Affecting Operational Change through Analysis – Thanksgiving 2008

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Economic conditions and passenger opinion throughout the National Airspace System are dictating a fresh look at delay mitigation strategies. This is especially true during the high traffic U.S. Thanksgiving holiday period in late November. The Tuesday and Wednesday before Thanksgiving has increasingly become an air travel nightmare with delays in 2007 leading to record customer dissatisfaction. In an attempt to reverse this trend, the work presented in this paper explores the creation and implementation of a comprehensive pre-coordinated delay reduction initiative for New York metro Thanksgiving departures, on the Tuesday and Wednesday before Thanksgiving 2008. The success of the 2008 program, which resulted in a decrease in average taxi out delays by 28 percent compared to 2007 (with only 3 percent fewer departing flights at the 3 major NY airports), continues to drive research and application into 2009 to improve the performance of the National Airspace System.

Nomenclature

TRACON	=	Terminal Radar Approach Control
CAASD	=	Center for Advanced Aviation System Development
FAA	=	Federal Aviation Administration
ETMS	=	Enhanced Traffic Management System
ARTCC	=	Air Route Traffic Control Center
NAS	=	National Airspace System
TMO	=	Traffic Management Officer
UTC	=	Coordinated Universal Time
ZNY	=	New York ARTCC
N90	=	New York Consolidated TRACON
J	=	Jet Airway
GA	=	General Aviation
ZDC	=	Washington, D.C. ARTCC
JFK	=	New York John F. Kennedy International Airport
EWR	=	Newark Liberty International Airport
LGA	=	New York LaGuardia Airport
TEB	=	Teterboro Airport
HPN	=	Westchester County/White Plains Airport
ISP	=	Long Island MacArthur Airport
FRG	=	Farmingdale Republic Airport
MMU	=	Morristown Municipal Airport
ORD	=	Chicago O'Hare International Airport
ATL	=	Hartsfield-Jackson Atlanta International Airport
GDP	=	Ground Delay Program

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I. Introduction

RECENT economic conditions have led many industries to seek ways to maintain their position in the marketplace by improving efficiency. Since December 2007, the airline industry has seen six domestic airlines file for bankruptcy or go out of business[1]. As Figure 1 illustrates, airline profit margins are currently in negative territory. In order to succeed, airlines must improve profitability while countering uncertain fuel costs and declining air travel demand. This can only be done by cutting costs and improving operations. These efforts start internally, but inevitably airlines look to changes in external factors. Airlines and consumer groups often lobby the government to reduce the delays that flights experience through the National Airspace System (NAS). Flight delays are often unpredictable, and can cause gridlock concerns; this impacts arrivals, departures for the next leg, and connections in other cities, ultimately reducing traveler satisfaction. Initiatives that mitigate delays locally are significant to NAS efficiency. Consequently, very often these efforts focus on the departure aspect, as this particular phase of flight is most easily controlled.

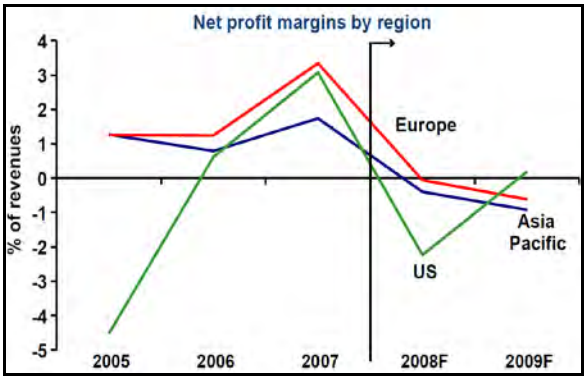

Figure 1. Airline Profit Margins. *(FAA)*

Table 1: 2008 NYC Airport Operations Numbers. ***(FAA)***

Airport	Annual Airport Operations
JFK	446,968
LGA	384,080
EWR	442,098
TEB	173,699
HPN	180,218
ISP	177,582
MMU	137,982
FRG	169,770
NY Total	2,112,397
ATL	978,084

A major Federal Aviation Administration (FAA) focus area is the New York City (NYC) metropolitan area[2]. The individual NYC airports, though not nearly as busy as some major hubs such as Hartsfield-Jackson Atlanta International Airport (ATL) (Table 1) or Chicago O'Hare International Airport (ORD), combine to create the busiest airspace in the country. Due to such area confines, the three major airports, John F. Kennedy International Airport (JFK), La Guardia Airport (LGA) and Newark Liberty International Airport (EWR), use a limited number of fixes for arrival, departure and crossing flows, a subset of which are illustrated in Figure 2. These fixes are also used by the General Aviation (GA) or satellite airports in the same area, which include Teterboro Airport (TEB), Westchester County Airport (HPN), Long Island MacArthur Airport (ISP), Morristown Municipal Airport (MMU) and Republic Airport (FRG). The combined traffic for these airports and the respective breakdowns for 2008 are contained within Table 1; total operations for the combined airports, 2,112,397 per year, illustrates just how much extra traffic there is within the NYC area when compared to ATL, the busiest passenger airport in the world[3,4]. The ATL total is less than 50 percent of the NYC total.

The Thanksgiving holiday is one of the busiest times of the year for air travel in the United States. It is also known as a particularly bad period for travel delays. The New York Times reported that in 2007 overall delays on Tuesday, November 20 of the same year were up 65.9 percent from 2006; Wednesday, November 21, 2007 delays were up 21 percent[5]. Similarly, in 2007 the delays at the three major NYC airports for the same days were at their worst at an average of 100 minutes[6]. These delays are not limited to the main commercial airfields. The surrounding GA airfields also experienced significant delays. The delays at TEB on Tuesday (11/20/2007) were an average 62 minutes[7] and HPN on Wednesday (11/21/2007) were an average of 71 minutes[8]. Southbound departure routes have been particularly congested. The typical routes south out of the NY airports are notionally depicted in Figure 2, along with their associated departure fixes.

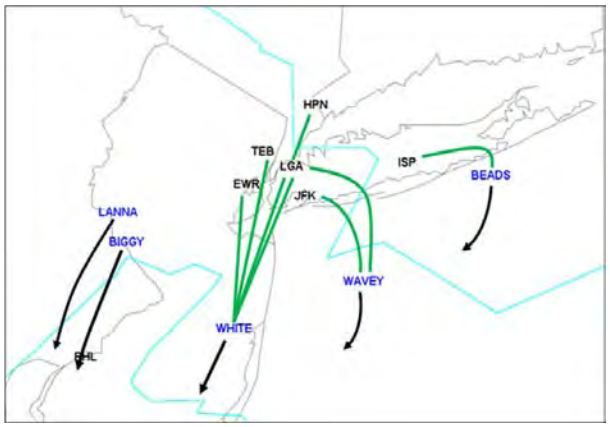

Figure 2. Available Southbound Fixes, with Notional Illustration of Preferred Routes. ***(MITRE)***

II. Preemptive Analysis

Analysts from the MITRE Corporation's Center for Advanced Aviation System Development (CAASD) worked with the N90 TMO to analyze the New York metro departure fix flow situation during Thanksgiving 2007, anticipating a desire by the FAA to improve the scenario in 2008. Considering the departing aircraft filing flight plans over the fixes, illustrated in Figure 2, demonstrates the increased volume on the Tuesday (11/20/2007) and Wednesday (11/21/2007) that the delay figures suggested previously, as depicted in Figure 4. Consequently, it was decided to concentrate the analysis efforts on these days to investigate the possible causes for the significant delays. Highly typical causes are explored in the following sections.

A. Impact of Weather

When considering abnormally large air travel delays, one might be forgiven if first turning to weather as the primary cause of such events. Thus before the CAASD team delved further into the Thanksgiving 2007 traffic situation, the consideration of the weather impact was paramount, especially en-route weather. Commercial weather radar type products where explored to provide the necessary insight. These products, such as Figure 3, showed very little adverse weather both en-route and in the destination terminal areas. The New York area did experience low ceilings and visibility issues but these were above any minimums for a good departure operation, especially with the GDPs to assist with the control of the arrival traffic to balance the airport.

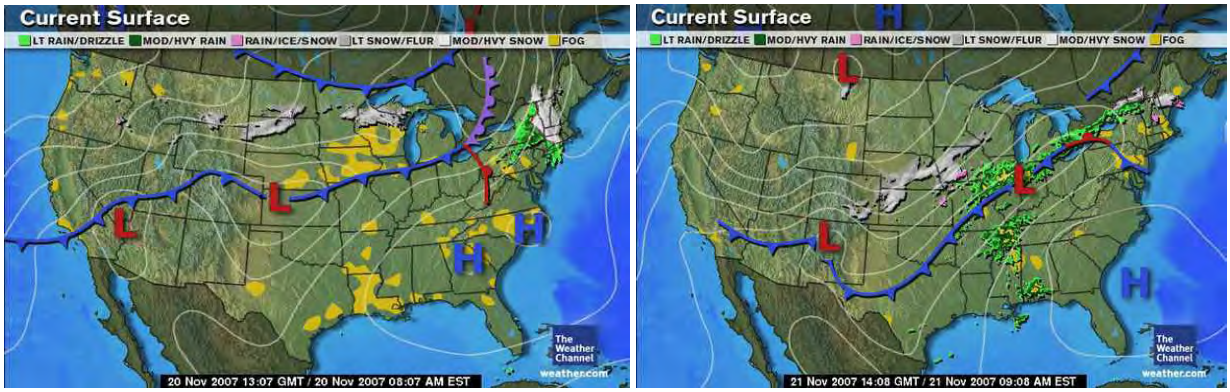

Figure 3. Surface weather conditions for Tuesday (left) and Wednesday (right), Thanksgiving 2007. *(Weather Channel)*

B. Fix flow Analysis

Subsequently, a daily breakdown of the traffic was conducted to determine the daily total and hourly numbers of aircraft over these fixes. The analysis of these days as a whole showed an undue reliance on WHITE as the major departure route out of NYC, as illustrated in Figure 5. Figure 2 depicts the preferred southbound route from New York as WHITE and surrounding fixes with southbound options. Relying on this one southbound option during peak periods especially leads to delays as demand grows and the airspace surrounding this fix becomes saturated. Thus, it

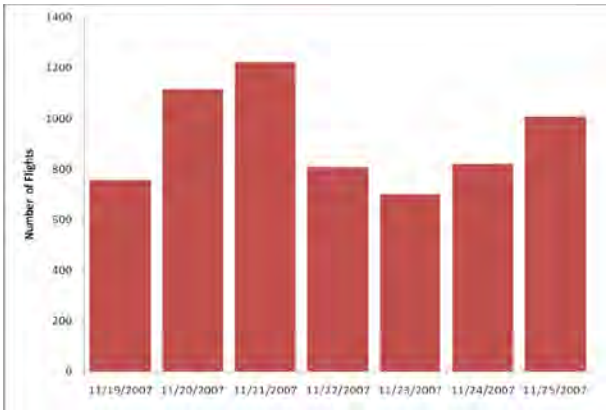

Figure 4. Filed Traffic Volume over Southern Fixes for November 19 through 25, 2007 (UTC). *(ETMS)*

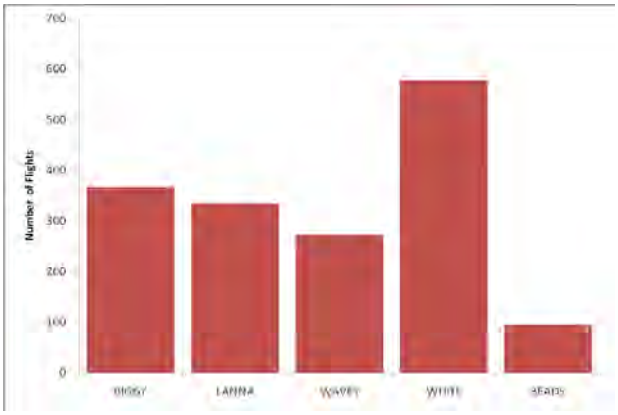

Figure 5. Filed Traffic Volume over Southern Fixes for November 20 and 21, 2007 (UTC). *(ETMS)*

became clear that in order to help to reduce the departure

delays in 2008, a means to reduce the traffic going to particular fixes would be required to produce a better overall traffic flow balance.

Traffic breakdowns over the two days (Figure 7 & Figure 6) in question, reflected the trend revealed in Figure 5. Over both days, considered from 1000 UTC until 0400 UTC the following day, traffic filing over WHITE was almost double that of the next highest fixes (LANNA and BIGGY). In total nearly 300 flights during the 18 hour time period, filed out over WHITE. The identification of this significant imbalance within the southerly departures provided a logical insight into the problems in 2007.

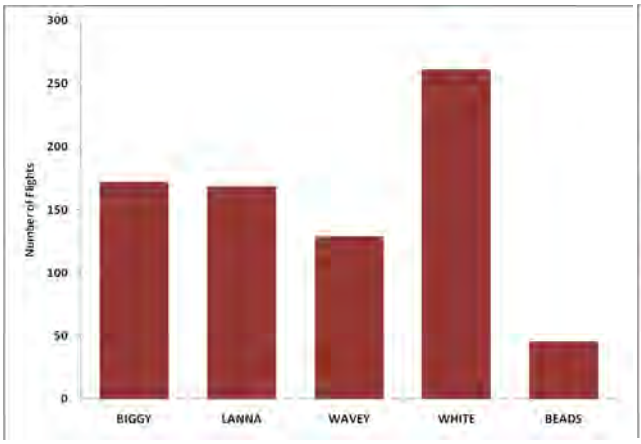

Figure 6. Filed Traffic Volume over Southern Fixes for Tuesday, November 20, 2007. *(ETMS)*

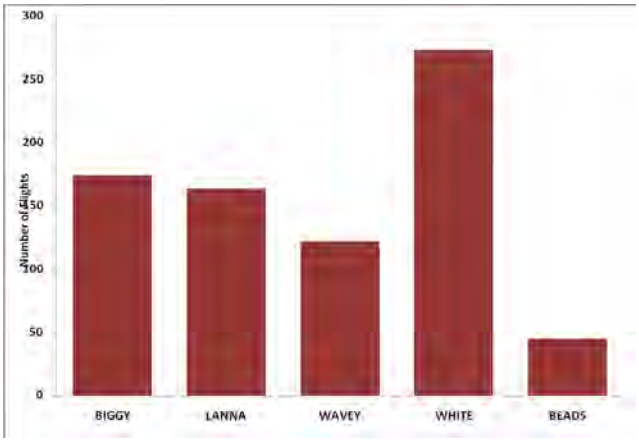

Figure 7. Filed Traffic Volume over Southern Fixes for Wednesday, November 21, 2007. *(ETMS)*

Now the question becomes, "what can be done to mitigate this imbalance?" However, before this can really get underway a full understanding of the traffic is necessary. To aide in this endeavor, a regional compartmentalization of the traffic by destination region was undertaken. This would enable the use of directed traffic initiatives to affect the most significant traffic group. Such analysis for the days in question demonstrated the heavy volume of NYC traffic bound for the sunnier climes of Florida. The mix over the southern fixes is illustrated in Figure 8, depicting the preference towards Floridian destinations, particularly over WHITE. Thus working with this particular traffic group would likely have the most beneficial effect.

In order to facilitate beneficial change within the NAS through data analysis, data in hand, a CAASD team met with the Traffic Management Officers (TMO) from both New York Air Route Traffic Control Center (ZNY ARTCC) and TRACON (N90). These meetings took place during September 2008, to provide recommendations and plan activities for the 2008 Thanksgiving holiday. Identified during these meetings was the need to spread the traffic over the available southern departure fixes as the data had highlighted in Figure 4 through Figure 8. In addition, it was highlighted significant the GA traffic departing for Florida contributes to the traffic volume over WHITE as depicted in the hourly breakdowns in Figure 9 and Figure 10. These breakdowns also reveal just how much volume departed over WHITE during the two day period. This is especially important during the peak travel hours, with the peaks during Wednesday being particularly severe. Thus any options would have to concentrate on reducing WHITE traffic during these hours in particular.

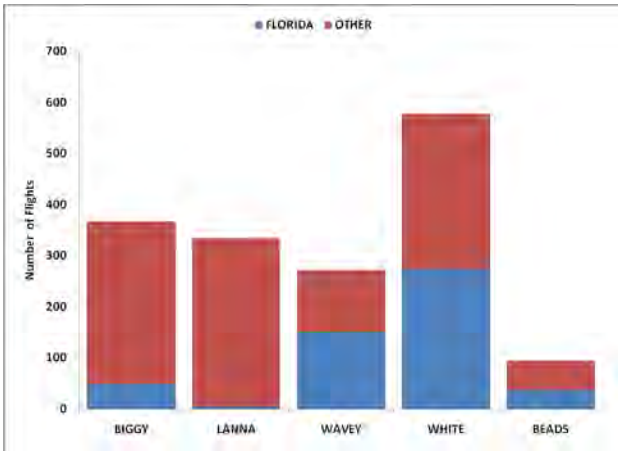

Figure 8. Regional traffic mix over southern fixes for Wednesday, November 21, 2007. *(ETMS)*

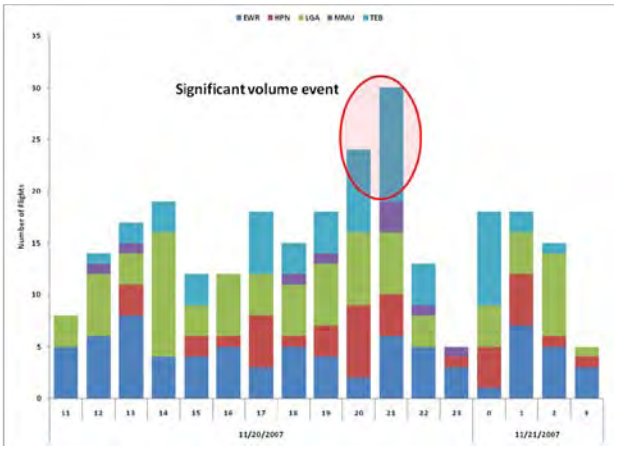

Figure 10. Filed traffic volume over WHITE, Tuesday, November 20, 2007. *(ETMS)*

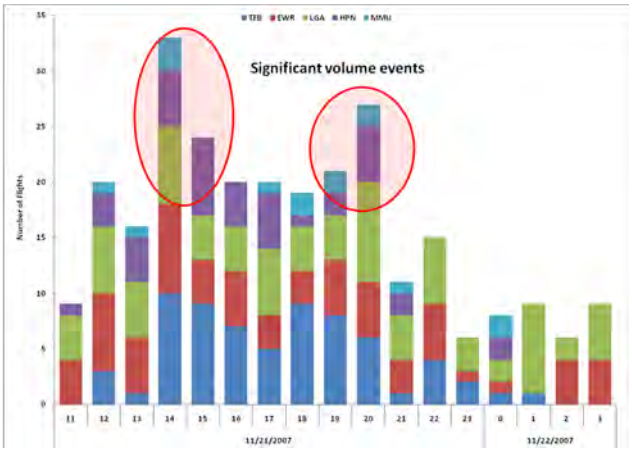

Figure 9. Filed traffic volume over WHITE, Wednesday, November 21, 2007. *(ETMS)*

The inherent flexibility that comes with GA travel suggested that this portion of the traffic could easily be moved to help achieve balanced fix loading. With nearly 150 flights from the NYC metro area GA airports over the 2 days in question in 2007, this reduction would be very beneficial, but was not to be viewed as the only option by any means. However, working within a similar process with the commercial carriers, options would need to be identified that routed Florida bound traffic from the most congested fixes.

C. Use of Military Airspace

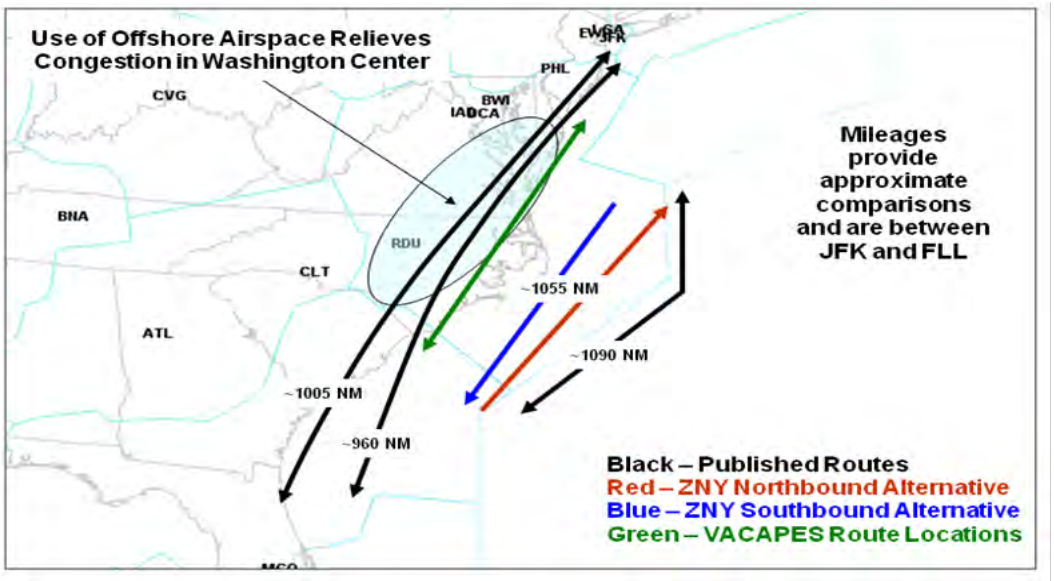

Figure 11. Notional Illustration of Offshore Routes and Associated Distances *(MITRE/FAA)*

The use of fix balancing is only as good as the availability of suitable routes within the en-route environment downstream of the New York area. This becomes of particular importance within the Washington Air Route Traffic Control Center (ZDC ARTCC) area where numerous air routes converge as traffic heads offshore to utilize the Atlantic Routes (ARs) to get to the southern tip of Florida, particularly around the Wilmington, NC area. Despite the delays on Wednesday, November 22, 2007, the use of the military airspace off the Eastern Seaboard[9] did help to reduce delays through expanded airspace availability. This airspace in question includes the vast Virginia Capes range area, that stretches from south of Nantucket to Charleston, SC, and more than 200nm into the Atlantic[10]. The planned release of these areas by the Department of Defense for the 2008 Thanksgiving holiday would not be complete until 3:00 PM on Wednesday[11], after much of the expected traffic would have departed. Therefore, initiatives were needed that would work both with and without the military airspace to accommodate both days of operation. This led the FAA/CAASD team to identify ways to improve the use of the inland airspace, which as

Figure 11 illustrates, are shorter and therefore more fuel-conscious routes. These initiatives are discussed in detail in the following section. Airline representatives later confirmed the fuel-conscious approach in delay reduction.

III. Offload Identification and Co-Ordination

Further analysis to define the peak hours for departures from the NYC airports was used to identify new initiatives. Considering all the available fixes in turn, this analysis assisted in the identification of the best methods for spreading traffic amongst underutilized fixes. BIGGY, LANNA and BEADS were identified as the most logical choices in addition to the more widely used WHITE and WAVEY. The use of LANNA would send traffic down Jet(J)-48, while BIGGY would send traffic out on J-75. Moving this traffic from the normal route of J-174 had a secondary benefit of reducing the sector complexity along the East Coast within ZDC. Additionally, a new staff position at N90, a Tactical Route Coordinator (TRC), was discussed. The role of this position would be to implement the reroutes for extra or non-complying traffic as necessary and move traffic back to the preferred route if the traffic allows. To improve the communication with the GA service providers, the TRC would use the NYC Hotline telecommunication system to issue specific routes to eliminate some time consuming reroutes, this telcon would be the first time in the NY area a 2-way participation customer/FAA telcon had been implemented.

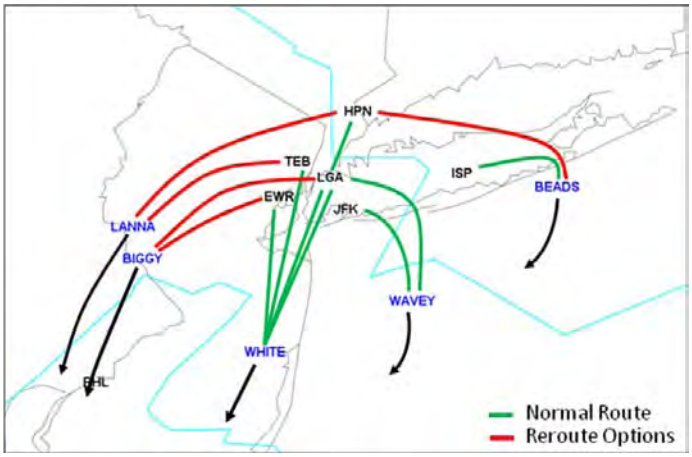

Figure 12. Available Southbound Fixes, with Notional Illustration of Preferred Routes. ***(MITRE)***

Having used the analysis to identify possible initiatives for the Thanksgiving holiday, the focus shifted to a coordination task among the Air Traffic Control System Command Center (ATCSCC), all East Coast ARTCCs and N90, with the N90 TMO and CAASD acting as lead. This took the form of teleconferences and face-to-face meetings, discussing the analysis and the best methods of applying it. During this period, the exact traffic split over the fixes was developed, the main initiatives being for GA departures to Florida over various fixes and EWR to Orlando International Airport (MCO) traffic via BIGGY. It was realized that better communication with the aviation community would be required in order for the initiatives to work. Once a comprehensive, coordinated plan was developed, the FAA/CAASD team presented it to both commercial and GA customers through one-on-one meetings and presentations at customer forums. The feedback from these meetings was positive and brought about significant customer support. Reacting to a request for the early information dissemination, advisories were developed and published closer to and during the holiday period[12,13]. A simple graphic depicting these new coordinated offloads is shown in Figure 12, as featured in the published FAA advisories[12,13]. With the pre-planning and dissemination in place, the FAA/CAASD team's attention turned to the event itself. N90 moved to staff and train for the TRC position, the CAASD team members prepared a next day fix traffic analysis for the FAA to judge performance and alter any plans on that basis. That step describes the daily air traffic numbers over the fixes of interest, with comparisons to the previous year. Further information based on observations by the CAASD team and advisories will be presented to help determine the success of the program.

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THE FOLLOWING ROUTES ARE PLANNED.

-HPN-TO EAST COAST FL DESTINATIONS:  CMK BETHA HTO BEADS J174
     TO WEST COAST FL DESTINATIONS: LANNA J48
-FRG TO EAST COAST FL DESTINATIONS:  BEADS J174
-TEB/MMU TO SELECT FL DESTINATIONS: LANNA J48
-EWR/LGA TO MCO AND WEST COAST DESTINATIONS: BIGGY J75
-LGA/JFK FILE NORMAL ROUTES (MAY BE OFFLOADED FOR FIX BALANCING)
-AZEZU PLAYBOOK IS AVAILABLE

POTENTIAL OFFLOAD STRATEGIES FOR VOLUME INCLUDE:
-LGA VIA WAVEY OR BIGGY J75
-JFK VIA WHITE OR RBV J75
-EWR VIA BIGGY J75 OR LANNA J48
-GSO/RDU VIA J75
-HPN/TEB/MMU MAY BE OFFLOADED VIA WHITE/WAVEY/BIGGY

ATLANTIC SOUTH 1&2 PLAYBOOKS ARE PLANNED WHEN ALL WARNING AREAS ARE
AVAILABLE AND WILL BE PUBLISHED VIA AN ADVISORY.

FUEL ADVISORY: CAPPING TO ZNY FACILITES IS A POSSIBILITY AND
CUSTOMERS WILL BE ADVISED WHEN THIS IS PLANNED VIA AN ADVISORY.
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Figure 13. Excerpt of Thanksgiving routes planning advisory. ***(FAA[12])***

IV. Event

As the week began, coordinating through the Command Center, a planning summary advisory was published on Monday 11/24[14], to increase the customer knowledge beyond the group that had been consulted in the

development of the holiday strategy. This advisory listed the likely strategies developed within the FAA/CAASD team and other issues of note; an excerpt is depicted in Figure 13.

All the planning had now fallen into place and in essence it was left to see how the days would play out. To best assist the FAA in the execution of the planned initiatives, the MITRE CAASD team set up an observational position within MITRE, taking advantage of the access to the ETMS and additional FAA/MITRE systems that the corporation has. Through the intent of this position was that the CAASD team would be able to observe the traffic movements and provide near term and possible real time analysis to assist the TMOs in the execution of the plan. Additionally, the CAASD team would be taking notes to record the events as they unfolded for future high volume traffic days, as a best practices exercise and for future review.

A. Tuesday 25th November 2008

The day began well with the forecast for the day calling for relatively good en-route traffic and little impact on the departures out of New York, as shown in Figure 14. The holiday planning advisory was published by the Command center at 1247 UTC. Traffic was handled as per the advisory throughout the day, with some traffic being rerouted back to the preferable WHITE route when conditions allowed. Once the volume began to pick up, the NY area hotline was initiated at 1822 UTC[15]. Prior to this, FAA communication had been internal or through the TRC GA telcon. Throughout the event, CAASD monitoring of the satellite airport clearance/delivery frequencies and TRC telcon had highlighted good use of the TRC position. On various occasions, advisory compliant routes were passed to GA pilots flying to Florida via the towers, along with open discussions with the GA flight plan providers as to the best use of the available airspace when routes became free.

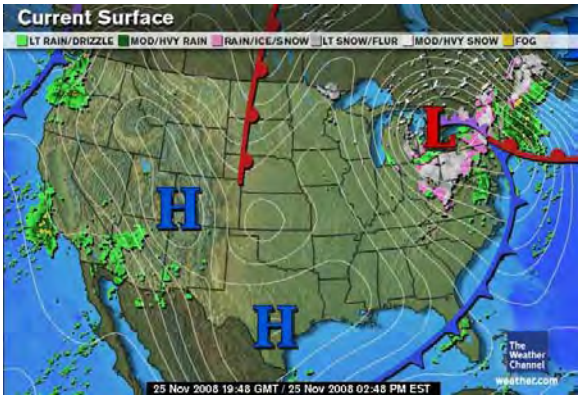

Figure 14. Surface weather picture for Tuesday, November 25 at 1948 UTC. ***(Weather Channel)***

All this activity was reflected in the final traffic numbers for the day. The numbers, depicted in Figure 15, illustrate just how effective the advisory reroutes and offloads where at moving traffic away from WHITE over to the alternate fixes. The overall WHITE volume dropped by approximately 30%, with increased use of BEADS and BIGGY to compensate, reflecting the concentration of WHITE offloading in the advisory. Breaking down the WHITE traffic by hour, the benefits of the initiatives in terms of traffic volume become increasingly clear. Figure 16 shows how there was only one major traffic spike, that being during the 21 UTC hour, with only twenty aircraft filing over the fix. This number was far less than was experienced during the same time period in 2007, where excessive hourly volume had lead to significant departure delays.

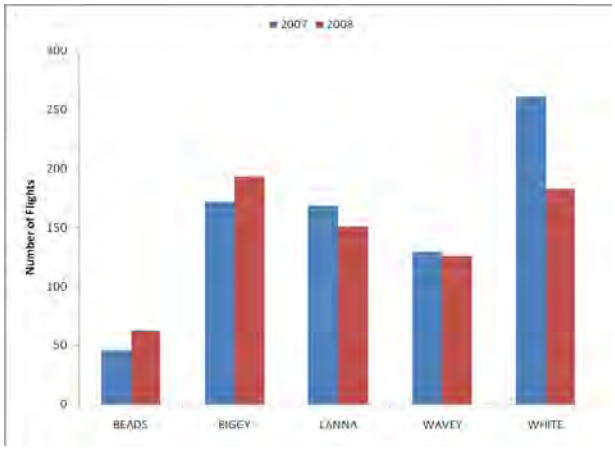

Figure 15. Filed traffic volume over Southern fixes, Tuesday, November 25, 2008 versus 2007. ***(ETMS)***

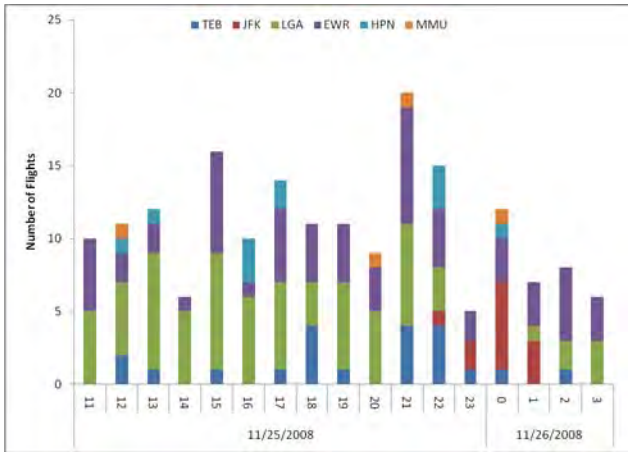

Figure 16. Filed traffic volume over WHITE, Tuesday, November 25. 2008. ***(ETMS)***

B. Wednesday 26th November 2008

Wednesday again saw the ATCSCC holiday route advisory being issued early in the day, at 1208 UTC, to help with the information dissemination to the NAS customers. The next day traffic analysis was provided to the NY Area TMOs by the MITRE CAASD team early in the morning to help them formulate a departure plan around the advisory and utilizing the lessons learned from the previous day. The weather outlook for the day was also favorable, with little if any terminal and en-route impact expected, as depicted in Figure 17.

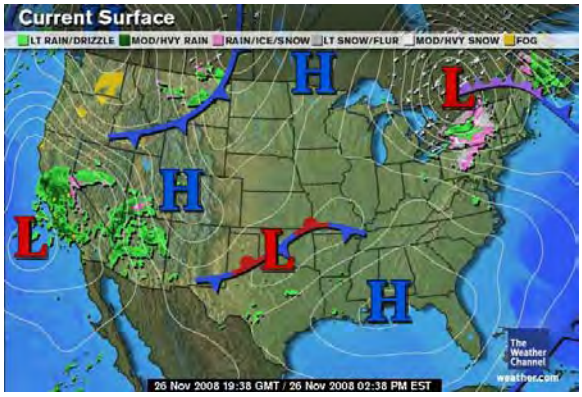

Figure 17. Surface weather picture for Wednesday 26 at 1938 UTC. ***(Weather Channel)***

As with the previous day, traffic management was handled internally within the various FAA facilities and through internal communications until the traffic levels began to increase. On this day, at 1525 UTC, the NY area hotline[16] was initiated to allow for faster intra facility communications and transparency with the airlines to keep them apprised of the situation. The TRC telcon ran well, though not utilized as much as the previous day, given the earlier NY area hotline start time. MITRE/CAASD observations during the day reflected favorably on the route use and coordination between FAA facilities and between the customers and the FAA.

The traffic numbers from Wednesday again reflect the real time observations of the MITRE CAASD team. Figure 18, demonstrates the significant drop in traffic over WHITE that was seen on the Tuesday. However, this time the change is more significant with a drop of approximately 37 percent over the previous year. In fact looking at WHITE, LANNA and BIGGY, one can see a near perfect balance being achieved, along with a good use of BEADS for the HPN departures. Considering the hourly breakdown of traffic filed over WHITE, it can be seen that the drop in traffic, depicted in Figure 18, corresponded with a very favorable traffic flow as depicted in Figure 19. The only traffic spike of note occurred during the 19z hour, when 22 aircraft filed over the fix. This number could have been lowered further had the need arisen, through expanded tactical use of the reroute options via the TRC telcon, to encompass the non Florida GA traffic.

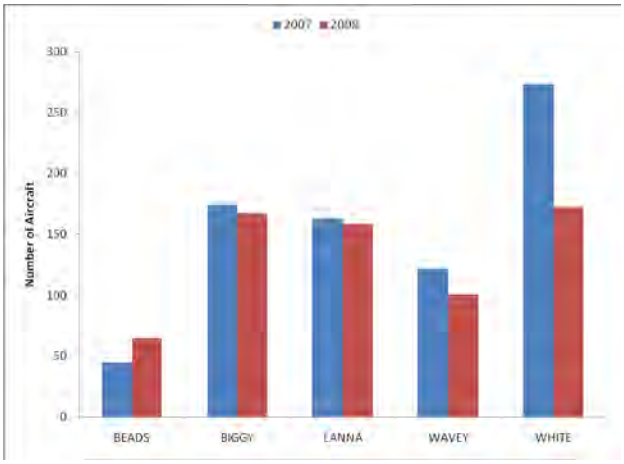

Figure 18. Filed traffic volume over Southern fixes, Wednesday, November 26, 2008 versus 2007. ***(ETMS)***

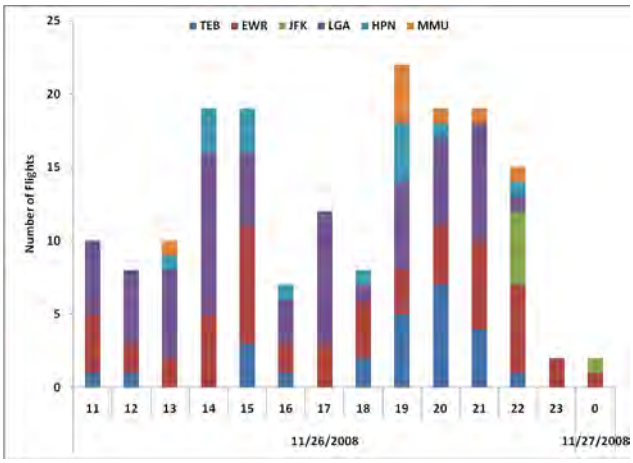

Figure 19. Filed traffic volume over WHITE, Wednesday, November 26, 2008. ***(ETMS)***

V. Post Event Analysis

A. Daily Analysis

At the beginning of every day during the Thanksgiving period, a post event analysis package was put together by CAASD for the FAA as a quick cursory means to judge the performance the previous day and then build off that. This package, the need for which was discussed within Section III, contained only traffic flow analysis. This analysis consisted of a total traffic fix comparison for all the considered fixes, hourly traffic breakdowns for each fix, graphical representations of the day's traffic and any pertinent observations by the MITRE CAASD team from the day before. The graphical representation provided an excellent means to gauge the success of the initiative through the compilation of the complete traffic set. It was generated using a MITRE in house tool that overlays the ETMS aircraft track data on a map of the U.S. and areas of interest. Examples of these representations will be depicted and discussed later within this section.

B. Measures of Success

The success of these initiatives can be measured in many different ways. Most often the end user judges his/her travelling experience by any delays. These results come through a combination of factors, many being investigated and discussed at different stages during and after the holiday period, due in part to the different times at which the data sources matured. Thus, the measures of success will be approached in a similar vein, working with the most immediate first.

1. Traffic Flows

The downstream impact of the Florida bound traffic was a major consideration when the planning process began. Airspace within the Norfolk (ORF) and Elizabeth City NC (ECG) areas is particularly constricted. The need to move the traffic away from these areas through use of the alternate airways, J75 and J48, alleviate the constriction and improve traffic flows over the 2007 situation. The graphical representations provided with the daily post event analysis for Wednesday (Figure 20) illustrate the good fix balance based on the published routes and its subsequent downstream effects. While this is not by any means a truly scientific comparison of the day's events, it did provide the most useful means to drive home the airspace benefits in the shortest amount of time.

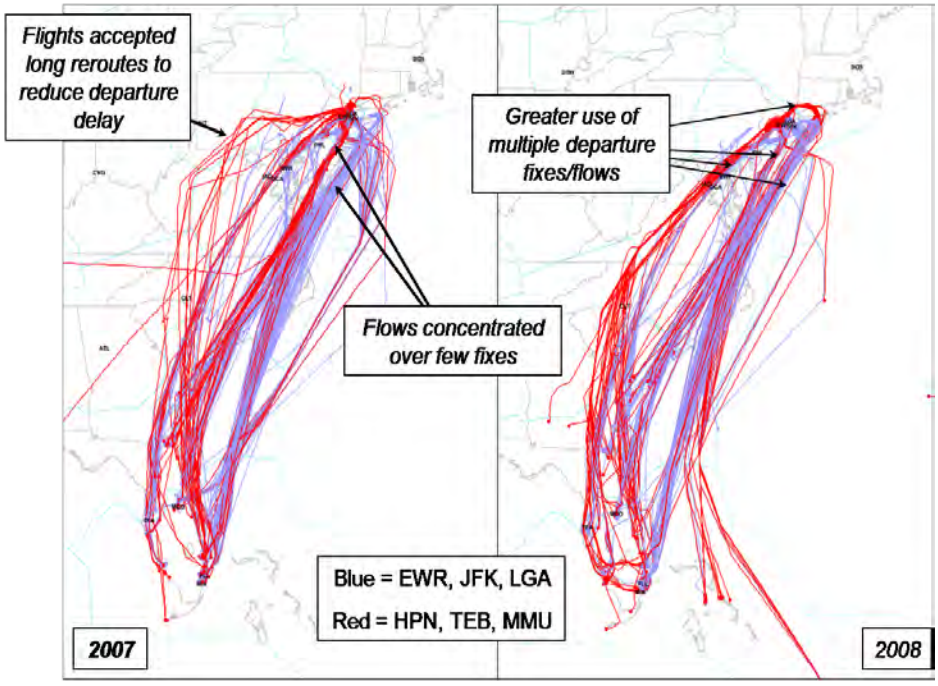

Figure 20. Comparison of Thanksgiving Wednesday 2007/2008 Traffic Flows. *(ETMS/MITRE)*

The annotations in Figure 20 pick out the clear differences in the traffic flows between the two events. It can be seen that in 2007, to alleviate the delays at the GA airports, aircraft took reroutes issued by the ATCSCC[17] that tactically departed them West out of the NY area to their Floridian destinations. The contrast with the 2008 traffic picture is immediate. From this we see better use of the offload fixes and a better balance of the traffic in general. This improved balance is especially evident in Figure 21, which depicts the traffic flow closer into the airports on Wednesday, November 26, 2008. In this figure the GA and commercial traffic use of the alternate fixes is very evident along with the increased lateral spread along J174 enabled once the warning areas were released. It is this good fix balancing that was being sought after in the beginning to reduce delays, after the lack of balance was identified as the major driver in the delays in 2007.

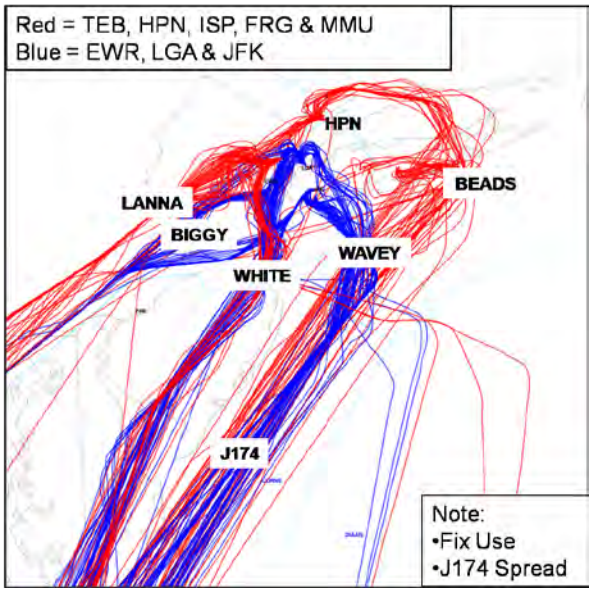

Figure 21. NY Terminal Area traffic flows WednesdayNovember 26 2008. *(ETMS/MITRE)*

2. Ground Delay Program numbers comparison

A Ground Delay Program (GDP) is implemented to control traffic volume to an airport where the projected traffic demand is expected to exceed the Airport Acceptance Rate (AAR) for a period of time. These provide a means to meter all traffic to the airport in question within the scope of the program. This is achieved by providing arrivals with Controlled Departure Times (CDT) which supersedes their planned departure times. In terms of measuring the effectiveness of the Thanksgiving plan, one must consider that GDPs can be implemented when departure volume reaches a level that requires the metering of arrival traffic to permit a so called departure "push". Thus the improvement in the departure traffic would reduce the need of GDPs for volume situations.

Table 2. Thanksgiving Tuesday GDP Comparison 2007/2008. *(FAA)*

Airport	2007			2008		
	Advzy count	Lengths (Hrs)	Reason	Advzy count	Lengths (Hrs)	Reason
HPN	6	12.8	VOLUME			
TEB	5	11.95	VOLUME			
LGA	6	14.35	CIGS/VIS	3	9.4	VOLUME
ORD	5	11.82	CIGS/VIS			
EWR	5	11.42	CIGS/VIS	3	5.65	CIGS/VIS
PHL	4	8.77	CIGS/VIS	2	2.15	CIGS/VIS
BOS	3	6.53	CIGS/VIS	4	6.08	CIGS/VIS
JFK	2	5.68	CIGS/VIS			

Table 3. Thanksgiving Wednesday GDP Comparison 2007/2008. *(FAA)*

Airport	2007			2008		
	Advzy count	Lengths (Hrs)	Reason	Advzy count	Lengths (Hrs)	Reason
HPN	4	10.43	VOLUME			
TEB	2	1.58	VOLUME			
LGA	5	13.58	CIGS/VIS			
EWR	7	12.47	CIGS/VIS	4	6.93	WIND
TEB	2	6.33	VOLUME			
BOS	2	7.48	CIGS/VIS			
ORD	2	5.33	CIGS/VIS			

The numbers of GDPs over the two days in question are compared with the previous years in Table 2 for Tuesday and Table 3 for Wednesday. Both days show significant reductions in volume and visibility based programs, with Wednesday showing the greatest drop with only one program at EWR for wind during the day. In addition to the drop in GDPs, it can be seen from these tables that the volume issues at HPN and TEB that necessitated GDPs in 2007 did not repeat themselves in 2008. The lack of any programs for these airports on the days in 2008 can be said to reflect the lack of significant departure issues at the GA airports. This can be attributed to both the reduction in departure volume (TEB) and the success of the offload and reroute options (HPN) for the GA airports.

3. Taxi out delays

For the commercial and GA customers, this consideration is one of the more significant. While the look of the airspace and the number of restrictions are important to them, one of the more common airline industry delay measures is the taxi delay. With an aircraft stuck on the ground waiting for departure, the company is not making any revenue; in fact, it is losing revenue as the fuel burnt in taxi adds up. Relating the Thanksgiving holiday work might not seem particularly clear cut at first. However, when you consider that any flights departing one of the three

Table 4. Average taxi out time differences by airport.

Airport	Tuesday	Wednesday
EWR	22%	6%
JFK	-44%	-75%
LGA	-27%	-30%

major airports is delayed before takeoff due to excessive volume or en-route issues, a delay will be incurred as the flight waits in the departure queue for its departure time. Thus the work undertaken and described within this paper should, in theory, help to reduce the taxi-out delays at the three major NY airports. These numbers are taken from the FAA's Airspace System Performance Metrics (ASPM) database that matures some six weeks after the event date once Airline Service Quality Performance (ASQP) data has been combined[18]. They represent the total taxi time from gate departure to take-off, not including the airport, seasonal specific, unimpeded taxi-out time. Consequently, during the event airline anecdotal data was used until the finalized data could confirm these assertions. This data in Figure 22 shows some very promising results for both days, though on Wednesday in particular.

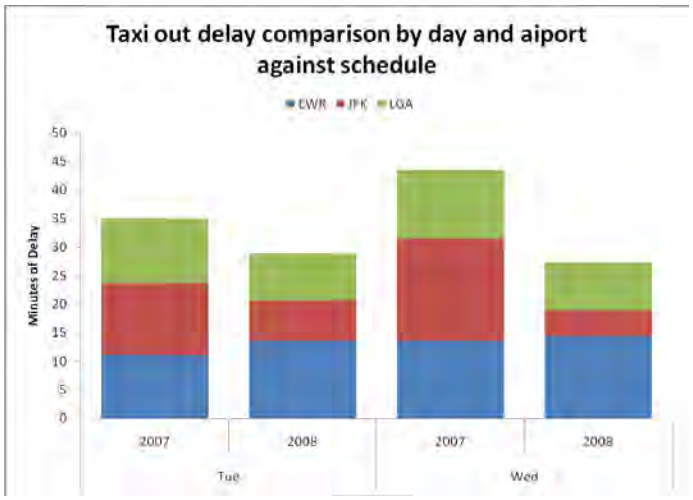

Figure 22. Airport average taxi out delays for the Thanksgiving holiday 2007/2008. *(FAA ASPM[18])*

While Figure 22 shows an overall improvement in the taxi-out delay year over year, it can be see from Table 4 that the benefits where not the same across the board. LGA and JFK saw significant drops in the taxi out times, where EWR saw increases on both days. The size of the EWR increase might appear to be significant, but in fact reflected an increase of just 2.45 minutes. The exact cause of this increase is yet to be determined and has been overshadowed by the other airport improvments . This is exemplified by a decrease at JFK on Wednesday that characterized a 13.38 minute reduction. However, given that the focus of this work had been the moving of traffic off WHITE to better balance the fix flows, the determination of success could in someways be through the consideration of the taxi time benefits to its highest user, LGA. The airport saw approximately 30 percent reductions in taxi times for both days during the 2008 holiday.

4. Arrival and Departure Delays

Though the taxi-out delays are noticeable to the paying customer, a more important measure for them is based on the flight arriving/departing on time, where the time referred to is the scheduled time. The most robust measure of the delays is by measuring the percentage chance of an on-time arrival or departure at a particular airport. Changes in 2008 to the FAA means of delay reporting prevent a direct delay comparison for the 2008 and 2007 holiday. Moving to these more tenable success metrics again required the maturing of the ASPM data source to get a truly accurate picture. With the passenger in mind, the consideration of the gate departure performance is most apt, as this is based on the time that is shown on the ticket.

Figure 23 illustrates a general trend of improvement over 2007, as the three other success measures have shown. In fact, the figures demonstrate greater improvements over the previous year than the average taxi-out delays were showing, as Table 5 brings to our attention.

Table 5. Average percent on time gate departure differences by airport.

Airport	2007	2008
EWR	+50%	+30%
JFK	+21%	+8%
LGA	+67%	+75%

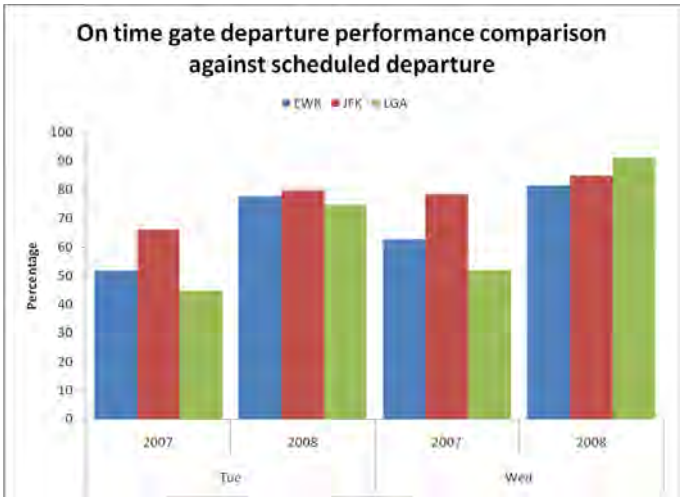

Figure 23. Airport average on time gate departure performance for the Thanksgiving holiday 2007/2008. (FAA ASPM)

VI. Conclusion

The consideration of the measures of success has given a good, brief summary of the benefits of the application of analysis-driven initiatives within the air traffic environment. These results are very positive overall, but can only be put into

context when one also considers the departure traffic levels out of the NY metro area over both years. The downturn in the economy has also lead to a reduction in air traffic as passengers look elsewhere for their vacation needs. From Table 6, it can be seen that while there were some significant drops in departure traffic from the NY airports, particularly the GA airports, overall the reduction in traffic is minimal.

Table 6: ASPM Departure traffic numbers for NYC metro area airports for Thanksgiving Tuesday and Wednesday 2007 and 2008. *(FAA ASPM[18])*

Airport	Tuesday		% difference	Wednesday		% difference
	2007	2008		2007	2008	
EWR	617	615	0%	617	603	-2%
JFK	597	568	-5%	600	588	-2%
LGA	586	558	-5%	591	558	-6%
TEB	130	94	-28%	111	81	-27%
HPN	125	106	-15%	112	114	2%
TOTAL	**2055**	**1941**	**-6%**	**2031**	**1944**	**-4%**

The overall traffic reduction thus does not match the improvement in the fix balance and the other measures of success. Neither can this improvement be attributed to an improvement in the weather, as even a cursory look at the weather pictures provided within this paper can concur with this conclusion. Thus the overall results can reasonably be attributed to the benefits of the Thanksgiving traffic management plan. The implementation of this plan saw improvements in the percentage of on-time gate departures of up to 75 percent over the previous year, along with average taxi out delay reductions, again up to 75 percent.

In addition to an analysis of the specific impact of these initiatives, this effort provides an opportunity to evaluate the use of data analysis, operational observation and post-event feedback as a means of pursuing better Traffic Management strategies. In this case, the FAA/CAASD collaboration indicated that developing and implementing strategies can be complex and time consuming. The collaborative effort requires a combination of expertise, knowledge, appropriate analysis and documentation of events to become successful. Since the TMOs do not have operational, probabilistic real-time NAS simulation environments within their traffic management facilities, new strategies must be implemented in the live operational environment with its associated uncertainties. In order to gain acceptance from all stakeholders, the supporting analysis and documentation becomes key to the TMOs.

Based on the success of this Thanksgiving initiative the traffic management strategies developed for it have been extended throughout the 2008/2009 holiday season right up to President's Day, evolving to meet the needs of the different traffic volume events. Similar strategies for other traffic management issues within the New York area are in development using this initiative development process as a baseline. Additionally, separate efforts by the ATCSCC have increased the coordination with the military to dramatically improve the military airspace release process, providing the FAA with improved lead times on the releases and more flexibility in the release requests.

Acknowledgments

The authors thank all the FAA and CAASD employees involved in the development and implementation of this traffic management plan. It was their determination to see this through that made this program a success.

References

[1] *Timeline of Airline Bankruptcy – Timeline of Chapter 11 filings*, Wikipedia Foundation Inc, July 2008, http://en.wikipedia.org/wiki/Timeline_of_airline_bankruptcies
[2] Maer P., *FAA: NYC is "Sore Point" for Flight Delays*, CBS News, November 15, 2007
[3] *Traffic Movements 2007 Final*, Airports Council International, July 2008
[4] *Year to date Passenger Traffic*, Airports Council International, October 2008
[5] Wald L., *Air Traffic Delays Up Over Last Thanksgiving*, New York Times, November, 27, 2007
[6] *The Operations Network (OPSNET) Delays (EWR)*, FAA, November 20, 2007
[7] *The Operations Network (OPSNET) Delays (TEB)*, FAA, November 20, 2007
[8] *The Operations Network (OPSNET) Delays (HPN)*, FAA, November 21, 2007

[9] *Military Airspace Release for Thanksgiving Period*, New York Center Traffic Management Bulletin 07-024, November 19, 2007
[10] *Fleet Area Control And Surveillance Facility Virginia Capes &Fleet Forces Atlantic Exercise Coordination Center*, http://www.vacapes.navy.mil
[11] *ATCSCC Memorandum*, FAA, November 17, 2007
[12] *ADV # 008 Holiday_Route_Planning_Summary_FYI*, FAA Advisory Database, November 25, 2008
[13] *ADV #013 Holiday_Route_Planning_Summary_FYI*, FAA Advisory Database, November 26, 2008
[14] *ADV # 011 Holiday_Route_Planning_Summary_FYI*, FAA Advisory Database, November 24, 2008
[15] *ADV # 030 New York Area Hotline_FYI*, FAA Advisory Database, November 25, 2008
[16] *ADV # 031 New York Area Hotline_FYI*, FAA Advisory Database, November 26, 2008
[17] *ADV # 091HPN_Offload_South*, FAA Advisory Database, November 21, 2007 21:27Z
[18] FAA Airspace System Performance Metrics, http://aspm.faa.gov

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