Business Based Flow Management (BBFM) Operational Benefits Review

1. FAA Task J BBFM Benefits Summary (2010 through 2012)

FAA, in coordination with Embry-Riddle University, independently validated actual BBFM, queue management operations at the Charlotte International and Minneapolis International Airports.

Using BBFM to time synchronize the arrival flow (starting around 2 hours prior to landing) to the arrival fixes (30 NM from landing), based on a Required Time of Arrival (RTA) process, produced significant benefits.

With limited operational support and marginal compliance, the FAA "*Task J*" Report (excerpts available on request) listed the following benefits.

a) **15.94 second per flight system-wide benefits (managed and unmanaged, compliant and not);**
b) **Optimized flights that complied have 31.81 seconds shorter time in the terminal airspace;**
c) **Optimized flights have better on-time performance than non-optimized flights;**
d) **TMA-BBFM interaction: 17.82 seconds shorter dwell time when TMA and BBFM work together;**
e) **Multi-user BBFM operations saved 2,073,454 pounds of fuel (307,178 gallons);**
f) **7.6% RTA Compliance (benefits improve with more flights optimized and complied).**

Additionally, the BBFM system, powered by the Attila™ software, airline monetized benefits include:

Table 2. Monetized Benefits Summary (for first year of operation)

	US Airways-CLT		*Delta Air Lines-MSP*	
	Active Phase 1	*Active Phase 2*	*All Observations*	*Representative Days*
Total System Costs	$1,587,458	$4,337,458	$1,553,530	$1,553,530
System Monetized Benefits	$1,232,774	$5,649,473	$12,328,152	$5,242,340
System Benefit/Cost Ratio	0.78	1.30	7.94	3.37
Total Participant Costs	$1,587,458	$1,587,458*	$1,553,530	$1,553,530
Participant Monetized Benefits	$1,130,337	$3,127,668	$3,330,214	$1,373,975
Participant Benefit Cost Ratio	0.71	1.97	2.16	0.88

(*)One Airline Attila™ system

Also, important to the business case, FAA Task J independently validated that BBFM reduces airspace complexity, holding and excess distance flown, all of which reduces costs and the airline environmental impact.

2. GE Aviation BBFM Benefits Summary (2012 through 2013)

In April of 2012, GE Aviation partnered with ATH Group Inc. to explore an air traffic flow management solution to the increasing traffic congestion. The objective of the 18 month program was to test the deployment of a simple, yet potentially effective tool marketed as Business Based Flow Management (BBFM), powered by ATH's Attila™ software, which enables airlines, in coordination with ATC, to sequence arrival traffic to avoid current and potential future airport delays/congestion/inefficiency.

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A successful outcome would prove the concept that an airline acting in their own best interests, could perform actions outside of local airport flow (2 to 3 hours, or more, prior to landing) that would provide a positive benefit to both the airline as well as the ATC system as a whole.

Below is an empirical assessment of the operational performance experienced while under the direction of the BBFM optimization software.

With compliance around 50%, BBFM benefits include.

- **Improvement in On Time Performance through improvements to A0/A14**
- **Improvement in Dwell time reduction through the reduction in the time an aircraft spends from the corner post to the runway**
- **Reduced fuel usage as a consequence of the above**

Findings:

KEY METRIC	RESULT
A0 Improvement (Passive to Active)	14.82 %
A14 Improvement (Passive to Active)	12.04 %
Dwell Time Reduction	2.98 Minutes
Fuel Reduction	25,055 Kg / Day

Table 1 Data Analysis Results

3. Airline's Annual Cost of Poor Quality (COPQ)

Along with benefits from BBFM, we must also look at what it costs individual airlines to not act, i.e., not manage their "*day of*" operations, 24/7-365, in real time, what manufacturing calls the Cost of Poor Quality (COPQ). The airline COPQ below is calculated based on a single airline with 2,000 flights per day, an average of 1.66 hours per flight and a conservative 18 minutes of scheduled block/gate buffer time.

Single Airline Cost of Poor Quality Analysis

Crew/Defects/Fuel/Lost Productivity Costs and Lost Revenue

Annual Crew Buffer Cost	$	98,550,000
Annual Defect Rework Cost	$	36,792,000
Annual Overnight Rework Cost	$	76,650,000
Annual Fuel Buffer Cost	$	560,382,353
Annual Aircraft Lost Productivity Cost	$	2,014,800,000
Annual Additional Ticket Revenue with A0 Quality	$	306,600,000
Total Single Airline Annual Buffer/Rework Cost	$	3,093,774,353

4. Delta BBFM Benefits Summary (2006 through 2014)

ATH Group operated Business Based Flow Management (BBFM) for Delta at Atlanta, Detroit and Minneapolis

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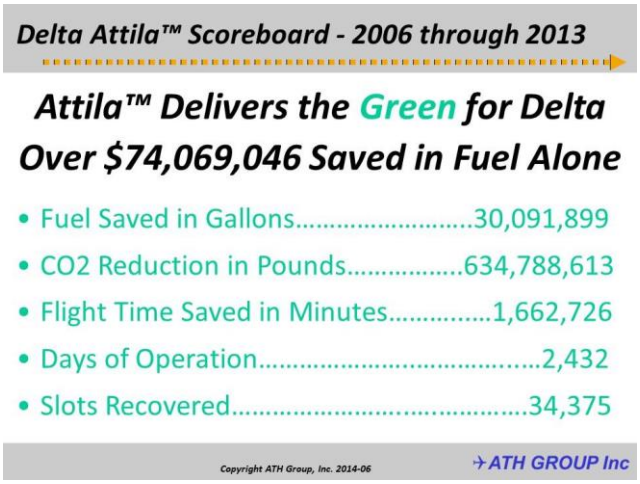
airports.

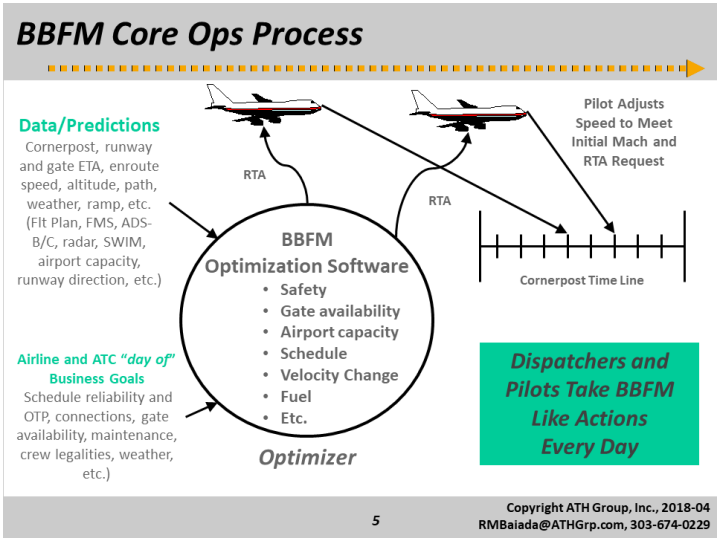
BBFM provided Delta aircraft assigned Required Time of Arrival (RTA) arrival fix messages via Acars for the pilot to execute. Even with lower than expected compliance, BBFM produced the following benefits for Delta.



In addition, during the BBFM operation, ATH also provided Delta with the world's most accurate runway and gate Estimated Time of Arrival (ETA) solution for all Delta arrivals, thus improving predictability.

5. Business Based Flow Management Overview

At its core, BBFM is a full time (24/7-365), interdependent, time based, queue management solution that applies, small, but constant pressure to move the right aircraft, to the right place at the right time.



In fact, BBFM is the only independently validated, "*day of*", real time, tactical, operationally implemented (8 years), system focused, yet aircraft specific, long range (hours prior to landing), queue management solution available today. By using predictive analytics and real time, aircraft by aircraft, time based management (RTA), BBFM rapidly mitigates delays and congestion.

Constantly applying speed/time pressure to the aircraft, hours prior to landing, accomplished from a system perspective, stabilizes the aircraft flow, dramatically increasing predictability and removing variation.

For example, why fly fast enroute if your gate is not available. Not only does this waste fuel enroute, it randomizes the queue, congests the arrival fix, delays other aircraft, takes up a valuable landing slot, which should be used by a late aircraft, congests the ramp, and, as proven by ATH, leads to increased taxi times, while early flights wait for gates. Further, the airline has ramp workers, fuelers and other ramp processes "*standing by*", wasting time and costing money. One action produces numerous highly variant and costly effects.

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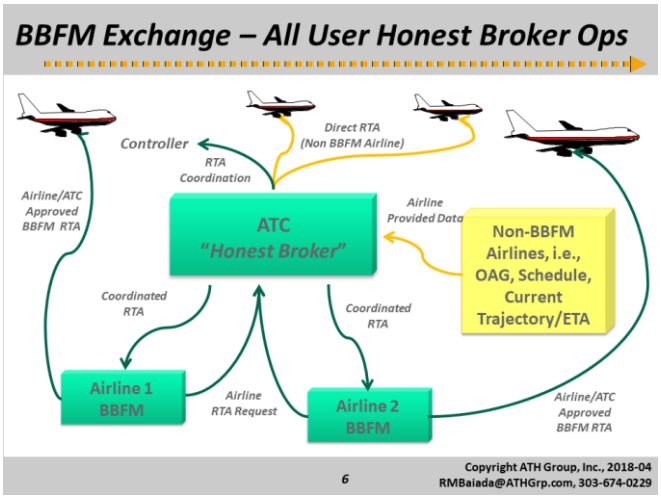
Or consider 2 of airline's aircraft at the front of a tightly packed arrival queue of 30 aircraft. By identifying and speeding up the first 2 aircraft, moving them forward just 2 minutes, the entire arrival queue moves forward. In other words, moving 2 aircraft forward at the front end of a large arrival queue doesn't just save 2 minutes, but saves 2 minutes for every aircraft in the queue behind the first 2 flights, as the entire queue moves forward. This creates what Dr. Clark of Georgia Tech labeled the "*draft effect*", thus dropping 60 minutes of flight time and delay from this one arrival flow alone.

To accomplish this, the BBFM solution constantly monitors the arrival flow hours before landing, starting prior to takeoff, and makes small business and operational time/speed based adjustments for schedule, arrival demand, aircraft capabilities, capacity requirements, predicted queuing, gate availability, etc.

Once the BBFM optimization process generates a coordinated arrival time for each aircraft, it coordinates with ATC in real time and then electronically sends the approved arrival fix time to the aircraft as a suggested Mach or cornerpost time (RTA) for the pilot to execute.

The real time ATC coordination is accomplished through the BBFM Exchange solution, which is also an available COTS product.



The BBFM Exchange solution, also implemented using the already deployed, onboard, Required Time of Arrival (RTA) process, is the only independently validated (FAA's Task J program, Embry-Riddle University, CLT/MSP, 2010-2012) long range air traffic flow management solution that is available today, providing real time coordination between the airlines and ATC.

BBFM Exchange is a rapidly deployable solution that quickly provides **what passengers, airlines, controllers, ATC and all users want - a more efficient, organized, predictable, on time aircraft flow**, and all the benefits that provides. BBFM simultaneously helps passengers, airlines, employees and ATC by coordinating what airlines want for each aircraft with the ATC system, all accomplished in real time, on the fly.

The point is that with BBFM, the airline has the ability to tactically choose and execute a more profitable business based system outcome and coordinate it with ATC in real time.

Further, by implementing the independently validated BBFM solution as an overlay to the existing and planned Air Traffic Control safety and separation process, airlines/ATC will provide the necessary leadership to leapfrog what the DOT Inspector General identified as the "*sequencing, spacing and interval management*" deficiencies in the skies and on the ground today, using commercially available, off-the-shelf technology, **which requires no new aircraft or ATC equipment, and only limited investment**.

Finally, BBFM is a low cost, system focused, time based, queue management solution, which can be implemented at the first large airport within months, and country wide within 3 years, or less, providing benefits to all users, with zero downside risk. **BBFM is a true win-win solution**.

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