.8%
ATLBOS	197.6	196.0	-1575	-0.7%	190	-7553	-3.7%
ATLBSB	234.0	234.5	501	0.3%	243.2	9226	4.0%
ATLBWI	189.0	189.8	771	0.6%	190	953	0.7%
ATLBZN	200.0	207.5	7501	3.9%	197.5	-2548	-1.2%
ATLCCS	210.7	212.4	1708	0.9%	212.6	1886	0.9%
ATLCLT	189.2	184.0	-5193	-2.7%	183.2	-5979	-3.1%
ATLCUN	197.5	194.9	-2574	-1.3%	190	-7458	-3.7%
ATLDAB	187.2	186.3	-864	-0.4%	183.2	-3971	-2.0%
ATLDCA	189.7	189.3	-404	-0.1%	183.2	-6524	-3.3%
ATLDEN	199.5	200.2	651	0.4%	197.5	-2049	-1.0%
ATLDFW	191.0	192.4	1448	0.9%	190	-961	-0.4%
ATLDTW	192.7	190.1	-2556	-1.2%	190	-2662	-1.3%
ATLEGE	189.7	202.1	12401	6.7%	197.5	7821	4.3%
ATLFLL	191.7	189.9	-1837	-0.8%	190	-1732	-0.7%
ATLGCM	196.1	197.0	865	0.5%	190	-6111	-3.1%
ATLGDL	200.5	204.7	4165	2.2%	197.5	-3024	-1.4%
ATLGGT	206.7	194.7	-12004	-5.7%	190	-16658	-8.0%
ATLGUA	208.0	203.0	-4975	-2.2%	197.5	-10457	-4.9%
ATLHSV	194.2	182.7	-11481	-5.9%	183.2	-11000	-5.6%
ATLIND	187.3	187.4	151	0.2%	183.2	-4050	-2.0%
ATLJAC	198.8	206.4	7583	3.9%	197.5	-1333	-0.6%
ATLJAX	187.2	184.7	-2514	-1.2%	183.2	-4009	-2.0%
ATLJFK	196.7	192.9	-3795	-1.9%	190	-6665	-3.3%
ATLLAS	206.7	209.3	2614	1.3%	212.6	5881	2.9%
ATLLAX	212.0	212.7	662	0.4%	212.6	610	0.4%
ATLLGA	193.3	192.9	-437	-0.1%	190	-3345	-1.6%
ATLLIR	206.4	206.7	222	0.2%	197.5	-8943	-4.2%
ATLMBJ	199.7	198.8	-847	-0.3%	190	-9684	-4.8%
ATLMCI	188.1	191.8	3679	2.1%	190	1923	1.2%
ATLMCO	189.8	186.9	-2896	-1.4%	183.2	-6636	-3.4%
ATLMEX	201.9	202.4	478	0.4%	197.5	-4409	-2.0%
ATLMGA	176.9	204.9	27994	16.0%	197.5	20556	11.8%
ATLMIA	193.3	190.1	-3202	-1.6%	190	-3328	-1.7%
ATLMKE	186.1	191.4	5292	3.1%	190	3939	2.3%
ATLMSP	197.8	195.3	-2441	-1.2%	190	-7766	-3.9%
ATLMSY	198.4	187.3	-11133	-5.3%	183.2	-15219	-7.4%
ATLNAS	192.9	192.3	-587	-0.2%	190	-2900	-1.4%
ATLNCA	209.3	198.7	-10645	-5.1%	190	-19348	-9.2%
ATLORD	192.1	190.3	-1837	-0.8%	190	-2135	-0.9%
ATLPBI	190.4	189.3	-1116	-0.5%	183.2	-7198	-3.7%
ATLPDX	213.3	216.4	3161	1.5%	212.6	-672	-0.3%
ATLPHL	191.0	191.3	336	0.4%	190	-979	-0.3%
ATLPHX	204.8	206.7	1892	1.0%	197.5	-7274	-3.5%
ATLPIT	188.2	189.0	766	0.5%	183.2	-5008	-2.6%
ATLPNS	187.0	184.7	-2280	-1.2%	183.2	-3814	-2.0%
ATLPUJ	204.2	204.2	-83	0.0%	197.5	-6735	-3.3%
ATLPVR	203.9	206.2	2282	1.2%	197.5	-6385	-3.1%
ATLRDU	186.1	186.1	0	0.1%	183.2	-2935	-1.4%
ATLRIC	188.6	188.2	-385	-0.1%	183.2	-5411	-2.7%
ATLRSW	190.3	188.8	-1544	-0.7%	183.2	-7127	-3.7%
ATLRTB	200.2	200.2	17	0.1%	197.5	-2682	-1.3%
ATLSAN	208.6	211.8	3132	1.6%	212.6	3982	2.0%
ATLSAT	190.4	194.8	4372	2.5%	190	-416	0.0%
ATLSEA	216.8	216.6	-165	0.0%	212.6	-4151	-1.9%
ATLSFO	215.7	215.9	148	0.1%	212.6	-3128	-1.4%
ATLSJC	210.2	215.5	5301	2.6%	212.6	2409	1.2%
ATLSJD	204.4	208.5	4112	2.3%	197.5	-6857	-3.1%
ATLSJO	207.4	207.3	-109	0.2%	197.5	-9946	-4.6%
ATLSJU	209.2	206.0	-3214	-1.5%	197.5	-11708	-5.5%
ATLSKB	205.3	209.5	4167	2.2%	212.6	7300	3.7%
ATLSLC	207.6	206.7	-834	-0.3%	197.5	-10057	-4.8%
ATLSMF	212.0	215.1	3065	1.5%	212.6	576	0.3%
ATLSNA	207.8	212.2	4438	2.3%	212.6	4847	2.5%
ATLSRQ	190.2	187.6	-2582	-1.2%	183.2	-6994	-3.5%
ATLSTL	186.9	188.3	1338	0.8%	183.2	-3746	-1.9%
ATLSTT	204.9	206.9	1909	1.0%	197.5	-7449	-3.5%
ATLSXM	209.8	208.6	-1261	-0.4%	197.5	-12326	-5.7%
ATLTPA	190.0	187.0	-2987	-1.5%	183.2	-6766	-3.5%
ATLTUS	200.3	205.9	5648	2.9%	197.5	-2750	-1.3%
ATLUIO	217.7	219.5	1792	0.9%	212.6	-5072	-2.2%
ATLUVF	215.0	213.8	-1278	-0.6%	212.6	-2443	-1.1%
ATLYVR	218.0	217.7	-301	-0.1%	212.6	-5400	-2.4%
AUAATL	209.5	207.5	-1953	-0.9%	197.5	-12000	-5.7%
AUSATL	193.2	193.7	489	0.3%	190	-3211	-1.6%
BHMATL	183.7	182.3	-1433	-0.7%	183.2	-537	-0.2%
BNAATL	182.7	183.3	616	0.4%	183.2	550	0.4%
BOGATL	216.2	215.2	-1000	-0.3%	212.6	-3614	-1.5%
BOGJFK	221.3	221.5	155	0.3%	212.6	-8715	-3.7%
BOISLC	184.2	184.1	-88	0.1%	183.2	-1035	-0.4%
BONATL	207.9	209.1	1128	0.6%	212.6	4651	2.3%
BOSATL	199.7	195.1	-4543	-2.2%	190	-9658	-4.8%
BOSCDG	231.0	229.9	-1057	-0.4%	230.9	-50	0.1%
BOSCUN	202.9	208.3	5378	2.8%	212.6	9700	4.9%
BOSDTW	193.3	189.9	-3426	-1.7%	190	-3303	-1.6%
BOSJFK	188.7	182.5	-6241	-3.2%	183.2	-5492	-2.8%
BOSMSP	202.1	198.1	-3980	-1.9%	190	-12069	-5.9%
BOSSLC	210.8	214.4	3604	1.8%	212.6	1767	0.9%
BSBATL	235.5	234.5	-1048	-0.4%	243.2	7676	3.3%

TABLE 1

B757-200 TABULAR RESULTS

APRTS	AVG_GWT	REG_EST	REG_DIF	REG_%DIF	AEDT_EST	AEDT_DIF	AEDT_%DIF
BWIATL	188.4	189.1	746	0.6%	190	1634	1.0%
BWIDTW	181.1	186.3	5228	3.1%	183.2	2117	1.4%
BWIMSP	193.4	195.1	1721	1.1%	190	-3378	-1.6%
BZNATL	208.6	206.3	-2301	-1.0%	197.5	-11079	-5.2%
BZNMSP	201.6	193.5	-8101	-3.9%	190	-11600	-5.6%
CCSATL	207.2	212.1	4861	2.6%	212.6	5378	2.8%
CDGBOS	227.5	229.9	2359	1.1%	230.9	3365	1.5%
CDGPHL	223.3	232.0	8618	4.0%	230.9	7567	3.5%
CDGPIT	226.7	233.1	6380	2.9%	230.9	4181	2.0%
CLTATL	182.5	183.1	558	0.4%	183.2	667	0.5%
CPHJFK	234.9	232.8	-2142	-0.9%	230.9	-4015	-1.7%
CUNATL	197.4	194.5	-2834	-1.4%	190	-7379	-3.7%
CUNBOS	202.9	208.8	5864	3.2%	212.6	9663	5.0%
CUNDTW	202.4	204.4	2052	1.1%	197.5	-4875	-2.3%
CUNMCO	190.7	191.7	991	0.6%	190	-714	-0.3%
CUNSLC	210.0	218.3	8338	4.0%	212.6	2600	1.3%
CVGATL	180.4	186.3	5848	3.6%	183.2	2771	1.9%
CVGLAS	200.8	208.0	7221	3.8%	197.5	-3315	-1.5%
CVGLAX	204.3	211.7	7421	3.8%	212.6	8282	4.2%
CVGSEA	208.2	212.8	4591	2.4%	212.6	4378	2.3%
CVGSLC	200.4	204.2	3792	2.0%	197.5	-2944	-1.4%
DABATL	191.0	185.6	-5414	-2.7%	183.2	-7814	-4.0%
DCAATL	190.0	187.4	-2668	-1.3%	183.2	-6835	-3.5%
DCAMSP	188.2	193.8	5576	3.0%	190	1800	1.0%
DCASLC	207.0	209.1	2099	1.1%	212.6	5572	2.7%
DENATL	201.7	201.5	-194	0.1%	197.5	-4243	-1.9%
DENMSP	197.7	192.9	-4804	-2.3%	190	-7700	-3.8%
DFWATL	193.0	192.8	-234	0.0%	190	-3021	-1.5%
DKRJFK	229.9	232.5	2562	1.2%	230.9	1005	0.5%
DTWATL	191.4	190.0	-1418	-0.6%	190	-1380	-0.6%
DTWBOS	193.2	190.6	-2644	-1.2%	190	-3239	-1.5%
DTWBWI	187.5	186.9	-612	-0.2%	183.2	-4284	-2.1%
DTWCUN	205.3	204.6	-629	-0.3%	197.5	-7750	-3.8%
DTWFLL	197.4	198.9	1504	0.9%	190	-7361	-3.6%
DTWGRR	192.6	182.1	-10580	-5.5%	183.2	-9436	-4.9%
DTWLAS	207.1	209.2	2151	1.1%	212.6	5525	2.7%
DTWLAX	209.9	213.1	3162	1.7%	212.6	2698	1.4%
DTWMCO	193.9	196.0	2143	1.3%	190	-3882	-1.8%
DTWMIA	198.9	199.2	244	0.2%	190	-8909	-4.4%
DTWMKE	186.2	184.0	-2168	-1.0%	183.2	-2982	-1.5%
DTWMSP	190.5	188.9	-1632	-0.7%	183.2	-7300	-3.6%
DTWPBI	193.4	198.2	4799	2.5%	190	-3375	-1.7%
DTWPDX	207.4	212.6	5238	2.6%	212.6	5215	2.6%
DTWPHL	189.9	187.6	-2246	-1.1%	183.2	-6667	-3.4%
DTWPHX	206.1	207.9	1782	0.9%	197.5	-8640	-4.1%
DTWRSW	197.7	198.1	401	0.3%	190	-7735	-3.8%
DTWSAN	209.9	212.7	2751	1.4%	212.6	2671	1.3%
DTWSEA	208.8	212.2	3422	1.7%	212.6	3821	1.9%
DTWSFO	212.2	214.7	2518	1.3%	212.6	404	0.3%
DTWSLC	203.8	204.8	989	0.6%	197.5	-6266	-3.0%
DTWTPA	195.6	196.4	870	0.6%	190	-5577	-2.7%

APRTS	AVG_GWT	REG_EST	REG_DIF	REG_%DIF	AEDT_EST	AEDT_DIF	AEDT_%DIF
DUBJFK	226.2	227.6	1375	0.6%	230.9	4698	2.1%
EGEATL	204.8	200.8	-3983	-1.7%	197.5	-7295	-3.3%
FAIMSP	223.3	221.1	-2164	-0.9%	212.6	-10668	-4.7%
FAISEA	208.7	205.5	-3133	-1.4%	197.5	-11176	-5.2%
FLLATL	191.7	188.6	-3028	-1.5%	190	-1656	-0.8%
FLLDTW	195.5	197.7	2229	1.3%	190	-5513	-2.6%
FLLJFK	192.3	196.8	4418	2.5%	190	-2345	-1.0%
FLLMSP	197.7	203.7	6048	3.3%	197.5	-180	0.1%
GCMATL	206.2	195.0	-11232	-5.4%	190	-16200	-7.8%
GDLATL	204.4	205.0	554	0.4%	197.5	-6909	-3.3%
GDLLAX	207.0	202.3	-4723	-2.2%	197.5	-9500	-4.6%
GEGMSP	206.8	199.3	-7542	-3.6%	197.5	-9319	-4.4%
GEGSLC	192.8	188.8	-3949	-2.0%	183.2	-9550	-4.9%
GGTATL	204.4	192.7	-11776	-5.6%	190	-14433	-6.9%
GGTJFK	209.2	197.9	-11243	-5.2%	197.5	-11676	-5.4%
GGTLAX	217.5	222.5	5041	2.4%	212.6	-4892	-2.2%
GUAATL	208.4	202.0	-6382	-2.9%	197.5	-10895	-5.1%
GUALAX	218.9	215.8	-3072	-1.3%	212.6	-6281	-2.8%
HNLLAX	223.4	222.8	-639	-0.2%	212.6	-10832	-4.8%
HNLSEA	223.2	224.8	1641	0.9%	212.6	-10567	-4.6%
HNLSFO	218.3	220.2	1899	1.0%	212.6	-5665	-2.5%
INDATL	191.1	187.0	-4123	-2.1%	183.2	-7879	-4.1%
JACATL	207.0	204.1	-2861	-1.3%	197.5	-9500	-4.5%
JACMSP	197.2	192.5	-4742	-2.4%	190	-7214	-3.6%
JAXATL	190.2	183.8	-6380	-3.3%	183.2	-6981	-3.6%
JFKAGP	236.4	231.5	-4942	-2.1%	230.9	-5510	-2.3%
JFKARN	234.8	233.2	-1640	-0.6%	230.9	-3900	-1.6%
JFKATL	196.3	193.7	-2668	-1.3%	190	-6331	-3.2%
JFKBOG	215.1	222.2	7153	3.5%	212.6	-2481	-1.0%
JFKCPH	236.1	232.8	-3355	-1.4%	230.9	-5229	-2.2%
JFKDKR	232.9	232.5	-474	-0.1%	230.9	-2031	-0.8%
JFKDTW	195.1	189.5	-5645	-2.8%	183.2	-11925	-6.1%
JFKDUB	232.8	227.6	-5180	-2.2%	230.9	-1857	-0.7%
JFKFLL	195.0	198.8	3824	2.2%	190	-5000	-2.4%
JFKGGT	212.7	200.7	-12003	-5.6%	197.5	-15227	-7.1%
JFKKEF	222.2	224.2	2078	1.1%	212.6	-9551	-4.1%
JFKLAS	211.4	218.5	7077	3.4%	212.6	1204	0.7%
JFKLAX	212.5	222.3	9743	4.7%	212.6	71	0.2%
JFKMCO	194.6	196.7	2138	1.2%	190	-4595	-2.3%
JFKMEX	209.7	215.8	6180	3.1%	212.6	2936	1.5%
JFKMIA	198.3	199.2	836	0.5%	190	-8333	-4.1%
JFKMSP	189.9	198.2	8219	4.5%	190	67	0.2%
JFKPDX	209.0	221.9	12943	6.4%	212.6	3635	1.9%
JFKPHX	207.9	216.9	8955	4.4%	212.6	4656	2.3%
JFKPIT	182.3	186.7	4392	2.6%	183.2	933	0.7%
JFKSAN	210.7	221.8	11091	5.4%	212.6	1918	1.0%
JFKSDQ	208.2	206.8	-1341	-0.5%	197.5	-10667	-5.0%
JFKSEA	215.7	221.4	5694	2.7%	212.6	-3077	-1.3%
JFKSFO	214.6	224.1	9517	4.5%	212.6	-1997	-0.8%
JFKSJU	204.3	207.6	3370	1.7%	197.5	-6762	-3.2%
JFKSLC	210.2	214.2	3932	2.0%	212.6	2358	1.2%

TABLE 2

B757-200 TABULAR RESULTS

APRTS	AVG_GWT	REG_EST	REG_DIF	REG_%DIF	AEDT_EST	AEDT_DIF	AEDT_%DIF
JFKSNN	229.1	226.7	-2433	-1.0%	230.9	1813	0.8%
JFKSSA	237.2	235.2	-2057	-0.8%	243.2	5978	2.5%
JFKSTT	199.5	208.1	8589	4.5%	197.5	-1965	-0.8%
JFKSXM	200.9	209.0	8143	4.3%	197.5	-3389	-1.4%
JNUSEA	194.4	194.0	-384	-0.1%	190	-4426	-2.2%
KEFJFK	228.1	222.6	-5508	-2.3%	212.6	-15471	-6.7%
KOALAX	222.5	221.4	-1017	-0.4%	212.6	-9855	-4.4%
LASATL	212.2	210.1	-2068	-0.9%	212.6	406	0.2%
LASCVG	207.2	209.0	1808	0.9%	197.5	-9667	-4.6%
LASDTW	210.5	210.2	-297	-0.1%	212.6	2138	1.1%
LASJFK	216.3	218.5	2172	1.2%	212.6	-3701	-1.5%
LASMCO	198.4	215.0	16591	8.5%	212.6	14191	7.2%
LASMSP	202.4	202.7	239	0.2%	197.5	-4923	-2.4%
LASSLC	183.1	187.1	3980	2.4%	183.2	60	0.2%
LAXATL	216.0	212.5	-3430	-1.5%	212.6	-3371	-1.5%
LAXDTW	215.1	213.1	-1962	-0.8%	212.6	-2459	-1.1%
LAXGDL	190.9	201.9	11002	6.3%	197.5	6611	4.0%
LAXGGT	217.6	224.4	6846	3.2%	212.6	-4971	-2.2%
LAXGUA	216.6	216.7	87	0.2%	212.6	-3979	-1.7%
LAXHNL	209.7	222.7	13020	6.5%	212.6	2910	1.7%
LAXIND	213.0	210.3	-2666	-1.2%	212.6	-400	-0.2%
LAXJFK	218.7	221.4	2688	1.3%	212.6	-6079	-2.7%
LAXKOA	219.6	221.8	2295	1.1%	212.6	-6952	-3.1%
LAXLIH	217.0	223.7	6753	3.2%	212.6	-4355	-1.9%
LAXMCO	215.5	217.1	1576	0.8%	212.6	-2892	-1.3%
LAXMSP	204.9	205.7	771	0.5%	197.5	-7419	-3.5%
LAXOGG	216.5	221.5	5038	2.4%	212.6	-3902	-1.7%
LAXSEA	196.3	196.0	-288	0.0%	190	-6289	-3.0%
LAXSJO	221.4	225.5	4093	2.0%	212.6	-8780	-3.8%
LAXSLC	189.4	189.9	472	0.3%	190	554	0.4%
LGAATL	193.9	190.9	-3024	-1.5%	190	-3917	-1.9%
LGADTW	182.4	186.6	4182	2.6%	183.2	825	0.8%
LIHLAX	221.7	221.6	-86	0.1%	212.6	-9103	-4.0%
LIRATL	209.0	205.4	-3586	-1.6%	197.5	-11492	-5.4%
MBJATL	199.2	197.5	-1726	-0.8%	190	-9196	-4.6%
MCIATL	196.0	191.2	-4794	-2.3%	190	-5956	-2.9%
MCOATL	192.4	186.8	-5621	-2.8%	183.2	-9217	-4.7%
MCOCUN	190.9	191.9	1025	0.6%	190	-875	-0.4%
MCODTW	196.7	196.0	-713	-0.2%	190	-6738	-3.3%
MCOJFK	194.1	195.8	1743	1.1%	190	-4053	-1.9%
MCOLAS	194.6	214.1	19438	10.2%	212.6	17975	9.4%
MCOLAX	213.5	217.0	3578	1.8%	212.6	-858	-0.3%
MCOMSP	200.2	201.9	1741	1.0%	197.5	-2656	-1.2%
MCOSLC	209.9	212.3	2328	1.2%	212.6	2669	1.3%
MEXATL	209.4	202.6	-6842	-3.2%	197.5	-11944	-5.6%
MEXJFK	216.1	215.3	-862	-0.2%	212.6	-3528	-1.5%
MIAATL	193.1	190.4	-2706	-1.3%	190	-3066	-1.5%
MIADTW	196.6	199.5	2907	1.7%	190	-6625	-3.2%
MIAJFK	196.3	198.6	2361	1.6%	190	-6250	-2.8%
MKEATL	187.8	190.5	2702	1.6%	190	2246	1.4%
MKEDTW	179.6	183.3	3635	2.3%	183.2	3575	2.3%
MKEMSP	183.2	184.3	1044	0.7%	183.2	-14	0.1%
MSPANC	222.3	221.7	-604	-0.2%	212.6	-9694	-4.3%
MSPATL	199.2	194.8	-4396	-2.1%	190	-9204	-4.6%
MSPBOS	201.7	198.4	-3292	-1.6%	190	-11726	-5.7%
MSPBWI	192.1	195.3	3174	1.9%	190	-2114	-0.9%
MSPDCA	193.0	195.2	2211	1.3%	190	-3000	-1.4%
MSPDEN	192.0	191.0	-972	-0.4%	190	-2000	-1.0%
MSPDTW	189.9	188.5	-1383	-0.6%	183.2	-6678	-3.4%
MSPFAI	222.0	220.8	-1192	-0.5%	212.6	-9400	-4.2%
MSPFLL	204.3	204.5	145	0.3%	197.5	-6833	-3.1%
MSPGEG	195.4	199.3	3855	2.0%	197.5	2076	1.1%
MSPJAC	189.8	194.2	4447	2.4%	190	214	0.1%
MSPJFK	196.0	196.8	842	0.7%	190	-6000	-2.8%
MSPLAS	199.2	201.4	2129	1.2%	197.5	-1722	-0.8%
MSPLAX	201.9	205.3	3355	1.8%	197.5	-4429	-2.1%
MSPLGA	192.7	196.7	3993	2.2%	190	-2714	-1.3%
MSPMCI	184.0	186.2	2231	1.3%	183.2	-800	-0.4%
MSPMCO	202.2	201.5	-672	-0.3%	197.5	-4696	-2.3%
MSPMKE	187.1	184.6	-2442	-1.2%	183.2	-3880	-2.0%
MSPORD	188.7	185.3	-3491	-1.8%	183.2	-5543	-2.9%
MSPPDX	202.0	203.5	1417	0.8%	197.5	-4545	-2.2%
MSPPHX	199.4	201.0	1519	0.9%	197.5	-1948	-0.8%
MSPRSW	203.4	203.3	-76	0.0%	197.5	-5884	-2.8%
MSPSAN	201.3	205.2	3952	2.1%	197.5	-3775	-1.7%
MSPSEA	202.1	203.0	937	0.6%	197.5	-4583	-2.2%
MSPSFO	203.6	206.2	2576	1.4%	197.5	-6110	-2.9%
MSPSJO	210.9	220.7	9856	4.9%	212.6	1725	1.0%
MSPSJU	220.1	219.8	-324	0.0%	212.6	-7495	-3.3%
MSPSLC	192.1	196.2	4103	2.4%	190	-2105	-0.8%
MSPTPA	196.3	201.5	5149	2.8%	197.5	1183	0.8%
MSPYVR	205.7	203.6	-2080	-1.0%	197.5	-8214	-3.9%
MSYATL	187.8	186.4	-1342	-0.6%	183.2	-4572	-2.3%
NASATL	201.1	191.9	-9221	-4.6%	190	-11146	-5.5%
NCAATL	206.3	195.6	-10706	-5.2%	190	-16343	-7.9%
OGGLAX	219.3	219.6	357	0.3%	212.6	-6676	-2.9%
OGGSEA	228.0	222.2	-5795	-2.5%	212.6	-15400	-6.7%
ORDATL	195.0	190.5	-4481	-2.2%	190	-5008	-2.5%
ORDMSP	190.6	186.0	-4632	-2.3%	183.2	-7430	-3.8%
PBIATL	196.8	188.4	-8451	-4.2%	183.2	-13639	-6.9%
PBIDTW	195.4	197.4	2068	1.2%	190	-5357	-2.6%
PDXATL	219.6	215.9	-3715	-1.6%	212.6	-7027	-3.1%
PDXDTW	214.9	212.2	-2615	-1.2%	212.6	-2262	-1.0%
PDXJFK	215.0	220.6	5577	2.8%	212.6	-2417	-1.0%
PDXMSP	203.5	203.5	8	0.1%	197.5	-5952	-2.9%
PDXSLC	190.2	190.2	-7	0.1%	190	-189	0.0%
PHLATL	189.9	190.6	751	0.5%	190	141	0.2%
PHLCDG	231.0	232.0	966	0.5%	230.9	-86	0.1%
PHLDTW	186.8	187.1	227	0.3%	183.2	-3633	-1.8%
PHLSLC	205.4	211.6	6181	3.1%	212.6	7160	3.5%
PHXATL	208.3	206.3	-1999	-0.9%	197.5	-10827	-5.1%
PHXDTW	209.6	207.7	-1875	-0.8%	197.5	-12104	-5.7%

TABLE 3

B757-200 TABULAR RESULTS

APRTS	AVG_GWT	REG_EST	REG_DIF	REG_%DIF	AEDT_EST	AEDT_DIF	AEDT_%DIF
PHXJFK	214.3	215.8	1519	0.8%	212.6	-1650	-0.7%
PHXMSP	199.9	201.1	1250	0.7%	197.5	-2397	-1.1%
PHXSLC	185.1	188.3	3238	1.9%	183.2	-1893	-0.9%
PITATL	183.9	188.6	4723	2.8%	183.2	-718	-0.2%
PITCDG	231.5	233.1	1616	0.8%	230.9	-584	-0.2%
PITJFK	186.9	185.5	-1393	-0.5%	183.2	-3726	-1.8%
PNSATL	189.6	182.7	-6838	-3.5%	183.2	-6357	-3.2%
PUJATL	210.5	203.3	-7184	-3.4%	197.5	-13006	-6.1%
PVRATL	207.2	205.3	-1823	-0.8%	197.5	-9660	-4.6%
RDUATL	185.4	185.2	-209	0.0%	183.2	-2249	-1.1%
RICATL	189.6	187.0	-2686	-1.3%	183.2	-6445	-3.3%
RSWATL	195.0	188.6	-6392	-3.2%	183.2	-11829	-6.0%
RSWDTW	197.5	198.1	683	0.5%	190	-7451	-3.6%
RSWMSP	200.9	203.7	2757	1.5%	197.5	-3423	-1.6%
RTBATL	207.4	198.1	-9245	-4.4%	197.5	-9875	-4.7%
SANATL	216.0	210.6	-5381	-2.4%	212.6	-3413	-1.5%
SANDTW	216.4	211.7	-4681	-2.1%	212.6	-3788	-1.7%
SANJFK	220.4	219.9	-541	-0.2%	212.6	-7802	-3.5%
SANMSP	207.5	204.6	-2882	-1.3%	197.5	-10008	-4.8%
SANSLC	190.5	189.5	-1009	-0.4%	190	-534	-0.2%
SATATL	195.4	193.3	-2039	-0.9%	190	-5375	-2.6%
SDQJFK	212.2	205.5	-6669	-2.8%	197.5	-14682	-6.6%
SEAANC	198.2	204.2	5980	3.4%	197.5	-700	0.0%
SEAATL	221.5	216.4	-5122	-2.3%	212.6	-8925	-4.0%
SEACVG	210.2	212.8	2541	1.3%	212.6	2365	1.2%
SEADTW	216.2	212.2	-3990	-1.8%	212.6	-3553	-1.6%
SEAFAI	193.4	205.6	12171	6.5%	197.5	4090	2.3%
SEAHNL	223.5	224.7	1133	0.6%	212.6	-10921	-4.8%
SEAJFK	220.1	220.4	252	0.2%	212.6	-7542	-3.3%
SEAJNU	178.7	195.2	16514	9.5%	190	11333	6.6%
SEALAX	191.0	195.9	4960	2.8%	190	-969	-0.3%
SEAMSP	206.8	203.4	-3485	-1.6%	197.5	-9340	-4.4%
SEAOGG	218.6	224.0	5422	2.6%	212.6	-6018	-2.6%
SEASLC	193.0	191.5	-1458	-0.6%	190	-2955	-1.4%
SFOATL	221.4	215.7	-5759	-2.5%	212.6	-8840	-3.9%
SFODTW	217.8	214.7	-3118	-1.4%	212.6	-5182	-2.3%
SFOHNL	218.2	220.0	1793	0.9%	212.6	-5606	-2.5%
SFOJFK	221.1	223.1	1992	1.0%	212.6	-8535	-3.8%
SFOMSP	208.3	206.5	-1826	-0.8%	197.5	-10835	-5.1%
SFOSLC	191.4	190.0	-1386	-0.6%	190	-1375	-0.6%
SJCATL	213.3	215.0	1689	0.9%	212.6	-683	-0.2%
SJDATL	203.1	207.5	4383	2.2%	197.5	-5633	-2.7%
SJOATL	211.5	206.4	-5085	-2.3%	197.5	-13985	-6.5%
SJOJFK	207.4	216.0	8632	4.4%	212.6	5200	2.7%
SJOLAX	223.8	224.6	806	0.5%	212.6	-11241	-4.9%
SJOMSP	220.8	220.3	-490	-0.2%	212.6	-8200	-3.6%
SJUATL	209.0	205.2	-3725	-1.7%	197.5	-11475	-5.4%
SJUJFK	202.4	206.1	3690	2.1%	197.5	-4904	-2.2%
SJUMSP	215.4	219.5	4195	2.0%	212.6	-2750	-1.2%
SKBATL	215.5	207.7	-7864	-3.6%	212.6	-2938	-1.3%
SLCANC	215.8	215.5	-284	-0.1%	212.6	-3166	-1.4%

APRTS	AVG_GWT	REG_EST	REG_DIF	REG_%DIF	AEDT_EST	AEDT_DIF	AEDT_%DIF
SLCATL	210.9	206.6	-4326	-2.0%	197.5	-13404	-6.3%
SLCBOI	184.2	184.9	666	0.5%	183.2	-1030	-0.5%
SLCBOS	213.9	215.2	1222	0.8%	212.6	-1333	-0.4%
SLCCUN	209.4	218.5	9104	4.4%	212.6	3171	1.5%
SLCCVG	204.9	204.2	-663	-0.2%	197.5	-7400	-3.5%
SLCDCA	210.1	210.9	832	0.5%	212.6	2498	1.3%
SLCDTW	207.2	204.8	-2483	-1.1%	197.5	-9738	-4.6%
SLCGEG	185.0	189.2	4175	2.4%	183.2	-1800	-0.9%
SLCJFK	212.9	213.2	384	0.3%	212.6	-252	0.0%
SLCLAS	185.5	186.2	669	0.5%	183.2	-2312	-1.1%
SLCLAX	188.1	189.9	1826	1.1%	190	1941	1.2%
SLCMCO	212.0	212.3	308	0.2%	212.6	650	0.4%
SLCMSP	196.5	196.6	83	0.1%	190	-6498	-3.2%
SLCPDX	190.4	190.6	191	0.2%	190	-365	-0.1%
SLCPHL	209.5	212.2	2634	1.3%	212.6	3053	1.5%
SLCPHX	187.0	188.5	1497	0.9%	183.2	-3825	-1.9%
SLCSAN	189.6	190.5	904	0.6%	190	406	0.3%
SLCSEA	194.4	191.5	-2867	-1.3%	190	-4402	-2.1%
SLCSFO	187.1	190.0	2967	1.6%	190	2929	1.6%
SLCSMF	184.4	188.9	4525	2.5%	183.2	-1200	-0.6%
SMFATL	217.1	213.7	-3468	-1.6%	212.6	-4542	-2.1%
SMFMSP	206.3	204.1	-2187	-1.0%	197.5	-8786	-4.2%
SMFSLC	191.8	187.7	-4145	-2.1%	183.2	-8600	-4.4%
SNAATL	213.4	209.7	-3680	-1.7%	212.6	-770	-0.3%
SNNJFK	223.8	226.7	2825	1.3%	230.9	7071	3.2%
SRQATL	192.9	186.5	-6324	-3.2%	183.2	-9655	-4.9%
SSAJFK	235.2	235.2	-17	0.0%	243.2	8018	3.4%
STLATL	190.2	187.8	-2434	-1.2%	183.2	-7004	-3.6%
STTATL	211.6	204.8	-6780	-3.1%	197.5	-14122	-6.6%
STTJFK	208.0	205.2	-2708	-1.2%	197.5	-10452	-4.9%
SXMATL	212.8	206.8	-5984	-2.7%	197.5	-15298	-7.1%
SXMJFK	210.7	206.5	-4226	-1.9%	197.5	-13214	-6.2%
SXMMSP	225.0	220.8	-4236	-1.8%	212.6	-12400	-5.5%
TPAATL	189.4	186.5	-2893	-1.4%	183.2	-6152	-3.2%
TPADTW	193.3	196.1	2794	1.6%	190	-3278	-1.5%
TPAMSP	198.0	201.5	3465	1.8%	197.5	-500	-0.2%
TUSATL	203.8	205.4	1615	0.8%	197.5	-6262	-3.0%
UIOATL	221.4	219.9	-1577	-0.6%	212.6	-8838	-3.9%
UVFATL	218.2	212.5	-5675	-2.6%	212.6	-5574	-2.5%
YVRATL	216.5	217.4	827	0.4%	212.6	-3938	-1.8%
YVRMSP	204.6	203.8	-781	-0.3%	197.5	-7100	-3.4%

TABLE 4

B767-400ER/CF6-80C2/B8F

Takeoff Weight Determination:

Specifics of the Flight Planning Database:

- 12,138 Flights
- 94 Routes from 28 Departure Airports
- 81 "Tankered" Flights
  - 8187 lbs. Average
  - 3060 NM Average Trip
- Added Airport Elevation, Runway Length, and GCD for each Airport/Flight

As before, multiple linear regressions on the database were conducted in a stepwise method using the independent variables: runway length, airport elevation, and either GCD or Planned Distance. The regressions were applied to the total database of individual flights and repeated with an "average" database that contained the average data for each route and in the case of Planned Distance, the average planned distance.

The statistical summary of the GCD and Planned Distance regressions are as follows:

B767-400ER Planned Distance with All Data:

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.640[a]	.410	.410	20542.942
2	.642[b]	.412	.412	20513.368
3	.643[c]	.413	.413	20494.976

a. Predictors: (Constant), PL_DIST

b. Predictors: (Constant), PL_DIST, RWYL

c. Predictors: (Constant), PL_DIST, RWYL, ELEV

d. Dependent Variable: ACTWT

B767-400ER Great Circle Distance with All Data:

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.640[a]	.410	.410	20545.571
2	.642[b]	.412	.412	20516.248
3	.643[c]	.413	.413	20497.507

a. Predictors: (Constant), GCD

b. Predictors: (Constant), GCD, RWYL

c. Predictors: (Constant), GCD, RWYL, ELEV

d. Dependent Variable: ACTWT

B767-400ER Planned Distance with Average Route Data:

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.930[a]	.865	.863	13.66311234

a. Predictors: (Constant), AVG_PDST

b. Dependent Variable: AVG_GWT

B767-400ER Great Circle Distance with Average Route Data:

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.930[a]	.865	.863	13.66898455

a. Predictors: (Constant), GCD

b. Dependent Variable: AVG_GWT

Again, there was very little difference in the strength of the correlation using Great Circle Distance or Planned Distance, and the correlation is much better when using average route data versus the total departure data. The stepwise statistical analysis eliminated inputs of runway length and elevation and produced a very acceptable relationship using distance. To remain consistent, GCD will be used.

B767-400ER Takeoff Weight Estimation Final Results

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.930[a]	.865	.863	13.66898455

a. Predictors: (Constant), GCD

b. Dependent Variable: AVG_GWT

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	297.966	4.230		70.443	.000
	GCD	.031	.001	.930	24.239	.000

a. Dependent Variable: AVG_GWT

$$GWT = 297.966 + .031(GCD)$$

(See Figure 6 below)

Testing of the Takeoff Weight Estimation

The resulting takeoff weight regression equations were compared with the ACARS database which has recorded data for 10,512 flights. The resulting data represented 56 flights/routes departing 21 airports. The results of the testing are shown in the following figures, and tabulated in Table 5.

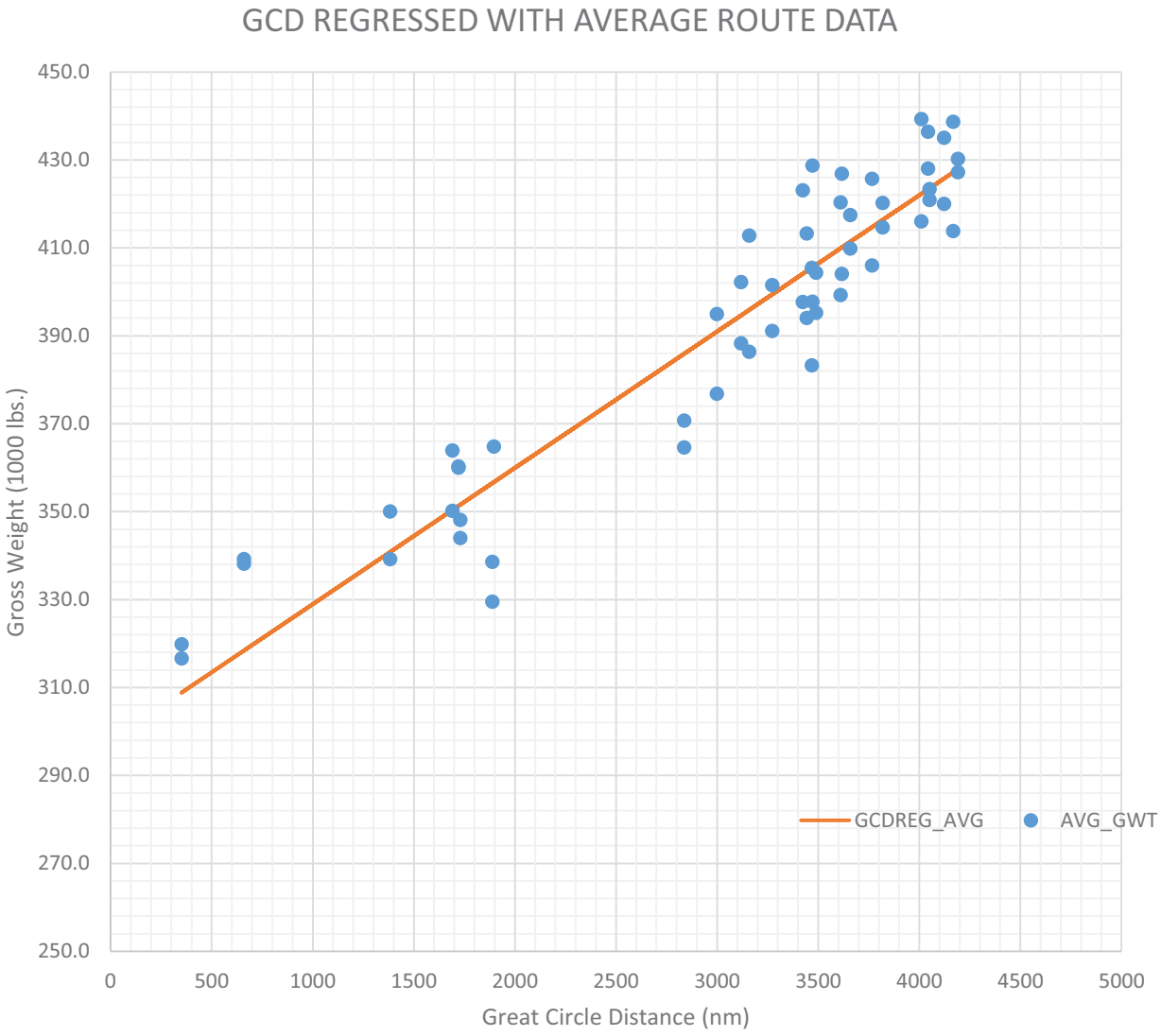

GCD REGRESSED WITH AVERAGE ROUTE DATA
Gross Weight (1000 lbs.)
450.0
430.0
410.0
390.0
370.0
350.0
330.0
310.0
290.0
270.0
250.0
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
Great Circle Distance (nm)
GCDREG_AVG
AVG_GWT

FIGURE 6

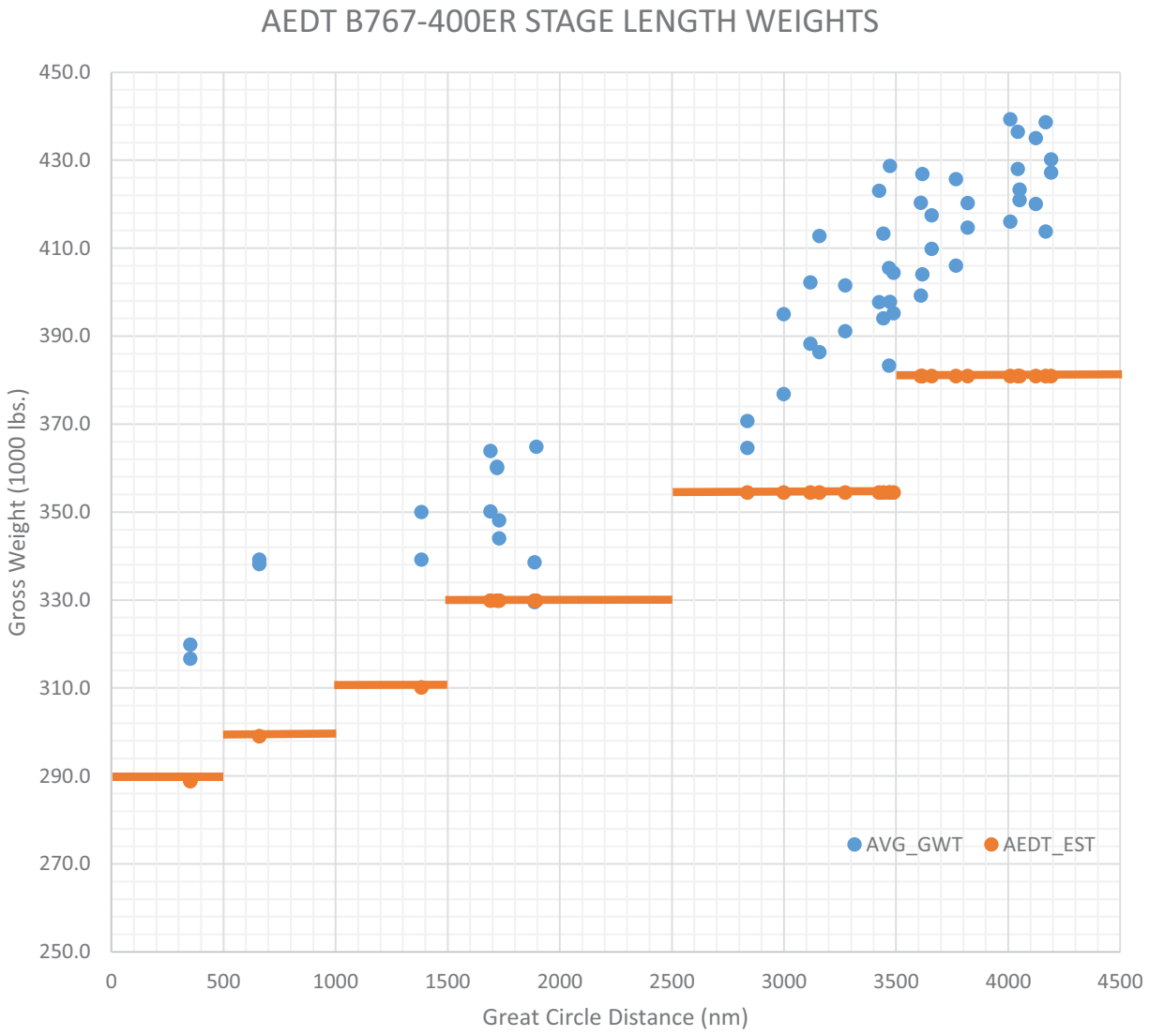


FIGURE 7

The plot for AEDT weights has been augmented by imposing the AEDT weight "step function" over the existing data. It can be clearly seen that the existing AEDT weight tables for the B767-400ER are significantly underestimated.

The average route tabular data is contained in the following tables, showing the actual weight, and the differences in the regression and AEDT stage length weights.

B767-400ER TABULAR RESULTS

APRTS	GWT	REG_GWT	REG_DIF	REG_%DF	AEDT_WT	AEDT_DIF	AEDT_%DF
AMSDTW	423.0	404.1	-18933	-4.5%	354.4	-68616	-16.2%
ATLCDG	414.6	416.4	1719	0.4%	380.9	-33730	-8.1%
ATLFRA	416.0	422.3	6273	1.5%	380.9	-35097	-8.4%
ATLGRU	436.4	423.3	-13094	-3.0%	380.9	-55487	-12.7%
ATLJFK	338.1	318.4	-19689	-5.8%	299.0	-39078	-11.6%
ATLLAX	363.9	350.4	-13470	-3.7%	329.9	-33996	-9.3%
ATLLHR	409.8	411.4	1606	0.4%	380.9	-28883	-7.0%
ATLMAD	406.0	414.7	8753	2.2%	380.9	-25084	-6.2%
ATLMCO	319.8	308.8	-10953	-3.4%	288.8	-30982	-9.7%
ATLMUC	413.8	427.2	13384	3.2%	380.9	-32884	-7.9%
ATLPDX	338.6	356.5	17923	5.3%	329.9	-8710	-2.6%
ATLSEA	364.8	356.7	-8058	-2.2%	329.9	-34939	-9.6%
ATLSLC	350.0	340.8	-9192	-2.6%	310.1	-39875	-11.4%
BOSLHR	364.6	385.9	21350	5.9%	354.4	-10136	-2.8%
CDGATL	420.2	416.4	-3845	-0.9%	380.9	-39294	-9.4%
CDGDTW	413.3	404.7	-8570	-2.1%	354.4	-58842	-14.2%
CDGJFK	412.8	395.9	-16896	-4.1%	354.4	-58333	-14.1%
DTWAMS	397.7	404.1	6443	1.6%	354.4	-43240	-10.9%
DTWCDG	394.1	404.7	10646	2.7%	354.4	-39626	-10.1%
DTWFRA	404.0	410.1	6057	1.5%	380.9	-23130	-5.7%
DTWLAX	360.3	351.3	-8964	-2.5%	329.9	-30389	-8.4%
DTWLHR	391.1	399.4	8358	2.1%	354.4	-36644	-9.4%
FRAATL	439.3	422.3	-17020	-3.9%	380.9	-58390	-13.3%
FRADTW	426.8	410.1	-16717	-3.9%	380.9	-45904	-10.8%
GRUATL	428.0	423.3	-4673	-1.1%	380.9	-47066	-11.0%
GRUJFK	420.0	425.8	5787	1.4%	380.9	-39086	-9.3%
JFKATL	339.2	318.4	-20728	-6.1%	299.0	-40117	-11.8%
JFKCDG	386.3	395.9	9531	2.5%	354.4	-31906	-8.3%
JFKGRU	435.0	425.8	-9194	-2.1%	380.9	-54067	-12.4%
JFKLHR	376.8	390.9	14149	3.8%	354.4	-22359	-5.9%
JFKMAD	388.3	394.6	6355	1.6%	354.4	-33842	-8.7%
JFKMXP	397.8	405.6	7842	2.0%	354.4	-43329	-10.9%
JFKNCE	383.3	405.5	22198	5.8%	354.4	-28849	-7.5%
JFKSLC	348.1	351.6	3491	1.0%	329.9	-18213	-5.2%
JFKSVO	423.3	423.5	241	0.1%	380.9	-42400	-10.0%
JFKVCE	399.2	409.9	10655	2.7%	380.9	-18315	-4.6%
LAXATL	350.1	350.4	244	0.1%	329.9	-20282	-5.8%
LAXDTW	360.0	351.3	-8714	-2.4%	329.9	-30139	-8.4%
LHRATL	417.4	411.4	-6052	-1.4%	380.9	-36541	-8.8%
LHRBOS	370.7	385.9	15222	4.1%	354.4	-16264	-4.4%
LHRDTW	401.5	399.4	-2066	-0.5%	354.4	-47068	-11.7%
LHRJFK	394.9	390.9	-4009	-1.0%	354.4	-40517	-10.3%
LHRMSP	404.4	406.1	1773	0.4%	354.4	-49925	-12.3%
MADATL	425.7	414.7	-10959	-2.6%	380.9	-44796	-10.5%
MADJFK	402.2	394.6	-7539	-1.9%	354.4	-47736	-11.9%
MCOATL	316.6	308.8	-7753	-2.4%	288.8	-27782	-8.8%
MSPLHR	395.2	406.1	10954	2.8%	354.4	-40744	-10.3%
MUCATL	438.6	427.2	-11444	-2.6%	380.9	-57712	-13.2%
MXPJFK	428.7	405.6	-23091	-5.4%	354.4	-74262	-17.3%
NCEJFK	405.4	405.5	45	0.0%	354.4	-51002	-12.6%
NRTPDX	427.2	427.9	720	0.2%	380.9	-46261	-10.8%
PDXATL	329.5	356.5	26994	8.2%	329.9	361	0.1%
PDXNRT	430.2	427.9	-2280	-0.5%	380.9	-49261	-11.5%
SLCATL	339.2	340.8	1641	0.5%	310.1	-29042	-8.6%
SLCJFK	344.0	351.6	7602	2.2%	329.9	-14102	-4.1%
SVOJFK	420.9	423.5	2659	0.6%	380.9	-39982	-9.5%
VCEJFK	420.3	409.9	-10432	-2.5%	380.9	-39402	-9.4%

TABLE 5

B737-800/CFM56-7B26

Takeoff Weight Determination:

Specifics of the Flight Planning Database:

- 33,933 Flights
- 467 Routes Departing 94 Airports
- 4,990 "Tankered" Flights
  - 5960 lbs. Average
  - 704 NM Average Trip
- Added Airport Elevation, Runway Length, and GCD for each Airport/Flight

As with the previous aircraft, multiple linear regressions on the database were conducted in a stepwise method using independent variables: runway length, airport elevation, and either GCD or Planned Distance. The regressions were applied to the total database of individual flights and repeated with an "average" database that contained the average data for each route and in the case of Planned Distance, the average planned distance.

The statistical summary of the GCD and Planned Distance regressions are as follows:

B737-800 Planned Distance with All Flight Data

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.752[a]	.566	.566	7069.417
2	.755[b]	.570	.570	7036.659
3	.755[c]	.570	.570	7036.198

a. Predictors: (Constant), PLN_DST

b. Predictors: (Constant), PLN_DST, RWYL

c. Predictors: (Constant), PLN_DST, RWYL, ELEV

d. Dependent Variable: ACT_TOGW

B737-800 Planned Distance with Average Route Data

Model Summary[c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.895[a]	.801	.801	4361.5687221
2	.901[b]	.812	.811	4251.5240030

a. Predictors: (Constant), AVG_PLDST

b. Predictors: (Constant), AVG_PLDST, RWYL

c. Dependent Variable: AVG_GWT

B737-800 GCD with All Flight Data

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.751[a]	.564	.564	7083.650
2	.754[b]	.568	.568	7051.356
3	.754[c]	.569	.569	7049.650

a. Predictors: (Constant), GCD

b. Predictors: (Constant), GCD, RWYL

c. Predictors: (Constant), GCD, RWYL, ELEV

d. Dependent Variable: ACT_TOGW

B737-800 GCD with Average Route Data

Model Summary[c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.895[a]	.801	.801	4361.5687221
2	.901[b]	.812	.811	4251.5240030

a. Predictors: (Constant), AVG_PLDST

b. Predictors: (Constant), AVG_PLDST, RWYL

c. Dependent Variable: AVG_GWT

Again, the correlation for takeoff weight estimate was stronger when using average route data, and when using this dataset, the results using GCD or Planned Distance are nearly identical. As before, GCD is selected to remain consistent.

The regression coefficients for GCD and Average/Route data are as follows:

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	128007.473	1406.541		91.009	.000
	RWYL	.625	.122	.107	5.124	.000
	ELEV	-.094	.155	-.013	-.606	.545
	GCD	14.880	.346	.886	43.015	.000

a. Dependent Variable: AVG_GWT

The resulting B737-800 takeoff weight estimation equation is:

$$GWT = 128007.473 + .625(RUNWAY\ LEN) - .094(ELEV) + 14.880(GCD)$$

(Reference Figures 9 and 10 below)

Testing of the Takeoff Weight Estimation

The resulting takeoff weight regression equations were compared with the ACARS database which has recorded data for 58,206 flights. The resulting data represented 504 flights/routes departing 104 airports.

As seen in the B757 data, there were a number of "tankered" fuel flights that could have potentially influenced the takeoff weight estimation. To resolve the issue, regressions were made using the database with the "tankered" flights removed and the resulting equation tested against the ACARS database. The absolute value of the difference in the estimated weights for the average/route data with both the "untankered" regression and the equation above are plotted in the frequency diagram below.

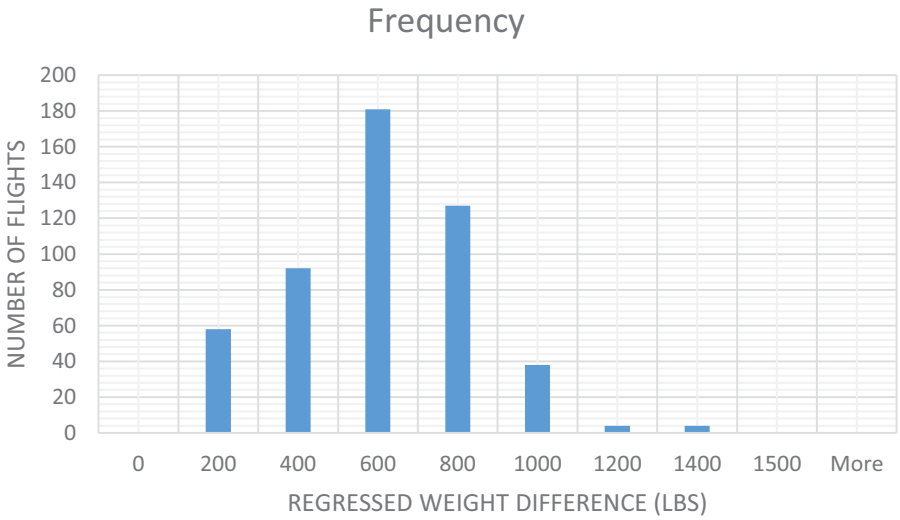


CHART 2

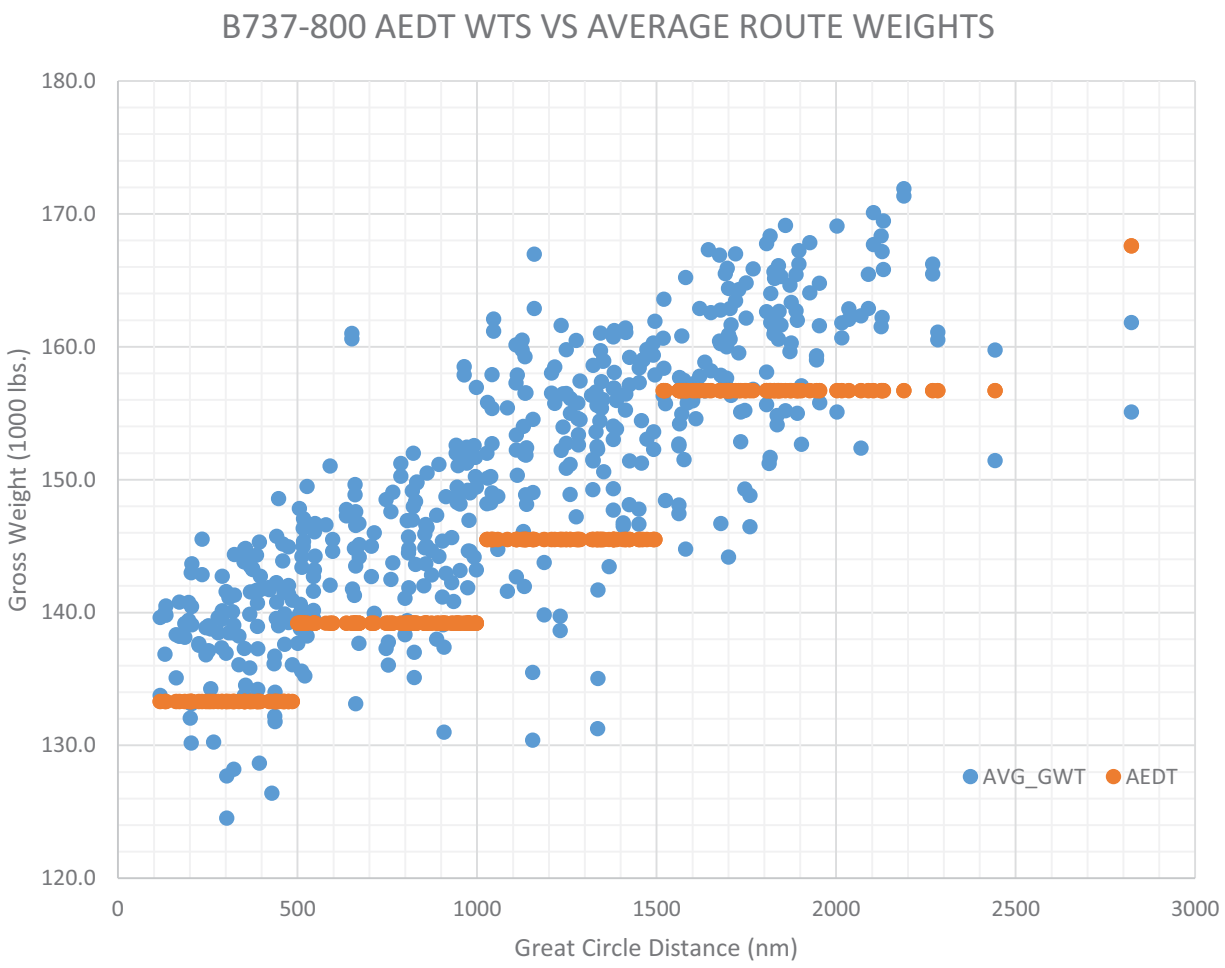

B737-800 AEDT WTS VS AVERAGE ROUTE WEIGHTS
Gross Weight (1000 lbs.)
180.0
170.0
160.0
150.0
140.0
130.0
120.0
0
500
1000
1500
2000
2500
3000
Great Circle Distance (nm)
AVG_GWT
AEDT

FIGURE 8

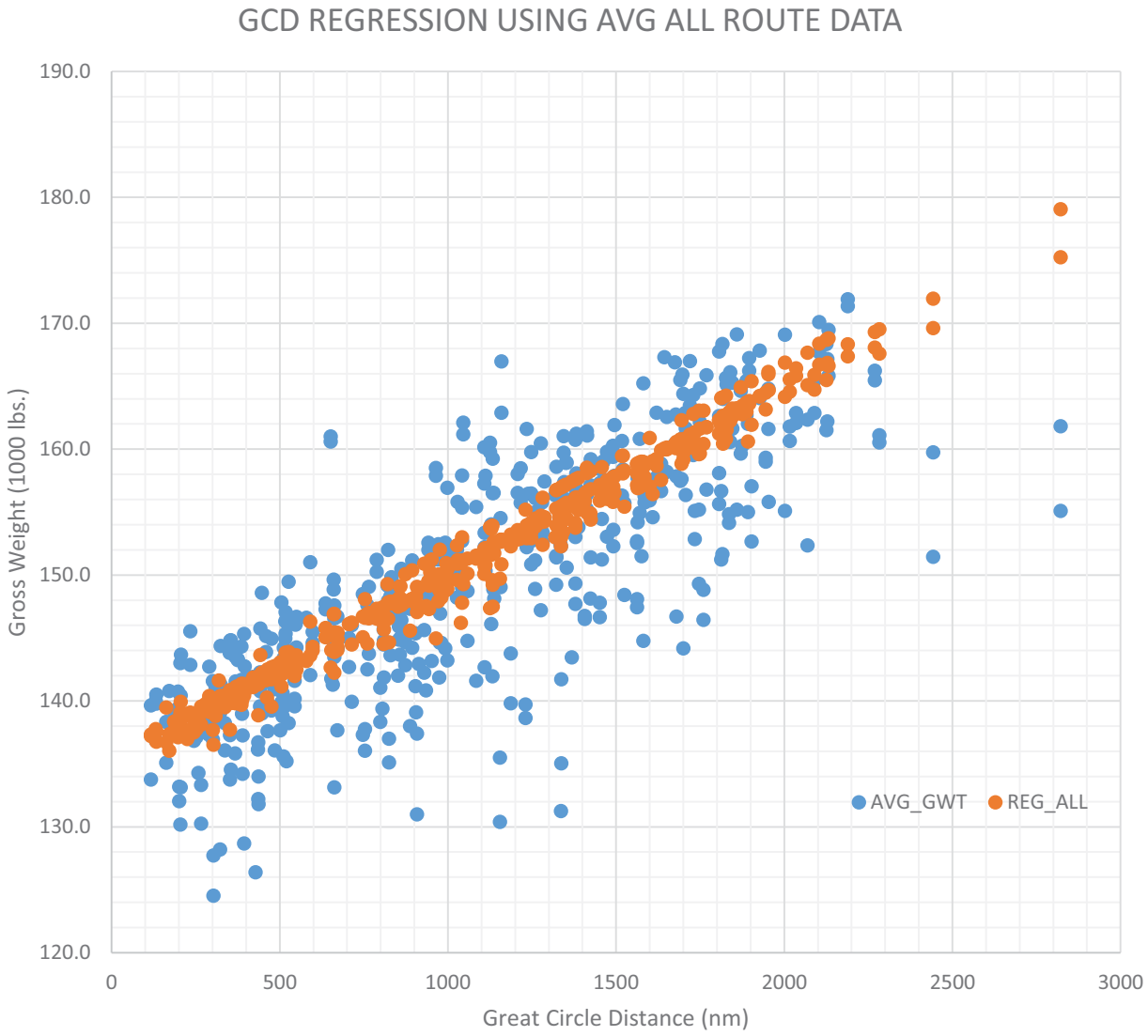


FIGURE 9

Tables 6 through 10 are the tabulated results of comparing the takeoff weight regression with the ACARS database. Shown in the tables are the average route weight, the estimated weight, weight difference and percentage difference of the regressed takeoff weight and the existing AEDT Stage Length Weight.

B737-800 TABULAR RESULTS

APRPTS	AVG_GWT	REG_ALL	REG_DF	%REG_DF	AEDT	AEDT_DF	%AEDT_DF	APRPTS	AVG_GWT	REG_ALL	REG_DF	%REG_DF	AEDT	AEDT_DF	%AEDT_DF
ANCMSP	171.4	168.3	-3025	-1.7%	156.7	-14650	-8.5%	ATLMSY	143.5	141.1	-2388	-1.6%	133.3	-10177	-7.0%
ANCSEA	148.9	154.5	5589	4.3%	145.5	-3398	-1.7%	ATLNCA	157.9	149.9	-7946	-5.0%	139.2	-18689	-11.8%
ANCSLC	165.3	163.2	-2064	-1.2%	156.7	-8586	-5.2%	ATLOMA	146.0	146.2	223	0.4%	139.2	-6800	-4.4%
ANUATL	154.9	157.0	2038	1.8%	156.7	1762	1.6%	ATLORD	149.5	143.4	-6055	-4.0%	139.2	-10280	-6.8%
APAATL	161.2	149.3	-11913	-7.1%	145.5	-15682	-9.4%	ATLPAP	157.9	152.1	-5730	-3.6%	145.5	-12375	-7.8%
APAJFK	148.1	154.9	6768	5.7%	145.5	-2625	-0.7%	ATLPDX	165.4	163.7	-1738	-1.0%	156.7	-8730	-5.2%
ATLANU	160.8	159.0	-1852	-1.0%	156.7	-4113	-2.4%	ATLPHX	160.8	156.1	-4635	-2.8%	145.5	-15253	-9.4%
ATLAPA	162.1	151.2	-10937	-6.5%	145.5	-16600	-10.0%	ATLPTY	161.9	157.8	-4081	-2.4%	145.5	-16425	-10.0%
ATLAUA	159.4	157.8	-1593	-1.0%	145.5	-13878	-8.7%	ATLPUJ	159.8	154.2	-5600	-3.5%	145.5	-14269	-8.9%
ATLAUS	145.0	146.1	1118	1.0%	139.2	-5786	-3.8%	ATLPVR	158.9	155.7	-3212	-1.9%	145.5	-13443	-8.3%
ATLBDA	156.9	150.4	-6487	-4.1%	139.2	-17736	-11.2%	ATLRDU	138.5	140.2	1717	1.5%	133.3	-5180	-3.5%
ATLBDL	137.3	146.7	9406	7.2%	139.2	1892	1.7%	ATLROC	161.0	145.3	-15715	-9.7%	139.2	-21800	-13.5%
ATLBGI	154.1	162.9	8782	6.1%	156.7	2564	2.0%	ATLRSW	148.6	142.2	-6333	-4.2%	133.3	-15283	-10.2%
ATLBHM	139.6	137.3	-2296	-1.6%	133.3	-6335	-4.4%	ATLRTB	157.9	151.1	-6806	-4.3%	145.5	-12409	-7.8%
ATLBNA	139.2	138.4	-813	-0.4%	133.3	-5879	-4.0%	ATLSAL	161.6	154.0	-7640	-4.5%	145.5	-16100	-9.7%
ATLBON	147.4	158.8	11406	8.0%	156.7	9265	6.6%	ATLSAN	167.3	160.1	-7251	-4.3%	156.7	-10613	-6.3%
ATLBOS	152.0	147.8	-4159	-2.7%	139.2	-12789	-8.4%	ATLSAT	147.6	146.9	-693	-0.3%	139.2	-8400	-5.5%
ATLBWI	137.7	143.1	5382	4.2%	139.2	1529	1.4%	ATLSDF	139.6	139.8	129	0.3%	133.3	-6321	-4.3%
ATLBZN	159.2	156.8	-2404	-1.4%	145.5	-13706	-8.5%	ATLSDQ	156.5	153.6	-2961	-1.8%	145.5	-11019	-6.9%
ATLCCS	157.8	160.6	2734	1.9%	156.7	-1148	-0.6%	ATLSEA	167.2	163.8	-3427	-2.0%	156.7	-10538	-6.3%
ATLCHS	137.5	138.9	1407	1.3%	133.3	-4240	-2.8%	ATLSFO	169.1	163.3	-5865	-3.4%	156.7	-12425	-7.3%
ATLCLT	140.8	138.5	-2220	-1.5%	133.3	-7450	-5.2%	ATLSJC	166.1	163.0	-3148	-1.8%	156.7	-9411	-5.6%
ATLCMH	140.7	141.4	668	0.6%	133.3	-7404	-5.1%	ATLSJD	159.8	157.5	-2278	-1.3%	145.5	-14295	-8.8%
ATLCOS	155.8	150.9	-4893	-3.1%	145.5	-10303	-6.5%	ATLSJO	161.1	156.6	-4440	-2.7%	145.5	-15579	-9.6%
ATLCUN	149.1	147.0	-2079	-1.3%	139.2	-9861	-6.5%	ATLSJU	161.0	155.6	-5435	-3.3%	145.5	-15532	-9.6%
ATLCVG	144.4	140.4	-3939	-2.6%	133.3	-11058	-7.6%	ATLSKB	155.7	158.3	2576	2.1%	156.7	986	1.0%
ATLDCA	141.4	142.7	1267	1.0%	133.3	-8100	-5.6%	ATLSLC	161.2	156.2	-5055	-3.0%	145.5	-15718	-9.7%
ATLDEN	155.4	151.1	-4254	-2.7%	145.5	-9857	-6.3%	ATLSLP	160.1	152.1	-8057	-5.0%	145.5	-14643	-9.1%
ATLDFW	147.8	145.1	-2697	-1.8%	139.2	-8560	-5.7%	ATLSMF	164.0	162.7	-1350	-0.8%	156.7	-7300	-4.4%
ATLDSD	158.8	159.9	1075	0.7%	156.7	-2137	-1.3%	ATLSRQ	144.3	141.3	-2980	-1.9%	133.3	-11023	-7.5%
ATLDTW	145.0	143.3	-1681	-1.0%	139.2	-5758	-3.8%	ATLSTL	141.7	141.9	136	0.4%	133.3	-8427	-5.7%
ATLFLL	147.8	143.1	-4716	-3.1%	139.2	-8629	-5.8%	ATLTPA	144.1	140.9	-3290	-2.2%	133.3	-10841	-7.4%
ATLGDL	160.5	154.6	-5885	-3.5%	145.5	-14971	-9.2%	ATLTPP	159.8	172.0	12194	7.7%	156.7	-3057	-1.9%
ATLGSO	130.3	139.6	9307	7.2%	133.3	3050	2.4%	ATLUVF	164.8	161.6	-3193	-1.9%	156.7	-8117	-4.9%
ATLGSP	139.8	137.6	-2212	-1.4%	133.3	-6489	-4.4%	ATLYVR	155.8	164.7	8874	6.3%	156.7	900	1.2%
ATLHSV	136.9	137.5	691	0.7%	133.3	-3557	-2.4%	AUAATL	160.3	155.8	-4462	-2.7%	145.5	-14775	-9.2%
ATLIAD	137.6	142.5	4903	3.8%	133.3	-4300	-2.9%	AUAJFK	157.6	158.8	1219	0.9%	156.7	-930	-0.4%
ATLIND	143.2	141.2	-2057	-1.3%	133.3	-9935	-6.8%	AUSATL	142.7	146.1	3422	2.7%	139.2	-3496	-2.1%
ATLJAX	145.5	139.1	-6445	-4.4%	133.3	-12225	-8.3%	AUSDTW	143.2	150.5	7244	5.5%	139.2	-4019	-2.4%
ATLJFK	149.6	145.4	-4221	-2.7%	139.2	-10440	-6.9%	AUSJFK	149.2	155.3	6046	4.3%	145.5	-3738	-2.2%
ATLLAS	160.7	158.2	-2471	-1.5%	156.7	-3957	-2.4%	BDAATL	149.4	148.9	-546	-0.2%	139.2	-10246	-6.7%
ATLLAX	165.5	160.8	-4732	-2.8%	156.7	-8792	-5.2%	BDABOS	137.7	144.0	6359	4.9%	139.2	1525	1.4%
ATLLGA	146.6	145.4	-1114	-0.7%	139.2	-7363	-4.9%	BDAJFK	133.1	143.9	10773	8.4%	139.2	6074	4.9%
ATLLIR	156.8	156.1	-719	-0.3%	145.5	-11337	-7.0%	BDLATL	148.5	145.1	-3450	-2.2%	139.2	-9300	-6.1%
ATLMBJ	152.4	150.0	-2394	-1.5%	139.2	-13241	-8.6%	BGIATL	154.8	162.2	7353	5.3%	156.7	1867	1.7%
ATLMCO	144.3	140.8	-3429	-2.3%	133.3	-10950	-7.5%	BGIJFK	151.2	161.8	10617	7.8%	156.7	5473	4.4%
ATLMEM	137.3	139.9	2551	2.2%	133.3	-4033	-2.6%	BHMATL	133.8	137.2	3450	2.8%	133.3	-466	-0.1%
ATLMEX	154.5	152.8	-1731	-0.9%	145.5	-9031	-5.6%	BILSLC	136.1	139.5	3414	2.8%	133.3	-2777	-1.8%
ATLMIA	147.1	143.3	-3770	-2.4%	139.2	-7862	-5.2%	BJXLAX	139.8	152.3	12462	9.3%	145.5	5676	4.4%
ATLMSO	157.7	158.9	1179	0.9%	156.7	-992	-0.5%	BNAATL	138.1	137.6	-514	-0.1%	133.3	-4827	-3.2%
ATLMSP	151.2	147.3	-3891	-2.4%	139.2	-12015	-7.8%	BNADTW	141.7	140.7	-991	-0.5%	133.3	-8428	-5.8%

TABLE 6

B737-800 TABULAR RESULTS

APRPTS	AVG_GWT	REG_ALL	REG_DF	%REG_DF	AEDT	AEDT_DF	%AEDT_DF	APRPTS	AVG_GWT	REG_ALL	REG_DF	%REG_DF	AEDT	AEDT_DF	%AEDT_DF
BNALAX	152.5	158.1	5550	3.9%	156.7	4163	3.0%	DFWATL	147.3	145.8	-1488	-0.9%	139.2	-8077	-5.4%
BOIMSP	144.2	148.7	4572	3.4%	139.2	-4976	-3.2%	DFWDTW	146.6	149.1	2456	1.9%	139.2	-7422	-4.8%
BOISLC	137.1	137.7	609	0.7%	133.3	-3828	-2.5%	DFWSLC	145.0	149.1	4089	3.1%	139.2	-5819	-3.7%
BONATL	148.1	157.2	9059	6.7%	156.7	8605	6.4%	DSDATL	156.7	157.6	894	0.6%	156.7	33	0.1%
BOSATL	148.0	146.5	-1434	-0.8%	139.2	-8773	-5.7%	DSDJFK	155.9	157.1	1127	1.2%	156.7	772	1.0%
BOSBDA	146.7	144.3	-2408	-1.5%	139.2	-7500	-5.0%	DTWATL	146.3	143.1	-3203	-2.1%	139.2	-7130	-4.7%
BOSCVG	141.8	144.0	2261	1.8%	139.2	-2563	-1.6%	DTWBNA	142.7	141.3	-1396	-0.8%	133.3	-9437	-6.5%
BOSDTW	144.2	142.5	-1772	-1.0%	139.2	-5048	-3.3%	DTWBOS	146.7	143.6	-3072	-2.0%	139.2	-7490	-5.0%
BOSJFK	138.3	136.7	-1615	-0.8%	133.3	-5033	-3.3%	DTWBWI	134.5	140.7	6188	5.0%	133.3	-1243	-0.5%
BOSLAS	162.3	165.1	2761	2.1%	156.7	-5633	-3.1%	DTWCUN	154.6	154.5	-122	0.0%	145.5	-9117	-5.8%
BOSLAX	166.2	168.1	1840	1.3%	156.7	-9531	-5.6%	DTWDCA	133.8	140.7	6932	5.6%	133.3	-454	0.1%
BOSMCO	141.9	148.8	6927	5.2%	139.2	-2673	-1.6%	DTWDEN	152.0	150.0	-2001	-1.1%	139.2	-12773	-8.2%
BOSMSP	146.9	148.8	1913	1.7%	139.2	-7732	-4.9%	DTWDFW	143.7	148.2	4534	3.3%	139.2	-4467	-3.0%
BOSSLC	165.1	161.5	-3609	-2.1%	156.7	-8432	-5.0%	DTWFLL	144.6	150.0	5425	4.1%	139.2	-5406	-3.4%
BWIATL	139.3	142.0	2719	2.2%	139.2	-93	0.2%	DTWIND	132.0	138.4	6392	5.4%	133.3	1252	1.5%
BWIDTW	144.8	139.8	-4985	-3.3%	133.3	-11525	-7.8%	DTWJFK	140.8	142.0	1248	1.1%	133.3	-7478	-5.1%
BWISLC	162.9	158.7	-4226	-2.5%	156.7	-6189	-3.7%	DTWLAS	163.6	158.1	-5509	-3.3%	156.7	-6876	-4.2%
BZELAX	155.0	160.6	5596	4.0%	156.7	1700	1.4%	DTWLAX	167.0	161.0	-5958	-3.5%	156.7	-10300	-6.1%
BZNATL	151.4	154.4	3001	2.1%	145.5	-5912	-3.8%	DTWLGA	132.2	141.9	9736	7.8%	133.3	1100	1.3%
BZNSLC	136.9	137.7	756	0.7%	133.3	-3632	-2.5%	DTWMCO	149.8	147.8	-1921	-1.2%	139.2	-10550	-6.9%
CCSATL	146.7	160.1	13453	9.6%	156.7	10008	7.3%	DTWMEX	165.2	159.0	-6248	-3.6%	156.7	-8522	-5.0%
CHSATL	137.7	137.0	-676	-0.3%	133.3	-4353	-3.0%	DTWMIA	150.2	150.3	26	0.2%	139.2	-11028	-7.2%
CLTATL	139.4	137.1	-2298	-1.5%	133.3	-6117	-4.3%	DTWMKE	139.1	138.5	-555	-0.4%	133.3	-5769	-4.1%
CMHATL	139.0	140.0	1057	1.0%	133.3	-5668	-3.9%	DTWMSP	145.2	142.3	-2879	-1.9%	133.3	-11858	-8.1%
CMHLAX	155.1	160.1	4958	3.4%	156.7	1605	1.3%	DTWMSY	139.4	147.4	8038	6.4%	139.2	-189	0.5%
CMHMSP	140.2	142.3	2185	1.8%	139.2	-961	-0.5%	DTWORD	130.2	138.5	8302	7.1%	133.3	3118	3.0%
COSATL	150.1	151.2	1064	0.8%	145.5	-4611	-3.0%	DTWPDX	165.9	160.7	-5221	-3.1%	156.7	-9221	-5.5%
CUNATL	143.7	146.6	2811	2.4%	139.2	-4545	-2.8%	DTWPHL	128.7	141.3	12645	10.4%	133.3	4633	4.2%
CUNCVG	141.6	151.3	9712	7.5%	145.5	3900	3.4%	DTWPHX	158.4	157.1	-1357	-0.8%	145.5	-12912	-8.1%
CUNDTW	155.8	154.2	-1561	-1.0%	145.5	-10275	-6.6%	DTWPVR	160.6	160.7	145	0.5%	156.7	-3900	-2.0%
CUNLAX	162.7	162.6	-89	0.0%	156.7	-5959	-3.6%	DTWRDU	136.1	141.9	5788	4.5%	133.3	-2833	-1.8%
CUNMSP	159.0	156.9	-2092	-1.2%	145.5	-13527	-8.4%	DTWRSW	152.6	149.5	-3113	-1.9%	139.2	-13379	-8.6%
CVGATL	141.3	140.2	-1057	-0.6%	133.3	-8002	-5.5%	DTWSAN	164.4	160.7	-3642	-2.2%	156.7	-7687	-4.6%
CVGCUN	155.4	151.6	-3847	-2.4%	145.5	-9900	-6.3%	DTWSEA	166.9	160.4	-6535	-3.9%	156.7	-10208	-6.1%
CVGFLL	141.9	147.5	5609	4.3%	139.2	-2667	-1.5%	DTWSFO	167.8	162.3	-5445	-3.1%	156.7	-11067	-6.5%
CVGLAS	154.5	157.1	2666	2.2%	145.5	-8952	-5.4%	DTWSLC	157.4	154.6	-2826	-1.7%	145.5	-11925	-7.5%
CVGLAX	162.6	160.0	-2568	-1.4%	156.7	-5858	-3.5%	DTWTPA	145.9	148.2	2245	1.8%	139.2	-6711	-4.4%
CVGMCO	144.8	145.2	385	0.4%	139.2	-5629	-3.7%	DTWYVR	162.9	160.8	-2056	-1.2%	156.7	-6175	-3.7%
CVGSEA	161.6	160.8	-823	-0.3%	156.7	-4946	-2.8%	FLLATL	139.9	141.1	1271	1.4%	139.2	-675	0.0%
CVGSFO	165.9	161.7	-4129	-2.5%	156.7	-9175	-5.5%	FLLCVG	144.8	145.7	876	0.9%	139.2	-5608	-3.6%
CVGSLC	156.1	154.2	-1919	-1.0%	145.5	-10591	-6.5%	FLLDTW	149.0	148.2	-786	-0.3%	139.2	-9800	-6.4%
CVGTPA	144.2	145.4	1249	1.1%	139.2	-4974	-3.3%	FLLJFK	142.2	147.5	5211	4.1%	139.2	-3044	-1.7%
CZMMSP	153.6	156.6	2960	2.2%	145.5	-8100	-5.0%	FLLLGA	140.8	147.5	6711	5.2%	139.2	-1633	-0.7%
DCAATL	142.0	139.6	-2485	-1.5%	133.3	-8740	-5.9%	FSDMSP	138.2	136.0	-2158	-1.5%	133.3	-4900	-3.5%
DCADTW	137.3	137.7	439	0.7%	133.3	-3986	-2.6%	GCMJFK	131.3	152.3	21025	16.4%	145.5	14250	11.2%
DCAMSP	145.7	144.5	-1164	-0.6%	139.2	-6490	-4.2%	GDLATL	147.2	154.7	7525	5.7%	145.5	-1700	-0.6%
DCASLC	157.3	156.4	-871	-0.5%	156.7	-600	-0.3%	GDLLAX	151.9	152.6	790	0.7%	145.5	-6352	-4.0%
DENATL	152.7	153.0	295	0.2%	145.5	-7207	-4.7%	GEGSLC	139.3	141.7	2478	2.0%	133.3	-5950	-4.1%
DENDTW	144.6	152.0	7392	5.6%	139.2	-5428	-3.3%	GNDJFK	161.0	160.8	-146	0.2%	156.7	-4260	-2.4%
DENJFK	155.2	158.5	3283	2.2%	145.5	-9739	-6.2%	GSOATL	133.3	138.1	4796	3.8%	133.3	-33	0.2%
DENMSP	142.1	146.3	4237	3.2%	139.2	-2854	-1.8%	GSPATL	140.5	136.8	-3728	-2.6%	133.3	-7200	-5.0%

TABLE 7

B737-800 TABULAR RESULTS

APRPTS	AVG_GWT	REG_ALL	REG_DF	%REG_DF	AEDT	AEDT_DF	%AEDT_DF	APRPTS	AVG_GWT	REG_ALL	REG_DF	%REG_DF	AEDT	AEDT_DF	%AEDT_DF
HSVATL	140.0	137.8	-2227	-1.6%	133.3	-6700	-4.8%	LASDTW	158.4	159.5	1109	0.8%	156.7	-1681	-1.0%
IADATL	139.9	142.1	2176	1.8%	133.3	-6594	-4.5%	LASJFK	161.6	165.9	4338	2.8%	156.7	-4895	-2.9%
INDATL	143.3	140.5	-2800	-1.9%	133.3	-10013	-6.9%	LASLAX	140.4	139.9	-522	-0.1%	133.3	-7144	-4.8%
INDDTW	133.2	137.9	4747	4.2%	133.3	124	0.7%	LASMEM	139.7	155.2	15468	12.1%	145.5	5778	5.1%
INDLAX	157.5	158.4	911	0.9%	156.7	-772	-0.2%	LASMSP	146.1	153.7	7565	5.5%	145.5	-607	-0.2%
INDMSP	131.8	141.4	9635	7.5%	133.3	1500	1.3%	LASRDU	148.8	163.1	14243	10.1%	156.7	7882	5.8%
JAXATL	142.9	137.7	-5117	-3.5%	133.3	-9554	-6.6%	LASSEA	137.8	148.1	10311	8.0%	139.2	1434	1.5%
JFKAPA	157.1	158.3	1140	0.9%	145.5	-11625	-7.2%	LASSLC	140.1	141.6	1569	1.4%	133.3	-6751	-4.5%
JFKATL	148.9	146.9	-1960	-1.1%	139.2	-9657	-6.3%	LAXATL	157.5	160.7	3239	2.3%	156.7	-775	-0.3%
JFKAUA	160.0	162.3	2303	1.6%	156.7	-3294	-1.9%	LAXBJX	143.8	153.2	9440	7.0%	145.5	1725	1.6%
JFKAUS	151.5	156.7	5230	3.7%	145.5	-6017	-3.7%	LAXBNA	152.7	158.8	6107	4.2%	156.7	4011	2.9%
JFKBDA	143.5	146.9	3431	2.6%	139.2	-4296	-2.8%	LAXBOS	165.5	169.3	3846	2.4%	156.7	-8769	-5.2%
JFKBGI	156.7	164.1	7386	4.9%	156.7	33	0.2%	LAXBZE	162.0	163.7	1706	1.2%	156.7	-5300	-3.1%
JFKBOS	135.1	139.5	4395	3.6%	133.3	-1791	-1.0%	LAXCMH	152.9	161.4	8496	5.8%	156.7	3841	2.7%
JFKDEN	161.4	158.1	-3324	-2.0%	145.5	-15925	-9.8%	LAXCUN	161.7	162.9	1243	0.8%	156.7	-5004	-3.0%
JFKDSD	156.2	160.9	4707	3.3%	156.7	524	0.6%	LAXCVG	158.2	160.1	1923	1.3%	156.7	-1497	-0.8%
JFKDTW	145.7	143.7	-2087	-1.3%	133.3	-12439	-8.4%	LAXDTW	163.5	161.1	-2314	-1.3%	156.7	-6760	-4.1%
JFKFLL	145.6	150.9	5262	4.0%	139.2	-6437	-4.0%	LAXGDL	156.5	152.5	-4070	-2.6%	145.5	-11026	-7.0%
JFKGCM	152.3	157.0	4683	3.4%	145.5	-6773	-4.2%	LAXIND	151.5	159.0	7497	5.3%	156.7	5193	3.8%
JFKGND	165.7	164.3	-1391	-0.6%	156.7	-8952	-5.2%	LAXLAS	133.1	138.6	5457	4.7%	133.3	154	0.7%
JFKKIN	143.5	157.4	13977	10.5%	145.5	2045	2.2%	LAXLIR	161.1	169.5	8424	5.5%	156.7	-4400	-2.4%
JFKLAS	164.8	166.1	1346	1.0%	156.7	-8090	-4.8%	LAXMCO	164.1	164.2	168	0.2%	156.7	-7358	-4.4%
JFKLIR	157.1	165.4	8330	5.9%	156.7	-363	0.4%	LAXMEM	146.8	156.5	9737	7.2%	145.5	-1252	-0.4%
JFKMBJ	155.9	157.0	1159	0.9%	145.5	-10385	-6.5%	LAXMIA	162.9	165.8	2966	2.0%	156.7	-6167	-3.6%
JFKMCO	149.2	149.3	124	0.2%	139.2	-9953	-6.5%	LAXMPR	150.2	151.0	766	0.6%	145.5	-4732	-3.1%
JFKMEX	168.3	164.1	-4250	-2.4%	156.7	-11648	-6.8%	LAXMSP	152.5	155.4	2915	2.3%	145.5	-6988	-4.2%
JFKMIA	151.1	151.2	113	0.3%	139.2	-11854	-7.6%	LAXMSY	146.7	157.1	10485	7.7%	145.5	-1158	-0.3%
JFKMSP	151.2	150.4	-777	-0.4%	139.2	-11956	-7.8%	LAXMZT	137.4	149.1	11667	9.1%	139.2	1803	1.9%
JFKMSY	152.0	152.4	357	0.6%	145.5	-6500	-3.9%	LAXPHX	128.2	140.3	12144	10.0%	133.3	5100	4.4%
JFKNAS	148.2	151.2	3088	2.4%	139.2	-8954	-5.8%	LAXPVR	148.7	151.3	2559	2.0%	145.5	-3236	-1.9%
JFKNCA	159.8	153.8	-5946	-3.6%	145.5	-14261	-8.9%	LAXRDU	159.0	164.5	5483	3.6%	156.7	-2311	-1.3%
JFKPAP	158.6	156.8	-1847	-1.0%	145.5	-13109	-8.1%	LAXSAL	161.8	165.6	3748	2.7%	156.7	-5102	-2.8%
JFKPDX	169.5	168.8	-665	-0.3%	156.7	-12764	-7.5%	LAXSEA	143.6	147.9	4258	3.3%	139.2	-4430	-2.8%
JFKPHX	164.6	164.9	283	0.3%	156.7	-7934	-4.7%	LAXSLC	143.4	143.2	-231	0.0%	139.2	-4202	-2.8%
JFKPLS	151.9	153.9	1992	1.6%	145.5	-6428	-3.9%	LAXSLP	167.0	152.8	-14161	-8.2%	145.5	-21459	-12.6%
JFKPUJ	158.9	157.2	-1750	-1.0%	145.5	-13414	-8.4%	LAXTPA	160.3	163.5	3177	2.1%	156.7	-3576	-2.1%
JFKPVR	169.1	166.9	-2226	-1.3%	156.7	-12391	-7.3%	LAXZIH	141.7	155.4	13739	10.4%	145.5	3792	3.4%
JFKSAN	168.3	168.7	351	0.3%	156.7	-11644	-6.8%	LAXZLO	135.5	152.7	17239	13.7%	145.5	10000	8.3%
JFKSAT	149.3	157.6	8273	5.9%	145.5	-3823	-2.2%	LGAATL	147.6	142.2	-5349	-3.4%	139.2	-8382	-5.5%
JFKSDQ	157.4	157.1	-279	0.1%	145.5	-11884	-7.3%	LGADTW	136.7	138.9	2158	1.9%	133.3	-3412	-2.2%
JFKSEA	170.1	168.4	-1710	-0.9%	156.7	-13393	-7.8%	LGAMCO	135.1	144.7	9547	7.5%	139.2	4089	3.4%
JFKSJU	155.9	157.7	1784	1.4%	145.5	-10445	-6.4%	LGAMSP	138.0	145.6	7581	5.5%	139.2	1200	0.9%
JFKSLC	164.3	162.8	-1488	-0.8%	156.7	-7591	-4.5%	LGANCA	156.5	149.2	-7258	-4.6%	145.5	-11000	-7.0%
JFKSTI	153.4	156.2	2778	2.2%	145.5	-7874	-4.7%	LIRATL	154.0	154.1	106	0.4%	145.5	-8536	-5.2%
JFKTPA	144.7	150.1	5399	4.0%	139.2	-5467	-3.6%	LIRJFK	152.7	161.9	9278	6.8%	156.7	4033	3.3%
JFKTPP	161.8	179.1	17236	10.7%	167.6	5769	3.6%	LIRLAX	160.5	167.6	7074	4.7%	156.7	-3822	-2.1%
JFKUVF	155.2	163.1	7856	5.5%	156.7	1500	1.4%	LIRMSP	162.9	164.7	1845	1.6%	156.7	-6175	-3.3%
JFKYVR	167.2	168.7	1588	1.0%	156.7	-10452	-6.2%	MBJATL	151.2	147.9	-3327	-2.1%	139.2	-12042	-7.9%
LASATL	156.3	159.5	3146	2.2%	156.7	386	0.5%	MBJJFK	154.4	153.4	-981	-0.4%	145.5	-8916	-5.6%
LASBOS	152.4	167.7	15297	10.4%	156.7	4338	3.1%	MCISLC	138.3	146.6	8217	6.3%	139.2	867	1.0%
LASCVG	151.2	158.6	7326	5.2%	145.5	-5741	-3.5%	MCOATL	143.8	140.7	-3094	-2.1%	133.3	-10518	-7.3%

TABLE 8

B737-800 TABULAR RESULTS

APRPTS	AVG_GWT	REG_ALL	REG_DF	%REG_DF	AEDT	AEDT_DF	%AEDT_DF	APRPTS	AVG_GWT	REG_ALL	REG_DF	%REG_DF	AEDT	AEDT_DF	%AEDT_DF
MCOBOS	149.2	150.0	795	0.6%	139.2	-10000	-6.6%	MSPSEA	158.5	152.9	-5582	-3.4%	145.5	-12984	-8.1%
MCOCVG	141.3	145.3	3993	3.1%	139.2	-2100	-1.2%	MSPSFO	156.9	155.4	-1518	-0.8%	145.5	-11375	-7.1%
MCODTW	149.8	147.9	-1952	-1.2%	139.2	-10633	-7.0%	MSPSLC	150.5	147.6	-2868	-1.8%	139.2	-11287	-7.4%
MCOJFK	147.0	147.7	731	0.7%	139.2	-7773	-5.1%	MSPSTL	137.3	140.6	3332	2.8%	133.3	-3963	-2.6%
MCOLAX	167.8	164.2	-3648	-2.1%	156.7	-11124	-6.6%	MSPTPA	148.9	151.7	2821	2.1%	145.5	-3375	-2.1%
MCOLGA	137.0	147.8	10778	8.3%	139.2	2200	2.0%	MSPYVR	152.7	153.4	654	0.5%	145.5	-7223	-4.7%
MCOMSP	152.4	152.4	40	0.1%	145.5	-6895	-4.4%	MSYATL	141.6	139.8	-1743	-1.0%	133.3	-8256	-5.6%
MCOSLC	162.8	160.5	-2280	-1.3%	156.7	-6050	-3.6%	MSYDTW	146.9	146.3	-616	-0.3%	139.2	-7717	-5.2%
MDWMSP	124.5	136.5	11996	9.9%	133.3	8762	7.3%	MSYJFK	148.2	149.6	1404	1.1%	145.5	-2700	-1.6%
MEMATL	139.5	139.2	-267	0.0%	133.3	-6178	-4.2%	MSYLAX	147.8	155.9	8121	6.1%	145.5	-2292	-1.0%
MEMLAS	138.6	153.2	14596	11.2%	145.5	6853	5.6%	MSYMSP	145.4	147.8	2392	1.9%	139.2	-6167	-4.0%
MEMLAX	146.5	155.9	9353	6.7%	145.5	-1009	-0.4%	MZTLAX	131.0	147.1	16051	12.9%	139.2	8200	6.9%
MEXATL	149.0	152.6	3603	2.6%	145.5	-3541	-2.2%	NASJFK	143.2	149.3	6101	4.5%	139.2	-3967	-2.5%
MEXDTW	144.8	159.0	14190	10.1%	156.7	11922	8.5%	NCAATL	158.5	145.0	-13529	-8.4%	139.2	-19300	-12.1%
MEXJFK	151.7	162.5	10798	7.1%	156.7	5033	3.3%	NCAJFK	160.5	147.4	-13133	-8.1%	145.5	-15000	-9.2%
MIAATL	145.4	143.8	-1519	-0.9%	139.2	-6154	-4.1%	NCALGA	159.3	147.5	-11764	-7.3%	145.5	-13750	-8.6%
MIADTW	151.7	150.9	-738	-0.3%	139.2	-12486	-8.1%	OAKSLC	135.6	142.2	6597	5.1%	139.2	3612	2.9%
MIAJFK	148.8	150.2	1429	1.2%	139.2	-9604	-6.2%	OMAATL	139.9	144.5	4541	3.4%	139.2	-738	-0.4%
MIALAX	162.1	166.4	4348	2.9%	156.7	-5375	-3.1%	OMAMSP	136.8	137.5	678	0.7%	133.3	-3521	-2.4%
MKEDTW	143.7	137.2	-6430	-4.1%	133.3	-10379	-6.9%	ONTSLC	136.1	142.8	6687	5.1%	133.3	-2771	-1.8%
MKEMSP	138.8	138.0	-743	-0.4%	133.3	-5466	-3.8%	ORDATL	138.2	143.9	5657	4.3%	139.2	960	0.9%
MPRLAX	148.3	146.2	-2046	-1.3%	145.5	-2750	-1.8%	ORDDTW	143.0	139.1	-3895	-2.7%	133.3	-9700	-6.7%
MSOATL	154.2	156.9	2717	1.8%	156.7	2500	1.7%	ORDMSP	140.1	140.4	260	0.5%	133.3	-6825	-4.6%
MSPANC	171.9	167.4	-4525	-2.6%	156.7	-15205	-8.8%	PAPATL	150.3	150.8	444	0.5%	145.5	-4833	-3.0%
MSPATL	150.3	146.5	-3735	-2.4%	139.2	-11067	-7.3%	PAPJFK	151.4	153.9	2507	2.0%	145.5	-5911	-3.5%
MSPAUS	139.1	148.3	9185	6.8%	139.2	112	0.3%	PDXATL	162.7	163.0	264	0.2%	156.7	-6009	-3.6%
MSPBOI	152.6	149.6	-3003	-1.8%	139.2	-13371	-8.6%	PDXDTW	160.4	160.1	-310	-0.1%	156.7	-3741	-2.2%
MSPBOS	151.7	149.3	-2338	-1.4%	139.2	-12483	-8.1%	PDXJFK	165.8	166.6	780	0.5%	156.7	-9124	-5.4%
MSPCMH	139.6	142.9	3319	2.5%	139.2	-383	-0.1%	PDXMSP	154.0	153.3	-637	-0.2%	145.5	-8453	-5.3%
MSPCUN	159.0	156.6	-2453	-1.5%	145.5	-13515	-8.5%	PDXSLC	143.2	143.0	-192	0.1%	139.2	-4011	-2.6%
MSPCZM	152.3	157.0	4723	3.6%	145.5	-6786	-4.0%	PHLATL	146.6	143.2	-3414	-2.3%	139.2	-7400	-5.0%
MSPDCA	144.5	146.8	2360	1.9%	139.2	-5285	-3.4%	PHLDTW	145.3	140.4	-4877	-3.2%	133.3	-12010	-8.1%
MSPDEN	151.0	143.6	-7416	-4.8%	139.2	-11817	-7.7%	PHXATL	153.0	155.6	2590	2.0%	145.5	-7511	-4.6%
MSPDTW	143.9	141.6	-2246	-1.4%	133.3	-10583	-7.2%	PHXDTW	157.3	156.7	-619	-0.3%	145.5	-11807	-7.4%
MSPFSD	140.8	137.4	-3434	-2.3%	133.3	-7486	-5.1%	PHXJFK	159.6	162.9	3282	2.3%	156.7	-2940	-1.6%
MSPIND	134.0	141.3	7310	5.7%	133.3	-700	-0.3%	PHXLAX	139.0	139.9	827	0.8%	133.3	-5745	-3.9%
MSPJFK	144.2	148.1	3888	3.0%	139.2	-5022	-3.2%	PHXMSP	152.2	151.6	-639	-0.3%	145.5	-6722	-4.3%
MSPLAS	154.0	151.6	-2410	-1.5%	145.5	-8516	-5.5%	PHXSLC	142.3	141.6	-618	-0.3%	133.3	-8962	-6.2%
MSPLAX	155.6	154.7	-939	-0.5%	145.5	-10096	-6.4%	PLSJFK	142.0	149.6	7646	5.9%	145.5	3547	3.0%
MSPLGA	147.3	148.0	672	0.6%	139.2	-8133	-5.4%	PTYATL	157.9	156.5	-1395	-0.7%	145.5	-12389	-7.7%
MSPLIR	165.4	165.9	462	0.6%	156.7	-8744	-5.0%	PUJATL	156.5	152.9	-3549	-2.2%	145.5	-10980	-7.0%
MSPMCO	148.1	151.7	3598	2.5%	145.5	-2643	-1.8%	PUJJFK	156.0	154.4	-1582	-0.8%	145.5	-10531	-6.6%
MSPMDW	127.7	139.3	11602	9.3%	133.3	5586	4.6%	PVRATL	150.6	154.5	3895	2.9%	145.5	-5100	-3.1%
MSPMKE	134.3	138.6	4374	3.6%	133.3	-972	-0.4%	PVRDTW	144.2	159.7	15482	11.3%	156.7	12524	9.2%
MSPMSY	141.2	148.2	7066	5.5%	139.2	-1978	-1.0%	PVRJFK	155.1	164.2	9052	6.4%	156.7	1600	1.6%
MSPOMA	138.9	138.5	-402	-0.2%	133.3	-5555	-3.9%	PVRLAX	144.8	150.1	5342	4.2%	145.5	737	1.0%
MSPORD	142.7	139.1	-3611	-2.4%	133.3	-9433	-6.5%	PVRSEA	158.1	161.2	3135	2.1%	156.7	-1400	-0.7%
MSPPDX	156.5	153.2	-3222	-1.9%	145.5	-10965	-6.8%	RDUATL	141.1	138.8	-2301	-1.5%	133.3	-7816	-5.4%
MSPPHX	153.4	151.3	-2050	-1.3%	145.5	-7859	-5.0%	RDULAS	146.5	160.4	13954	9.9%	156.7	10248	7.4%
MSPRDU	142.0	147.5	5485	4.1%	139.2	-2800	-1.8%	RDULAX	159.3	163.2	3847	2.7%	156.7	-2611	-1.3%
MSPSAN	156.6	154.6	-1990	-1.2%	145.5	-11103	-7.0%	RDUMSP	142.7	150.7	8034	5.9%	145.5	2816	2.2%

TABLE 9

B737-800 TABULAR RESULTS

APRPTS	AVG_GWT	REG_ALL	REG_DF	%REG_DF	AEDT	AEDT_DF	%AEDT_DF	APRPTS	AVG_GWT	REG_ALL	REG_DF	%REG_DF	AEDT	AEDT_DF	%AEDT_DF
RDUSLC	155.8	157.8	2032	1.6%	156.7	931	0.9%	SLCDCA	154.6	159.1	4468	3.0%	156.7	2114	1.5%
RNOSLC	135.8	139.9	4108	3.2%	133.3	-2521	-1.7%	SLCDFW	146.5	147.9	1424	1.2%	139.2	-7269	-4.8%
ROCATL	160.6	142.6	-17957	-11.1%	139.2	-21400	-13.2%	SLCDTW	154.5	154.3	-260	-0.1%	145.5	-9022	-5.7%
RSWATL	139.0	142.2	3156	2.5%	133.3	-5700	-3.9%	SLCGEG	144.9	142.2	-2754	-1.8%	133.3	-11633	-7.9%
RSWDTW	152.0	149.5	-2478	-1.6%	139.2	-12800	-8.3%	SLCJFK	159.5	160.8	1309	1.0%	156.7	-2830	-1.6%
RTBATL	149.0	147.8	-1203	-0.7%	145.5	-3500	-2.3%	SLCLAS	138.5	139.9	1371	1.2%	133.3	-5187	-3.5%
SALATL	152.2	152.9	722	1.1%	145.5	-6700	-3.8%	SLCLAX	144.2	142.7	-1492	-0.9%	139.2	-5022	-3.3%
SALLAX	160.7	164.6	3898	2.8%	156.7	-3960	-2.1%	SLCMCI	141.1	147.0	5938	4.4%	139.2	-1863	-1.1%
SANDTW	160.9	159.2	-1742	-1.0%	156.7	-4219	-2.6%	SLCMCO	160.2	160.1	-168	-0.1%	156.7	-3548	-2.2%
SANJFK	161.5	165.5	3994	2.6%	156.7	-4807	-2.9%	SLCMSP	146.4	147.9	1511	1.4%	139.2	-7212	-4.6%
SANMSP	153.6	153.7	92	0.2%	145.5	-8094	-5.2%	SLCOAK	139.5	142.7	3245	2.6%	139.2	-270	0.1%
SANSEA	142.9	147.5	4529	3.4%	139.2	-3738	-2.4%	SLCONT	140.9	142.3	1405	1.3%	133.3	-7623	-5.1%
SANSLC	141.6	142.0	370	0.5%	139.2	-2406	-1.5%	SLCPDX	146.1	143.3	-2818	-1.8%	139.2	-6869	-4.6%
SATATL	142.5	144.6	2056	1.6%	139.2	-3300	-2.2%	SLCPHX	139.6	141.7	2111	1.7%	133.3	-6262	-4.3%
SATJFK	147.7	153.8	6066	4.4%	145.5	-2201	-1.2%	SLCRDU	156.3	158.7	2396	1.6%	156.7	400	0.3%
SATSLC	148.3	147.3	-992	-0.4%	139.2	-9086	-5.9%	SLCRNO	139.9	140.6	704	0.6%	133.3	-6568	-4.6%
SDFATL	138.5	139.5	1075	1.0%	133.3	-5167	-3.5%	SLCSAN	142.7	143.2	500	0.6%	139.2	-3506	-2.2%
SDQATL	158.0	152.8	-5182	-3.2%	145.5	-12519	-7.8%	SLCSAT	149.4	149.2	-286	0.0%	139.2	-10244	-6.7%
SDQJFK	155.4	154.9	-463	0.2%	145.5	-9869	-5.8%	SLCSEA	145.5	144.0	-1476	-0.7%	139.2	-6286	-4.1%
SEAANC	151.2	154.1	2983	2.4%	145.5	-5656	-3.4%	SLCSFO	140.0	142.8	2800	2.4%	139.2	-849	-0.2%
SEAATL	166.2	163.6	-2603	-1.5%	156.7	-9520	-5.7%	SLCSJC	140.6	142.7	2046	1.8%	139.2	-1425	-0.7%
SEACVG	156.3	160.8	4456	3.1%	156.7	351	0.4%	SLCSMF	141.5	142.0	445	0.3%	133.3	-8241	-5.8%
SEADTW	160.4	160.3	-111	0.0%	156.7	-3740	-2.2%	SLPATL	157.3	150.1	-7178	-4.5%	145.5	-11773	-7.4%
SEAJFK	167.7	166.7	-983	-0.5%	156.7	-10996	-6.5%	SLPLAX	162.9	150.9	-12029	-7.1%	145.5	-17382	-10.4%
SEALAS	136.0	146.6	10571	8.4%	139.2	3161	2.9%	SMFATL	161.8	160.4	-1383	-0.8%	156.7	-5118	-3.1%
SEALAX	148.4	147.7	-619	-0.2%	139.2	-9159	-5.9%	SMFMSP	156.3	153.0	-3324	-2.1%	145.5	-10833	-6.9%
SEAMSP	155.7	153.5	-2240	-1.3%	145.5	-10239	-6.5%	SMFSLC	141.8	140.3	-1586	-1.1%	133.3	-8544	-6.0%
SEAPVR	155.6	162.3	6642	4.7%	156.7	1064	1.1%	SRQATL	141.7	139.7	-1992	-1.3%	133.3	-8377	-5.8%
SEASAN	148.7	149.0	267	0.4%	139.2	-9523	-6.2%	STIJFK	152.6	152.4	-215	0.4%	145.5	-7117	-4.1%
SEASLC	144.6	144.3	-306	0.0%	139.2	-5409	-3.5%	STLATL	141.9	141.1	-798	-0.4%	133.3	-8600	-5.9%
SFOATL	155.2	163.1	7896	5.5%	156.7	1510	1.4%	STLMSP	134.2	140.6	6415	5.2%	133.3	-911	-0.2%
SFOCVG	156.8	161.7	4948	3.5%	156.7	-100	0.2%	TPAATL	144.8	140.1	-4653	-3.2%	133.3	-11487	-7.9%
SFODTW	162.6	162.3	-334	-0.1%	156.7	-5932	-3.6%	TPACVG	145.1	144.9	-235	0.1%	139.2	-5915	-3.9%
SFOMSP	156.9	156.0	-909	-0.5%	145.5	-11384	-7.2%	TPADTW	144.9	147.6	2714	2.2%	139.2	-5675	-3.6%
SFOSLC	135.2	143.2	7942	6.4%	139.2	3980	3.4%	TPAJFK	142.8	147.9	5038	3.9%	139.2	-3633	-2.2%
SJCATL	160.6	162.2	1658	1.1%	156.7	-3883	-2.3%	TPALAX	163.3	162.8	-549	-0.2%	156.7	-6630	-3.9%
SJCSLC	138.8	142.4	3650	2.8%	139.2	414	0.5%	TPPATL	151.4	169.6	18166	12.3%	156.7	5257	3.7%
SJDATL	153.0	156.0	2994	2.1%	145.5	-7549	-4.8%	TPPJFK	155.1	175.2	20148	13.2%	167.6	12500	8.3%
SJOATL	156.4	154.9	-1490	-0.7%	145.5	-10930	-6.7%	UVFATL	162.2	159.7	-2505	-1.3%	156.7	-5463	-3.2%
SJUATL	159.7	154.5	-5211	-3.2%	145.5	-14217	-8.9%	UVFJFK	149.3	159.6	10314	7.7%	156.7	7400	5.8%
SJUJFK	153.8	155.2	1345	1.3%	145.5	-8315	-5.0%	YVRDTW	160.6	160.6	-7	0.2%	156.7	-3871	-2.3%
SKBATL	148.4	155.4	7004	4.9%	156.7	8271	5.8%	YVRJFK	162.2	166.9	4661	3.0%	156.7	-5498	-3.3%
SLCABQ	126.4	141.5	15080	12.1%	133.3	6900	5.6%	YVRMSP	150.8	153.8	2914	2.1%	145.5	-5350	-3.4%
SLCANC	161.6	162.6	955	1.1%	156.7	-4925	-2.6%	ZIHLAX	135.0	153.0	17985	14.0%	145.5	10459	8.4%
SLCATL	158.1	155.7	-2402	-1.4%	145.5	-12578	-7.9%	ZLOLAX	130.4	149.7	19302	15.4%	145.5	15100	12.1%
SLCBIL	138.2	140.1	1884	1.7%	133.3	-4942	-3.3%								
SLCBOI	139.0	138.9	-139	0.1%	133.3	-5700	-3.9%								
SLCBOS	161.3	162.3	1062	0.7%	156.7	-4565	-2.8%								
SLCBWI	157.8	159.2	1439	1.0%	156.7	-1078	-0.6%								
SLCBZN	141.6	139.6	-1981	-1.2%	133.3	-8271	-5.6%								
SLCCVG	155.0	153.9	-1144	-0.7%	145.5	-9504	-6.1%								

TABLE 10

B767-300ER/CF680C2/B6F

Takeoff Weight Determination:

Specifics of the Flight Planning Database:

- 15,956 Flights
- 185 Routes Departing 53 Airports
- 179 "Tankered" Flights
    - 12,914lbs. Average
    - 1877 NM Average Trip
- Added Airport Elevation, Runway Length, and GCD for each Airport/Flight

As with the previous aircraft, multiple linear regressions on the database were conducted in a stepwise method using independent variables: runway length, airport elevation, and either GCD or Planned Distance. The regressions were applied to the total database of individual flights and repeated with an "average" database that contained the average data for each route and in the case of Planned Distance, the average planned distance.

The statistical summary of the GCD and Planned Distance regressions are as follows:

B767-300ER Planned Distance with All Flight Data:

Model Summary[c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.834[a]	.695	.695	16320.834
2	.835[b]	.697	.697	16257.502

a. Predictors: (Constant), PLN_DIST

b. Predictors: (Constant), PLN_DIST, RWYL

c. Dependent Variable: ACT_GWT

B767-300ER Great Circle Distance with All Flight Data

Model Summary[c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.824[a]	.680	.680	16721.991
2	.825[b]	.681	.681	16677.780

a. Predictors: (Constant), GCD

b. Predictors: (Constant), GCD, RWYL

c. Dependent Variable: ACT_GWT

B767-300ER Planned Distance with Average Route Data

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.928[a]	.861	.860	11798.1594128

a. Predictors: (Constant), AVG_PLND

b. Dependent Variable: AVG_GWT

B767-300ER Great Circle Distance with Average Route Data

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.907[a]	.822	.819	13417.6824909

a. Predictors: (Constant), GCD, RWYL, ELEV

b. Dependent Variable: AVG_GWT

The analysis of this aircraft revealed a number of issues to be addressed. It was the first analysis where the regression with the Planned Distance produced a slightly better correlation with the average route data than did the Great Circle Distance. The Great Circle Distance is a fixed number and can be readily obtained from a number of different sources. The Planned Distance, while also available to the user, can vary with each flight as a result of approved routes and/or changing wind patterns. To effectively use the Planned Distance an "accumulation" of these distances is required.

In an effort to remain consistent with regard to the input required for weight estimation, the absolute differences resulting from both regressions were compared to the ACARS database, and the results are shown in Chart 3 below. The maximum difference of 4000 lbs. on 19 of the 185 routes in the database was considered acceptable for the continued use of the GCD.

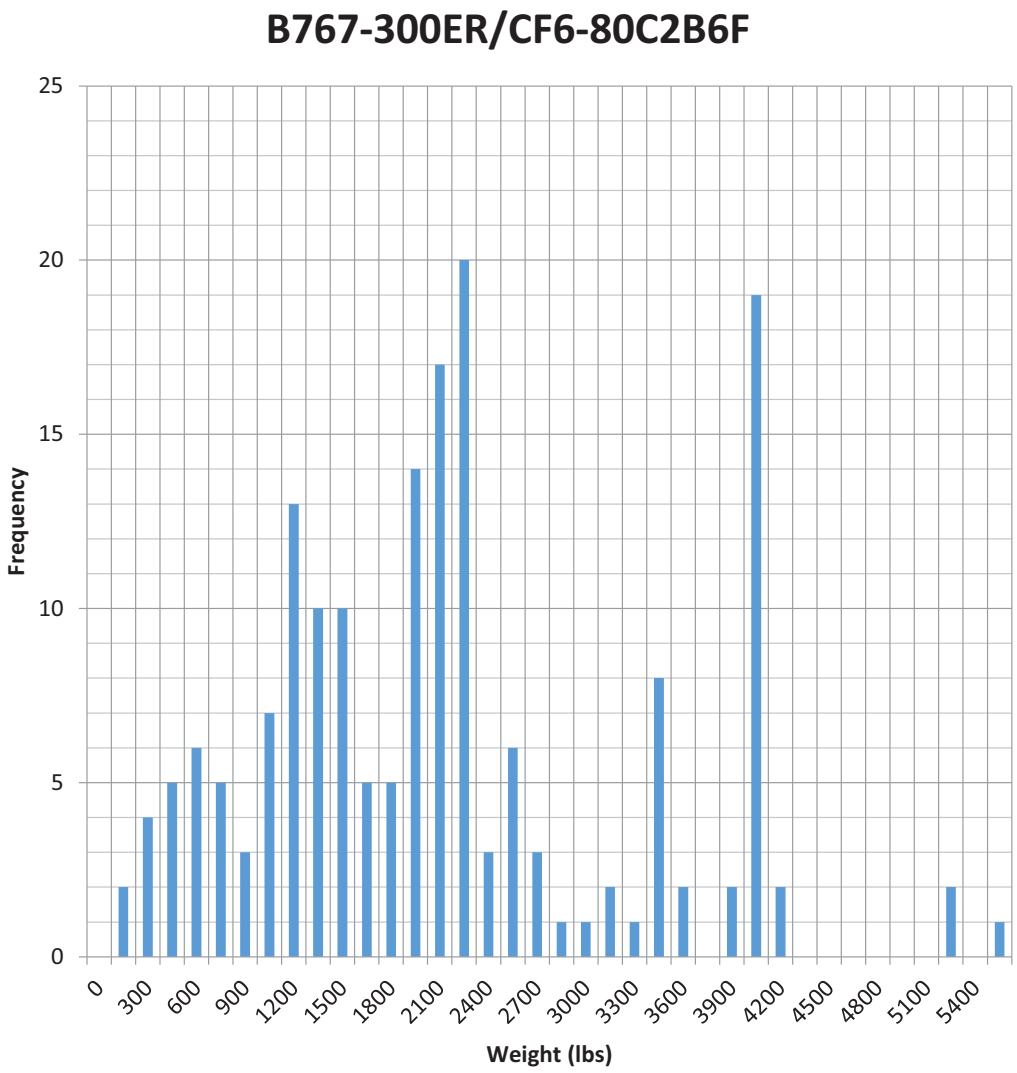


CHART 3

As mentioned, there were other issues requiring attention. The current AEDT Stage Length database does not have weight data for the GE powered B767-300ER. The database only has the PW powered B767-300 and the GE powered B767-400ER. The B767-300ER has a maximum takeoff weight of approximately 55,000 lbs. more than the B767-300 and, depending on variant, a range slightly over 5500 nautical miles. This range is a stage length 8 in the AEDT but there are no stage length 8 weights, the maximum stage length provided is 7; a 4500 to 5500 nautical mile trip.

Maintaining the consistency of using GCD as discussed above, the takeoff weight estimation for the B767-300ER/CF80C2/B6F is:

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.907[a]	.822	.819	13417.6824909

a. Predictors: (Constant), GCD, RWYL, ELEV

b. Dependent Variable: AVG_GWT

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	260913.478	10636.292		24.530	.000
	ELEV	.716	1.320	.017	.542	.588
	RWYL	1.247	.816	.048	1.528	.128
	GCD	24.520	.850	.905	28.842	.000

a. Dependent Variable: AVG_GWT

$$GWT = 260913.478 + .716(ELEV) + 1.247(RUNWAY\ LEN) + 24.520(GCD)$$

Figures 10, 11, and 12 below address the issue of the AEDT Stage Length weights discussed and present a graphical representation of the regression. Tabular results comparing the regression and the Average Route data follow in Tables 11 and 12.

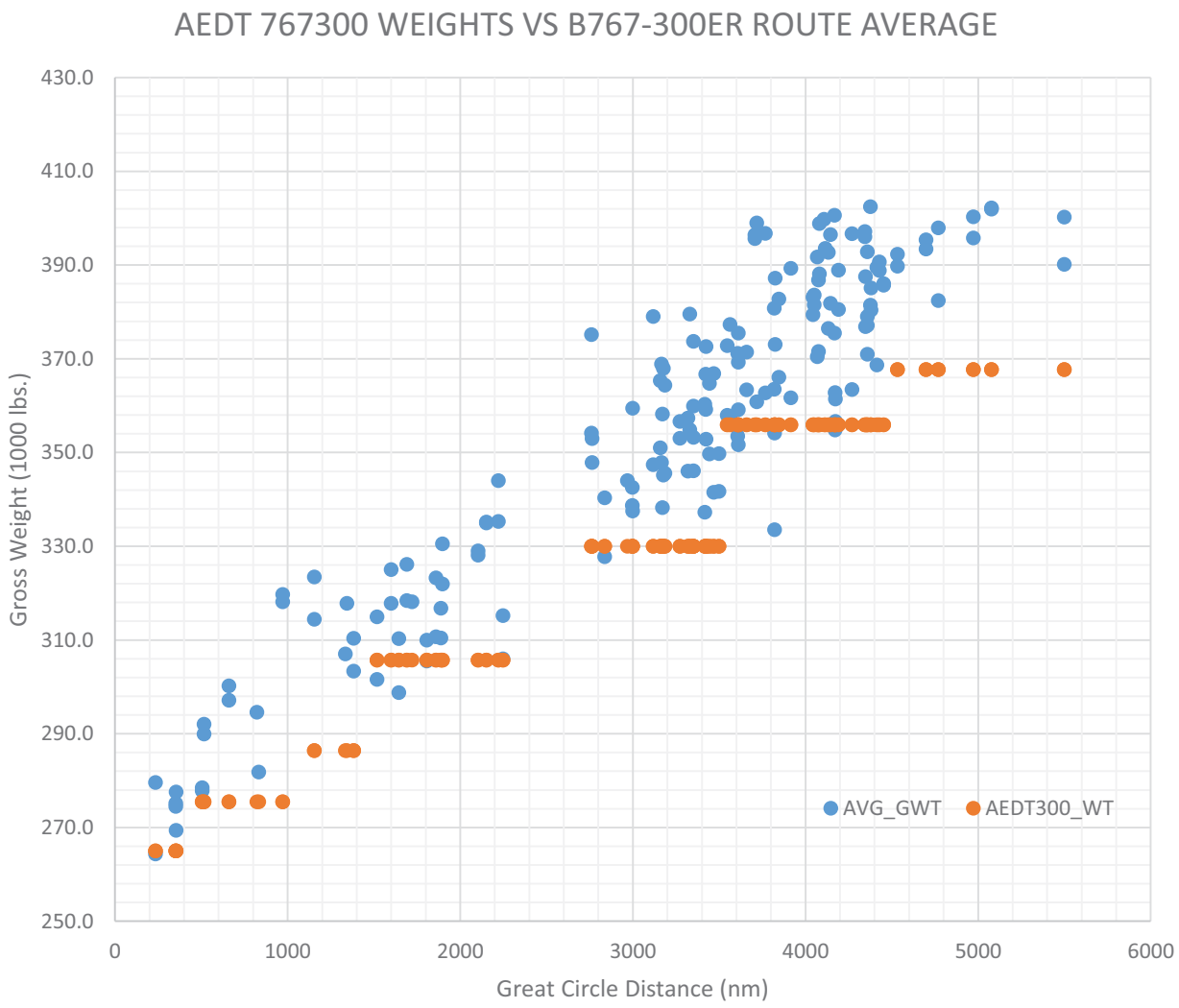


FIGURE 10

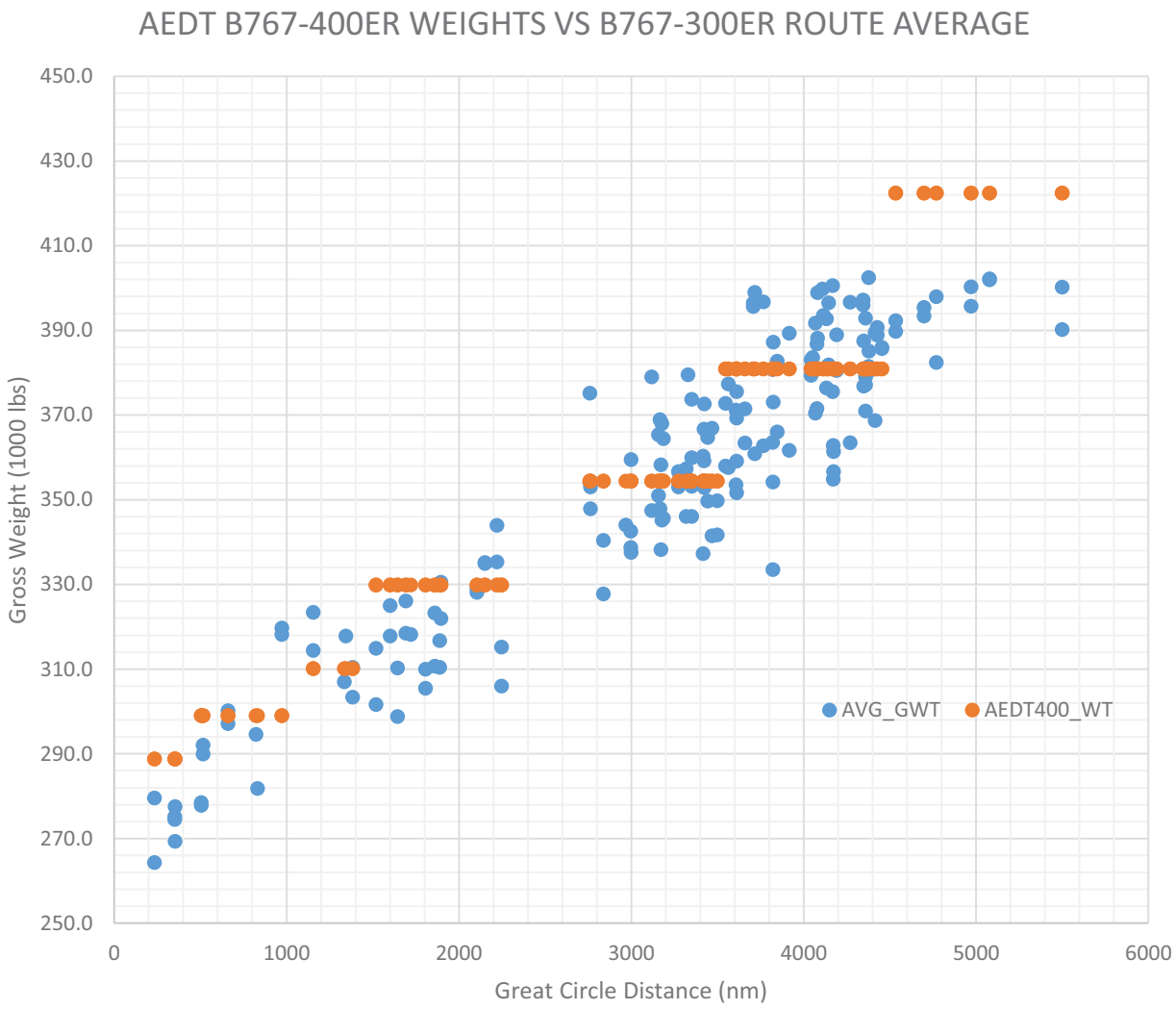

AEDT B767-400ER WEIGHTS VS B767-300ER ROUTE AVERAGE
Gross Weight (1000 lbs)
450.0
430.0
410.0
390.0
370.0
350.0
330.0
310.0
290.0
270.0
250.0
0
1000
2000
3000
4000
5000
6000
Great Circle Distance (nm)
AVG_GWT
AEDT400_WT

FIGURE 11

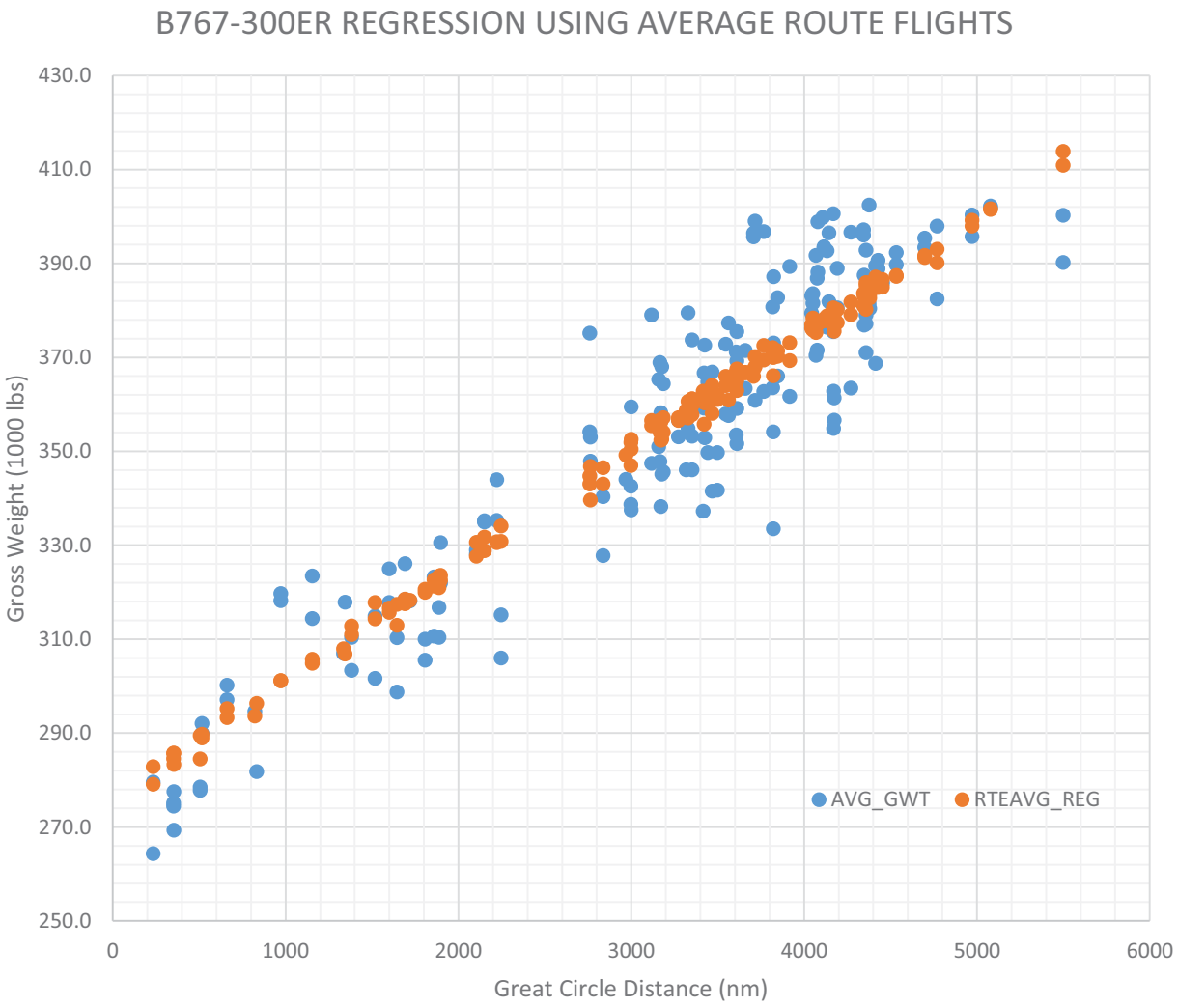

B767-300ER REGRESSION USING AVERAGE ROUTE FLIGHTS
Gross Weight (1000 lbs)
430.0
410.0
390.0
370.0
350.0
330.0
310.0
290.0
270.0
250.0
0
1000
2000
3000
4000
5000
6000
Great Circle Distance (nm)
AVG_GWT
RTEAVG_REG

FIGURE 12

B767-300ER TABULAR RESULTS

ROUTE	AVGWT	REG_WGT	REG_DIF	REG_%	AED_WGT	AED_DIF	AED_%		ROUTE	AVGWT	REG_WGT	REG_DIF	REG_%	AED_WGT	AED_DIF	AED_%
AMSATL	387.2	370.2	-16989	-4.3%	355.9	-31305	-8.0%		CDGDTW	364.8	362.9	-1889	-0.4%	330.0	-34750	-9.4%
AMSBOM	395.7	367.3	-28319	-7.1%	355.9	-39767	-10.0%		CDGEWR	358.2	356.2	-2034	-0.4%	330.0	-28226	-7.8%
AMSDTW	372.6	360.4	-12207	-3.1%	330.0	-42615	-11.3%		CDGJFK	365.3	355.9	-9460	-2.6%	330.0	-35333	-9.6%
AMSEWR	368.0	354.4	-13638	-3.5%	330.0	-37990	-10.2%		CDGORD	371.2	366.9	-4247	-0.8%	355.9	-15254	-3.8%
AMSJFK	368.9	354.1	-14823	-3.9%	330.0	-38905	-10.5%		CDGSEA	379.0	385.3	6312	1.8%	355.9	-23109	-6.0%
AMSPDX	387.5	383.1	-4474	-1.0%	355.9	-31638	-8.1%		CDGSLC	389.5	386.7	-2830	-0.7%	355.9	-33600	-8.6%
ANCATL	344.0	349.2	5209	1.6%	330.0	-14000	-4.0%		CPHJFK	359.9	357.8	-2108	-0.5%	330.0	-29929	-8.2%
ATLAMS	373.1	370.9	-2188	-0.5%	355.9	-17151	-4.5%		CVGCDG	351.7	365.1	13402	4.1%	355.9	4241	1.5%
ATLBRU	366.0	371.4	5353	1.6%	355.9	-10150	-2.7%		DTWAMS	352.9	360.3	7433	2.3%	330.0	-22867	-6.3%
ATLCDG	363.5	370.7	7209	2.1%	355.9	-7631	-2.0%		DTWATL	292.0	289.0	-3048	-0.9%	275.5	-16543	-5.6%
ATLDTW	290.0	289.8	-208	0.1%	275.5	-14459	-4.8%		DTWCDG	349.7	360.8	11051	3.2%	330.0	-19714	-5.6%
ATLDUB	359.2	361.0	1785	0.6%	330.0	-29221	-8.0%		DTWGRU	390.7	384.9	-5797	-1.3%	355.9	-34790	-8.8%
ATLDUS	361.7	373.1	11445	3.3%	355.9	-5774	-1.5%		DTWLHR	353.1	356.6	3538	1.1%	330.0	-23059	-6.4%
ATLEZE	396.0	383.6	-12410	-3.1%	355.9	-40124	-10.1%		DTWSFO	310.0	320.6	10626	3.5%	305.7	-4300	-1.4%
ATLFCO	381.5	384.4	2945	0.8%	355.9	-25553	-6.7%		DUBATL	366.7	355.8	-10917	-2.9%	330.0	-36700	-9.9%
ATLFLL	277.8	289.5	11663	4.2%	275.5	-2318	-0.8%		DUBJFK	353.0	339.6	-13375	-3.7%	330.0	-23000	-6.4%
ATLGIG	393.6	378.0	-15568	-3.9%	355.9	-37667	-9.5%		DUSATL	389.3	369.3	-20009	-5.1%	355.9	-33421	-8.5%
ATLGRU	383.1	376.2	-6880	-1.6%	355.9	-27213	-6.9%		EWRAMS	345.2	352.5	7388	2.3%	330.0	-15155	-4.2%
ATLJAX	279.6	282.8	3236	1.4%	265.0	-14600	-5.0%		EWRCDG	338.2	352.4	14159	4.4%	330.0	-8236	-2.3%
ATLJFK	300.2	293.3	-6915	-2.1%	275.5	-24696	-8.1%		EZEATL	397.2	381.0	-16187	-4.0%	355.9	-41265	-10.3%
ATLLAS	314.9	314.3	-603	0.1%	305.7	-9223	-2.6%		FCOATL	402.4	384.2	-18246	-4.5%	355.9	-46526	-11.5%
ATLLAX	326.1	318.6	-7557	-2.2%	305.7	-20418	-6.2%		FCOJFK	399.0	368.0	-30980	-7.7%	355.9	-43100	-10.8%
ATLLHR	363.4	366.8	3413	1.1%	355.9	-7504	-1.9%		FLLATL	278.5	284.5	6028	2.4%	275.5	-3000	-0.9%
ATLLIM	354.2	344.8	-9385	-2.6%	330.0	-24159	-6.8%		FRAJFK	373.7	359.7	-14037	-3.7%	330.0	-43742	-11.6%
ATLLOS	401.9	401.6	-332	0.0%	367.7	-34243	-8.5%		FUKHNL	333.5	366.1	32569	10.0%	355.9	22387	6.9%
ATLMAD	362.8	369.5	6715	1.9%	355.9	-6850	-1.8%		GIGATL	393.3	378.2	-15093	-3.7%	355.9	-37390	-9.4%
ATLMAN	357.6	364.4	6805	2.0%	355.9	-1734	-0.4%		GRUATL	379.4	376.9	-2447	-0.5%	355.9	-23494	-6.1%
ATLMCO	275.1	285.7	10576	3.9%	265.0	-10129	-3.6%		GRUDTW	388.9	386.4	-2504	-0.5%	355.9	-32967	-8.3%
ATLMUC	375.5	379.3	3784	1.1%	355.9	-19614	-5.1%		HKGNRT	325.0	315.7	-9288	-2.8%	305.7	-19300	-5.9%
ATLMXP	376.4	378.4	1978	0.6%	355.9	-20538	-5.4%		HNDLAX	382.4	390.1	7705	2.1%	367.7	-14734	-3.8%
ATLPDX	316.8	323.4	6627	2.2%	305.7	-11065	-3.4%		HNDSEA	356.6	375.5	18917	5.5%	355.9	-732	0.0%
ATLSAN	310.3	317.4	7115	2.3%	305.7	-4594	-1.4%		HNLFUK	354.2	370.0	15812	4.6%	355.9	1746	0.6%
ATLSCL	388.1	377.1	-11005	-2.8%	355.9	-32245	-8.3%		HNLLAX	335.3	330.7	-4578	-1.3%	305.7	-29613	-8.8%
ATLSEA	330.5	323.6	-6945	-2.0%	305.7	-24834	-7.4%		HNLNGO	349.8	362.0	12280	3.6%	330.0	-19766	-5.5%
ATLSFO	323.2	322.7	-554	0.0%	305.7	-17535	-5.2%		HNLNRT	357.3	357.6	292	0.2%	330.0	-27341	-7.5%
ATLSLC	310.4	311.0	600	0.3%	286.4	-23985	-7.6%		ICNSEA	389.7	387.4	-2306	-0.6%	367.7	-22027	-5.6%
ATLSTR	370.4	376.8	6427	1.8%	355.9	-14519	-3.8%		ISTJFK	392.8	380.2	-12659	-3.2%	355.9	-36946	-9.3%
ATLTPA	277.5	285.8	8209	3.1%	265.0	-12545	-4.4%		JAXATL	264.3	279.1	14809	5.8%	265.0	667	0.5%
ATLVCE	363.5	381.8	18335	5.1%	355.9	-7564	-2.0%		JFKAMS	347.8	356.6	8807	2.6%	330.0	-17841	-5.0%
ATLZRH	371.6	377.0	5476	1.6%	355.9	-15666	-4.1%		JFKATL	297.1	295.2	-1944	-0.6%	275.5	-21645	-7.2%
BCNJFK	379.5	357.1	-22440	-5.8%	330.0	-49522	-13.0%		JFKBCN	354.8	360.6	5803	1.8%	330.0	-24842	-6.9%
BOMAMS	396.4	365.9	-30515	-7.7%	355.9	-40544	-10.2%		JFKBRU	345.6	357.1	11536	3.5%	330.0	-15603	-4.4%
BOSATL	294.6	293.7	-943	-0.1%	275.5	-19100	-6.3%		JFKCDG	351.0	356.5	5452	1.6%	330.0	-21000	-5.9%
BOSCDG	338.7	347.0	8273	2.5%	330.0	-8714	-2.5%		JFKCPH	346.1	361.2	15113	4.4%	330.0	-16071	-4.6%
BOSLHR	327.8	343.1	15263	4.9%	330.0	2198	0.9%		JFKDUB	347.9	346.8	-1100	-0.2%	330.0	-17867	-5.0%
BRUATL	382.7	370.2	-12490	-3.1%	355.9	-26823	-6.9%		JFKFCO	360.8	370.2	9326	2.6%	355.9	-4933	-1.3%
BRUJFK	364.4	354.1	-10340	-2.7%	330.0	-34390	-9.3%		JFKFRA	353.2	361.2	7979	2.4%	330.0	-23206	-6.4%
CDGATL	380.8	372.1	-8683	-2.2%	355.9	-24864	-6.4%		JFKIST	377.1	385.9	8770	2.5%	355.9	-21230	-5.5%
CDGBOS	342.6	351.9	9370	2.8%	330.0	-12556	-3.6%		JFKLAX	335.2	331.8	-3435	-0.9%	305.7	-29495	-8.7%
CDGCVG	369.3	367.0	-2273	-0.5%	355.9	-13354	-3.5%		JFKLHR	337.5	352.6	15023	4.6%	330.0	-7531	-2.1%

TABLE 11

B767-300ER TABULAR RESULTS

ROUTE	AVGWT	REG_WGT	REG_DIF	REG_%	AED_WGT	AED_DIF	AED_%		ROUTE	AVGWT	REG_WGT	REG_DIF	REG_%	AED_WGT	AED_DIF	AED_%
JFKMAD	347.4	355.5	8064	2.5%	330.0	-17407	-4.9%		SANATL	298.8	313.0	14173	4.8%	305.7	6914	2.3%
JFKNCE	341.5	364.1	22553	6.7%	330.0	-11500	-3.3%		SCLATL	398.9	377.6	-21266	-5.2%	355.9	-42981	-10.7%
JFKPRG	358.0	366.0	8040	2.3%	355.9	-2050	-0.5%		SEAATL	321.9	322.6	604	0.3%	305.7	-16250	-4.9%
JFKSEA	329.0	330.6	1608	0.6%	305.7	-23300	-7.0%		SEACDG	371.0	382.9	11956	3.4%	355.9	-15090	-3.9%
JFKSFO	315.2	334.1	18914	6.0%	305.7	-9500	-3.0%		SEAHND	361.4	378.4	17022	5.0%	355.9	-5489	-1.2%
JFKSVO	383.6	378.3	-5242	-1.3%	355.9	-27691	-7.2%		SEAICN	392.3	387.2	-5120	-1.3%	367.7	-24633	-6.3%
JFKTSE	390.2	413.9	23681	6.2%	367.7	-22472	-5.7%		SEAJFK	328.1	327.7	-455	-0.1%	305.7	-22409	-6.8%
JFKVCE	359.1	367.5	8418	2.4%	355.9	-3218	-0.8%		SEAKIX	385.1	383.4	-1697	-0.3%	355.9	-29234	-7.5%
JFKZRH	337.3	362.8	25517	7.8%	330.0	-7261	-2.0%		SEALHR	354.8	378.3	23508	6.8%	355.9	1071	0.5%
KIXSEA	380.4	382.6	2239	0.7%	355.9	-24486	-6.3%		SEANRT	396.5	377.7	-18825	-4.7%	355.9	-40600	-10.2%
LASATL	301.6	317.8	16168	5.4%	305.7	4075	1.4%		SEAPEK	395.4	391.3	-4128	-0.9%	367.7	-27687	-6.9%
LAXATL	318.4	317.5	-898	-0.2%	305.7	-12742	-4.0%		SEAPVG	395.7	398.0	2232	0.7%	367.7	-28046	-7.0%
LAXDTW	318.2	318.3	88	0.1%	305.7	-12467	-3.8%		SFOATL	310.7	321.3	10626	3.5%	305.7	-4982	-1.5%
LAXHND	397.9	393.0	-4929	-1.1%	367.7	-30246	-7.5%		SFODTW	305.5	320.0	14508	4.8%	305.7	200	0.1%
LAXHNL	344.0	330.5	-13439	-3.8%	305.7	-38279	-11.0%		SFOJFK	306.0	330.8	24821	8.2%	305.7	-300	0.0%
LAXJFK	335.0	328.8	-6148	-1.6%	305.7	-29271	-8.6%		SFONRT	385.7	384.9	-754	-0.1%	355.9	-29767	-7.6%
LHRATL	371.5	366.7	-4796	-1.1%	355.9	-15552	-4.0%		SJUATL	317.9	306.8	-11014	-3.1%	286.4	-31457	-9.6%
LHRBOS	340.4	346.5	6137	2.0%	330.0	-10364	-2.8%		SLCATL	303.4	312.8	9408	3.2%	286.4	-16985	-5.5%
LHRDTW	356.6	357.2	555	0.3%	330.0	-26636	-7.3%		SLCCDG	368.7	387.1	18431	5.2%	355.9	-12806	-3.3%
LHRJFK	359.5	350.5	-8993	-2.3%	330.0	-29466	-8.0%		STRATL	391.7	375.3	-16477	-4.2%	355.9	-35836	-9.1%
LHRSEA	362.8	379.2	16394	4.7%	355.9	-6916	-1.8%		SVOJFK	381.5	375.8	-5679	-1.3%	355.9	-25612	-6.6%
LIMATL	375.2	343.0	-32132	-8.5%	330.0	-45150	-12.0%		TPAATL	269.4	283.3	13944	5.4%	265.0	-4364	-1.4%
LOSATL	402.2	401.5	-714	-0.1%	367.7	-34491	-8.5%		TSEJFK	400.2	410.9	10667	2.7%	367.7	-32535	-8.1%
LOSSJU	399.8	377.7	-22108	-5.5%	355.9	-43900	-11.0%		TSEROB	294.3	393.9	99660	34.1%	367.7	73450	25.2%
MADATL	396.8	372.5	-24248	-6.1%	355.9	-40858	-10.3%		VCEATL	396.7	379.1	-17547	-4.4%	355.9	-40767	-10.2%
MADJFK	379.0	356.6	-22438	-5.8%	330.0	-49034	-12.8%		VCEJFK	375.5	362.9	-12563	-3.2%	355.9	-19600	-5.1%
MANATL	377.4	360.9	-16436	-4.3%	355.9	-21452	-5.6%		ZRHATL	386.8	377.0	-9808	-2.5%	355.9	-30917	-7.9%
MCOATL	274.5	284.6	10090	3.9%	265.0	-9469	-3.3%		ZRHJFK	360.3	360.8	521	0.3%	330.0	-30304	-8.3%
MCODTW	281.8	296.4	14553	5.2%	275.5	-6300	-2.2%									
MSPLAX	307.0	307.9	949	0.5%	286.4	-20600	-6.6%									
MUCATL	400.6	380.5	-20052	-5.0%	355.9	-44694	-11.1%									
MXPATL	392.7	378.8	-13902	-3.5%	355.9	-36819	-9.3%									
NCEJFK	366.9	358.1	-8807	-2.0%	330.0	-36875	-9.7%									
NGOHNL	341.7	361.0	19281	5.8%	330.0	-11733	-3.3%									
NRTHKG	317.8	316.6	-1193	-0.3%	305.7	-12100	-3.8%									
NRTHNL	346.0	358.7	12683	3.8%	330.0	-16049	-4.5%									
NRTPDX	380.5	380.1	-383	0.2%	355.9	-24621	-6.2%									
NRTPEK	314.4	305.7	-8722	-2.5%	286.4	-28017	-8.6%									
NRTPVG	318.2	301.2	-16974	-5.1%	275.5	-42682	-13.2%									
NRTSEA	381.8	379.0	-2848	-0.7%	355.9	-25933	-6.8%									
NRTSFO	386.0	386.6	562	0.2%	355.9	-30100	-7.7%									
ORDCDG	353.5	366.1	12571	3.7%	355.9	2400	0.8%									
PDXAMS	376.9	381.3	4398	1.4%	355.9	-20967	-5.4%									
PDXATL	310.4	320.9	10546	3.5%	305.7	-4700	-1.4%									
PDXNRT	388.9	377.4	-11510	-2.9%	355.9	-33025	-8.4%									
PEKNRT	323.4	304.9	-18566	-5.6%	286.4	-37029	-11.4%									
PEKSEA	393.4	391.7	-1654	-0.3%	367.7	-25691	-6.4%									
PRGJFK	372.8	364.0	-8822	-2.3%	355.9	-16900	-4.4%									
PVGNRT	319.7	301.1	-18594	-5.7%	275.5	-44214	-13.8%									
PVGSEA	400.3	399.2	-1113	-0.2%	367.7	-32613	-8.1%									
ROBTSE	275.5	392.5	116957	42.5%	367.7	92162	33.5%									

TABLE 12

SECTION II

REDUCED THRUST (USAGE AND LEVEL)

B757-200/PW2037

Reduced Power/Thrust Determination:

The initial ACARS database contained 91,519 departures, but was reduced, by a number of actions to 85,738 flights. Flights were removed from the database for the following reasons:

- Obvious data recording errors
- Missing essential data (aircraft weight, origin, destination, or de-rate)
- Charter, maintenance, or other non-revenue positioning flights
- An imposed minimum of 5 flights for any city pair (origin and destination)

In addition to the database edits above, there still remained a number of suspect entries for percent reduced thrust/power particularly at very low recorded percentage levels. To circumvent any potential problem with the validity of this data, a decision was made to only consider flights with recorded reduced thrust percentages greater or equal to one as being actual reduced thrust/power departures.

Specifics of the B757-200 ACARS Database:

- 85,738 Flights
- 412 Routes Departing 101 Airports
- 96% of All Departures Used Reduced Thrust/Power
- Average Reduced Thrust/Power was 15.3%

Chart 4 below, is a histogram of the B757-200 reduced thrust percentages, while Tables 13, 14, and 15 provide the average route data of actual weight and reduced thrust/power percentage. There was some concern regarding the increase in frequency at the 2% reduced power level, but the weight distribution shown in Chart 5, shows a step increase in the 220 to 225 thousand pound range. In this weight range, a 2% reduced thrust/power was accepted as correct considering the earlier discussion on pilot acceptance and air carrier implementation of reduced thrust/power takeoffs.

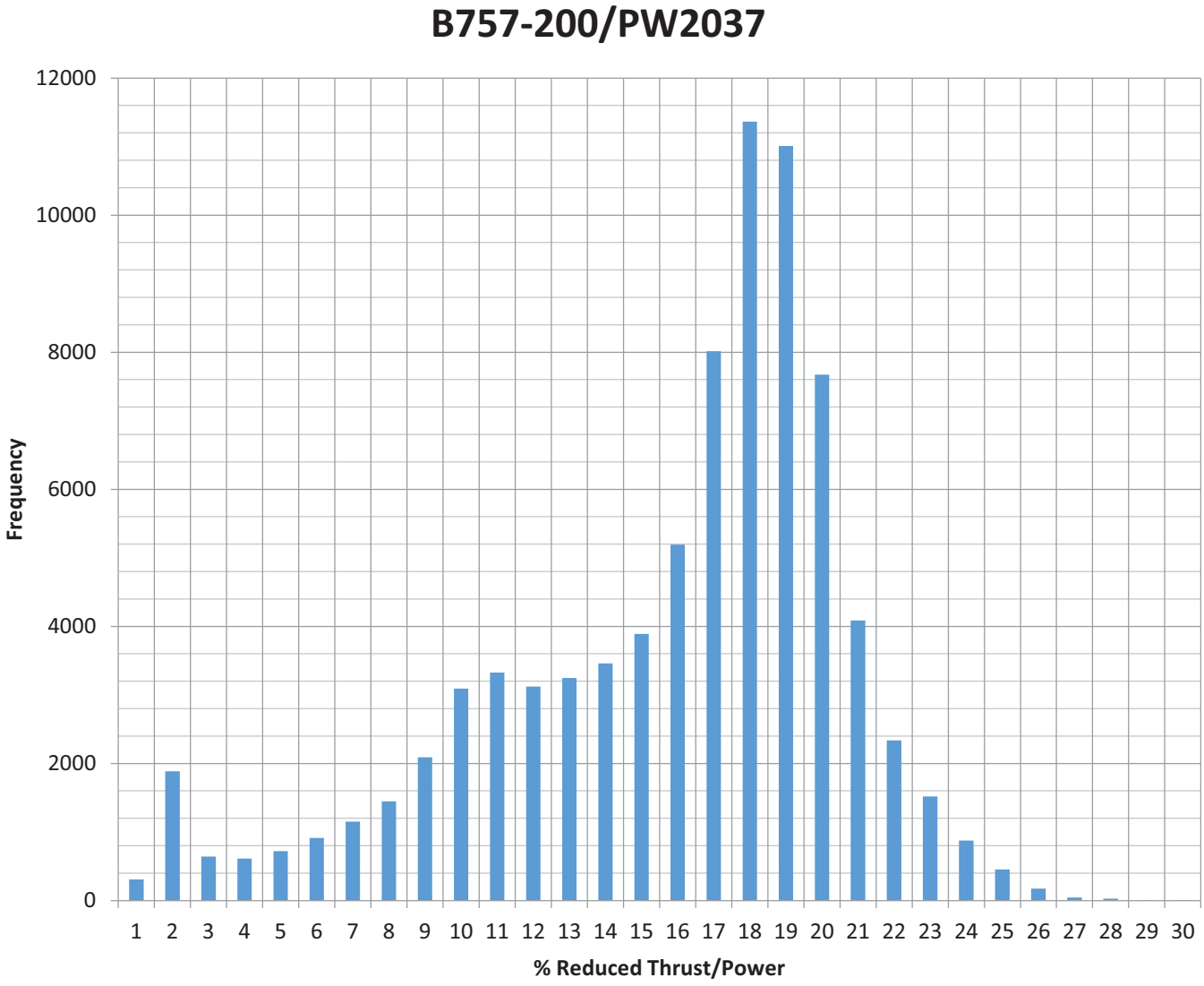

B757-200/PW2037
12000
10000
8000
6000
4000
2000
0
Frequency
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
% Reduced Thrust/Power

CHART 4

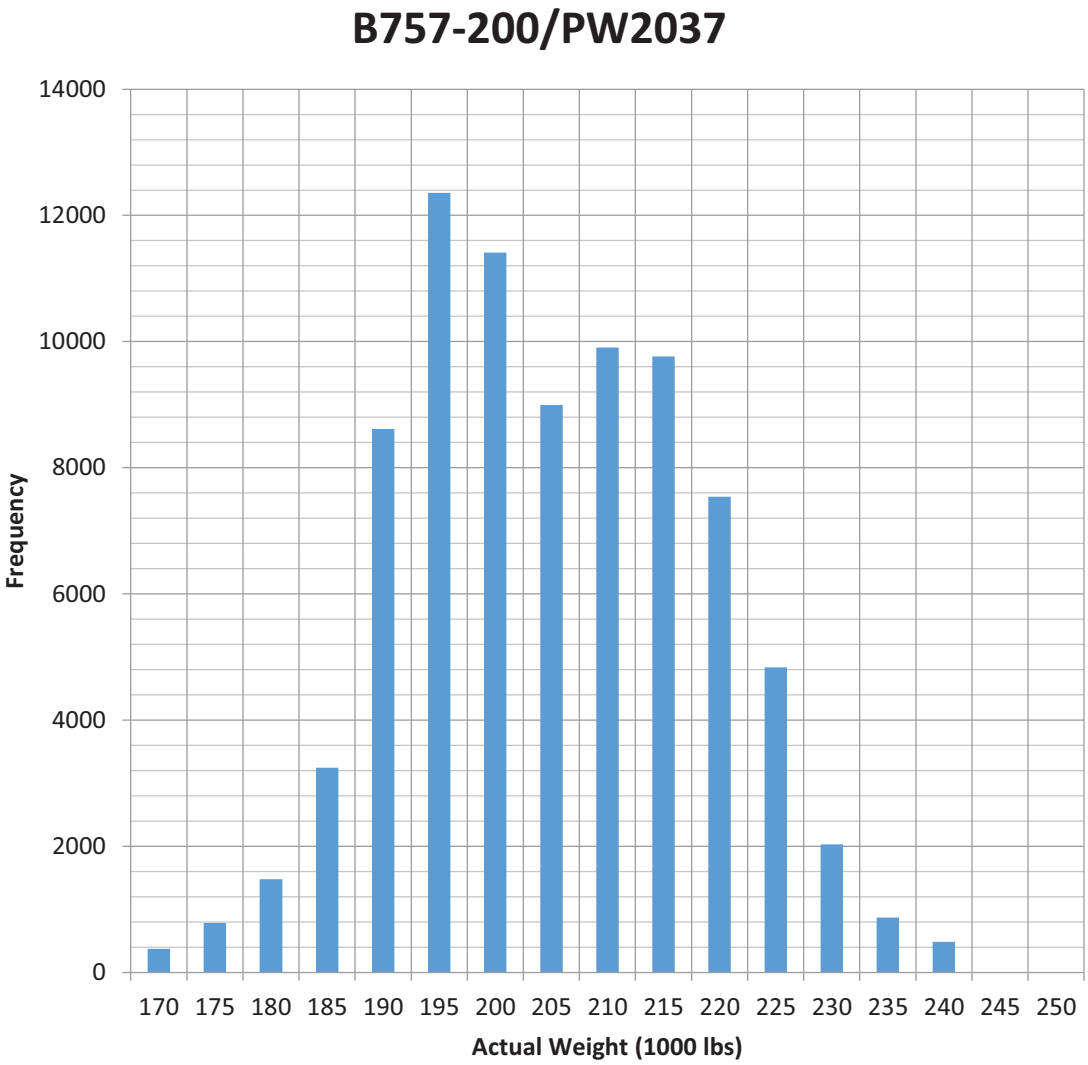

B757-200/PW2037
14000
12000
10000
8000
6000
4000
2000
0
Frequency
170 175 180 185 190 195 200 205 210 215 220 225 230 235 240 245 250
Actual Weight (1000 lbs)

CHART 5

B757-200 AVERAGE ROUTE REDUCED THRUST RESULTS

ROUTE	AVG_WGT	AVG_DRATE		ROUTE	AVG_WGT	AVG_DRATE		ROUTE	AVG_WGT	AVG_DRATE
ABQATL	204.5	15.6		ATLMEX	201.9	9.8		BHMATL	183.7	19.2
AGPJFK	227.2	14.8		ATLMGA	176.9	17.6		BNAATL	182.7	18.5
ANCATL	232.2	6.0		ATLMIA	193.3	18.0		BOGATL	216.2	15.8
ANCMSP	224.5	7.9		ATLMKE	186.1	18.5		BOGJFK	221.3	12.7
ANCSLC	212.6	9.7		ATLMPR	203.5	18.7		BOISLC	184.2	20.2
ARNJFK	236.1	8.1		ATLMSP	197.8	17.0		BONATL	207.9	15.6
ATLABQ	198.8	15.4		ATLMSY	198.4	15.5		BOSATL	199.7	17.8
ATLANC	233.1	5.9		ATLNAS	192.9	19.4		BOSCDG	231.0	11.1
ATLAUA	209.8	6.7		ATLNCA	209.3	8.3		BOSCUN	202.9	16.6
ATLAUS	191.9	18.4		ATLORD	192.1	16.9		BOSDTW	193.3	17.6
ATLBHM	185.3	18.8		ATLPBI	190.4	18.9		BOSJFK	188.7	16.6
ATLBNA	183.5	18.7		ATLPDX	213.3	12.6		BOSMSP	202.1	14.7
ATLBOG	217.9	6.0		ATLPHL	191.0	17.6		BOSSLC	210.8	12.8
ATLBON	209.1	16.2		ATLPHX	204.8	15.9		BRUATL	235.5	10.4
ATLBOS	197.6	13.7		ATLPIT	188.2	18.4		BWIATL	188.4	18.9
ATLBRU	232.5	5.6		ATLPNS	187.0	18.0		BWIDTW	181.1	17.3
ATLBSB	239.5	2.7		ATLPUJ	204.2	18.9		BWIMSP	193.8	17.4
ATLBWI	189.0	18.0		ATLPVR	205.0	17.4		BZNATL	208.6	14.2
ATLBZN	200.0	11.1		ATLRDU	186.1	18.3		BZNMSP	201.6	10.9
ATLCCS	210.7	15.5		ATLRIC	188.6	16.2		CCSATL	207.2	15.5
ATLCLT	189.2	19.0		ATLROC	208.5	7.0		CDGBOS	227.5	9.3
ATLCUN	197.5	19.6		ATLRSW	190.3	18.6		CDGPHL	223.3	11.8
ATLDAB	187.2	18.0		ATLRTB	197.5	12.1		CDGPIT	226.7	11.9
ATLDCA	189.7	16.6		ATLSAN	208.6	8.7		CLTATL	182.5	19.7
ATLDEN	199.5	15.3		ATLSAT	190.4	17.0		CPHJFK	234.9	11.2
ATLDFW	191.2	19.0		ATLSEA	216.8	12.8		CUNATL	197.4	18.3
ATLDTW	192.7	17.6		ATLSFO	215.7	10.5		CUNBOS	202.9	8.9
ATLEGE	189.7	5.1		ATLSJC	210.2	14.1		CUNDTW	202.4	14.7
ATLFLL	191.8	17.8		ATLSJD	204.4	18.0		CUNMCO	190.7	20.7
ATLGCM	196.1	16.8		ATLSJO	205.9	8.2		CUNSLC	210.0	7.6
ATLGDL	200.5	15.0		ATLSJU	209.2	13.1		CVGATL	180.4	17.0
ATLGGT	206.7	7.4		ATLSKB	205.3	13.8		CVGLAS	200.8	16.8
ATLGUA	208.0	7.5		ATLSLC	207.6	14.0		CVGLAX	204.3	16.2
ATLHRO	201.7	9.2		ATLSMF	212.0	11.7		CVGSEA	208.2	15.7
ATLHSV	194.2	16.1		ATLSNA	207.8	3.3		CVGSLC	200.4	18.1
ATLIND	187.3	18.6		ATLSRQ	190.2	17.1		DABATL	191.0	18.4
ATLJAC	198.8	4.3		ATLSTL	186.9	18.3		DCAATL	190.0	18.8
ATLJAX	187.2	18.3		ATLSTT	204.9	3.8		DCAMSP	188.2	19.5
ATLJFK	196.7	16.4		ATLSXM	209.8	4.7		DCASLC	207.0	14.8
ATLLAS	206.7	13.3		ATLTPA	190.0	19.1		DENATL	201.7	15.1
ATLLAX	212.0	14.4		ATLTUS	200.3	16.2		DENMSP	197.7	16.6
ATLLGA	193.3	14.6		ATLUIO	217.7	6.0		DFWATL	193.0	18.2
ATLLIR	206.4	11.2		ATLUVF	215.0	12.0		DKRJFK	229.9	11.0
ATLMBJ	199.7	18.3		ATLYVR	218.0	13.4		DTWATL	191.4	18.2
ATLMCI	188.1	18.3		AUAATL	209.5	15.8		DTWBOS	193.2	14.5
ATLMCO	189.8	18.6		AUSATL	193.2	17.9		DTWBWI	187.5	17.4

TABLE 13

B757-200 AVERAGE ROUTE REDUCED THRUST RESULTS

ROUTE	AVG_WGT	AVG_DRATE		ROUTE	AVG_WGT	AVG_DRATE		ROUTE	AVG_WGT	AVG_DRATE
DTWCUN	205.3	16.9		JFKAGP	236.4	8.2		LAXGUA	216.6	4.7
DTWFLL	197.4	16.5		JFKARN	234.8	8.6		LAXHNL	209.7	13.3
DTWGRR	192.6	18.8		JFKATL	196.3	18.3		LAXIND	213.0	14.3
DTWLAS	207.1	12.9		JFKBOG	215.1	7.2		LAXJFK	218.7	14.5
DTWLAX	209.9	14.1		JFKBOS	181.3	15.7		LAXKOA	219.6	12.8
DTWMCO	193.9	18.7		JFKCPH	236.1	8.4		LAXLIH	217.0	2.9
DTWMIA	198.9	18.2		JFKDKR	232.9	10.8		LAXMCO	215.5	13.4
DTWMKE	186.2	18.6		JFKDTW	195.1	15.4		LAXMSP	204.9	14.8
DTWMSP	190.5	17.8		JFKDUB	232.8	5.4		LAXOGG	216.5	3.8
DTWPBI	193.4	16.9		JFKFLL	195.8	16.4		LAXROC	220.3	4.6
DTWPDX	207.4	15.0		JFKGGT	212.7	4.9		LAXSEA	196.3	17.6
DTWPHL	189.9	18.0		JFKKEF	222.2	11.5		LAXSJO	222.2	5.6
DTWPHX	206.1	16.0		JFKLAS	211.4	11.3		LAXSLC	189.4	19.9
DTWRSW	197.7	18.0		JFKLAX	212.5	15.5		LGAATL	193.9	18.2
DTWSAN	209.9	7.4		JFKMCO	194.6	17.7		LGADTW	182.4	18.4
DTWSEA	208.8	15.6		JFKMEX	209.7	7.9		LGAMSP	182.8	15.2
DTWSFO	212.2	12.1		JFKMIA	198.3	17.8		LIHLAX	221.7	11.1
DTWSLC	203.8	16.1		JFKMSP	189.9	17.8		LIRATL	209.0	15.8
DTWTPA	195.6	16.5		JFKPDX	209.0	14.5		MBJATL	199.2	17.9
DUBJFK	226.2	12.7		JFKPHX	207.9	16.3		MCIATL	196.0	17.2
EGEATL	204.8	16.0		JFKPIT	182.3	19.8		MCOATL	192.4	18.8
FAIMSP	223.3	8.6		JFKROC	198.0	14.9		MCOCUN	190.9	21.1
FAISEA	208.7	14.2		JFKSAN	210.7	8.1		MCODTW	196.7	16.9
FLLATL	191.7	19.0		JFKSDQ	208.2	16.0		MCOJFK	194.1	16.8
FLLDTW	195.5	17.0		JFKSEA	215.7	14.8		MCOLAS	194.6	15.0
FLLJFK	192.3	17.3		JFKSFO	214.6	12.9		MCOLAX	213.5	13.5
FLLMSP	197.7	16.4		JFKSJU	204.3	16.1		MCOMSP	200.2	16.8
GCMATL	206.2	17.5		JFKSLC	210.2	13.9		MCOSLC	209.9	12.7
GDLATL	204.4	14.3		JFKSNN	229.1	10.2		MEXATL	209.4	14.1
GDLLAX	207.0	16.5		JFKSSA	237.2	6.4		MEXJFK	216.1	13.6
GEGMSP	206.8	14.2		JFKSTT	199.5	8.5		MIAATL	193.1	18.6
GEGSLC	192.8	21.4		JFKSXM	200.9	5.8		MIADTW	196.6	17.4
GGTATL	204.4	15.8		JNUSEA	194.4	17.8		MIAJFK	196.3	17.5
GGTJFK	209.2	15.7		KEFJFK	228.1	12.1		MKEATL	187.8	19.7
GGTLAX	217.5	12.8		KOALAX	222.5	11.1		MKEDTW	179.6	18.2
GUAATL	208.4	14.7		LASATL	212.2	12.3		MKEMSP	183.2	18.2
GUALAX	218.9	11.3		LASCVG	207.2	16.0		MPRATL	204.7	15.0
HNLLAX	223.4	8.6		LASDTW	210.5	15.0		MSPANC	222.3	9.0
HNLSEA	223.2	9.5		LASJFK	216.3	13.0		MSPATL	199.2	16.8
HNLSFO	218.3	12.4		LASMCO	198.4	18.8		MSPBOS	201.7	10.8
HROATL	206.1	17.3		LASMSP	202.4	16.6		MSPBWI	192.1	17.5
INDATL	191.1	18.0		LASSLC	183.1	21.1		MSPDCA	193.0	14.1
INDLAX	200.3	14.8		LAXATL	216.0	11.2		MSPDEN	192.0	16.1
JACATL	207.0	14.0		LAXDTW	215.1	13.6		MSPDTW	189.9	17.8
JACMSP	197.2	17.8		LAXGDL	190.9	18.2		MSPFAI	222.0	10.8
JAXATL	190.2	18.7		LAXGGT	217.6	4.6		MSPFLL	204.3	13.2

TABLE 14

B757-200 AVERAGE ROUTE REDUCED THRUST RESULTS

ROUTE	AVG_WGT	AVG_DRATE		ROUTE	AVG_WGT	AVG_DRATE		ROUTE	AVG_WGT	AVG_DRATE
MSPGEG	195.4	20.0		PNSATL	189.6	19.7		SLCATL	210.9	12.8
MSPJAC	189.8	4.5		PUJATL	210.5	15.9		SLCBOI	184.2	19.6
MSPJFK	196.0	18.0		PVRATL	213.6	12.5		SLCBOS	213.9	9.3
MSPLAS	199.2	15.8		RDUATL	185.4	18.6		SLCCUN	209.4	17.1
MSPLAX	201.9	16.7		RICATL	189.6	17.9		SLCCVG	204.9	18.0
MSPLGA	192.7	14.4		ROCATL	208.7	16.6		SLCDCA	210.1	7.3
MSPMCI	184.0	15.5		ROCJFK	207.4	16.2		SLCDTW	207.2	15.6
MSPMCO	202.2	17.2		ROCLAX	221.3	12.6		SLCGEG	185.0	21.6
MSPMKE	187.1	18.0		RSWATL	195.0	18.2		SLCJFK	212.9	14.3
MSPORD	188.7	18.3		RSWDTW	197.5	16.0		SLCLAS	185.5	19.3
MSPPDX	202.0	16.5		RSWMSP	200.9	16.7		SLCLAX	188.1	17.4
MSPPHX	199.4	17.8		RTBATL	208.3	16.1		SLCMCO	212.0	14.7
MSPRSW	203.4	17.7		SANATL	216.0	11.1		SLCMSP	196.5	17.3
MSPSAN	201.3	11.0		SANDTW	216.4	13.6		SLCPDX	190.4	18.0
MSPSEA	202.1	16.9		SANJFK	220.4	12.6		SLCPHL	209.5	15.6
MSPSFO	203.6	15.4		SANMSP	207.5	13.9		SLCPHX	187.0	20.0
MSPSJO	210.9	4.5		SANSLC	190.5	19.0		SLCSAN	189.6	15.9
MSPSJU	220.1	10.3		SATATL	195.4	17.7		SLCSEA	194.4	17.7
MSPSLC	192.1	19.4		SDQJFK	212.2	14.4		SLCSFO	187.1	18.7
MSPTPA	196.3	17.4		SEAANC	198.2	17.7		SLCSMF	184.4	19.8
MSPYVR	205.7	16.6		SEAATL	221.5	9.2		SMFATL	217.1	10.9
MSYATL	187.8	18.6		SEACVG	210.2	16.0		SMFMSP	206.3	15.5
NASATL	201.1	18.6		SEADTW	216.2	13.2		SMFSLC	191.8	19.8
NCAATL	206.3	17.2		SEAFAI	193.4	16.8		SNAATL	213.4	11.8
OGGLAX	219.3	10.4		SEAHNL	223.5	9.3		SNNJFK	223.8	13.3
OGGSEA	228.0	8.3		SEAJFK	220.1	13.6		SRQATL	192.9	18.1
ORDATL	195.0	17.3		SEAJNU	178.7	10.5		SSAJFK	235.2	10.4
ORDMSP	190.6	17.1		SEALAX	191.1	16.9		STLATL	190.2	18.5
PBIATL	196.8	18.5		SEAMSP	206.8	14.0		STLMSP	190.0	20.1
PBIDTW	195.4	16.0		SEAOGG	218.6	2.9		STTATL	211.6	17.4
PDXATL	219.6	9.5		SEASLC	193.0	18.9		STTJFK	208.0	16.5
PDXDTW	214.9	14.3		SFOATL	221.4	8.6		SXMATL	212.8	14.9
PDXJFK	215.0	13.8		SFODTW	217.8	12.6		SXMJFK	210.7	14.6
PDXMSP	203.5	14.9		SFOHNL	218.2	12.9		SXMMSP	225.0	8.6
PDXSLC	190.2	19.8		SFOJFK	221.1	13.8		TPAATL	189.4	18.9
PHLATL	189.9	18.9		SFOMSP	208.3	14.5		TPADTW	193.3	16.8
PHLCDG	231.0	11.4		SFOSLC	191.4	19.3		TPAMSP	198.0	16.6
PHLDTW	186.8	18.6		SJCATL	213.3	12.1		TUSATL	203.8	15.4
PHLSLC	205.4	12.3		SJDATL	203.1	15.9		UIOATL	221.4	14.1
PHXATL	208.4	14.1		SJOATL	214.7	14.3		UVFATL	218.2	13.9
PHXDTW	209.6	14.6		SJOLAX	226.0	11.1		YVRATL	216.5	10.6
PHXJFK	214.3	15.3		SJOMSP	220.8	11.5		YVRMSP	204.6	14.1
PHXMSP	199.9	16.7		SJUATL	209.0	15.7				
PHXSLC	185.1	20.1		SJUJFK	202.4	15.9				
PITATL	183.9	19.3		SJUMSP	215.4	12.5				
PITCDG	231.5	11.2		SKBATL	215.5	14.1				
PITJFK	186.9	17.7		SLCANC	215.8	10.6				

TABLE 15

B767-400ER/CF6-80C2/B8F

Reduced Power/Thrust Determination:

The initial ACARS database contained 11,774 departures, but was reduced, by a number of actions to 11,585 flights. Flights were removed from the database for the following reasons:

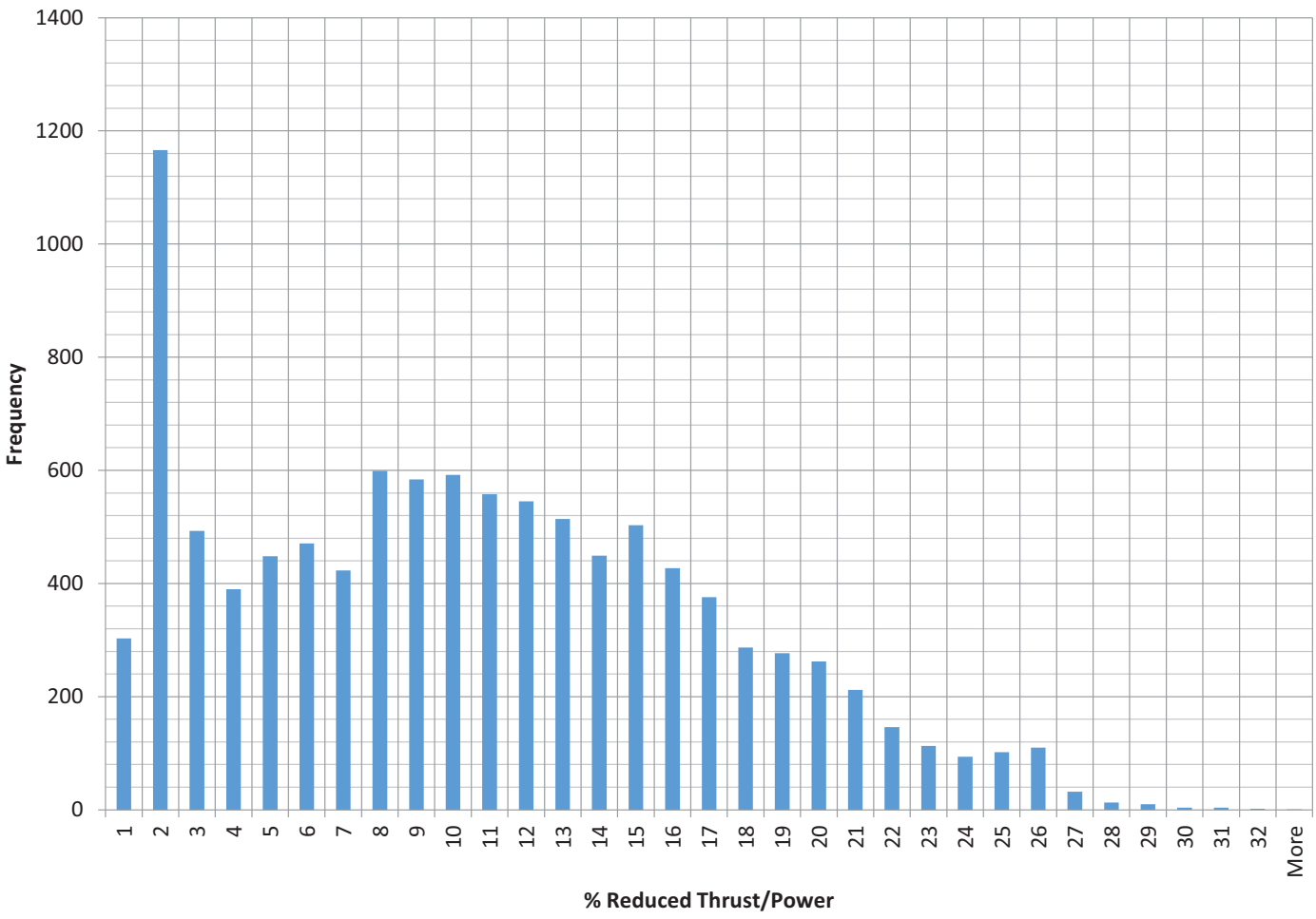
- Obvious data recording errors
- Missing essential data (aircraft weight, origin, destination, or de-rate)
- Charter, maintenance, or other non-revenue positioning flights
- An imposed minimum of 5 flights for any city pair (origin and destination)

In addition to the database edits above, there still remained a number of suspect entries for percent reduced thrust/power particularly at very low recorded percentage levels. To circumvent any potential problem with the validity of this data, a decision was made to only consider flights with recorded reduced thrust percentages greater or equal to one as being actual reduced thrust/power departures.

Specifics of the B767-400ER ACARS Database:

- 10,511 Flights
- 57 Routes Departing 21 Airports
- 93.5% of All Departures Used Reduced Thrust/Power
- Average Reduced Thrust/Power was 10.4%

Chart 6 below, is a histogram of the B767-400ER reduced thrust percentages. The explanation for the 2% reduced thrust/power spike is the same as with the B757. The spike is simply more pronounced due to the significant difference in the database size with respect to flights recorded. Chart 6, the weight distribution is also presented to support the explanation.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1000
800
600
400
200
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1
2
3
4
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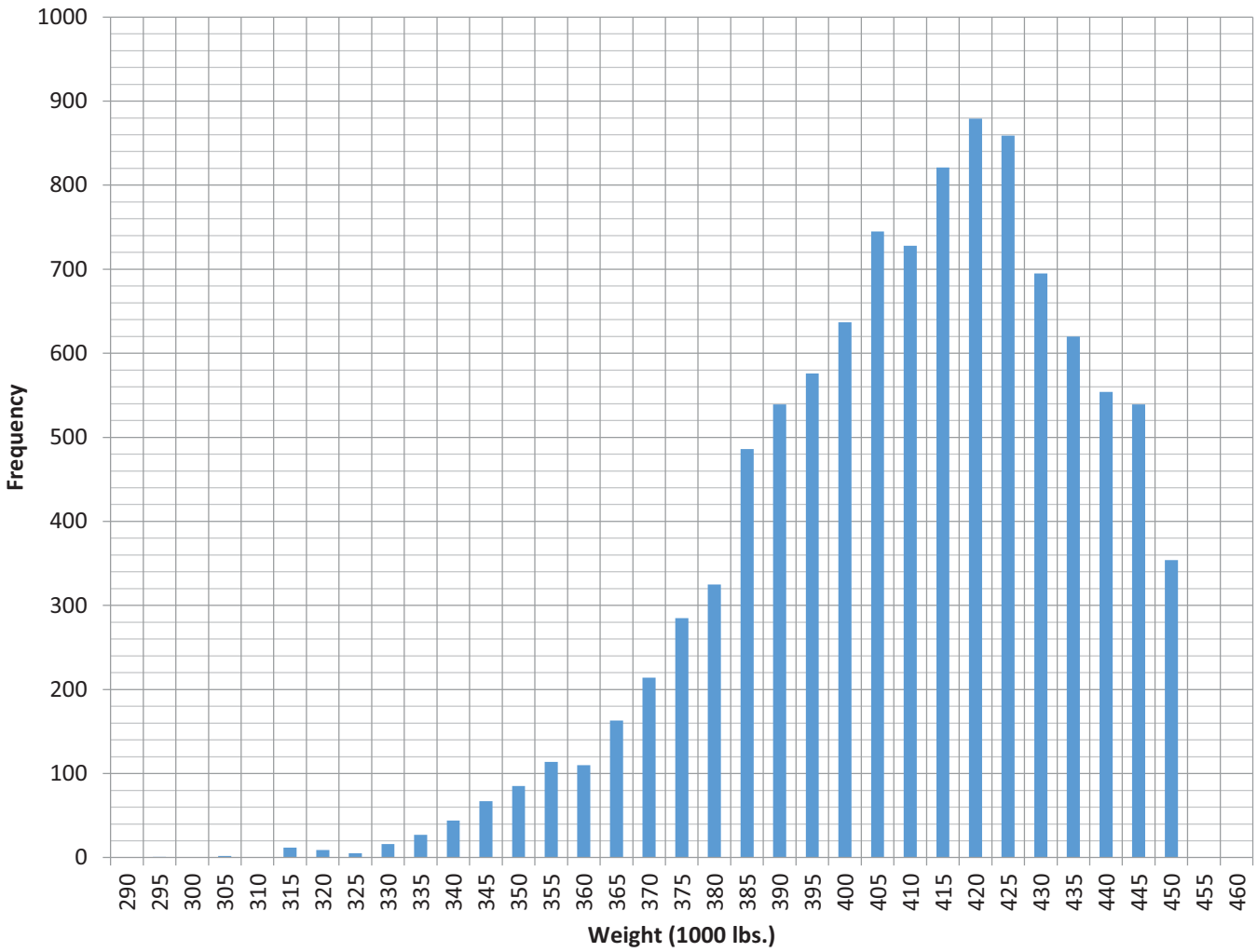
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
More
% Reduced Thrust/Power

CHART 6


B767-400ER/CF680-C2B8F
Frequency
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800
700
600
500
400
300
200
100
0
290
295
300
305
310
315
320
325
330
335
340
345
350
355
360
365
370
375
380
385
390
395
400
405
410
415
420
425
430
435
440
445
450
455
460
Weight (1000 lbs.)

CHART 7

B767-400ER AVERAGE ROUTE REDUCED THRUST RESULTS

APRTS	AVG_GWT	AVG_DRATE		APRTS	AVG_GWT	AVG_DRATE
AMSDTW	423.0	4.6%		JFKLHR	376.8	18.7%
ATLCDG	414.6	8.1%		JFKMAD	388.3	15.9%
ATLFRA	416.0	7.1%		JFKMXP	397.8	14.1%
ATLGRU	436.4	2.7%		JFKNCE	383.3	17.5%
ATLJFK	338.1	24.3%		JFKSLC	348.1	22.2%
ATLLAX	363.9	15.8%		JFKSVO	423.3	8.5%
ATLLHR	409.8	8.5%		JFKVCE	399.2	13.8%
ATLMAD	406.0	9.3%		LAXATL	350.1	24.6%
ATLMCO	319.8	27.1%		LAXDTW	360.0	19.7%
ATLMUC	413.8	7.6%		LHRATL	417.4	8.6%
ATLPDX	338.6	22.6%		LHRBOS	370.7	19.1%
ATLSEA	364.8	16.0%		LHRDTW	401.5	12.2%
ATLSLC	350.0	20.7%		LHRJFK	394.9	13.8%
BOSLHR	364.6	11.8%		LHRMSP	404.4	11.6%
CDGATL	420.2	6.2%		MADATL	425.7	8.2%
CDGDTW	413.3	6.9%		MADJFK	402.2	13.7%
CDGJFK	412.8	7.3%		MCOATL	316.6	25.0%
DTWAMS	397.7	11.8%		MSPLHR	395.2	9.1%
DTWCDG	394.1	12.4%		MUCATL	438.6	3.4%
DTWFRA	404.0	10.1%		MXPJFK	428.7	3.4%
DTWLAX	360.3	19.7%		NCEJFK	405.4	7.3%
DTWLHR	391.1	13.3%		NRTPDX	427.2	9.9%
FRAATL	439.3	6.4%		PDXATL	329.5	20.5%
FRADTW	426.8	9.9%		PDXNRT	430.2	3.9%
GRUATL	428.0	6.0%		SLCATL	339.2	18.8%
GRUJFK	420.0	2.5%		SLCJFK	344.0	19.6%
JFKATL	339.2	23.1%		SVOJFK	420.9	8.1%
JFKCDG	386.3	16.5%		VCEJFK	420.3	4.7%
JFKGRU	435.0	5.9%				

TABLE 16

B737-800/CFM56-7B26

Reduced Power/Thrust Determination:

The initial ACARS database was reduced, by a number of actions to 62,326 flights. Flights were removed from the database for the following reasons:

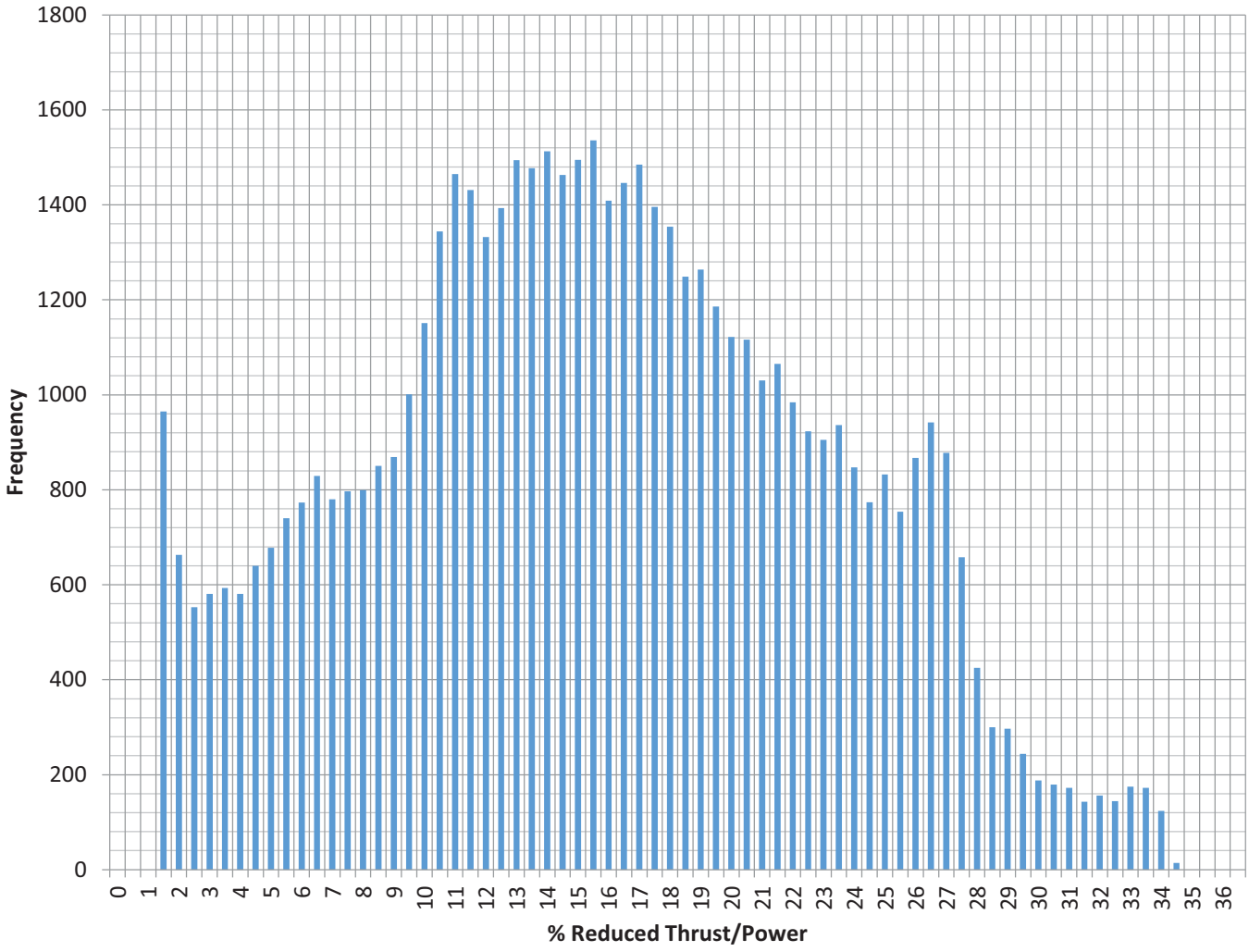
- Obvious data recording errors
- Missing essential data (aircraft weight, origin, destination, or de-rate)
- Charter, maintenance, or other non-revenue positioning flights
- An imposed minimum of 5 flights for any city pair (origin and destination)

In addition to the database edits above, there still remained a number of suspect entries for percent reduced thrust/power particularly at very low recorded percentage levels. To circumvent any potential problem with the validity of this data, a decision was made to only consider flights with recorded reduced thrust percentages greater or equal to one as being actual reduced thrust/power departures.

Specifics of the B737-800 ACARS Database:

- 58,921 Flights
- 504 Routes Departing 105 Airports
- 94.5% of All Departures Used Reduced Thrust/Power
- Average Reduced Thrust/Power was 15.5%

Chart 8 below, is a histogram of the B737-800 reduced thrust percentages. The explanation for the 2% reduced thrust/power spike is the same as with the B757. Chart 9, is the weight frequency or distribution.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1600
1400
1200
1000
800
600
400
200
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36
% Reduced Thrust/Power

CHART 8

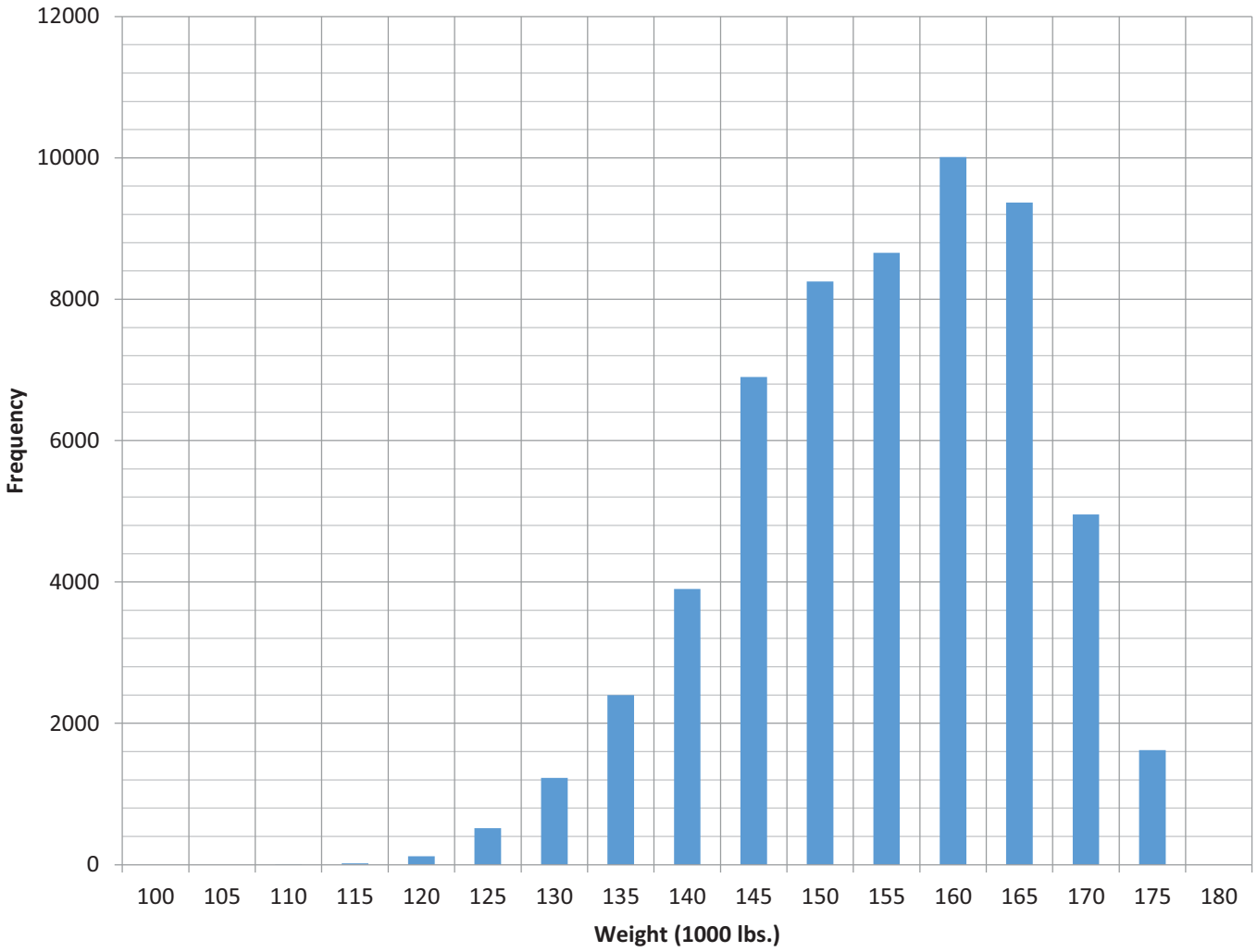
B737-800/CFM56-7B26
12000
10000
8000
6000
4000
2000
0
Frequency
100
105
110
115
120
125
130
135
140
145
150
155
160
165
170
175
180
Weight (1000 lbs.)

CHART 9

B737-800 AVERAGE ROUTE REDUCED THRUST RESULTS

ROUTE	AVG_WT	AVG_%DRATE		ROUTE	AVG_WT	AVG_%DRATE		ROUTE	AVG_WT	AVG_%DRATE
ANCMSP	171.4	4.4		ATLMSY	143.6	21.2		BNALAX	152.5	8.5
ANCSEA	148.9	16.4		ATLNCA	157.9	15.0		BOIMSP	144.2	16.1
ANCSLC	165.3	8.4		ATLOMA	146.0	17.3		BOISLC	137.2	19.7
ANUATL	154.9	15.1		ATLORD	149.5	17.1		BONATL	148.1	19.5
APAATL	161.2	12.0		ATLPAP	157.9	15.1		BOSATL	148.0	11.1
APAJFK	152.0	17.7		ATLPDX	165.4	5.1		BOSBDA	146.7	12.5
ATLANU	160.8	13.9		ATLPHX	160.8	8.6		BOSCVG	141.8	18.4
ATLAPA	162.1	11.7		ATLPTY	161.9	12.5		BOSDTW	144.2	14.2
ATLAUA	159.4	14.8		ATLPUJ	159.8	13.8		BOSJFK	138.3	21.9
ATLAUS	145.1	21.2		ATLPVR	158.9	11.0		BOSLAS	163.3	6.5
ATLBDA	156.9	12.8		ATLRDU	139.9	26.8		BOSLAX	166.5	5.4
ATLBDL	137.3	28.3		ATLROC	161.0	13.0		BOSMCO	142.1	18.0
ATLBGI	154.1	17.6		ATLRSW	148.6	22.5		BOSMSP	146.9	13.7
ATLBHM	140.1	23.8		ATLRTB	157.9	17.4		BOSSLC	165.1	5.5
ATLBNA	139.7	25.6		ATLSAL	161.6	8.8		BWIATL	139.7	26.0
ATLBON	147.4	20.7		ATLSAN	167.3	5.4		BWIDTW	144.8	20.9
ATLBOS	152.0	19.6		ATLSAT	147.6	15.9		BWISLC	162.9	10.3
ATLBWI	137.7	27.4		ATLSDF	139.6	24.8		BZELAX	155.0	15.4
ATLBZN	159.2	9.3		ATLSDQ	156.5	15.8		BZNATL	151.4	2.1
ATLCCS	157.8	14.6		ATLSEA	167.2	4.3		BZNSLC	136.9	11.5
ATLCHS	139.4	26.9		ATLSFO	169.1	3.9		CCSATL	146.7	20.3
ATLCLT	140.8	26.9		ATLSJC	166.1	5.2		CHSATL	137.7	23.0
ATLCMH	140.7	23.0		ATLSJD	159.8	10.2		CLTATL	139.4	27.2
ATLCOS	155.8	11.2		ATLSJO	161.1	13.4		CMHATL	139.2	22.8
ATLCUN	149.1	20.3		ATLSJU	161.2	13.0		CMHLAX	155.2	7.3
ATLCVG	144.4	21.8		ATLSKB	155.7	18.6		CMHMSP	140.2	16.7
ATLDCA	141.5	26.1		ATLSLC	161.4	8.5		COSATL	150.1	3.5
ATLDEN	155.4	11.4		ATLSLP	160.1	10.9		CUNATL	143.7	23.1
ATLDFW	147.8	18.8		ATLSMF	164.0	6.2		CUNCVG	141.6	22.6
ATLDSD	159.0	13.2		ATLSRQ	144.3	25.1		CUNDTW	155.8	17.4
ATLDTW	145.0	20.4		ATLSTL	141.7	24.0		CUNLAX	162.7	14.4
ATLFLL	147.8	21.7		ATLTPA	144.1	24.5		CUNMSP	159.0	15.3
ATLGDL	160.5	10.0		ATLTPP	159.8	13.5		CVGATL	141.7	26.6
ATLGSO	130.9	31.2		ATLUVF	164.8	10.9		CVGCUN	155.4	18.3
ATLGSP	140.9	25.7		ATLYVR	161.0	9.7		CVGFLL	141.9	20.7
ATLHSV	138.8	26.2		AUAATL	160.3	3.3		CVGLAS	155.3	19.2
ATLIAD	139.0	27.4		AUAJFK	157.6	4.9		CVGLAX	162.7	12.4
ATLIND	143.2	22.4		AUSATL	143.0	21.8		CVGMCO	145.1	24.5
ATLJAX	145.5	23.7		AUSDTW	143.2	16.3		CVGSEA	161.9	12.8
ATLJFK	149.7	21.3		AUSJFK	149.3	17.8		CVGSFO	165.9	11.8
ATLLAS	160.7	8.6		BDAATL	149.4	16.0		CVGSLC	156.1	18.8
ATLLAX	165.5	5.5		BDABOS	137.8	22.7		CVGTPA	144.2	25.4
ATLLGA	146.6	23.0		BDAJFK	133.1	22.9		CZMMSP	153.6	8.3
ATLLIR	156.8	15.6		BDLATL	148.5	16.2		DCAATL	142.0	14.5
ATLMBJ	152.4	17.5		BGIATL	154.8	17.6		DCADTW	137.3	14.0
ATLMCO	144.3	24.8		BGIJFK	151.2	19.3		DCAMSP	145.7	8.8
ATLMEM	138.6	25.9		BHMATL	133.8	27.3		DCASLC	157.3	2.2
ATLMEX	154.6	12.1		BILSLC	136.1	17.2		DENATL	152.7	5.4
ATLMIA	147.1	23.2		BJXLAX	139.8	11.4		DENDTW	144.6	10.2
ATLMSO	157.7	10.4		BNAATL	138.7	23.6		DENJFK	155.3	4.5
ATLMSP	151.2	16.5		BNADTW	141.7	15.6		DENMSP	142.1	11.1

TABLE 17

B737-800 AVERAGE ROUTE REDUCED THRUST RESULTS

ROUTE	AVG_WT	AVG_%DRATE	ROUTE	AVG_WT	AVG_%DRATE	ROUTE	AVG_WT	AVG_%DRATE
DFWATL	147.5	21.5	HSVATL	140.0	22.5	LASDTW	158.4	7.4
DFWDTW	146.6	21.6	IADATL	139.9	24.4	LASJFK	161.6	5.7
DFWSLC	145.3	23.6	INDATL	143.3	22.2	LASLAX	140.4	16.8
DSDATL	156.9	18.7	INDDTW	133.2	25.3	LASMEM	139.7	15.3
DSDJFK	155.9	19.3	INDLAX	158.0	14.5	LASMSP	146.2	13.5
DTWATL	146.4	21.4	INDMSP	131.8	27.1	LASRDU	148.8	11.2
DTWBNA	142.7	18.7	JAXATL	143.4	26.8	LASSEA	137.8	17.8
DTWBOS	146.7	19.3	JFKAPA	157.1	17.3	LASSLC	140.2	19.7
DTWBWI	134.5	22.8	JFKATL	149.9	23.3	LAXATL	157.5	18.2
DTWCUN	154.6	12.2	JFKAUA	160.0	14.2	LAXBJX	143.8	21.5
DTWDCA	133.8	23.1	JFKAUS	151.7	22.0	LAXBNA	152.7	16.1
DTWDEN	152.0	17.5	JFKBDA	143.5	23.5	LAXBOS	165.6	9.5
DTWDFW	143.7	23.1	JFKBGI	156.7	15.9	LAXBZE	162.0	11.6
DTWFLL	144.6	22.0	JFKBOS	141.3	27.8	LAXCMH	152.9	16.5
DTWIND	132.8	29.2	JFKDEN	161.4	16.5	LAXCUN	161.7	15.4
DTWJFK	140.8	20.1	JFKDSD	156.2	19.4	LAXCVG	158.2	17.2
DTWLAS	163.6	11.9	JFKDTW	145.7	21.8	LAXDTW	163.5	10.3
DTWLAX	167.0	10.3	JFKFLL	147.1	24.2	LAXGDL	156.5	18.2
DTWLGA	132.2	24.2	JFKGCM	152.3	18.9	LAXIND	151.5	17.1
DTWMCO	149.8	17.8	JFKGND	165.7	11.0	LAXLAS	133.1	24.9
DTWMEX	165.2	9.6	JFKKIN	143.5	20.5	LAXLIR	161.1	12.0
DTWMIA	150.2	17.4	JFKLAS	164.9	14.5	LAXMCO	164.1	10.4
DTWMKE	139.1	24.9	JFKLIR	157.1	16.6	LAXMEM	146.8	19.8
DTWMSP	145.2	24.3	JFKMBJ	155.9	19.0	LAXMIA	163.0	11.2
DTWMSY	139.4	22.4	JFKMCO	149.3	23.6	LAXMPR	150.2	22.7
DTWORD	130.2	25.5	JFKMEX	168.3	9.8	LAXMSP	152.5	16.6
DTWPDX	165.9	11.4	JFKMIA	151.3	22.4	LAXMSY	146.8	24.0
DTWPHL	128.9	28.1	JFKMSP	151.2	19.7	LAXMZT	137.4	23.3
DTWPHX	158.6	16.7	JFKMSY	152.0	19.3	LAXPHX	128.2	26.2
DTWPVR	160.6	13.9	JFKNAS	148.2	21.3	LAXPVR	149.1	23.2
DTWRDU	136.1	22.7	JFKNCA	159.8	15.1	LAXRDU	159.0	13.1
DTWRSW	152.6	13.9	JFKPAP	158.6	17.4	LAXSAL	161.8	11.8
DTWSAN	164.4	11.7	JFKPDX	169.6	9.2	LAXSEA	143.7	24.8
DTWSEA	166.9	10.0	JFKPHX	164.7	14.5	LAXSLC	143.8	26.2
DTWSFO	167.8	9.0	JFKPLS	151.9	18.9	LAXSLP	167.0	9.4
DTWSLC	157.4	15.1	JFKPUJ	158.9	17.9	LAXTPA	160.3	16.3
DTWTPA	145.9	16.9	JFKPVR	169.1	9.5	LAXZIH	141.7	21.5
DTWYVR	162.9	12.6	JFKSAN	168.5	9.7	LAXZLO	135.5	23.5
FLLATL	139.9	22.8	JFKSAT	149.5	20.2	LGAATL	147.6	8.3
FLLCVG	144.8	16.2	JFKSDQ	157.4	18.5	LGADTW	136.7	16.0
FLLDTW	149.0	16.8	JFKSEA	170.3	8.3	LGAMCO	135.1	16.3
FLLJFK	142.3	20.5	JFKSJU	156.1	19.0	LGAMSP	138.0	12.9
FLLLGA	140.8	19.6	JFKSLC	164.3	14.8	LGANCA	156.5	2.8
FSDMSP	138.2	16.2	JFKSTI	153.4	21.0	LIRATL	154.0	12.9
GCMJFK	131.3	20.2	JFKTPA	144.9	25.9	LIRJFK	152.7	13.8
GDLATL	147.2	9.1	JFKTPP	161.8	16.3	LIRLAX	160.5	10.6
GDLLAX	151.9	6.9	JFKUVF	155.2	17.3	LIRMSP	162.9	5.3
GEGSLC	139.3	20.7	JFKYVR	167.2	11.5	MBJATL	151.2	14.2
GNDJFK	161.0	6.7	LASATL	156.3	8.9	MBJJFK	154.4	12.1
GSOATL	134.3	30.1	LASBOS	152.4	10.0	MCISLC	138.3	23.6
GSPATL	140.5	26.9	LASCVG	151.2	12.2	MCOATL	143.8	24.0

TABLE 18

B737-800 AVERAGE ROUTE REDUCED THRUST RESULTS

ROUTE	AVG_WT	AVG_%DRATE		ROUTE	AVG_WT	AVG_%DRATE		ROUTE	AVG_WT	AVG_%DRATE
MCOBOS	150.3	18.5		MSPSEA	158.5	7.3		RDUSLC	157.7	14.2
MCOCVG	141.3	25.5		MSPSFO	156.9	10.9		RNOSLC	135.8	5.7
MCODTW	149.8	21.8		MSPSLC	150.5	17.3		ROCATL	160.6	3.3
MCOJFK	147.8	23.1		MSPSTL	137.3	22.7		RSWATL	139.0	25.5
MCOLAX	167.8	9.0		MSPTPA	148.9	15.2		RSWDTW	152.0	23.0
MCOLGA	141.1	28.5		MSPYVR	152.7	9.2		RTBATL	149.0	6.2
MCOMSP	152.4	20.3		MSYATL	141.6	17.5		SALATL	152.2	16.4
MCOSLC	162.8	11.7		MSYDTW	146.9	9.2		SALLAX	160.7	14.5
MDWMSP	124.5	18.3		MSYJFK	148.2	13.8		SANDTW	160.9	3.6
MEMATL	139.5	26.2		MSYLAX	147.8	13.6		SANJFK	161.5	3.7
MEMLAS	138.6	26.4		MSYMSP	145.4	12.7		SANMSP	153.6	7.7
MEMLAX	146.8	20.6		MZTLAX	131.0	24.1		SANSEA	142.9	14.7
MEXATL	149.2	3.3		NASJFK	143.2	21.7		SANSLC	141.6	15.6
MEXDTW	144.8	4.5		NCAATL	158.5	4.7		SATATL	142.5	15.3
MEXJFK	151.7	2.4		NCAJFK	160.5	3.3		SATJFK	147.7	11.9
MIAATL	145.6	24.4		NCALGA	159.3	4.2		SATSLC	148.3	11.7
MIADTW	151.7	20.7		OAKSLC	137.2	30.0		SDFATL	138.5	19.4
MIAJFK	148.8	18.5		OMAATL	139.9	19.7		SDQATL	158.0	18.3
MIALAX	162.1	11.8		OMAMSP	136.8	22.4		SDQJFK	155.5	19.3
MKEDTW	143.7	14.2		ONTSLC	136.1	25.8		SEAANC	151.2	18.4
MKEMSP	138.8	20.5		ORDATL	138.6	20.8		SEAATL	166.2	10.4
MPRLAX	148.3	21.1		ORDDTW	143.0	23.4		SEACVG	156.3	16.8
MSOATL	154.2	5.2		ORDMSP	140.1	23.3		SEADTW	160.5	14.6
MSPANC	171.9	5.2		PAPATL	150.3	18.8		SEAJFK	167.7	10.8
MSPATL	150.3	19.2		PAPJFK	151.4	14.3		SEALAS	137.1	25.9
MSPAUS	139.1	21.9		PDXATL	162.7	8.4		SEALAX	148.4	20.6
MSPBOI	152.6	16.3		PDXDTW	160.4	11.3		SEAMSP	155.7	16.7
MSPBOS	151.7	10.1		PDXJFK	165.9	7.3		SEAPVR	155.6	17.5
MSPCMH	139.6	21.4		PDXMSP	154.0	14.4		SEASAN	148.7	20.1
MSPCUN	159.0	9.9		PDXSLC	143.2	21.0		SEASLC	144.7	22.9
MSPCZM	152.3	13.3		PHLATL	146.6	24.0		SFOATL	155.2	11.5
MSPDCA	144.5	15.5		PHLDTW	145.3	24.9		SFOCVG	156.8	12.9
MSPDEN	151.0	12.7		PHXATL	153.0	13.1		SFODTW	162.6	7.7
MSPDTW	144.3	22.1		PHXDTW	157.3	10.7		SFOMSP	156.9	10.7
MSPFSD	140.8	24.3		PHXJFK	159.9	10.1		SFOSLC	135.2	22.6
MSPIND	134.0	24.2		PHXLAX	139.0	24.0		SJCATL	160.6	11.9
MSPJFK	144.2	15.9		PHXMSP	152.2	14.0		SJCSLC	140.1	26.5
MSPLAS	154.0	12.9		PHXSLC	142.3	19.2		SJDATL	153.0	15.7
MSPLAX	155.6	13.3		PLSJFK	142.0	21.0		SJOATL	156.4	5.9
MSPLGA	147.3	14.7		PTYATL	157.9	6.8		SJUATL	159.7	8.8
MSPLIR	165.4	8.7		PUJATL	156.6	16.1		SJUJFK	153.9	12.9
MSPMCO	148.1	16.0		PUJJFK	156.0	16.6		SKBATL	148.4	14.0
MSPMDW	127.7	25.8		PVRATL	150.6	19.7		SLCABQ	126.4	22.6
MSPMKE	134.3	22.0		PVRDTW	144.2	21.7		SLCANC	165.4	1.8
MSPMSY	141.2	20.5		PVRJFK	155.1	17.2		SLCATL	158.1	5.5
MSPOMA	138.9	24.5		PVRLAX	144.8	22.1		SLCBIL	138.2	16.6
MSPORD	142.7	20.3		PVRSEA	158.1	15.9		SLCBOI	139.0	15.4
MSPPDX	156.5	8.9		RDUATL	141.4	26.1		SLCBOS	161.3	4.1
MSPPHX	153.4	13.9		RDULAS	146.5	20.0		SLCBWI	157.8	5.5
MSPRDU	142.0	18.1		RDULAX	159.3	12.8		SLCBZN	141.6	14.6
MSPSAN	156.6	11.7		RDUMSP	142.7	22.5		SLCCVG	155.0	6.3

TABLE 19

B737-800 AVERAGE ROUTE REDUCED THRUST RESULTS

ROUTE	AVG_WT	AVG_%DRATE
SLCDCA	154.6	6.6
SLCDFW	146.5	9.5
SLCDTW	154.5	6.4
SLCGEG	144.9	11.2
SLCJFK	159.6	5.2
SLCLAS	138.5	16.8
SLCLAX	144.2	14.1
SLCMCI	141.1	14.6
SLCMCO	160.2	4.8
SLCMSP	146.4	10.8
SLCOAK	139.5	15.8
SLCONT	140.9	14.9
SLCPDX	146.1	11.3
SLCPHX	139.6	13.9
SLCRDU	156.3	4.3
SLCRNO	139.9	16.6
SLCSAN	142.7	13.4
SLCSAT	149.4	9.4
SLCSEA	145.5	11.9
SLCSFO	140.1	14.4
SLCSJC	140.6	16.3
SLCSMF	141.5	12.9
SLPATL	157.3	15.7
SLPLAX	162.9	13.1
SMFATL	161.8	8.6
SMFMSP	156.3	10.5
SMFSLC	141.8	24.1
SRQATL	141.7	20.4
STIJFK	152.7	12.2
STLATL	141.9	19.4
STLMSP	134.2	22.3
TPAATL	144.8	26.1
TPACVG	145.1	25.7
TPADTW	145.0	22.5
TPAJFK	142.8	23.6
TPALAX	163.3	14.0
TPPATL	151.4	11.1
TPPJFK	155.1	10.3
UVFATL	162.2	9.2
UVFJFK	149.3	17.1
YVRDTW	160.6	15.4
YVRJFK	162.2	15.2
YVRMSP	150.8	20.8
ZIHLAX	135.0	21.5
ZLOLAX	130.4	20.1

TABLE 20

B767-300ER/CF680C2-7B26

Reduced Power/Thrust Determination:

The initial ACARS database was reduced, by a number of actions to 12,243 flights. Flights were removed from the database for the following reasons:

- Obvious data recording errors
- Missing essential data (aircraft weight, origin, destination, or de-rate)
- Charter, maintenance, or other non-revenue positioning flights
- An imposed minimum of 5 flights for any city pair (origin and destination)

In addition to the database edits above, there still remained a number of suspect entries for percent reduced thrust/power particularly at very low recorded percentage levels. To circumvent any potential problem with the validity of this data, a decision was made to only consider flights with recorded reduced thrust percentages greater or equal to one as being actual reduced thrust/power departures.

Specifics of the B767-300ER ACARS Database:

- 11,360 Flights
- 179 Routes Departing 61 Airports
- 92.8% of All Departures Used Reduced Thrust/Power
- Average Reduced Thrust/Power was 12.3%

Chart 10 below, is a histogram of the B767-300ER reduced thrust percentages. The explanation for the 2% reduced thrust/power spike is the same as with the B757. Chart 11, is the weight frequency or distribution.

B767-300ER/CF680C2-B6F

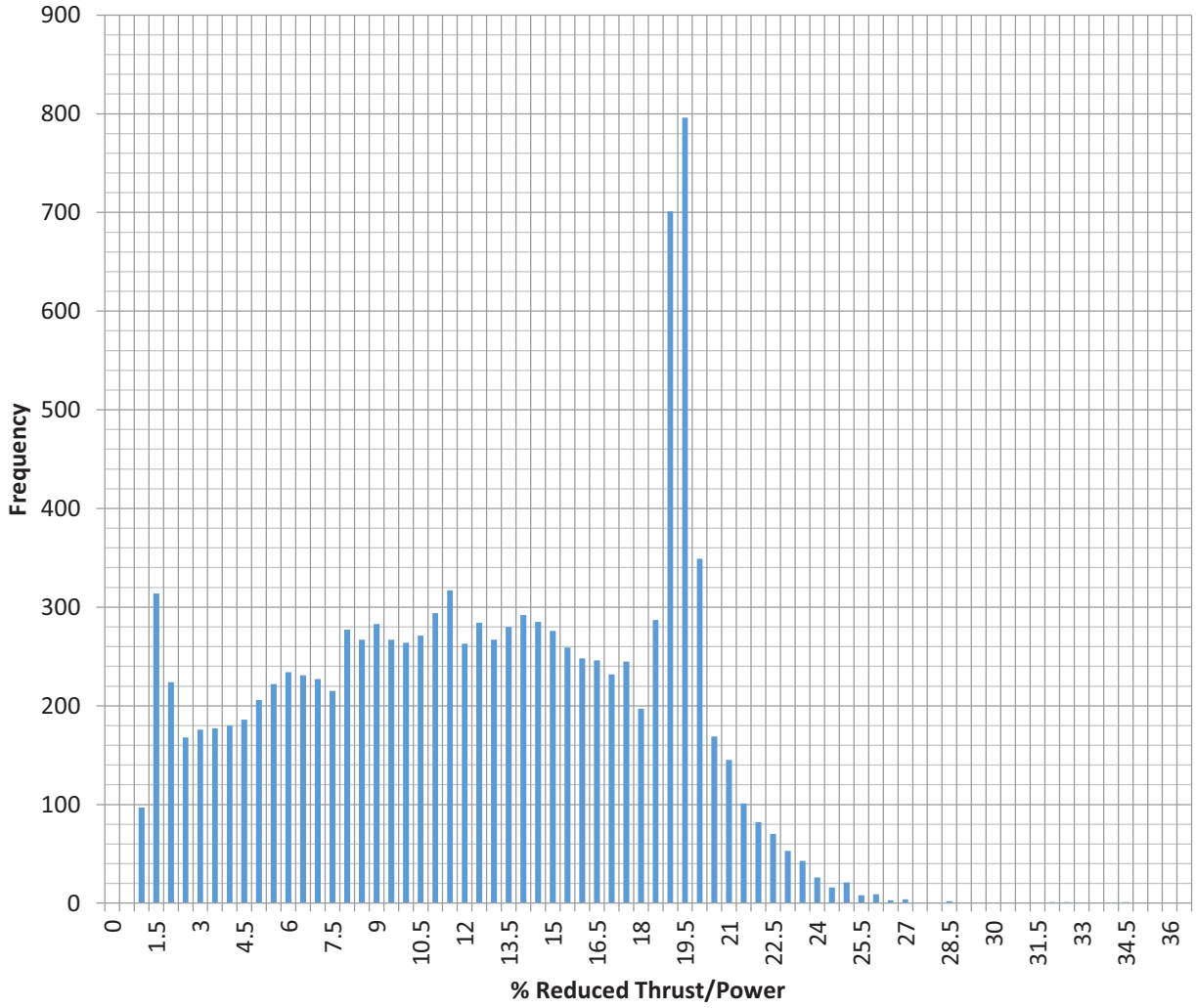

CHART 10

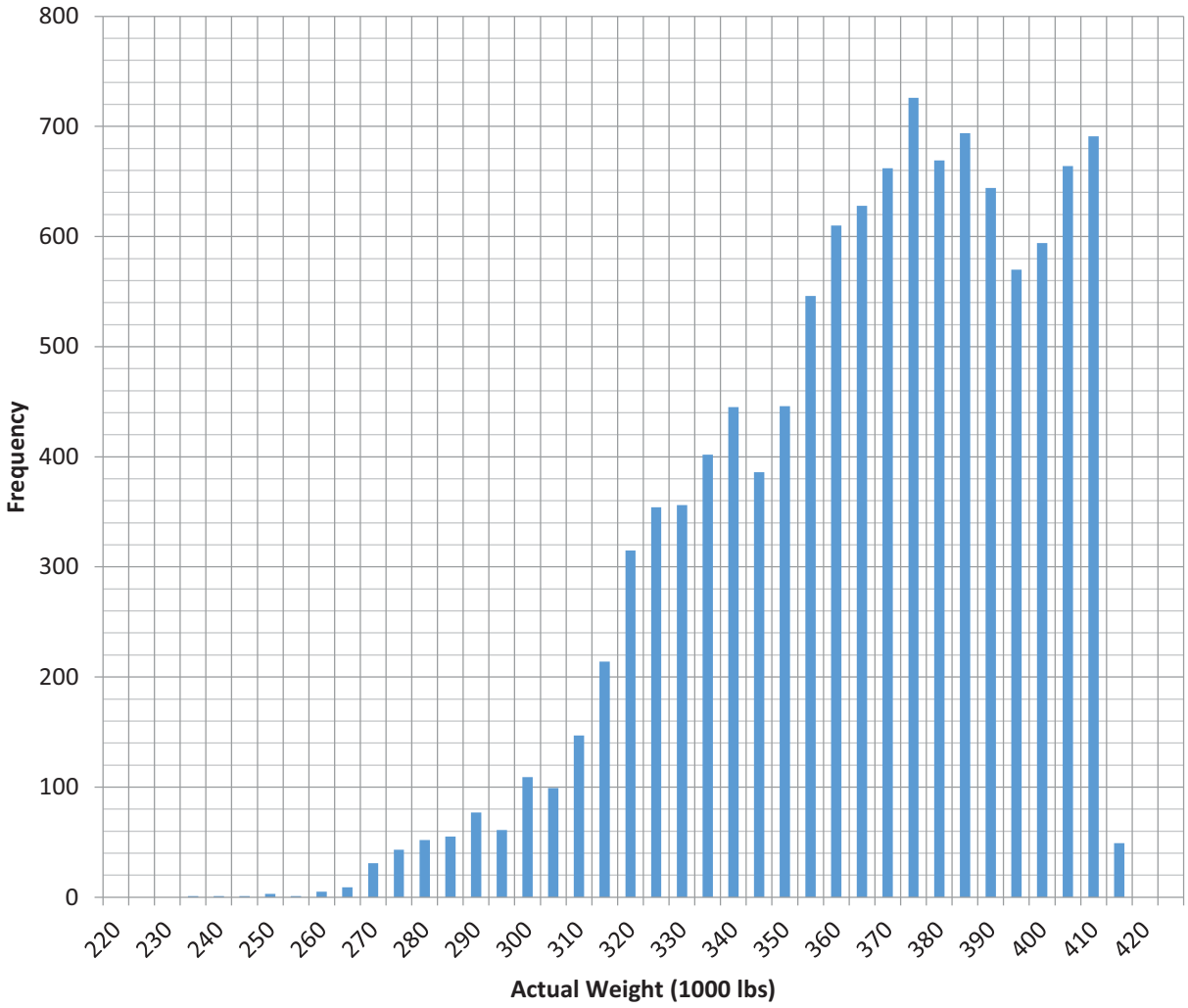
B767-300ER/CF680-C2B6
Frequency
800
700
600
500
400
300
200
100
0
220
230
240
250
260
270
280
290
300
310
320
330
340
350
360
370
380
390
400
410
420
Actual Weight (1000 lbs)

CHART 11

B737-800 AVERAGE ROUTE REDUCED THRUST RESULTS

ROUTE	AVG_WT	AVG_%DRATE		ROUTE	AVG_WT	AVG_%DRATE
AMSATL	388.8	6.9		CDGEWR	359.0	15.7
AMSBOM	396.5	5.9		CDGJFK	365.3	13.3
AMSDTW	372.8	10.8		CDGORD	370.8	12.6
AMSEWR	369.7	12.0		CDGSEA	378.5	11.7
AMSJFK	369.1	12.8		CDGSLC	389.3	9.5
AMSPDX	387.5	5.5		CPHJFK	360.6	14.9
ANCATL	344.0	8.7		CVGCDG	354.1	15.6
ATLAMS	373.3	11.0		DTWAMS	354.7	15.2
ATLBRU	366.5	11.2		DTWATL	292.2	19.7
ATLCDG	363.7	13.3		DTWCDG	351.2	18.1
ATLDTW	290.1	20.3		DTWGRU	390.9	7.5
ATLDUB	359.6	14.2		DTWLHR	353.5	15.8
ATLDUS	360.9	13.3		DTWSFO	310.0	20.7
ATLEZE	396.0	7.4		DUBATL	366.7	6.1
ATLFCO	382.5	9.3		DUBJFK	352.9	9.7
ATLFLL	277.8	21.1		DUSATL	387.1	3.5
ATLGIG	394.5	5.8		EWRAMS	345.7	15.1
ATLGRU	384.4	9.6		EWRCDG	338.7	16.6
ATLJAX	279.6	18.2		EZEATL	396.8	5.3
ATLJFK	300.3	21.1		FCOATL	402.7	7.4
ATLLAS	314.9	19.1		FCOJFK	399.0	7.8
ATLLAX	326.3	17.7		FLLATL	278.5	20.1
ATLLHR	362.8	12.6		FRAJFK	373.5	13.3
ATLLIM	354.2	16.6		FUKHNL	333.5	16.0
ATLLOS	401.9	4.5		GIGATL	394.5	7.4
ATLMAD	363.0	14.1		GRUATL	377.2	6.5
ATLMAN	358.1	14.1		GRUDTW	385.7	4.5
ATLMCO	275.1	19.4		HKGNRT	325.8	20.5
ATLMUC	376.9	9.9		HNDLAX	379.2	3.5
ATLMXP	376.5	9.7		HNDSEA	355.4	8.3
ATLPDX	317.1	18.7		HNLFUK	354.0	18.1
ATLSAN	310.3	19.3		HNLLAX	335.4	20.5
ATLSCL	388.1	8.2		HNLNGO	349.9	18.3
ATLSEA	330.5	17.0		HNLNRT	357.3	17.1
ATLSFO	321.2	18.1		ICNSEA	388.8	10.4
ATLSLC	309.5	19.8		ISTJFK	393.3	4.5
ATLSTR	370.5	10.8		JAXATL	264.3	17.5
ATLTPA	277.5	19.0		JFKAMS	349.1	18.5
ATLVCE	363.5	12.7		JFKATL	297.3	19.8
ATLZRH	371.6	11.2		JFKBCN	354.8	16.9
BCNJFK	379.9	6.3		JFKBRU	346.0	17.9
BOMAMS	396.4	5.1		JFKCDG	351.0	17.7
BOSATL	294.6	18.2		JFKCPH	346.1	19.1
BOSCDG	338.7	12.1		JFKDUB	348.5	17.8
BOSLHR	328.2	13.9		JFKFCO	360.8	15.9
BRUATL	381.2	5.5		JFKFRA	354.5	16.9
BRUJFK	363.2	9.6		JFKIST	377.1	13.2
CDGATL	380.6	11.6		JFKLAX	335.6	19.2
CDGBOS	343.1	18.1		JFKLHR	338.0	18.7
CDGCVG	370.4	13.2		JFKMAD	349.2	16.5
CDGDTW	364.5	14.0		JFKNCE	340.3	20.2

TABLE 21

B737-800 AVERAGE ROUTE REDUCED THRUST RESULTS

ROUTE	AVG_WT	AVG_%DRATE		ROUTE	AVG_WT	AVG_%DRATE
JFKPRG	358.0	17.1		SCLATL	399.0	5.5
JFKSEA	329.3	19.5		SEAATL	322.0	18.9
JFKSFO	315.2	19.3		SEACDG	372.7	12.4
JFKSVO	383.6	11.4		SEAHND	361.8	15.0
JFKTSE	390.3	9.6		SEAICN	392.3	9.5
JFKVCE	359.1	15.8		SEAJFK	328.0	18.7
JFKZRH	337.3	20.6		SEAKIX	385.0	10.6
KIXSEA	380.6	11.4		SEALHR	355.1	16.0
LASATL	301.6	21.7		SEANRT	396.5	2.9
LAXATL	318.4	19.2		SEAPEK	395.8	7.8
LAXDTW	318.2	19.2		SEAPVG	395.7	7.9
LAXHND	397.8	5.0		SFOATL	310.4	20.0
LAXHNL	344.0	16.1		SFODTW	305.5	20.0
LAXJFK	335.6	18.2		SFOJFK	306.0	19.4
LHRATL	371.8	12.3		SFONRT	385.7	7.5
LHRBOS	340.3	17.4		SJUATL	317.9	18.5
LHRDTW	356.6	15.6		SLCATL	302.2	19.1
LHRJFK	360.1	14.6		SLCCDG	369.4	6.8
LHRSEA	363.2	14.5		STRATL	390.2	5.3
LIMATL	375.4	11.3		SVOJFK	381.5	10.0
LOSATL	402.3	7.8		TPAATL	269.4	18.6
LOSSJU	399.8	8.5		TSEJFK	400.2	7.3
MADATL	395.4	6.5		TSEROB	294.3	22.7
MADJFK	379.3	8.4		VCEATL	396.7	6.4
MANATL	377.2	8.2		VCEJFK	374.7	9.9
MCOATL	274.5	20.0		ZRHATL	386.4	7.6
MCODTW	281.8	19.8		ZRHJFK	362.0	12.7
MSPLAX	307.0	19.3				
MUCATL	400.4	5.0				
MXPATL	391.5	4.2				
NCEJFK	364.8	8.8				
NGOHNL	341.7	19.1				
NRTHKG	317.8	18.9				
NRTHNL	346.0	18.9				
NRTPDX	384.2	11.6				
NRTPEK	314.4	18.2				
NRTPVG	319.0	20.5				
NRTSEA	381.8	9.0				
NRTSFO	386.0	11.1				
ORDCDG	353.9	9.5				
PDXAMS	377.5	10.3				
PDXATL	310.0	18.6				
PDXNRT	388.9	7.3				
PEKNRT	323.4	18.8				
PEKSEA	393.2	8.6				
PRGJFK	372.8	8.8				
PVGNRT	319.7	19.8				
PVGSEA	400.4	8.6				
ROBTSE	275.8	18.1				
SANATL	299.1	20.2				

TABLE 22

Departure Profile Impact:

To assess the impact of the weight differences and the use of reduced thrust versus full rated takeoff thrust using the FAA's All Engine Climb Program and the procedures provided in this section:

Weight Impact:
Use the tabular data provided for each aircraft and generate a profile with the AEDT estimated weight and one at either the actual average weight in the table or the weight generated by the suggested regression. Compare the resulting profiles or enter them into the AEDT to produce noise and emission differences.

Reduced Thrust/Power Impact:
Using the tabular data provided for each aircraft generate a profile with the weight shown at both full rated takeoff power and the average percentage of reduced thrust given. As with the weight impact above, compare the resulting profiles or enter them into the AEDT to produce noise and emission differences.

All Engine Climb Departure Procedures:

PROCEDURE 1: CLOSE-IN OR NADP1 (See Notes 3 and 4 below)

1) Takeoff and Climb at V2 + 15 knots to 800' AFE (retracting gear at 400')
2) At 800' AFE, Reduce Power to Maximum Climb
3) Continue Constant Speed Climb to 3000' AFE
4) At 3000' AFE, Reduce Pitch to 10^0-12^0, Accelerate and Retract Flaps per Manufacturer's Flap Speed Schedule. See Note 1 below.
5) Constant Speed Climb at 250 knots (IAS) to 10,000' AFE. See Note 2 below
6) At 10,000' AFE Transition to Normal Enroute Climb.

PROCEDURE 2: DISTANT OR NADP2 (See Notes 3 and 4 below)

1) Takeoff and Climb at V2 + 15 knots to 800' AFE (retracting gear at 400')
2) At 800' AFE, Reduce Power to Maximum Climb While Simultaneously Reducing Pitch to 10^0-12^0, Accelerate and Retract Flaps per Manufacturer's Flap Speed Schedule. See Note 1 below.
3) At Zero Flap or Clean Speed, if Below 3000' AFE, Constant Speed Climb to 3000' AFE. See Note 2 below.
4) At 3000' AFE, Accelerate to 250 knots (IAS)
5) Constant Speed Climb to 10,000' AFE
6) At 10,000' AFE Transition to Normal Enroute Climb.

NOTES:

1. Acceleration segment thrust split 45% Vertical, 55% Horizontal
2. Thrust split 50% Vertical, 50% Horizontal
3. Repeating the above procedures at both 1000' and 1500' AFE will represent the majority of air carrier departure procedures.
4. Takeoff Flap Setting:
    a. B737: Flap 01and 05

b. B757and B767, Flap 05 and 15

Conclusions

Takeoff Weight Determination:

The regressions developed from operational flight planning databases represented a definite improvement in aircraft specific takeoff weight determination. The existing AEDT Stage Length methodology can lead to discrepancies in weight determination which in turn leads to errors in the aircraft departure profile and subsequently errors in the noise and emission levels. Implementation of the regressed equations into the AEDT is not complex and the required information from the user is easily attained from a number of sources.

Reduced Thrust (Level and Usage):

The analysis of the significantly large ACARS databases presented the first known definitive data regarding the air carrier use of reduced thrust/power for departure. The high percentage of use confirms not only that the use of full rated takeoff power is very small but that existing noise and emissions inventories attributed to aircraft departures requires reexamination.

While there may be some discussion of whether one carrier's data is representative of industry practices, it is a fact the maximum certified reduced thrust level for a specific airframe/engine combination is the same for each carrier. As also stated in this report, different levels of use for departure can only result from the choices provided to the flight crew. Since a number of carrier's have reported various options presented to their respective flight crews that, in itself, confirms the comment in this report regarding the pilot community response to reduced thrust/power departures. Simply based on the population size of the ACARS databases used in this research, it would require a large operational database from another carrier which produced a significantly different result to alter the results of this analysis.

References

1. Forsyth, David W.; Gulding, John; DiPardo, Joseph: "Review of Integrated Noise Model (INM) Equations and Processes", NASA/CR-2003-212414 (May 2003)