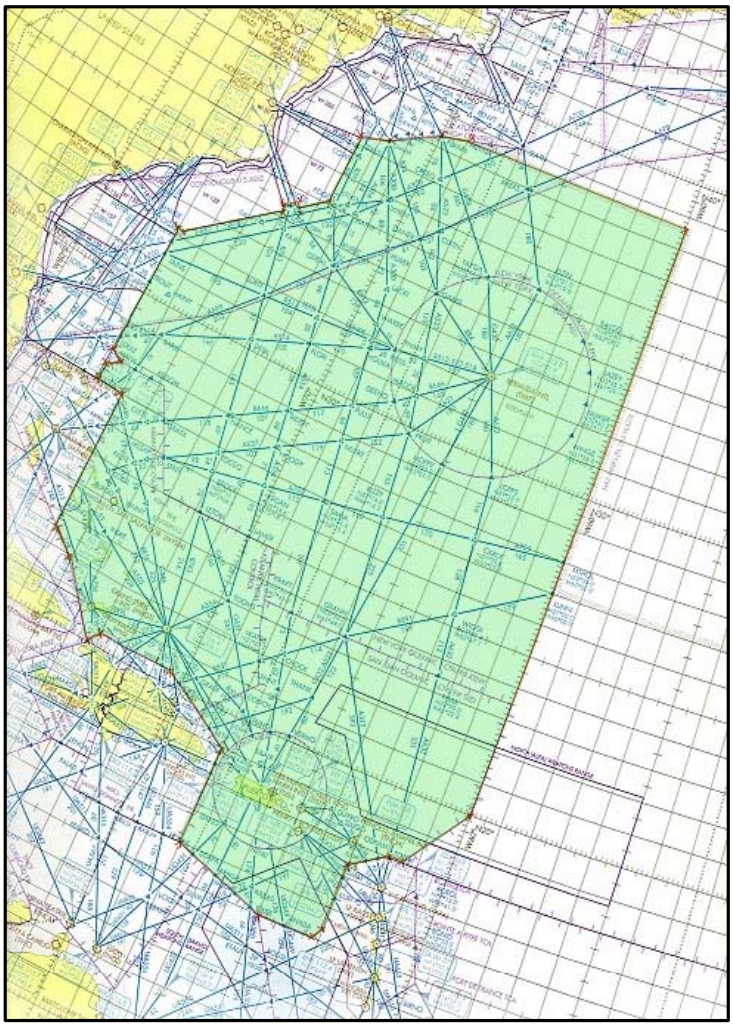
WATRS Plus Know Your Airspace Analysis

A Comprehensive Study of Operators, Aircraft, and Traffic Patterns in the West Atlantic Route System (WATRS) and Additional Airspace for a Separation Change



Prepared for the Separation Standards Analysis Group, AJP-7141 (formerly ACB-310), FAA Technical Center

Prepared by: CSSI, Inc.

1. Introduction

1.1. The West Atlantic Route System is a complex, high traffic area that is comprised mostly of fixed routes with a significant number of crossings. Historically, the traffic in this region has been increasing at an approximate rate of 2.8 percent per year. This upward trend is expected to continue. In an effort to accommodate the increased demand for optimum performance, the FAA has the opportunity to implement horizontal separation reductions and reorganize the route system to dramatically increase capacity and efficiency. This effort has been designated as the "Airspace Redesign and Separation Reduction Initiative". This initiative has been identified as a key milestone by the Operational Evolution Plan (OEP), the Federal Aviation Administration's (FAA) rolling ten-year plan to increase the capacity and efficiency of the National Airspace System (NAS)

1.2. The airspace considered for the oceanic lateral separation reduction includes the West Atlantic Route System (WATRS), San Juan Flight Information Region (FIR), and the Miami ARTCC (ZMA) Oceanic FIR, referred to collectively hereinafter as WATRS Plus. The WATRS Plus airspace is highlighted in Figure 1. The coordinates of the WATRS Plus airspace used in this analysis are contained in Appendix A.

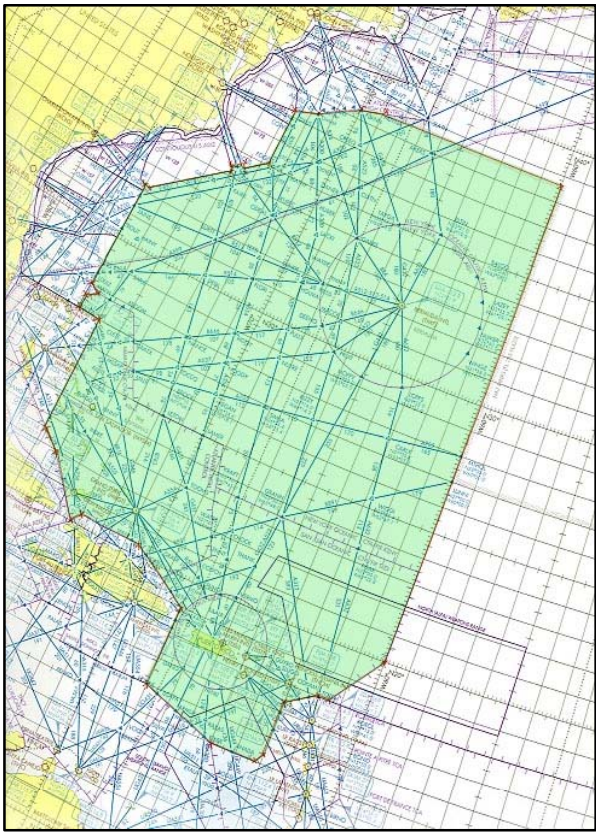


Figure 1. A Map Highlighting the Airspace Identified as WATRS Plus

2. Background

2.1. Due to the current structure of WATRS and the lateral separation requirement of 90 nautical miles, adding additional fixed routes to accommodate increased traffic demands would be difficult. Additional routes would conflict with existing heavily traveled north/south routes. This would cause undue restrictions on all aircraft in the airspace and result in unfavorable altitude assignments and fuel penalties.

2.2. Preliminary studies indicate that a lateral separation reduction from 90 to 50 nautical miles in WATRS may be attainable using the Required Navigation Performance (RNP) 10 standard. Accordingly, the FAA is proceeding with a preliminary risk analysis based on the internationally accepted collision risk modeling methodology to determine if the risk is acceptable in terms of the prescribed Target Level of Safety (TLS).

3. Purpose

3.1 The purpose of this analysis is to provide basic information about the airspace under consideration for a separation reduction and reorganization or redesign. This analysis is intended to provide airspace planners, separation analysts and decision makers with a starting point for further specific analysis and assessments.

4. Data Collection and Processing

4.1. In order to accurately assess the daily operations in the WATRS Plus airspace, a 105-day traffic sample was used for analysis. The time period of the sample was 01 December 2005 to 15 March 2006. The data for this sample was derived from the Enhanced Traffic Management System (ETMS)

4.1.1. ETMS is a data exchange system for supporting the management and monitoring of national air traffic flow. ETMS processes all available data sources to produce a picture of the state of the air traffic. This allows for several types of data to be available in the Flight Database such as geographical, aircraft situation, monitor/alert, request report, weather and traffic management data.

4.1.2. ETMS collects data from various sources; scheduled flight messages, National Airspace System (NAS) messages, Dynamic Oceanic Tracking System (DOTS) messages, Estimated Departure Clearance Time (EDCT) messages and flight substitution messages. The ETMS data is processed in multiple steps by a “Parser” software application. Table 1 highlights the message types used in the ETMS Parser.

Message Type	Description
FZ - Flight Plan	• Flight ID • Computer ID (for proposed flights only) • Aircraft type • Speed • Coordination fix • Coordination time • Cruising altitude • Flight path • Estimated time en route (ETE) (proposed flights only) • Estimated time of arrival (ETA) (active flights only)
AZ - Amended Flight Plan	• Flight ID • Computer ID (for proposed flights only) • Departure point • Destination • Which field to amend • New contents of field
DZ - Departure	• Flight ID • Computer ID (for proposed flights only) • Aircraft type • Departure point • Activation time • Destination • ETA
AZ Arrival	• Flight ID • Aircraft type • Departure point • Destination • Deactivation time
TZ - Position Update	• Flight ID • Computer ID • Speed • Altitude • Position
TO - Oceanic Position Updates	• Flight • Speed • Time of Current Report • Altitude • Position • Time of next report • Altitude • Position

Table 1. Description of ETMS Message Types

4.1.3. The ETMS Parser is a Fortran-based software application, which has been developed specifically for the purpose of combining all relevant flight information onto a single summary line, one line per Flight ID. Raw ETMS data is input to the Parser. In order to gather as much data as possible for each flight, the Parser application "looks" at 12 hours of the previous day and 12 hours of the following day in combination with the current data day to compile flights for the current data day. Through a series of steps, individual flights are processed with the final result matching the corresponding flight information, (aircraft, origin, destination and cruising altitude) to the flight ID. A flow chart illustrating this process is included in Appendix B.

4.1.4. Using the raw ETMS data, the parser separates the data into message types; Arrival messages (AZ), Flight planning (FZ), scheduled flight plans (FS), Amended Flight Plans (AF), Departure Messages (DZ), Position Reports (TZ), Oceanic Position Reports (TO), and Boundary Crossing Messages (UZ).

4.1.5. The geographic region for the data collection is determined from the airspace polygon definition or coordinates and center ID. In addition to the geographic boundary definition for WATRS Plus, the selected flight level range of FL275 – FL455 (inclusive), was used to identify the airspace.

4.1.6. Given that flight IDs can remain the same through a series of stops, it is necessary to determine the number of legs per flight ID. Flight legs are determined based on the gap in time between position reports. The assumption is that an aircraft needs more than one hour to descend below FL290, land and climb back to FL290 or above. Since the position reports are arranged by time, if the time difference between two position reports with the same flight ID exceeds one hour, then the flight has multiple legs. The duration and cruising altitudes of each leg, between FL275 and FL455, are then computed. The duration is calculated by subtracting the first occurrence of the leg from the last. Cruising altitudes are considered to be those that occur more than once since transitions between flight levels are not of interest.

4.1.7. Once all of the information is collected, it is stored on a single summary line. Using all of the message type files, AZ, AF, FZ-FS, DZ, TZ and UZ, the flight information is matched to the corresponding flight ID. The summary of each flight includes the date (DATE), entry time (TIME), flight ID (FLTID), segment of flight (LEG), aircraft type (ACTYPE), equipment code (EQUIP), origin (ORIG), destination (DEST), an estimate of time in the airspace (DURATION), and cruising altitudes (FLTLVL). An example of the final output from ETMS data used in this analysis is shown in Table 2.

DATE	TIME (hhmmss)	FLTID	LEG	ACTYPE	EQUIP	ORIG	DEST	DURATION (hhmmss)	FLTLVL
12/1/2005	000000	SSV3249	1	B752	/W	MDPC	CYEG	010059	340
12/1/2005	000005	AAL1312	1	A306	/Q	TJSJ	KMIA	003900	340
12/1/2005	234743	AAL796	2	B752	/Q	TNCA	KJFK	000600	380
12/1/2005	000011	AAL2251	1	A306	/W	KMCO	TJSJ	001004	350
12/1/2005	224443	AAL2251	2	A306	/W	KMCO	TJSJ	010747	330
12/1/2005	000011	BWA424	1	B738	/Q	TTPP	KJFK	024432	360
12/1/2005	232208	BWA424	2	B738	/Q	TTPP	KJFK	003213	340
12/1/2005	000011	AAL1792	1	B752	/J	TJSJ	KBWI	021016	380

Table 2. Output Sample of Parsed ETMS Data

5. Analysis

5.1. The following section presents the results of the analysis of the processed traffic sample. These results are presented in terms of summaries of operators, fleet composition, flight level utilization and origin-destination combinations in the WATRS Plus Airspace, as observed in the ETMS data sample.

5.2. Figure 1 shows the top 20 operators, in terms of total operations, as observed in the traffic sample. The top operator, American Airlines (AAL), accounts for just over 25 percent of the observed operations in the sample. In contrast, the twentieth most frequent operator, LTU Lufttransportunternehmen GBMH & CO. (LTU), conducted less than 1 percent of the flights. The remaining 20 percent of the flights in the airspace were attributed to the 336 other operators and collectively identified as "Other" in Figure 2. A complete list of all of the operators identified in the WATRS Plus airspace is included in Appendix C.

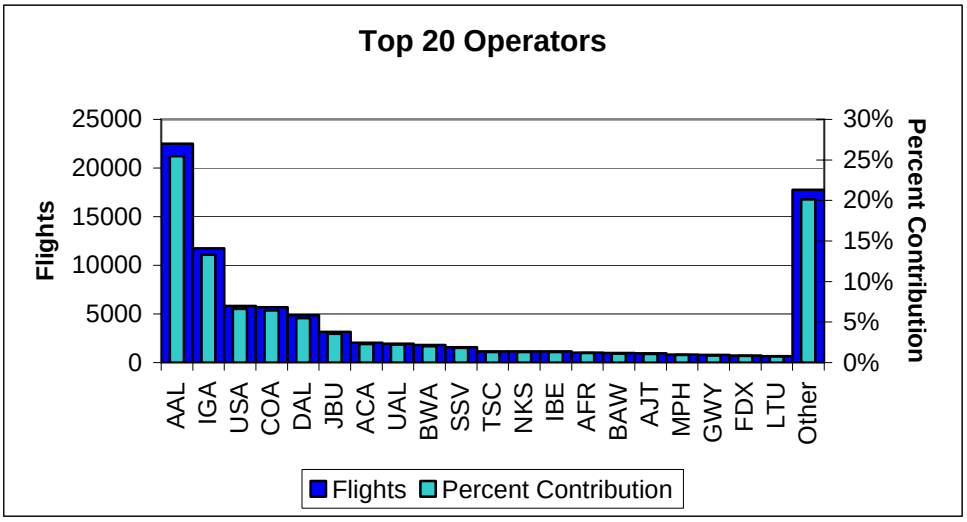


Figure 2. Top 20 Operators in Rank Order

5.2.1 Additionally, a large number of infrequent flight operations were identified in the traffic sample. It was noted that 98 out of 356 operators or 27.5 percent of the operators observed during the sample period, conducted only 1 or 2 flights in the WATRS Plus airspace.

5.3. A distribution of the top 20 aircraft types is shown in Figure 3 in rank order. The top 20 aircraft types represent approximately 82 percent of the operations. A total of 280 aircraft types were observed in the traffic sample.

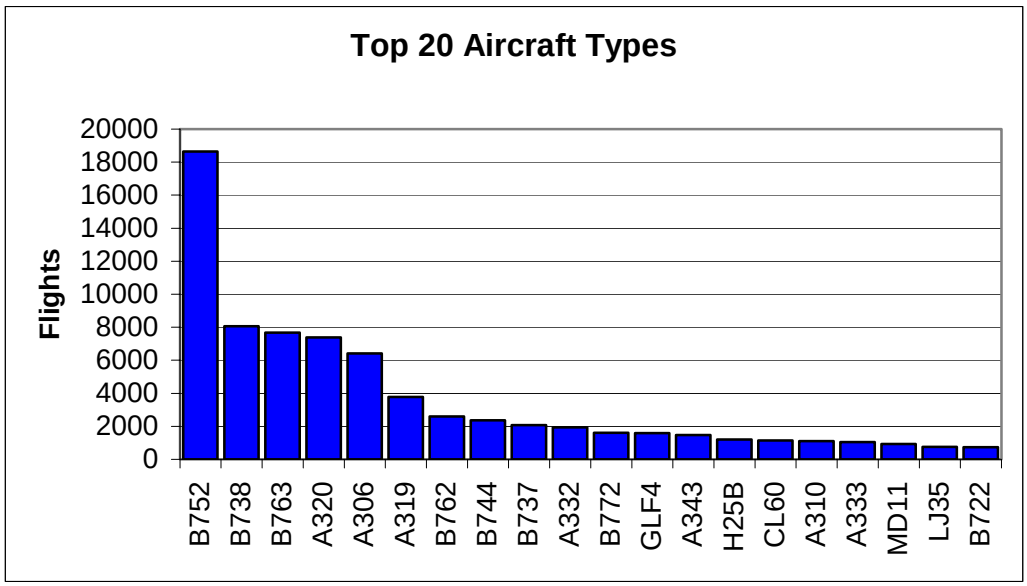


Figure 3. Top 20 Aircraft Types in Rank Order

5.4. A distribution of the top 20 operator/aircraft type combinations is shown in Figure 4 in rank order. The operator/aircraft type combination with the largest volume of traffic observed in the sample is American Airlines (AAL)/B752 contributing over 13 percent of the operations. The top 20 operator/aircraft type combinations represent approximately 52 percent of the operations.

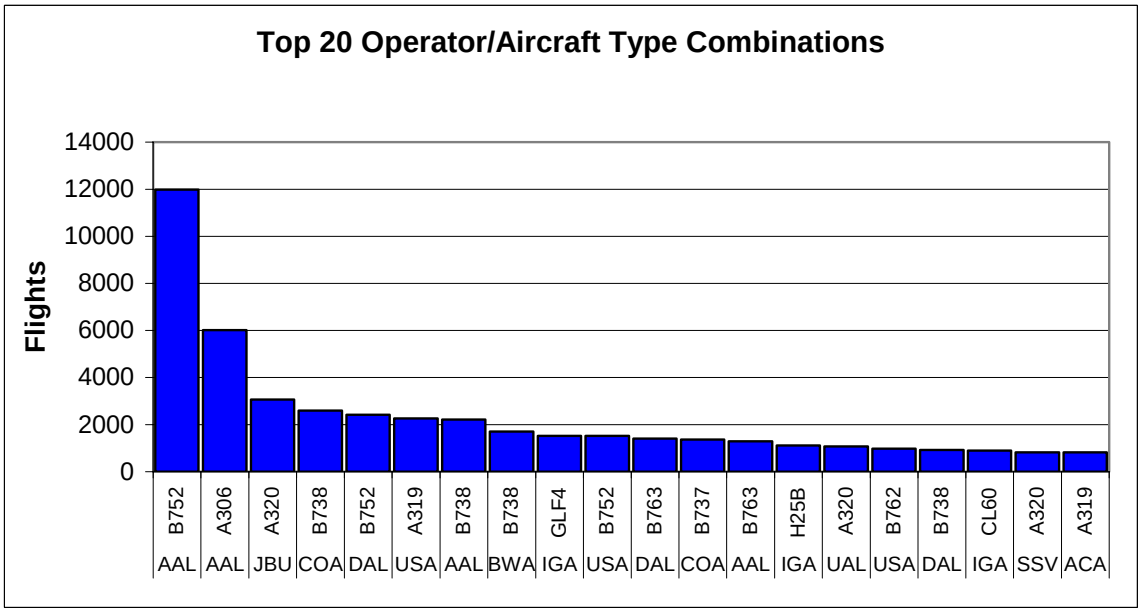


Figure 4. Top 20 Operator/Aircraft Type Combinations

5.5. Flight levels of flights observed operating at level flight were extracted and plotted in a graph. A distribution of the flight level utilization is shown in Figure 5. The flight levels with the highest concentration of traffic, 350,360 and 370, account for approximately 40 percent of the operations in the traffic sample.

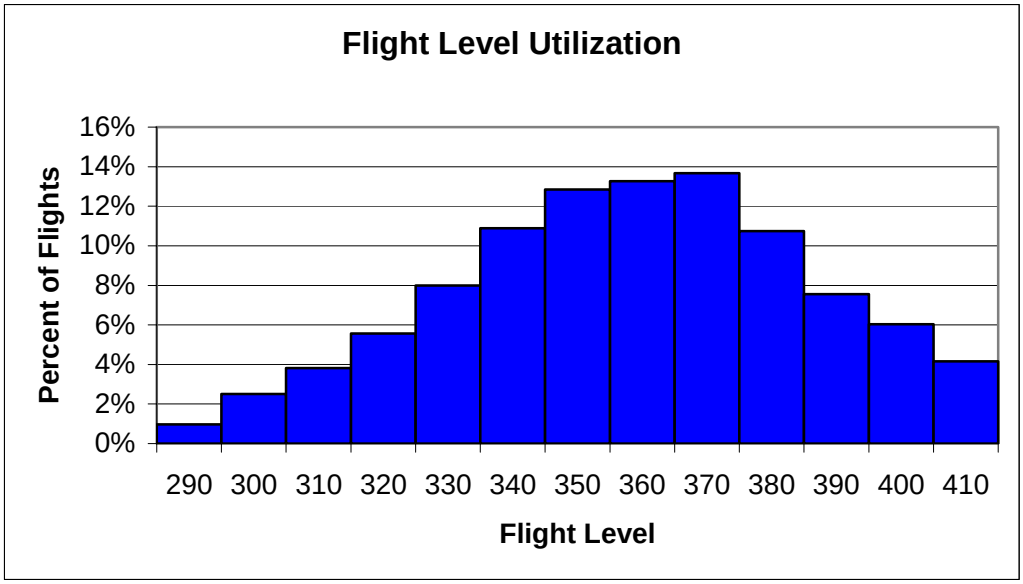


Figure 5. Distribution of Flight Level Utilization

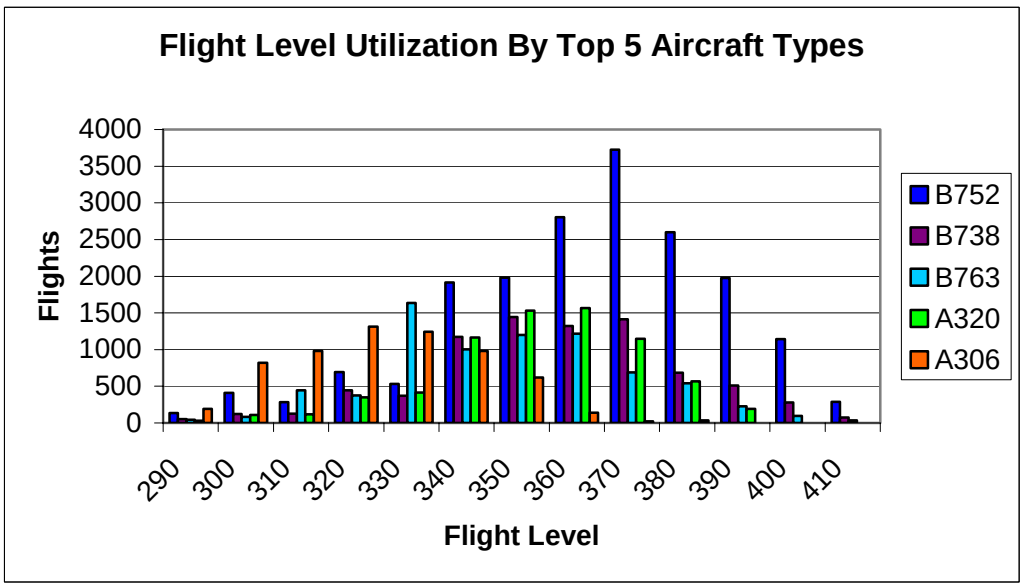


Figure6. Flight Level Utilization by the Top 5 Aircraft Types
The top 5 Aircraft Types Contribute 54% of the observed traffic

5.6. The time that an aircraft entered the WATRS Plus airspace was extracted from the sample for each flight. A distribution of the WATRS Plus entry time is shown in Figure 7. The highest concentration of traffic occurs between 1400 coordinated universal time (UTC) and 0100 UTC. The 1400 to 0100 UTC time block represents 68 percent of the total traffic.

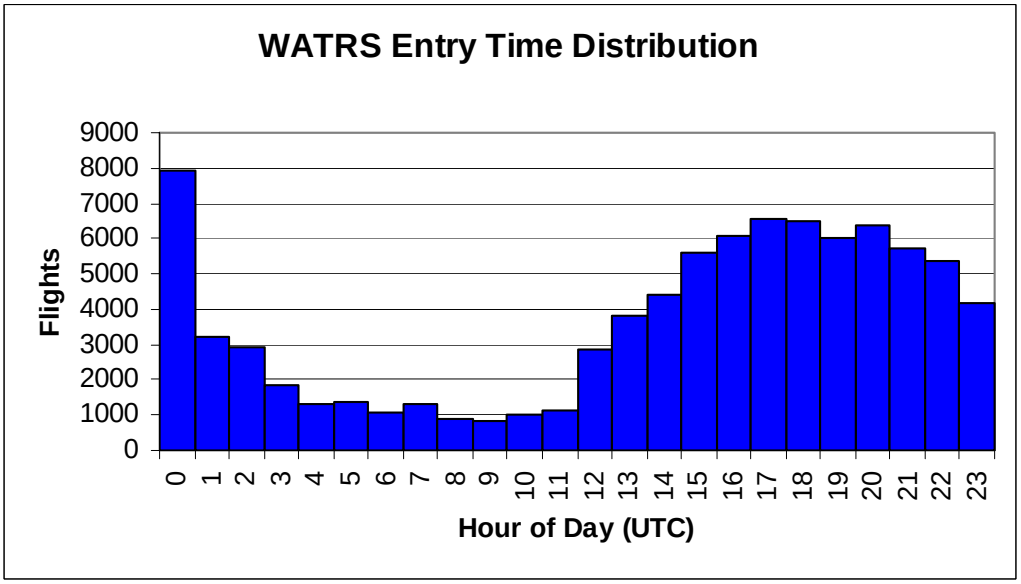


Figure 7. WATRS Plus Boundary Entry Time Distribution

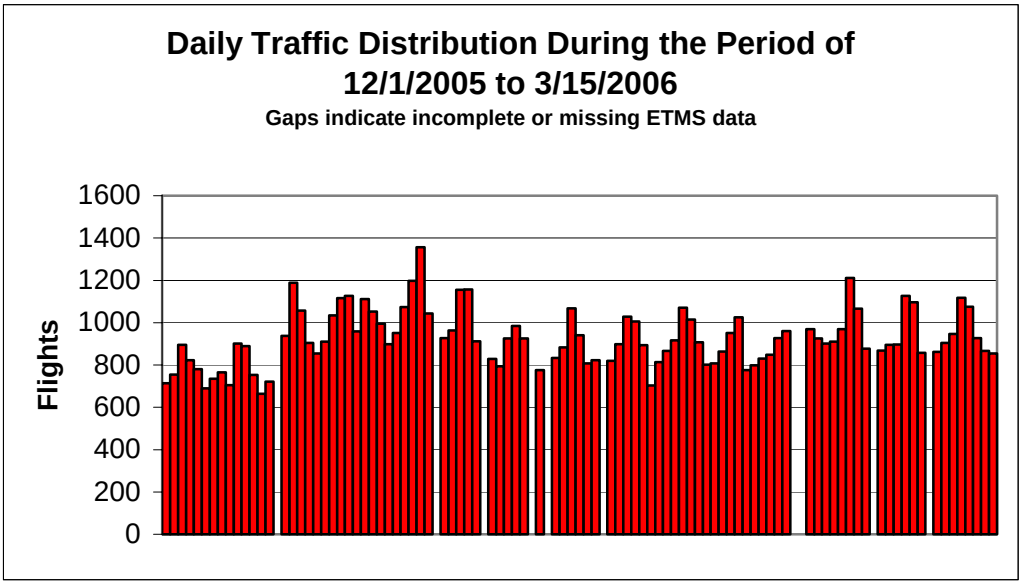


Figure 8. Daily Observed Traffic Distribution in WATRS Plus

*Gaps represent the following days with incomplete or missing ETMS data:

15 December 2005	18 January 2006	19 February 2006
04 January 2006	25 January 2006	28 February 2006
10 January 2006	18 February 2006	07 March 2006

5.7. The origin and destination information for each flight was extracted from the traffic sample. The data are further analyzed to determine unique origin/destination combinations; called city pairs. Figure 9 identifies the top 20 city pairs, which represent approximately 28 percent of the operations. San Juan Luis Munoz Marin Airport to New York John F. Kennedy Airport is the most flown city pair contributing 5 percent of the traffic.

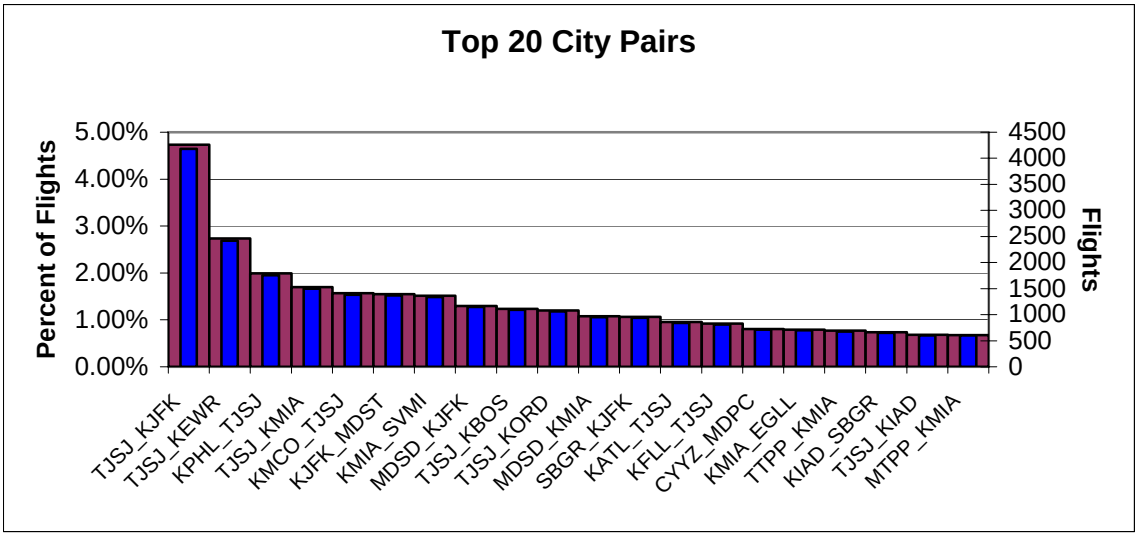
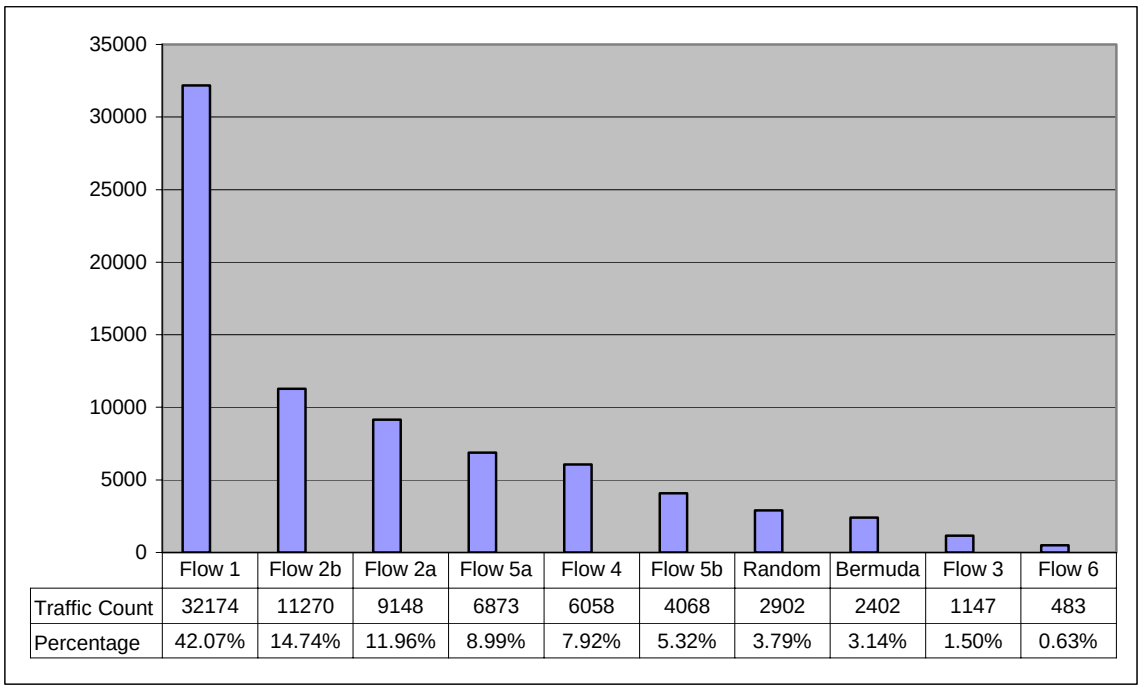


Figure 10. Top 20 City Pairs in Rank Order

5.8. All city pairs with an observed traffic count of 15 or higher were geographically plotted and joined together by great circle routes. The routes were analyzed and grouped together into general traffic flows to facilitate further analysis. A description and graphic of each flow is included in Appendix D. Figure 10 illustrates the total traffic count and the percentage of contribution of each flow. Flow 1, North America, Northeast to East Caribbean and South America (NAM NE - E Caribbean/SAM), represents 42 % of the traffic observed in WATRS Plus during the analytical period. A list of the identified flows is included in Table 3.

Flow ID	Flow Name	Flow Description
Flow 1	NAM NE - E Caribbean/SAM	North America, Northeast to East Caribbean and South America
Flow 2a	NAM Cent - E Caribbean	North America, Central to East Caribbean
Flow 2b	Florida + - E Caribbean	Florida Plus to East Caribbean
Flow 3	NAM N/Cent - W Caribbean/Florida	North America, North to Central to West Caribbean/Florida
Flow 4	Florida+ - SAM	Florida Plus to South America
Flow 5a	N Eur - Florida/W Caribbean	North Europe to Florida/West Caribbean
Flow 5b	Europe - E Caribbean	Europe to East Caribbean
Flow 6	NAM - Africa	North America to Africa
Bermuda	Bermuda	Bermuda
Random	Random	Random

Table 3. Flows Identified in the WATRS Plus Airspace



	Flow 1	Flow 2b	Flow 2a	Flow 5a	Flow 4	Flow 5b	Random	Bermuda	Flow 3	Flow 6
Traffic Count	32174	11270	9148	6873	6058	4068	2902	2402	1147	483
Percentage	42.07%	14.74%	11.96%	8.99%	7.92%	5.32%	3.79%	3.14%	1.50%	0.63%

Figure 11. Flow Analysis

6. Operator Survey

6.1.1. In an effort to determine current and near-term projected usage of WATRS Plus airspace for separation reduction analysis, a user long-range navigation capability survey was developed. The form used to conduct the survey is contained in Appendix E.

6.1.2. The top 40 operators observed in the sample have been targeted for the survey. As of May 31, 2006, 17 operators have returned completed surveys. The 17 operators that have responded to the survey represent 54 percent of the operations in the airspace. Coordination to obtain additional completed surveys is ongoing. A summary of the survey responses received is presented in Appendix F.

Appendix A

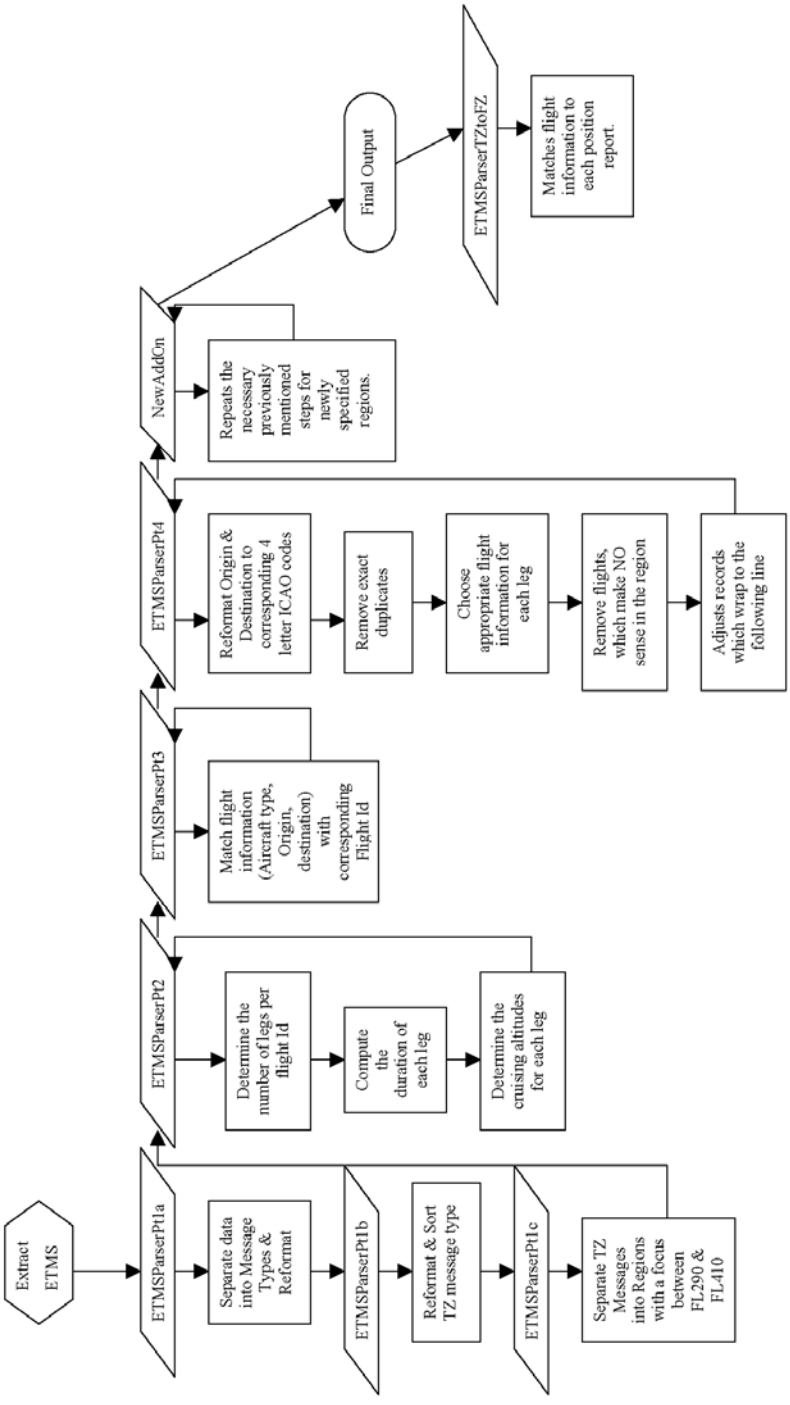
WATRS Plus Airspace Coordinates

The sources used to define the WATRS Plus airspace boundary coordinates were the National Airspace System (NAS) Adaptation Services Environment (NASE) web site, the Adaptation Controlled Environment System (ACES) database, the North Atlantic Route Chart, a custom controller chart of the airspace provided by the National Aeronautical Charting Office (NACO) and the International Civil Aviation Organization (ICAO) Regional Supplementary Procedures Document 7030. The coordinates are as listed below.

Latitude	Longitude
18° 00' 00" N	61° 30' 00" W
18° 00' 00" N	62° 00' 00" W
17° 21' 11" N	63° 00' 00" W
15° 20' 00" N	63° 00' 00" W
15° 00' 00" N	63° 15' 00" W
15° 00' 00" N	65° 00' 00" W
16° 00' 00" N	68° 00' 00" W
19° 00' 00" N	68° 00' 00" W
20° 25' 00" N	70° 30' 00" W
20° 25' 00" N	73° 00' 00" W
20° 00' 00" N	73° 20' 00" W
22° 00' 00" N	75° 10' 00" W
22° 35' 00" N	76° 00' 00" W
27° 00' 00" N	76° 00' 00" W
27° 00' 00" N	77° 00' 00" W
27° 30' 00" N	77° 00' 00" W
27° 50' 00" N	76° 30' 00" W
28° 10' 00" N	77° 00' 00" W
32° 15' 00" N	77° 00' 00" W
32° 13' 00" N	76° 50' 00" W
34° 15' 00" N	73° 58' 00" W
34° 20' 00" N	74° 03' 00" W
34° 33' 00" N	73° 47' 00" W
34° 30' 00" N	73° 35' 00" W
35° 07' 00" N	72° 40' 00" W
37° 15' 00" N	72° 40' 00" W
37° 31' 00" N	71° 40' 00" W
38° 20' 00" N	69° 56' 57" W
38° 30' 00" N	69° 17' 00" W
38° 30' 00" N	60° 00' 00" W
20° 00' 00" N	60° 00' 00" W
18° 00' 00" N	61° 30' 00" W

Appendix B

ETMS Process Flow Chart



Appendix C

Operators Identified in WATRS Plus

ICAO ID	Flight Count
AAL	22487
IGA	11740
USA	5838
COA	5680
DAL	4860
JBU	3144
ACA	2036
UAL	1943
BWA	1794
SSV	1588
TSC	1158
NKS	1151
IBE	1135
AFR	1034
BAW	971
AJT	944
MPH	824
GWY	781
FDX	734
LTU	655
KLM	649
CFG	647
UPS	590
NAO	552
VRG	538
VIR	472
ALV	454
AEA	441
SAA	418
AJM	380
BPA	374
WJA	343
CMP	343
SEU	324
CER	321
LVG	280
OOM	274
CRL	258
BAL	243
TPA	239
BBR	239
DRD	238
DLH	236
IWD	225
RCH	225
FCA	216
PCE	215
CUB	214
AMX	213
AVA	210
AZA	197
TAM	188
FWI	187
TFL	186

ICAO ID	Flight Count
NWA	179
CJT	173
TCX	165
MYT	164
BSK	157
RYN	157
CAA	155
MPD	155
LAN	155
AMT	150
ABX	148
CJA	145
FIV	144
HPJ	139
TAG	133
KHA	130
VPB	118
JAL	117
TUB	113
VEC	111
SCX	105
XNA	105
PLM	105
SWR	102
EEZ	99
CXP	97
NOS	94
APW	93
ICE	92
SWG	89
WOA	85
AUA	83
BHP	83
FIN	78
CWC	74
LCO	73
LXJ	67
CGR	64
FFP	57
DHL	53
EDW	53
IDE	42
SLM	39
TSO	38
ECJ	36
TFC	34
CKS	34
NVR	34
GMA	33
AFL	31
ATN	31
CSA	30
FJS	30
HBI	29

ICAO ID	Flight Count
GCO	29
PRD	28
AEY	27
PAT	27
RZO	26
FAO	26
FWK	26
DAE	25
EJA	25
JCT	24
LNE	24
NWD	23
LCG	23
VLE	22
FWL	21
GES	21
FIF	20
AAY	20
CFH	19
MON	18
CIU	18
LXG	17
JAV	17
PWA	17
DOJ	16
SWQ	16
SPA	15
CSD	15
PAC	15
MMZ	15
CLX	15
CFZ	14
SSH	14
WDR	14
CGH	14
CFC	14
YSS	14
CGS	13
TDX	13
TUS	13
BZF	13
XLA	12
PCL	11
CGI	11
CGK	11
CFJ	11
MAH	11
PTO	11
FRD	11
CGA	11
VDA	10
GEC	10
CGM	10
GTI	9

ICAO ID	Flight Count
PPA	9
BOX	9
KCE	9
AJI	9
XAA	9
PRS	9
SER	8
CGL	8
XAC	8
PRG	8
KFS	8
NAJ	7
CGD	7
MAL	7
XAM	7
CGW	7
SVV	7
DDA	7
ARG	7
CNK	7
EXH	6
SVW	6
CAZ	6
TRA	6
MDT	6
PCJ	6
STE	6
BRS	6
JIA	6
WML	6
CGG	6
VHT	6
SAZ	6
CFR	5
FAB	5
FPG	5
OPT	5
CCP	5
XAB	5
JUA	5
JMS	5
MAA	5
PHV	5
DUB	5
CGB	5
CGC	5
JAG	5
TVS	5
XAR	5
OAE	5
CGP	4
SVA	4
NAF	4
CJE	4

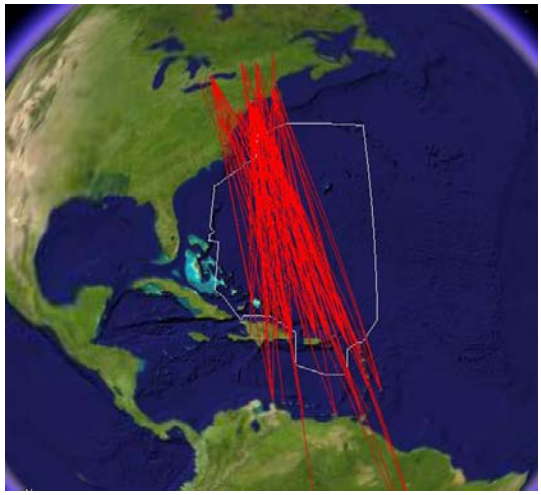
ICAO ID	Flight Count
ROS	4
RGN	4
SNT	4
POT	4
XAT	4
LLB	4
AME	4
OEG	4
ONG	4
KAI	4
JED	4
JCB	4
LXA	4
UJT	4
BMA	4
PRJ	4
GDA	4
BTA	4
NJE	4
PRR	4
TAP	4
NOA	4
XAS	3
XAO	3
FEX	3
SQC	3
AMI	3
SNA	3
CGU	3
CFD	3
CFT	3
CGO	3
ELJ	3
ACN	3
CFI	3
ISD	3
IVE	3
UEJ	3
BHS	3
EUK	3
RRR	3
TJS	3
ADB	2
XBO	2
CHH	2
XAV	2
TSI	2
AVL	2
BAT	2
BLU	2
CFS	2
CFE	2
TGR	2
VRT	2

ICAO ID	Flight Count
LNC	2
LRC	2
REL	2
OEA	2
HKI	2
PTP	2
IND	2
FAF	2
FLJ	2
RAI	2
PRO	2
LIA	2
OKS	2
LAM	2
HGR	2
IVJ	2
IJA	2
FLC	2
SKL	2
CTT	2
DEC	2
DGX	2
SMJ	2
DNJ	2
SHE	2
MMD	2
LXP	2
ETH	2
EGF	2
LXF	2
NAT	1
ADO	1
POL	1
PDR	1
YYY	1
JEP	1
JST	1
ARF	1
LAD	1
APE	1
LKS	1
LVB	1
NOR	1
LDA	1
AIZ	1
ADN	1
NSK	1
ALL	1
XAF	1
LLL	1
AIN	1
MOV	1
EJM	1
HLX	1

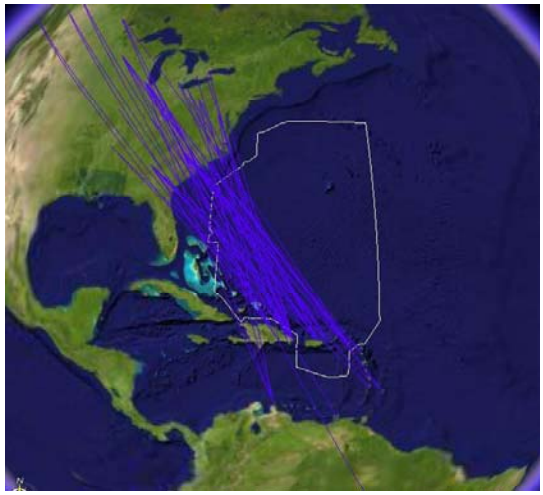
ICAO ID	Flight Count
RAL	1
TES	1
FGP	1
FFF	1
RHC	1
CCA	1
EVA	1
PTM	1
EIN	1
EFF	1
SEN	1
ECI	1
DCS	1
TAI	1
EXU	1
BRB	1
PRE	1
UAE	1
HVN	1
BJT	1
HTR	1
DSO	1
FWD	1
TAN	1
VBS	1
PRM	1
GUM	1
BTI	1
BVR	1
GAM	1
PRX	1
HHH	1

Appendix D

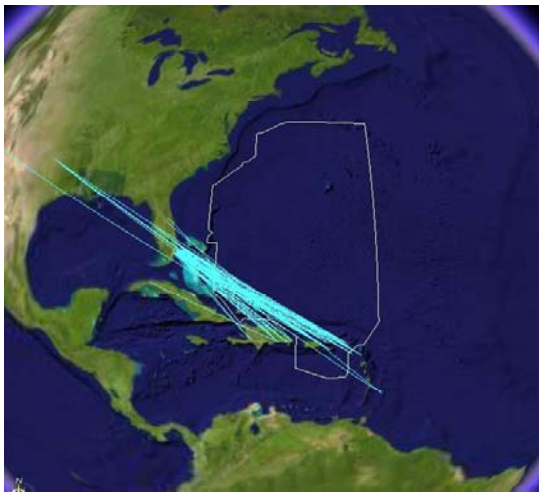
Flow Description and Analysis



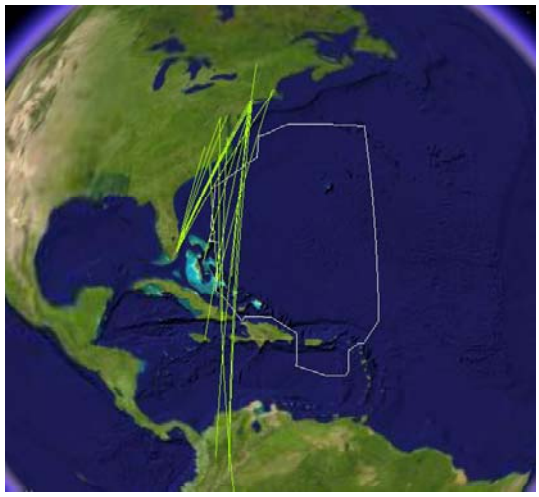
Flow 1
NAM NE - E Caribbean/SAM
145 Origin/Destination Pairs
Traffic count – 32174



Flow 2a
NAM Cent - E Caribbean
73 Origin/Destination Pairs
Traffic Count – 9148

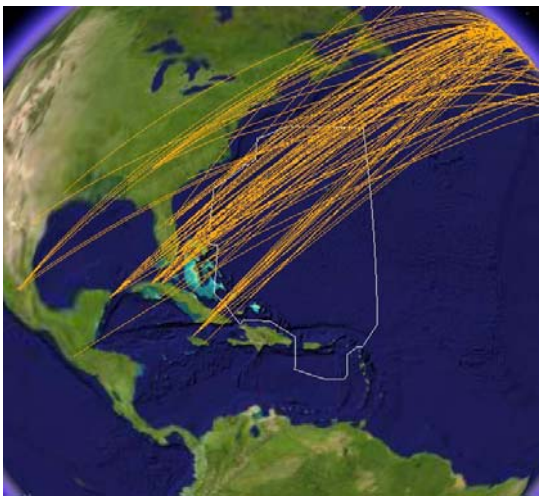


Flow 2b
Florida + - E Caribbean
66 Origin/Destination Pairs
Traffic Count – 11270

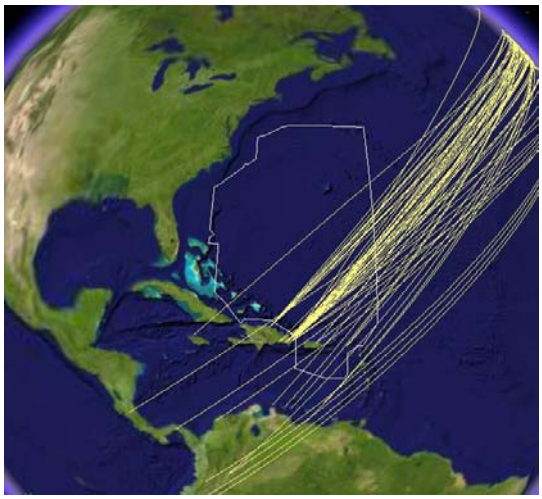


Flow 3
NAM N/Cent - W Caribbean/Florida
23 Origin/Destination Pairs
Traffic Count - 1147

Flow 4
Florida+ - SAM
36 Origin/Destination Pairs
Traffic Count – 6058

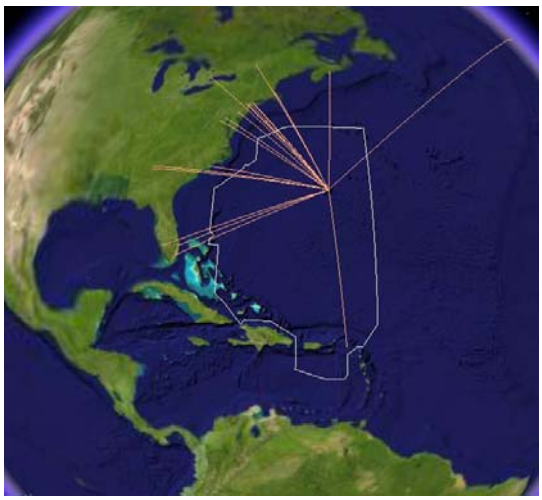


Flow 5a
N Eur - Florida/W Caribbean
90 Origin/Destination Pairs
Traffic Count – 6873

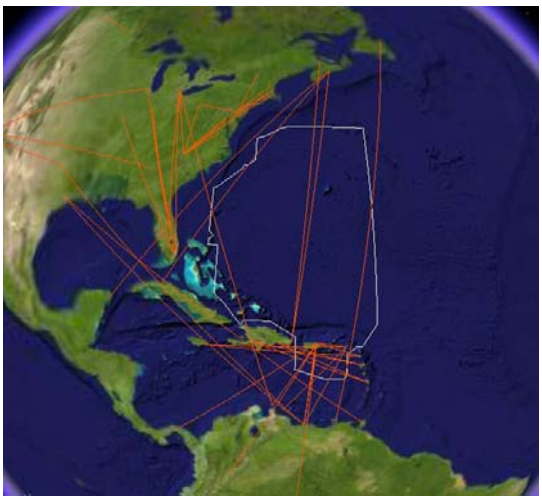


Flow 5b
Europe - E Caribbean
63 Origin/Destination Pairs
Traffic Count – 4068

Flow 6
NAM - Africa
4 Origin/Destination Pairs
Traffic Count - 483



Bermuda
22 Origin/Destination Pairs
Traffic Count – 2402



Random
52 Origin/Destination Pairs
Traffic Count - 2902

Appendix D (Continued)
Origin Destination Pairs Assigned to Each Flow

Flow 1 - NAM NE - E Caribbean/SAM

Origin	Dest	Traffic Count	Reciprocal
TJSJ	KJFK	4178	Yes
TJSJ	KEWR	2417	Yes
KPHL	TJSJ	1757	Yes
KJFK	MDST	1369	Yes
MDSD	KJFK	1147	Yes
TJSJ	KBOS	1090	Yes
SBGR	KJFK	941	Yes
CYYZ	MDPC	711	Yes
KIAD	SBGR	649	Yes
TJSJ	KIAD	602	Yes
TTPP	KJFK	596	Yes
TJBQ	KJFK	589	Yes
TBPB	KJFK	492	Yes
TBPB	CYYZ	449	Yes
TIST	KJFK	442	Yes
CYUL	MDPC	427	Yes
TNCM	KJFK	422	Yes
TJSJ	KBWI	412	Yes
CYYZ	TTPP	408	Yes
TNCA	KBOS	402	Yes
CYYZ	MDPP	393	Yes
KJFK	MDPC	330	Yes
KEWR	MDPC	318	Yes
TJPS	KEWR	317	Yes
TJPS	KJFK	311	Yes
TIST	KEWR	311	Yes
TNCA	KPHL	310	Yes
KJFK	TNCA	310	Yes
KPHL	TIST	307	Yes
TJSJ	KBDL	306	Yes
TJBQ	KEWR	304	Yes
TNCA	KEWR	300	Yes
MDPP	CYUL	288	Yes
SBGR	KEWR	276	Yes
MDSD	KEWR	267	Yes
MDST	KEWR	267	Yes
TNCM	KEWR	264	Yes
MDPP	KEWR	247	Yes
SBGR	CYYZ	231	Yes
KJFK	SAEZ	228	Yes
KTEB	TNCM	218	Yes
KJFK	MTPP	213	Yes
KJFK	MBPV	192	Yes
SVMI	KJFK	179	Yes
MDSD	KBOS	174	Yes
TIST	KBOS	171	Yes
SYCJ	KJFK	166	Yes
TAPA	KEWR	162	Yes
TAPA	CYYZ	146	Yes
TJSJ	CYYZ	146	Yes
MDLR	CYUL	135	Yes
TGPY	KJFK	134	Yes
KTEB	TQPF	133	Yes
TLPL	CYYZ	130	Yes
MDPC	KBOS	122	Yes
KIAD	TNCM	120	Yes
MDLR	CYYZ	118	Yes
SVMI	KEWR	114	Yes
TNCA	CYYZ	114	Yes
CYYZ	TNCM	110	Yes
MDPP	KJFK	110	Yes
CYOW	MDPC	109	Yes
KHPN	TNCM	108	Yes
MBPV	CYYZ	104	Yes
SVMG	CYUL	102	Yes
TTPP	KEWR	97	Yes
TJSJ	KTEB	91	Yes
KIAD	TBPB	91	Yes
TNCA	KLGA	88	Yes
KTEB	TIST	87	Yes
KIAD	TIST	85	Yes
MDPP	CYHZ	85	Yes
MDPP	CYOW	80	Yes
TIST	KHPN	78	Yes
CYYZ	SVMG	77	Yes
KHPN	TQPF	76	Yes
TFFR	CYUL	66	Yes
CYYZ	TKPK	61	Yes
TNCM	CYUL	60	Yes
CYUL	TBPB	60	Yes
TJSJ	KLGA	59	Yes
KTEB	TBPB	58	Yes
CYUL	MTPP	58	Yes
KHPN	TKPK	57	Yes
CYQB	MDPC	56	Yes
KTEB	TAPA	55	Yes
KTEB	MBPV	54	Yes
TNCC	CYYZ	53	Yes
MBPV	KBOS	52	Yes
KJFK	TAPA	50	Yes
CYOW	MDLR	50	Yes
KLGA	TIST	50	Yes
KHPN	TJSJ	49	Yes
CYQB	MDPP	47	Yes
KPHL	MDSD	44	Yes
TBPB	KPHL	44	Yes
MBPV	KPHL	43	Yes
TBPB	KEWR	41	Yes
KTEB	TKPK	39	Yes
KHPN	MBPV	38	Yes
TLPL	KPHL	38	Yes
TGPY	CYYZ	37	Yes
KHPN	MDLR	36	Yes
KBDL	MDPC	36	Yes
TNCC	KEWR	36	Yes
TAPA	KPHL	35	Yes
KIAD	SAEZ	32	Yes
SVMI	KTEB	32	Yes
TKPK	KPHL	32	Yes
CYUL	MDSD	30	Yes
KIAD	TTCP	30	Yes
KHPN	TAPA	28	Yes
SVMI	CYYZ	28	Yes
KTEB	MDLR	28	Yes
KBWI	MDLR	28	Yes
TJSJ	KMMU	27	Yes
TBPB	KBOS	27	Yes
KFRG	TNCM	26	Yes
TLPL	KJFK	26	Yes
TJSJ	CYUL	25	Yes
CYKF	MDPC	24	Yes
TUPJ	KTEB	23	Yes
KBED	TNCM	22	Yes
KBWI	TISX	22	Yes
CYQX	MDPP	22	Yes
KBOS	TNCM	22	No
MBPV	CYUL	21	No
KFRG	TIST	20	Yes
TJSJ	KFRG	19	Yes
KTEB	TLPL	19	Yes
CYXU	MDPC	19	Yes
KTEB	TISX	19	Yes
KBED	TIST	19	Yes
KPNE	TIST	18	Yes
KHPN	TBPB	17	Yes
TFFR	KJFK	16	Yes
TJSJ	KBED	16	Yes
KTEB	SBEG	16	Yes
KHPN	TUPJ	16	Yes
CYQX	MDPC	16	Yes
CYOW	TNCM	16	Yes
KTEB	TJIG	16	Yes
KLGA	TNCM	15	Yes
TNCM	KPSM	15	Yes
TAPA	KFRG	15	Yes

Flow 2a - NAM Cent - E Caribbean

Origin	Destination	Traffic Count	Reciprocal
TJSJ	KORD	1062	Yes
KATL	TJSJ	842	Yes
TJSJ	KCLT	577	Yes
KMEM	TJSJ	460	Yes
KPHL	MDPC	312	Yes
KSDF	TJSJ	291	Yes
TNCM	KCLT	283	Yes
KCLT	MDPC	256	Yes
TIST	KCLT	223	Yes
TNCA	KCLT	221	Yes
KATL	TIST	220	Yes
KCLT	MBPV	198	Yes
TLPL	KATL	195	Yes
KATL	MDPC	191	Yes
KMEM	TJBQ	188	Yes
KORD	MDPC	177	Yes
KPHL	TNCM	174	Yes
MDSD	KATL	173	Yes
KATL	TNCM	165	Yes
KCLT	TBPB	164	Yes
KATL	MBPV	152	Yes
KILN	TJSJ	130	Yes
TNCA	KIAD	115	Yes
TNCM	KILM	104	Yes
TJSJ	KMSP	100	Yes

Origin	Destination	Traffic Count	Reciprocal
KIAD	MDPC	97	Yes
KDTW	TJSJ	88	Yes
KBWI	MDPC	83	Yes
TBPB	KATL	81	Yes
KPIT	TJSJ	75	Yes
MDPC	CYVR	72	Yes
TJSJ	KMDW	69	Yes
MDSD	CYYZ	68	Yes
KORD	TNCA	65	Yes
KDTW	MDPC	65	Yes
MDPC	KCLE	64	Yes
MBPV	KILM	62	Yes
MDPC	KPIT	59	Yes
CYYC	MDPC	57	Yes
KORD	SBGR	56	Yes
KCLT	TLPL	53	Yes
KJAX	TJSJ	53	Yes
KATL	TISX	52	Yes
KORD	TIST	51	No
MDPC	CYWG	47	Yes
MDPC	KSTL	47	Yes
TKPK	KILM	44	Yes
CYHM	MDPC	44	Yes
TAPA	KATL	44	Yes
KMKE	MDPC	42	Yes

Origin	Destination	Traffic Count	Reciprocal
KCLE	TJSJ	42	Yes
TQPF	KILM	42	No
TAPA	KILM	41	Yes
MDPP	CYYC	39	Yes
MDPC	CYEG	37	Yes
CYWG	MDPP	35	Yes
TAPA	KCLT	35	Yes
KMSP	TNCM	33	No
TIST	KILM	29	Yes
CYEG	MDPP	28	Yes
MDPP	KMSP	28	Yes
KCLT	TISX	27	Yes
KCLT	TKPK	26	Yes
TBPB	KILM	23	Yes
KORD	TNCM	22	Yes
KCVG	MDPC	22	Yes
MDLR	KILM	20	No
KMSP	MDPC	19	Yes
TIST	KMSP	19	No
KIAD	MDLR	18	Yes
MDPP	CYXU	18	Yes
KPIT	TNCA	18	Yes
CYVR	MDPP	16	No

Flow 2b - Florida + - E Caribbean

Origin	Destination	Traffic Count	Reciprocal
TJSJ	KMIA	1501	Yes
KMCO	TJSJ	1383	Yes
MDSD	KMIA	950	Yes
KFLL	TJSJ	810	Yes
MTPP	KMIA	599	Yes
KDFW	TJSJ	558	Yes
KMIA	MBPV	466	Yes
KFLL	MDSD	436	Yes
TIST	KMIA	405	Yes
TJSJ	KTPA	287	Yes
KMIA	TNCM	267	Yes
KMIA	MDPC	260	Yes
MDST	KMIA	238	Yes
MDLR	KMIA	209	Yes
TIST	KFLL	202	Yes
KMIA	TISX	194	Yes
KMIA	MDPP	178	Yes
TNCM	KPBI	174	Yes
TNCM	KFLL	141	Yes
KMIA	TKPK	141	Yes
KFLL	MTPP	132	Yes
KFLL	MDPC	120	Yes

Origin	Destination	Traffic Count	Reciprocal
TQPF	KPBI	93	Yes
MBPV	KFLL	83	Yes
KLAX	TJSJ	81	Yes
KPBI	MDLR	77	Yes
TIST	KPBI	74	Yes
MBPV	KPBI	65	Yes
KFXE	TNCM	65	Yes
TJSJ	KPIE	63	Yes
TJSJ	KPBI	58	Yes
TAPA	KPBI	57	Yes
KMIA	TAPA	57	Yes
KJAX	TJSJ	53	Yes
KFXE	TIST	43	Yes
MBPV	MYNN	41	Yes
KFXE	MBPV	40	Yes
MDSD	MUHA	39	Yes
TJSJ	KFXE	39	Yes
TKPK	KPBI	36	Yes
KOPF	MDSD	35	Yes
KOPF	TNCM	34	Yes
TQPF	KFLL	30	Yes
TUPJ	KPBI	29	Yes

Origin	Destination	Traffic Count	Reciprocal
KFLL	KDFW	28	Yes
TBPB	TJSJ	28	Yes
TNCM	MYNN	25	Yes
TAPA	KFLL	25	Yes
MDPC	KSFB	24	Yes
TBPB	KFLL	23	Yes
TJSJ	KOPF	22	Yes
KFLL	TKPK	22	Yes
KFXE	TJIG	19	Yes
TQPF	KMIA	18	Yes
MYNN	KPBI	18	Yes
TISX	KPBI	17	Yes
TISX	KFXE	17	Yes
MYEF	KFLL	16	Yes
TJSJ	KBCT	16	Yes
KDAL	TNCM	16	Yes
KFLL	TISX	16	Yes
KOPF	TIST	16	Yes
KBCT	TNCM	16	No
KFXE	MDLR	15	Yes
KOPF	TJIG	15	Yes
MDSD	KPBI	15	Yes

Flow 3 - NAM N/Cent - W Caribbean/Florida

Origin	Destination	Traffic Count	Reciprocal
KLGA	KMIA	156	Yes
KEWR	KMIA	134	Yes
KJFK	SKBO	91	Yes
KFLL	KBOS	83	Yes
KMIA	KJFK	77	Yes
KMIA	KBOS	69	Yes
KMIA	KRDU	63	Yes
KMIA	KIAD	53	Yes

Origin	Destination	Traffic Count	Reciprocal
KNGU	MUGM	51	Yes
KIAD	SAWJ	42	Yes
KPBI	KHPN	41	Yes
KJFK	SKRG	37	Yes
KFLL	KPVD	33	Yes
MKJP	KJFK	31	Yes
KMIA	KBWI	31	Yes
KFLL	KACY	30	Yes

Origin	Destination	Traffic Count	Reciprocal
KEWR	SKBO	28	Yes
KPBI	KTEB	26	Yes
CYUL	MYSM	20	No
MYEF	KILM	18	Yes
MYNN	KJFK	18	Yes
KFXE	TNCA	15	Yes

Flow 4 - Florida+ - SAM

Origin	Destination	Traffic Count	Reciprocal
KMIA	SVMI	1339	Yes
TTPP	KMIA	678	Yes
KMIA	TBPB	570	Yes
KATL	SBGR	352	Yes
TJSJ	KIAH	343	Yes
KMIA	SVVA	327	Yes
KMIA	TNCC	213	Yes
KATL	SBGL	182	Yes
KMIA	TNCA	158	Yes
KMIA	SBGL	150	Yes
SVMI	KATL	149	Yes
KMIA	TLPL	147	Yes

Origin	Destination	Traffic Count	Reciprocal
KATL	TNCA	144	Yes
KMIA	SBGR	122	Yes
KFLL	SVMI	110	Yes
MDSD	TJSJ	104	Yes
KFLL	SVVA	100	Yes
KDFW	KMIA	98	Yes
KMEM	SBKP	94	Yes
KFXE	SVMI	74	Yes
KMIA	KLAS	67	No
KMIA	SBEG	58	Yes
KFXE	SVVA	56	Yes
KIAH	MDPC	45	Yes

Origin	Destination	Traffic Count	Reciprocal
TTPP	KFLL	43	Yes
KMIA	SVBC	40	Yes
SVJC	KFLL	39	Yes
TBPB	KPBI	37	Yes
MYEF	KPBI	35	Yes
SMJP	KMIA	32	Yes
KNIP	MUGM	31	Yes
KMIA	SBSV	31	Yes
KFLL	MDLR	29	Yes
KPBI	SVMI	27	Yes
SYCJ	KMIA	19	No
SVJC	KFXE	15	Yes

Flow 5a - N Eur - Florida/W Caribbean

Origin	Destination	Traffic Count	Reciprocal
KMIA	EGLL	699	Yes
LEMD	MUHA	514	Yes
KMIA	LEMD	401	Yes
MMMX	LEMD	340	Yes
KMIA	LFPG	328	Yes
KMCO	EGKK	303	Yes
KMIA	EHAM	242	Yes
KMIA	LIMC	171	Yes
MUHA	LFPG	167	Yes
KMIA	EDDF	165	Yes
EGLL	MYNN	127	Yes
EGLL	MKJS	124	Yes
MMUN	LIMC	123	Yes
MMMX	LFPG	122	Yes
MMUN	LEMD	110	Yes
MMUN	EHAM	105	Yes
KMIA	LSZH	104	Yes
LIMC	MUHA	104	Yes
MUHA	EGKK	85	Yes
KTPA	EGKK	78	Yes
MKJP	EGKK	75	Yes
KNGU	LERT	72	Yes
MUVR	EDDF	69	Yes
MKJS	EGKK	67	Yes
MKJP	EGLL	63	Yes
MMUN	EGKK	61	Yes
LEMD	MMTO	61	Yes
MKJS	EDDF	57	Yes
KMCO	EGCC	54	Yes
EGKK	MUHG	52	Yes

Origin	Destination	Traffic Count	Reciprocal
MUHG	EDDF	51	Yes
MUVR	EGKK	50	Yes
KMCO	EHAM	49	Yes
EHAM	MUHA	48	Yes
KATL	LEMD	48	Yes
MKJS	LIMC	46	Yes
EDDF	KRSW	46	Yes
MKJS	EGCC	43	Yes
MKJS	EDDL	42	Yes
LIRF	MUHA	42	Yes
MMUN	LIRF	41	Yes
MMUN	EDDF	41	Yes
MUHA	EDDF	41	Yes
EHAM	MUVR	41	Yes
MUHG	LIMC	39	Yes
MMUN	LFPG	39	Yes
MMMX	EDDF	37	Yes
MUHA	LFPO	36	Yes
EDDM	MKJS	36	Yes
KSFB	EGKK	34	Yes
MMMX	EHAM	33	Yes
KMIA	EGCC	33	Yes
MUVR	EGCC	33	Yes
MUCL	LIMC	33	Yes
MUHA	UUEE	33	Yes
LEMD	MGGT	32	No
MMUN	LFPO	31	Yes
EDDM	MUVR	31	Yes
MMUN	EGCC	31	Yes
EGKK	MYNN	31	Yes

Origin	Destination	Traffic Count	Reciprocal
KMCO	EDDF	30	Yes
MUVR	LIMC	29	Yes
KMIA	EDDL	29	Yes
MKJS	EHAM	28	Yes
LPPT	MUVR	28	Yes
MUHG	EGCC	27	Yes
KRSW	EDDL	27	Yes
EDDL	MUVR	25	Yes
CYHZ	EFHK	25	No
MUCC	EGKK	24	Yes
KATL	LFPG	23	Yes
LIMC	MUCU	23	Yes
KATL	EGKK	23	No
MMMX	EGLL	22	Yes
MUCC	EGCC	22	Yes
KIAH	EGKK	22	No
MMMY	LEMD	21	Yes
KATL	EDDF	20	Yes
KCHS	LERT	20	Yes
KATL	LIRF	20	Yes
KSFB	EGCC	19	Yes
MMUN	LOWW	19	Yes
MUHA	EDDL	18	Yes
MMUN	LFRS	18	Yes
MUVR	LFPO	17	Yes
KATL	EHAM	17	Yes
MUHG	EHAM	17	No
LIMC	MUSC	16	Yes
KMCO	BIKF	15	Yes
UUDD	MUVR	15	Yes

Flow 5b - Europe - E Caribbean

Origin	Destination	Traffic Count	Reciprocal
MDSD	LEMD	297	Yes
TNCB	EHAM	249	Yes
MDPC	LEMD	203	Yes
TNCC	EHAM	195	Yes
MDPC	LFPG	195	Yes
EHAM	TNCA	148	Yes
LIMC	MDLR	123	Yes
MDPC	EDDF	119	Yes
SKBO	LEMD	116	Yes
EGKK	MDPP	115	Yes
TJSJ	EHAM	107	Yes
SVMI	LFPG	106	Yes
EGCC	MDPP	101	Yes
MDPC	EHAM	92	Yes
MROC	LEMD	84	Yes
LEMD	TJSJ	81	Yes
MDSD	LFPG	80	Yes
MDPP	EDDF	77	Yes
EHAM	MDPP	75	Yes
SEGU	LEMD	72	Yes
SKBO	LFPG	70	Yes

Origin	Destination	Traffic Count	Reciprocal
MDPC	EDDM	69	Yes
MDPP	EBBR	57	Yes
EDDL	MDPC	57	Yes
MPTO	LEMD	56	Yes
EBBR	MDPC	55	Yes
MDLR	LFPO	55	Yes
MDPC	LFPO	54	Yes
TJSJ	EGSS	54	No
MDLR	EDDF	49	Yes
MDPP	LFPO	48	Yes
EDDL	MDPP	47	Yes
MDPC	EGKK	42	Yes
EGCC	MDPC	39	Yes
LPPT	MDPC	38	Yes
MDPP	LFPG	30	Yes
EHAM	TNCM	30	No
SVMI	EDDF	29	Yes
SKCG	LEMD	29	No
LSZH	MDPC	28	Yes
MDLR	EDDL	28	Yes
LFPG	TNCM	27	Yes

Origin	Destination	Traffic Count	Reciprocal
MDPC	EDDB	27	Yes
MDPC	EDDP	27	Yes
LFLL	MDLR	27	Yes
LIRF	MDLR	27	Yes
LEMD	SEQU	26	No
LIMC	MDPC	25	Yes
MDLR	EDDM	25	Yes
LFSB	MDLR	24	Yes
MDLR	LIPE	22	Yes
UUDD	MDPC	22	Yes
LFRS	MDLR	21	Yes
LFPG	MUVR	21	Yes
LFSB	LPAZ	19	Yes
MDLR	LFBO	18	Yes
EGCC	MDLR	17	Yes
MKJS	LSZH	17	No
LSZH	MDPP	16	Yes
MDPP	LOWW	16	No
SKCL	LEMD	15	Yes
MDLR	LKPR	15	Yes
LOWW	MDPC	15	No

Flow 6 - NAM - Africa

Origin	Destination	Traffic Count	Reciprocal
GVAC	KATL	204	Yes
GOOY	KJFK	121	Yes

Origin	Destination	Traffic Count	Reciprocal
DGAA	KIAD	90	Yes

Origin	Destination	Traffic Count	Reciprocal
FNLU	KIAH	68	Yes

Bermuda

Origin	Destination	Traffic Count	Reciprocal
TXKF	KJFK	385	Yes
TXKF	KEWR	373	Yes
TXKF	KBOS	216	Yes
TXKF	KPHL	192	Yes
CYYZ	TXKF	192	Yes
KATL	TXKF	177	Yes
KTEB	TXKF	161	Yes
KMIA	TXKF	131	Yes

Origin	Destination	Traffic Count	Reciprocal
EGKK	TXKF	109	Yes
TXKF	KBWI	103	Yes
TXKF	KHPN	73	Yes
TXKF	KBED	52	Yes
TXKF	KMMU	40	Yes
TXKF	KPBI	34	Yes
TXKF	KILM	27	Yes
KFRG	TXKF	24	Yes

Origin	Destination	Traffic Count	Reciprocal
TXKF	TNCM	23	Yes
KIAD	TXKF	22	Yes
TXKF	CYHZ	20	Yes
CYUL	TXKF	17	Yes
TXKF	KPDK	16	Yes
TXKF	KRSW	15	Yes

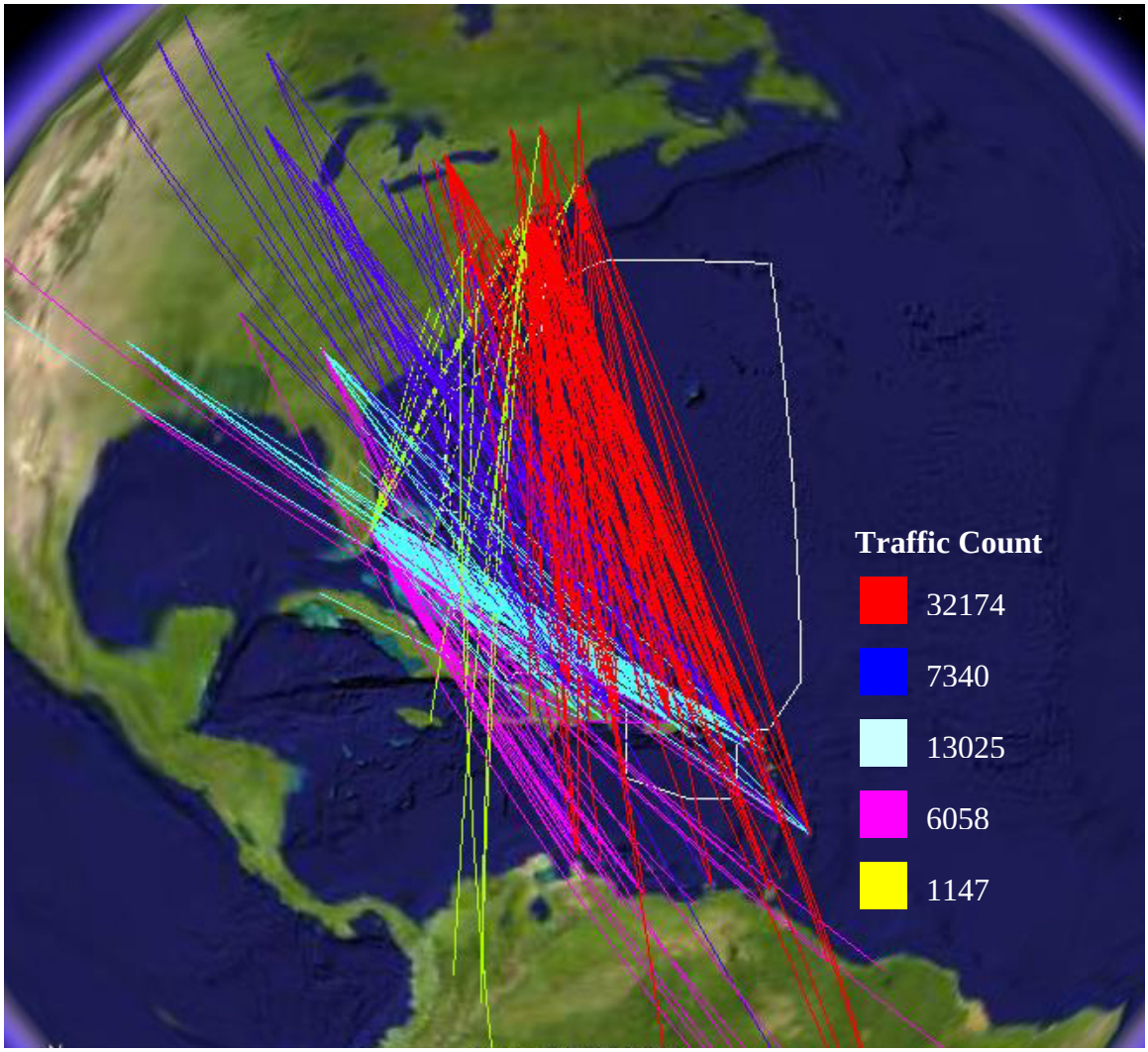
Random

Origin	Destination	Traffic Count	Reciprocal
MDPC	CYHZ	71	Yes
KCLT	KRIC	46	Yes
MDSD	TFFF	46	Yes
KCLT	KBDL	36	Yes
KCLT	KDCA	31	Yes
KPHL	KPIT	31	Yes
CYHZ	MUVR	29	Yes
KFLL	KSDF	28	No
KBTV	KPHL	26	Yes
KCLT	KDTW	25	No
TNCM	TNCC	22	Yes
KCLT	KBWI	20	No
TNCM	SVMI	19	Yes
MDPC	CYQM	19	Yes
TNCM	MDLR	16	Yes
KFLL	KORD	16	No
SVMG	CYQX	16	No
CYWG	CYXE	15	Yes

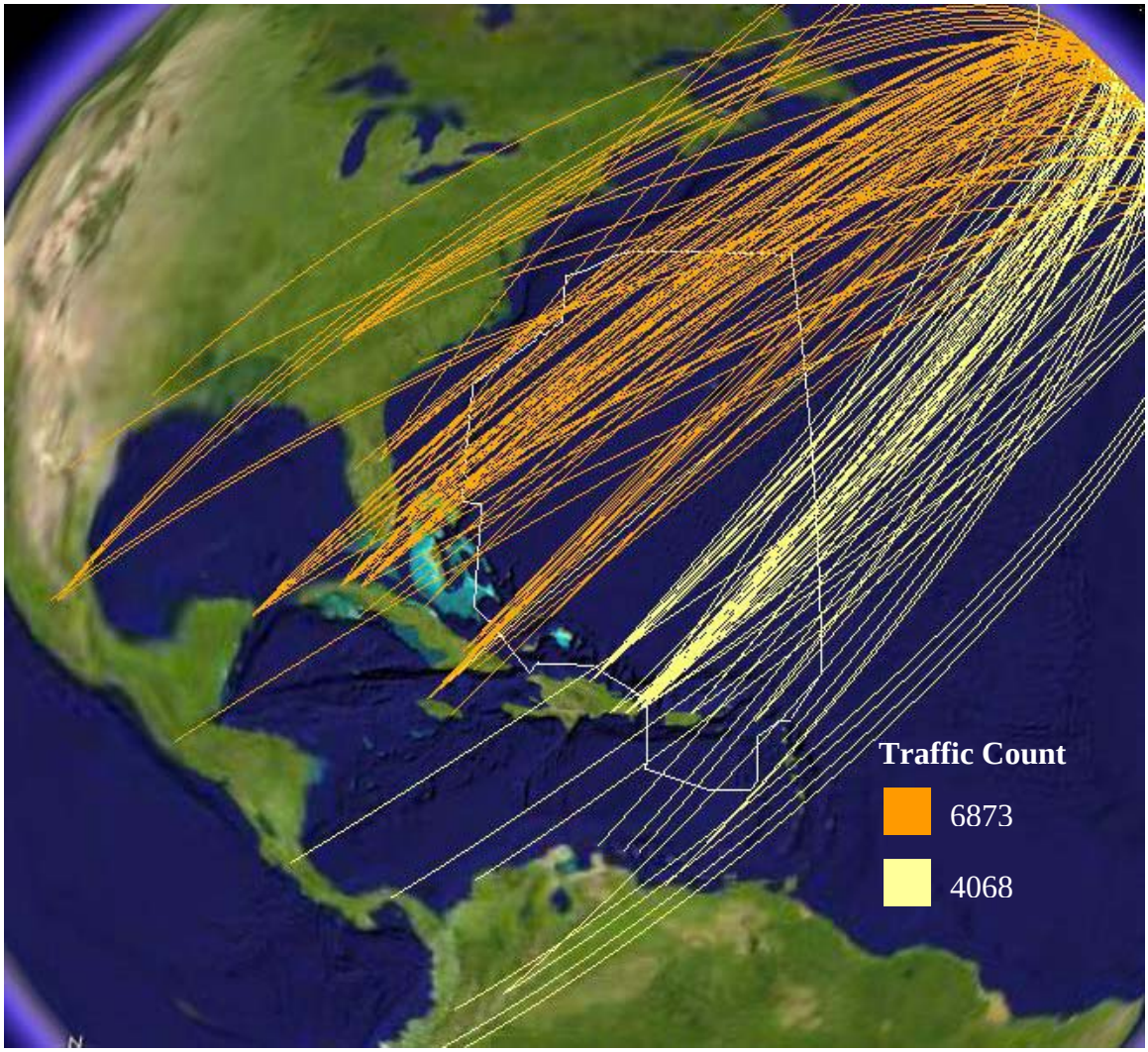
Origin	Destination	Traffic Count	Reciprocal
TJSJ	MPTO	337	Yes
TJSJ	SVMI	184	Yes
TJSJ	TNCA	169	Yes
TJSJ	TAPA	155	Yes
KMIA	KMCO	148	Yes
SKBO	TJSJ	121	Yes
KIAH	TTPP	105	Yes
MKJP	TAPA	98	Yes
KSNA	KORD	89	No
KSNA	KDFW	86	No
TNCM	MKJP	85	Yes
TFFR	MDSD	85	Yes
TIST	TJSJ	82	Yes
TNCM	TJSJ	77	Yes
KFLL	KDTW	71	Yes
TFFR	MTPP	71	Yes
KIAH	SVMI	43	Yes
KPHL	KBOS	35	Yes

Origin	Destination	Traffic Count	Reciprocal
KATL	KLAX	35	No
KCLT	KBOS	31	Yes
KMIA	KTPA	29	Yes
KDTW	TNCA	29	Yes
KDFW	SVMI	24	Yes
KPHL	KMHT	24	Yes
KCLT	KPIT	22	No
KMCO	KIND	19	Yes
KMIA	KSTL	16	Yes
KMIA	KSDF	16	No
KCLT	KPVD	15	Yes
TFFF	MTPP	20	Yes
KMCO	KDTW	19	Yes
CYHZ	MMUN	17	Yes
TJSJ	SCEL	17	No
SVMI	TJIG	16	Yes

Overview of the Traffic Flow between the Eastern United States and the Caribbean/South American Regions



Overview of the Traffic Flow between the Eastern United States and Europe



Appendix E
WATRS Plus Operator Survey

WATRS Plus Long Range Navigation (LRN) Capability Assessment

Airline/Aircraft Operator Name: _____ Date: _____

Note: for the purpose of this survey, WATRS Plus is considered to include the West Atlantic Route System (WATRS), Miami ARTCC Oceanic and San Juan Flight Information Region airspace.
Please complete one row for each aircraft make/model/series (M/M/S)/LRN System combination (i.e., M/M/S equipped with the same LRN system(s)). Please show those currently operational (Column 2) and those anticipated to operate in WATRS Plus in the 2008 time frame (Column 3, best estimate).

(1) A/C make, model, series (M/M/S). **(List all that apply)**	**(2) # of A/C of M/M/S listed in (1) currently operating in WATRS Plus**	**(3) # of A/C of M/M/S listed in (1) projected to operate in WATRS Plus in 2008 time frame**	**(4) # of A/C in (2) MNPS qualified**	**(5) Number, manufacturer, model and type of LRN equipment with which A/C in (2) equipped.** **Example: Three (3), Delco, Carousel IV, INS**	**(6) Type of Automatic Navigation Position Update Capability:** **DME/DME, VOR/DME, GPS, None**	**(7) For aircraft equipped only with INS, # of aircraft with position averaging or mixing capability (e.g., triple-mix)**

Appendix F

Top 40 Operator's Responding as of 31 May 2006	1 - A/C M/M/S	2 - # of A/C of M/M/S listed in 1 currently operating in WATRS Plus	3 - # of A/C of M/M/S listed in 1 projected to operate in WATRS Plus in 2008 time frame	4 - # of A/C in 2 MNPS qualified	5 - Number, manufacturer, model and type of LRN equipment with which A/C in #2 equipped	6 - Type of Automatic Navigation Position Update Capability	7 - For aircraft equipped only with INS, # of aircraft with position averaging or mixing capability
BWIA West Indies Airways Ltd.	B737-800	7	7		2 / Honeywell / ADIRU	DME / DME	
BWIA West Indies Airways Ltd.	A340-300	2	2	2	3 / Honeywell / ADIRU	DME / DME	
AIR FRANCE	A340	20	20	20	2 Each / - Honeywell Legacy L10; Honeywell Pegasus P2; Thales Smiths T2 (all aircraft equipped with in 2007)	GPS (MMR), VOR/DME, DME/DME,IRS.	
AIR FRANCE	A330	16	16	16	2 Each /- Honeywell Pegasus P2; Thales Smiths T2(all aircraft equipped with in 2007)	GPS (MMR), VOR/DME, DME/DME,IRS.	
AIR FRANCE	A320	1	1	1	2 Each /- Thales Smiths T2	GPS (MMR), VOR/DME, DME/DME,IRS.	
AIR FRANCE	B747-400ERF	8	8	8	3 Each / CMC CMA 900	GPS (MMR), DME/DME,INS (Delco CIVA used as IRS).	
AIR FRANCE	B747-400	21	21	21	2 Each / - Honeywell Legacy	GPS (MMR), VOR/DME, DME/DME,IRS.	
AIR FRANCE	B777	38	49	38	2 Each / - Honeywell AIMS	GPS (MMR), VOR/DME, DME/DME,IRS.	
Air Canada	Airbus A319	48	45	0	Three Honeywell IRU, Honeywell FMGC (32 FMS1, 13 FMS2), 13 aircraft have Collins MMR.	DME/DME, VOR/DME, 13 aircraft are equipped with GPS.	
Air Canada	Airbus A320	50	45	0	Three Honeywell IRU, Honeywell FMGC (30 FMS1, 15 FMS2), 15 aircraft have Collins MMR.	DME/DME, VOR/DME, 15 aircraft have GPS	
Air Canada	Airbus A321	10	10	0	Three Honeywell IRU, Honeywell FMGC (FMS2), Sextante MMR	DME/DME, VOR/DME, GPS	
Air Canada	Embraer 175	15	15	0	Honeywell EPIC FMC, Honeywell IRU, GPS	DME/DME, VOR/DME, GPS	

Top 40 Operator's Responding as of 31 May 2006	1 - A/C M/M/S	2 - # of A/C of M/M/S listed in 1 currently operating in WATRS Plus	3 - # of A/C of M/M/S listed in 1 projected to operate in WATRS Plus in 2008 time frame	4 - # of A/C in 2 MNPS qualified	5 - Number, manufacturer, model and type of LRN equipment with which A/C in #2 equipped	6 - Type of Automatic Navigation Position Update Capability	7 - For aircraft equipped only with INS, # of aircraft with position averaging or mixing capability
Air Canada	Embraer 190	6	45	0	Honeywell EPIC FMC, Honeywell IRU, GPS	DME/DME, VOR/DME, GPS	
Air Canada	Boeing 767	42	40	40	Three Honeywell IRU, Honeywell FMS (Pegasus), Six aircraft have Collins MMR	DME/DME, VOR/DME, Six aircraft have GPS capability. By 2012, number of aircraft operating in WATRS plus will be reduced to approximately 23-26. All will have Collins MMR.	
Air Canada	Airbus A330	8	8	8	Three Honeywell IRU, Honeywell FMGEC (FMS2), Sextante MMR	DME/DME, VOR/DME, GPS	
Air Canada	Airbus A340	12	9	9	Three Honeywell IRU, Honeywell FMGEC (FMS2), Sextante MMR	DME/DME, VOR/DME, GPS	
USA 3000 d.b.a. Brendon Airways	A320-212	1	1	1	Three (3) INS	DME/DME, VOR/DME	Triple-mixing
USA 3000 d.b.a. Brendon Airways	A320-214	12	13	12	Three (3) INS	GPS, DME/DME, VOR/DME	
Condor Flugdienst GmbH	B757-230	1	0	1	2 FMS, 3 IRU, 2GPS	DME/DME, VOR/DME, GPS	
Condor Flugdienst GmbH	B757-300	13	13	13	2 FMS, 3 IRU, 2GPS	DME/DME, VOR/DME, GPS	
Condor Flugdienst GmbH	B767-330	9	9	9	2 FMS, 3 IRU, 2GPS	DME/DME, VOR/DME, GPS	
Continental Airlines	B737-724	36	36	36	GPS – 2 ea Collins GNU-920, p/n 822-1152-002; IRS - 3EA, HONEYWELL, HG2050ACXX; FMS – 2 ea., Smiths FMC's P/N 171497-05-01 or P/N 176200-01-01	DME/DME, VOR/DME. GPS	
Continental Airlines	B737-824	90	92	90	GPS – 2 ea,Collins GNU-920, p/n 822-1152-002; IRS - 3EA, HONEYWELL, HG2050ACXX; FMS – 2 ea., Smiths FMC's P/N 171497-05-01 or P/N 176200-01-01	DME/DME, VOR/DME. GP	

Top 40 Operator's Responding as of 31 May 2006	1 - A/C M/M/S	2 - # of A/C of M/M/S listed in 1 currently operating in WATRS Plus	3 - # of A/C of M/M/S listed in 1 projected to operate in WATRS Plus in 2008 time frame	4 - # of A/C in 2 MNPS qualified	5 - Number, manufacturer, model and type of LRN equipment with which A/C in #2 equipped	6 - Type of Automatic Navigation Position Update Capability	7 - For aircraft equipped only with INS, # of aircraft with position averaging or mixing capability
Continental Airlines	B737-924	12	12	12	GPS – 2 ea,Collins GNU-920, p/n 822-1152-002; IRS - 3EA, HONEYWELL, HG2050ACXX; FMS – 2 ea., Smiths FMC's P/N 171497-05-01 or P/N 176200-01-01	DME/DME, VOR/DME. GP	
Continental Airlines	B757-224	41	41	41	GPS – 3 ea,Collins GNU-920, p/n 822-1152-002; IRS - – 3EA, HONEYWELL, HG1050ADXX; FMS—2 ea, Honeywell, Pegasus	DME/DME, VOR/DME. GP	
Continental Airlines	B757-324	17	17	17	GPS – 3 ea,Collins GNU-920, p/n 822-1152-002; IRS – 3EA, HONEYWELL, HG2050ACXX; FMS – 2 ea. Honeywell, Pegasus	DME/DME, VOR/DME. GP	
Continental Airlines	B767-200	10	10	10	GPS – 2 ea,Collins GNU-920, p/n 822-1152-002; IRS -3EA, HONEYWELL, HG1050ADXX; FMC – 2 ea., Honeywell Pegasus	DME/DME, VOR/DME. GP	
Continental Airlines	B767-400	16	16	16	GPS – 2 ea,Collins GNU-920, p/n 822-1152-002; IRS – 3EA, HONEYWELL, HG2050ACXX; FMC	DME/DME, VOR/DME. GP	
Continental Airlines	B777	18	20	18	GPS – 2 ea Collins GNU-920, p/n 822-1152-002; IRS – 1 EA,HONEYWELL, HG2060AD01; FMC	DME/DME, VOR/DME. GP	
Delta Air Lines	B737-800	71(ALL)	71(ALL)	71(ALL)	Dual Honeywell IRS and dual GPS	DME/DME, IRU, GPS	71(ALL)
Delta Air Lines	B757-200	121(ALL)	121(ALL)	121(ALL)	Triple Honeywell IRS (some with dual GPS)	DME/DME, IRU, GPS	121(ALL)
Delta Air Lines	B767-300	51 (ALL)	43 (ALL)		Triple Honeywell IRS –no GPS	DME/DME, IRU	43(ALL)
Delta Air Lines	B767-300ER	51(ALL)	59(ALL)	59(ALL)	Triple Honeywell IRS (some with dual GPS)	DME/DME, IRU, GPS	59 (ALL)
Delta Air Lines	B767-400ER	0	Between 8 and 21	Between 8 and 21	Triple Honeywell IRS and Dual GPS	DME/DME, IRU, GPS	Between 8 and 21
Delta Air Lines	B777	8(ALL)	8(ALL)	8(ALL)	Triple Honeywell IRS & Dual GPS)	DME/DME, IRU, GPS	8(ALL)

Top 40 Operator's Responding as of 31 May 2006	1 - A/C M/M/S	2 - # of A/C of M/M/S listed in 1 currently operating in WATRS Plus	3 - # of A/C of M/M/S listed in 1 projected to operate in WATRS Plus in 2008 time frame	4 - # of A/C in 2 MNPS qualified	5 - Number, manufacturer, model and type of LRN equipment with which A/C in #2 equipped	6 - Type of Automatic Navigation Position Update Capability	7 - For aircraft equipped only with INS, # of aircraft with position averaging or mixing capability
FedEx	MD10	32	50+	all	Honeywell FMS	GPS first then DME/DME id GPS fails	
FedEx	MD11	47	60+	all	Honeywell FMS	GPS first then DME/DME id GPS fails	
FedEx	DC10-30	15	5 or less	all	INS	None	all
IBERIA AIRLINES	AIRBUS A340-313; AIRBUS A340-642	29	30	29	3 ADIRU – HONEYWELL P/N HG115AC07; 3 ADIRU – LITTON LNT 101; 2 GPS LITTON LTN 2001; 2 MMR COLLINS P/N 822-1152-121; 2 FMGEC SEXTANT/HYWL PEGASUS	DME/DME, VOR/DME, GPS	
Martinair Holland NV	Boeing MD-11F	6	6	6	Three (3) Honeywell IRUs p/n HG1150BD02; MMR (GNS): Two (2) Rockwell Collins GLU-920 p/n 822-1152-220	DME/DME, VOR/DME, GPS	
Martinair Holland NV	Boeing MD-11F	1	1	1	Three (3) Honeywell IRUs p/n HG1150BD02; GNS: Two (2) Honeywell GNS Sensors p/n HG2021GM01	DME/DME, VOR/DME, GPS	
Martinair Holland NV	Boeing 767-300ER	6	5	5	Three (3); Boeing p/n S242T101-114, Honeywell p/n HG1050AD10; This year the units will be upgraded to: p/n S242T101-117, p/n HG1050AD11	DME/DME, VOR/DME	
AIR TRANSAT	Airbus A310-300	10	11	11	Two (2) Honeywell, FMS; Part no. 402510-970/976/978	DME/DME, VOR/DME	N/A
AIR TRANSAT	Airbus A330-200	3	3	3	- ADIRU: 465020-0303-0312 (LITTON); - GPS (MMR): 822-1152-121 (ROCKWELL); - FMGEC C12858CA01 (THALES)	DME/DME, VOR/DME, GPS	N/A
AIR TRANSAT	Airbus A330-300	1	1	1	- ADIRU HG2030AD10 (HONEYWELL); - GPS SENSOR UNIT (no MMR) 465205-0302-0304 (NORTHROP GRUMMAN); - FMGEC B490CAM0308 (THALES)	DME/DME, VOR/DME, GPS	N/A

Top 40 Operator's Responding as of 31 May 2006	1 - A/C M/M/S	2 - # of A/C of M/M/S listed in 1 currently operating in WATRS Plus	3 - # of A/C of M/M/S listed in 1 projected to operate in WATRS Plus in 2008 time frame	4 - # of A/C in 2 MNPS qualified	5 - Number, manufacturer, model and type of LRN equipment with which A/C in #2 equipped	6 - Type of Automatic Navigation Position Update Capability	7 - For aircraft equipped only with INS, # of aircraft with position averaging or mixing capability
American Airlines	B-777-200	47	47	47	Honeywell Integrated NAV, 2 FMC, 3 IRU, 2 GPS	GPS	
American Airlines	B-767-300	58	58	58	Honeywell Integrated NAV, 2 FMC, 3 IRU, 2 GPS	45 DME/DME, 13 GPS	
American Airlines	B-757-200	124	124	20	Honeywell Integrated NAV, 2 FMC, 3 IRU, 2 GPS	99 DME/DME, 25 GPS	
American Airlines	B-737-200	77	77	0	Smith's Integrated NAV, 2 FMC, 3 IRU, 2 GPS	GPS	
American Airlines	A-300-600	34	34	10	Honeywell Integrated NAV, 2 FMC, 3 IRU, 2 GPS	DME/DME	
North American Airlines	Boeing 757-28A	4	4	4	Two(2) Sperry FMCS w/ Dual IRS (CB54)	DME/DME, VOR/DME, GPS	
North American Airlines	Boeing 757-28A	1	1	1	Two(2) Sperry FMCS w/ Dual IRS(CB54)	DME/DME, VOR/DME	1
North American Airlines	Boeing 767-3xxER	2	2	2	Two(2) Sperry FMCS w/ Dual IRS(CB54)	DME/DME, VOR/DME, GPS	
North American Airlines	Boeing 767-3xxER	2	2	2	Two(2) Sperry FMCS w/ Dual IRS(CB54)	DME/DME, VOR/DME	2
North American Airlines							
UPS	(See Attached UPS D085 for full listing of A/C (M/M/S)	A-300-F4622R	Yes		Dual Honeywell FMC/IRS	RNP-10	
UPS		B-767-34AF	Yes	Yes	Dual Honeywell FMC/IRS	RNP-10	
UPS		B-757-24APF	Yes		Dual Honeywell FMC/IRS	RNP-10	
UPS		B-747-212B, B-747-283B, B-747-121	Yes	Yes	Dual Litton LTN-92 INS	RNP-10	triple-mix
UPS		DC-8-71F, DC-8-73F	Yes	Yes	Dual Litton LTN-92 INS	RNP-10	triple-mix
UPS		MD-11-11F	Yes	Yes	Dual Honeywell FMC/IRS	RNP-10	

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UPS	(See Attached UPS D085 for full listing of A/C (M/M/S)	B-727-51C, B-727-30C, B-727-180C, B-727-31C,B-727-22C, B-727-25C, B-727-185C, B-727-108C	Yes		Apollo 2101 NMS GPS	N/A	
UPS	Delivery 2007		B747-400F	(TBA)	(TBA)	(TBA)	(TBA)
UPS	Delivery 2009		A380F	(TBA)	(TBA)	(TBA)	(TBA)
Spirit Airlines	AIRBUS A319-132	8	?	8	3, Honeywell Pegasus, FMS	2 GPS, 3 three ring laser gyros GPS, DME/DME	N/A
Spirit Airlines	AIRBUS A321-231	3	?	3	3, Honeywell Pegasus, FMS	2 GPS, 3 three ring laser gyros GPS, DME/DME	N/A
Spirit Airlines	McDONNELL-DOUGLAS DC 9-82/83	3	0	?	Universal Avionics UNS-1K	GPS, VOR/DME	N/A
British Airways	B777	43	43	All	Honeywell AIMS BP2003C Honeywell ADIRU/SAARU, RNP-10, BRNAV, PRNAV	GPS, DME/DME, VOR/DME	
British Airways	B747-400	57	57	All	Triplex Honeywell HG1050 IRS Dual Honeywell FMS with Load 15 software (RNP capable) P/No. 4052508-952, RNP-10, BRNAV, PRNAV	GPS, DME/DME, VOR/DME	
British Airways	B767	14	14	All	Triplex HG1050 IRS Dual Honeywell PIP FMC P/No. 4052506-941, RNP-10, BRNAV, PRNAV	DME/DME, VOR/DME-No GPS	
Skyservice Airlines	A319-112	3	3	3	M-S RX1DHWY /C	VOR/DME, GPS	
Skyservice Airlines	A320-214	7	7	7	M-S H1RXYW /C	VOR/DME, GPS	

Top 40 Operator's Responding as of 31 May 2006	1 - A/C M/M/S	2 - # of A/C of M/M/S listed in 1 currently operating in WATRS Plus	3 - # of A/C of M/M/S listed in 1 projected to operate in WATRS Plus in 2008 time frame	4 - # of A/C in 2 MNPS qualified	5 - Number, manufacturer, model and type of LRN equipment with which A/C in #2 equipped	6 - Type of Automatic Navigation Position Update Capability	7 - For aircraft equipped only with INS, # of aircraft with position averaging or mixing capability
Skyservice Airlines	A320-231	3	3	3	M-S H1RXWY /C	VOR/DME	
Skyservice Airlines	A320-232	1	1	1	M-S H1RXWY /C	VOR/DME, GPS	
Skyservice Airlines	A330-343	1	1	1	H-S VH1XYWR /C	VOR/DME, GPS	
Skyservice Airlines	B757-28A	5	5	5	M-S DH1RXYW /C	VOR/DME	
Skyservice Airlines	B757-258	1	1	1	M-S DH1RXYW /C	VOR/DME	
Skyservice Airlines	B757-236	2	2	2	M-S DH1RXYW /C	VOR/DME	
Skyservice Airlines	B757-21K	1	1	1	M-S DH1RXYW /C	VOR/DME	
American Trans Air Inc. has suspended scheduled service in WATRS Plus	B737-800	0	0	0	Dual Smiths FMC, dual Honeywell GPS and dual IRS	GPS, VOR/DME	N/A
American Trans Air Inc. has….	B757-200	0	0	0	Dual Honeywell Pegasus FMC, dual GPS and Triple IRS	GPS, VOR/DME	N/A
American Trans Air Inc. has….	B757-300	0	0	0	Dual Honeywell Pegasus FMC, dual GPS and Triple IRS	GPS, VOR/DME	N/A
American Trans Air Inc. has….	L1011-500	0	0	0	Triple Litton LTN-92 INS	VOR/DME	N/A