# ASOS RESEARCH BRIEF

**Research Request:**

**Fuel Conservation**

**Research Response:**

## *Aircraft Fuel Conservation - Review, Audit and Questionnaire*

Skyboss Aviation Services

A very good power point presentation of fuel conservation strategies and an excellent questionnaire at:

http://www.skyboss.net/skybossPPT_files/frame.htm

## *Fact Sheet: New Fuel Management Procedures (UPS Airlines)*

http://www.pressroom.ups.com/mediakits/factsheet/0,2305,1286,00.html?mkname=upsairlines

UPS Airlines has designated an airline fuel manager to implement a fuel conservation program. That program is significantly reducing fuel consumption and emissions and is saving the company millions on its fuel bill each year. These innovative and aggressive initiatives demonstrate that environmental concerns are a core part of UPS's daily activities and engineering processes.

The role of UPS's fuel manager is to re-examine how the airline operates, looking for additional ways to reduce consumption and manage fuel purchases. As a result, UPS has implemented several procedures, including:

- using only one engine during taxiing;
- having more UPS airplanes use electrical power from buildings and in-ground electrical hook-ups instead of the aircraft's auxiliary power unit, which is powered by fuel; and
- slowing down flights to the most fuel efficient speeds where arrival times are not critical to making service commitments.

Additionally, UPS flight planners are considering fuel prices around the world when determining where to fuel the company's aircraft. Planners use a formula to calculate the costs and determine whether the price is right. This fuel program has proven its worth to the airline, yielding multimillion-dollar savings each year.

## Innovative Technology Lands Fuel Savings for UPS Airlines

UPS is testing and has implemented several programs that are proving to be successful in conserving fuel and reducing emissions.

**ADS-B**: In coordination with the FAA, UPS is testing Automatic Dependent Surveillance - Broadcast (ADS-B) technology on all of UPS's 757 and 767 aircraft. Among other things, this technology allows:

- 10 to 15 percent increase in landings per hour
- fuel savings of 1 million gallons a year
- 30 percent reduction in noise; and,
- a 34 percent lower nitrous oxide emissions.

UPS is the world's only fleet equipped with this advanced technology.

**Lido:** UPS Airlines is the first U.S.-based carrier to use the Lufthansa Systems Lido Operations Center, a flight planning system which calculates the most efficient route between two points, based on weather, winds, terrain and other factors.

**CDA:** UPS also is testing the effectiveness of continuous descent approach (CDA) rather than stepping down altitudes when landing. Pilot programs are underway at airports in Louisville, Ky. and Sacramento, Calif. With CDA, planes use idle power to glide down, which makes less noise, burns less fuel and creates fewer emissions. UPS expects to have operational approval from the Federal Aviation Administration (FAA) to implement CDA for several flights to Louisville by the end of the year.

## Worldport and the UPS Air Park

UPS Worldport™, UPS's all-points international air hub in Louisville, includes various features designed to reduce the operation's environmental impact. For example, Worldport's aircraft docks allow planes to park directly next to the facility, eliminating the need to run ground tugs, dollies and other equipment required to load and unload aircraft parked on ramps. This reduces fuel use and emissions.

The Worldport facility has backup electrical feeds from two substations fed by Louisville Gas & Electric in lieu of generators that burn fossil fuel.

The UPS Worldport facility received a federal grant to build a biodiesel infrastructure at the airport. This infrastructure will provide a 5 percent biodiesel blend of fuel to run 366 ground support vehicles starting in early 2008. Biodiesel is a clean-burning diesel replacement fuel that can be used in compression-ignition engines. It is manufactured using U.S.-produced oils such as soybean oil, recycled cooking oils or animal fats.

UPS's two Jet-A fuel tanks in Louisville have an internal floating roof, which reduces

VOC (volatile organic compound) emissions.

## *How to save aviation fuel? Fly slower!*

http://www.dancewithshadows.com/flights/save-aviation-fuel.asp

**In the face of skyrocketing fuel prices, airlines are doing what motorists have known for long – that slowing down on the road means saving on fuel.**

16 May, 2008: More and more airlines worldwide are adding a few minutes to flights to save millions in jet-fuel costs.

**Air Canada**

- Reducing cruising speed when flights are ahead of schedule.
- Reducing speed when an aircraft has prevailing winds.
- Taxiing on the ground with only one engine.
- Taking more weight off planes with the use of lighter trolleys and cargo containers.
- Optimizing the uses of water on board. Instead of flying with a full tank, the airline refills at a connecting destination.
- Making sure external surfaces are cleaned to cut down on drag.

Air Canada, Canada's largest airline and flag carrier, claims to be among the leaders in this area of saving on jet fuel.

**WestJet Airlines**

- WestJet equips its planes with blended winglets, which are bent-up tips at the end of the wings to provide more lift to the aircraft on takeoff.
- The carrier uses an onboard GPS system to allow planes to come in for more direct landings via satellite, cutting travel time and fuel expenses.

Canada's WestJet Airlines has been trying to cut fuel costs by using computer technology to calculate optimum speeds so that slowing down does not extend the work shift and add to staffing costs.

Isabelle Arthur, a spokeswoman of Air Canada, said that the carrier had taken a series of steps to save on fuel costs more than a year ago which are a joint effort of all Air Canada's operational branches, including input from flight operations, in-flight operations and the maintenance group.

**Southwest Airlines, USA**

Southwest Airlines, the low-cost airline based in Dallas, Texas, the United States, started flying slower two months ago. It expects to save US $42 million in fuel in 2008 by extending each flight by 1 to 3 minutes.

**Northwest Airlines, USA**

The Northwest Airlines, of the United States, saved 162 US gallons (613 litres) of aviation fuel worth $535 on its flight from Paris to Minneapolis recently. By flying slower, Northwest Airlines added 8 minutes to the flight, extending it to 8 hours, 58 minutes – that is, flying at an average speed of 532 miles per hour, down from the usual 542 miles per hour.

**JetBlue**

- Added 4 minutes to its flights

JetBlue, a low-cost airline owned by JetBlue Airways Corporation of the United States, adds an average of 2 minutes to each flight, and saves about $13.6 million a year in jet fuel. Adding just 4 minutes to its flights to and from Hawaii saves Northwest Airlines $600,000 a year on those flights alone, according to a spokesman of JetBlue.

**United Airlines**

- Flight planning software for optimum routes and speeds

United Airlines, a major airline of the United States and a subsidiary of UAL Corporation, has invested in flight-planning software that helps pilots choose the best routes and speeds. The airline estimates that the software will save it $20 million a year.

While slowing down flights can help airlines conserve fuel, it can also lead to greater labor and maintenance costs if airline employees work longer hours and planes spend more time in service, an independent airline consultant based in Port Washington, New York, was quoted by Star newspaper.

He added: “The slowing down to conserve fuel can only be pushed so far: below a certain speed, depending on the model, an aircraft's fuel usage can actually rise.

Not every airline is taking the slowdown approach.”

The “slowing down” of aircraft has received support form many consumer outfits in the United States. According to Travis Plunkett, legislative director at the Consumer Federation of America, “the extra minutes shouldn’t matter. If it means that airlines can keep their costs down, keep their ticket prices down, and save a little fuel, that’s fine.”

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## *Excerpts from: Coping With Sky-High Jet Fuel Prices*

John Heimlich — VP & Chief Economist
Air Transport Association of America
www.faa.gov/ats/ato/drvsm/benefits.asp
June 16, 2008

**Fuel Conservation Via Weight or Drag Reduction**

- One airline saved over 17 gallons/year per pound of weight per airplane after shedding in-flight phones, ovens, excess potable water, and some galley equipment on an older fleet
- In removing seatback phones from its MD-80s and B737-400s, another airline shed 200 pounds per airplane, translating into 3,400+ gallons saved annually
- Alaska Airlines indicated in March 2004 that removing just five magazines per aircraft could save $10,000 per year in fuel; also, the airline has reduced the weight of catering supplies
- Air Canada considered stripping primer and paint from its 767s to save 360 lbs. per plane
- JetBlue and US Airways and others have moved toward a paperless cockpit
- By removing six seats, JetBlue reduced A320 weight by approximately 904 pounds
- Airlines have been able to remove ovens, trash compactors, or even entire galleys, due to the elimination of hot meals on selected flights; others are using lighter seats; they have also removed magazine racks and replaced hard cabin dividers with curtains
- AirTran ordered carbon fiber Recaro seats for its 737-700s to shave 19.4 pounds per row, resulting in estimated fuel savings of $2,000 per year per aircraft
- Alaska's new beverage cart, at 20 lbs. lighter, could save $500,000 in annual fuel costs
- Many airlines are using Pratt & Whitney's EcoPower engine-washing process to save fuel
- Some airlines flush lavatories during extended ground delays to minimize takeoff weight

**Fuel Conservation Through Operational Means**

- En route, airlines utilize sophisticated software optimize speed, flight path, and altitude to reduce airborne consumption and avoid consuming extra fuel while awaiting a gate
- ALK, AA, SWA et al have added life vests on domestic routes (e.g., LAX-CUN, DFW-MIA, MIA-NYC, AUS-TPA) to enable over-water routings in cases where they are more efficient
- American redistributed cargo in the airplane's belly to minimize fuel consumption
- Alaska Airlines is deploying a new flight planning system to yield more direct routings
- American and Delta use super tugs on the ground to reposition aircraft where feasible
- Many have installed winglets to reduce drag – est. fuel savings of 3%-4% per B737-700 flight

- Several airlines taxi in on one engine when conditions permit; AA saves $10-$12 million/year
- American, Southwest, and others are using ground power to provide electricity and ground conditioned air, rather than the plane's auxiliary power unit (APU)
- Delta has deployed a decision support tool to provide pilots with coordinated speed adjustments, allowing more evenly spaced landings and less airspace congestion at ATL
- Most airlines have reduced excess fuel on international flights with FAA approval thanks to more precise navigation allowed by GPS and better wind forecasts
- New "end-around" taxiway at ATL will save airlines $26-$30 million per year; DFW is next
- Delta estimates saving 400 pounds of fuel per flight from continuous descent arrivals at ATL

**Fuel Conservation Through ATC Reform**

Testimony of Mike Cirillo, FAA VP-Systems Operations Services (Feb. 15, 2006)

- The introduction of Domestic Reduced Vertical Separation Minima (DRVSM) doubled the number of usable altitudes between 29,000 and 41,000 feet, allowing greater access to fuel-efficient routes previously unavailable due to increase separation requirements; FAA estimates savings at $500M/year
- Area Navigation (RNAV) procedures promote reduced fuel usage through more efficient climb and descent gradients; shorter, more predictable, and more repeatable ground tracks, and reduced delays; annual benefits estimated at tens of millions of dollars at ATL and DFW
- Required Navigation Performance (RNP) uses on-board technology that allows pilots to fly more direct point-to-point routes reliably and accurately; gives pilots lateral guidance and vertical precision; allows more efficient airspace management and reduces fuel burn
- Florida airspace redesign reduced flight distances on standard arrival and preferential routes into south Florida airports, re-routes into adjoining foreign airspace, and departure delays from BOS/NYC/WAS airports to south Florida; FAA estimates $20M/year in savings
- Advanced Technologies & Oceanic Procedures (ATOP) reduces current separation minima from 100 nautical miles to 50 (or 30 for equipped aircraft); permits more aircraft to access more fuel-efficient trajectories because routes can be spaced more closely together, and aircraft can operate more closely in trail; more efficient trajectories allow aircraft to operate on better time tracks with less excess fuel, consequently allowing them to carry extra payload; estimated to save airlines about 6.5 million pounds of fuel (or about $8 million a year) on oceanic flights from the U.S. to the Caribbean and South America
- User Request Evaluation Tool permits controllers to predict potential aircraft-to-aircraft and aircraft-to airspace conflicts earlier, allowing them to construct alternative flight paths or cancel climb or descent restrictions; addresses conflicts strategically rather than tactically, with fewer deviations to the route or altitude and less restrictive climb or descent profiles; estimated FY05 savings = 25M aircraft miles

**Potential Benefits of NY/NJ/PHL Airspace Redesign**

FAA Press Release, Fact Sheet and Briefing (Sept. 5, 2007)

- On Sept. 5, 2007, the FAA called for new flight patterns over five states and new procedures that will affect more than 15 FAA facilities
- New plan combines high- and low-altitude sectors to create more efficient arrival/departure routes, reducing delays while improving safety (less complexity and voice communications)
- Integrates NY TRACON airspace with portions of surrounding en route centers' airspace; allows controllers to direct IFR traffic more efficiently; improves use of available runways
- Key (estimated) benefits are:
  - 20% reduction in airport delays over five-year period of implementation
  - 12M fewer minutes of delay annually, yielding up to $9B in benefits to air carriers, passengers and local businesses in 2011
  - Saves $248M/year in direct operating costs plus $37M in severe-weather delay costs
  - 600,000 fewer people exposed to noise

## *Data Requirements for Effective Fuel Conservation*

By Michael E. Irrgang
http://www.airlineoperationsolutions.com/
AGIFORS OpsCtl 2005

**Basic Issues in Fuel Conservation**

- There is too much weight on an aircraft
- The airline does not accurately calculate the weight of the aircraft
- People waste fuel on the ground
- Pilots fly inefficient or inappropriate procedures
- The airplane is flown too fast
- Fuel is purchased in the wrong place for too much
- The airplane generally lands with too much fuel
- A special case of the airplane being too heavy
- There is something wrong with the aircraft that leads to excess fuel consumption

**Proper Data Modeling identifies and often leads to the correction of ALL of these problems!**

**Key Systems**

- DCS / Weight & Balance system
- Planned vs. actual pax & cargo loads
- Flight planning system
- Planned vs. actual weight & fuel load
- Scheduled vs. planned vs. actual times
- Record extra fuel & reason
- Record significant weather
- Fuel tinkering
- Planned altitudes
- ACARS
- OUT(+fuel)/OFF/ON/IN(+fuel)
- OFF fuel, altitudes if available
- Performance monitoring (if available)
- FOQA (if available)
- Monitor altitudes, compare to Flt. Plan
- Monitor descent & arrival process
- Monitor single engine taxi

**Other Data**

- Fuel prices
- Needs to be updated weekly to properly calculate tankering for every flight plan where appropriate
- Passenger weight, carry-on weight, luggage weight
- The weight of the aircraft needs to be accurate, or the altitudes flown will be inaccurate, resulting in major additional fuel burn
- MEL database
- Aircraft defects affecting fuel consumption. E.g. pack inop, anti-ice inop
- APU usage
- Usually requires manual data entry system, from pilot /ramp staff/Maintenance
- Maintenance & Crew Cost data
- For proper calculation of the Cost Index, which trades off time-related cost vs. fuel cost
- Cargo pricing
- Need to ensure proper cost vs. revenue analysis on routes that may involve tankering or from high-fuel cost airports
- FMS (aircraft Flight Management System)
- Ensure loaded with Performance Factor, Cost Index, and (for each flight plan) current forecast winds

**Planned vs. Actual:**
**Why Is It So Important?**

- Most airlines monitor consumption, but not how it compares to the original plans
- Without comparing actual consumption to plans, it is much more difficult to isolate & monitor these issues:
  - Excess loading of fuel by fueler
  - Excess APU fuel usage
  - Trends in excess arrival fuel

- Non-weather-related excess fuel burn
- Altitude issues
- Aircraft performance issues
- Incorrect block, taxi & air times
- Weight issues
- Excess Maintenance taxi (vs. tow)
- Any type of variance & trends

- Not having detailed trend analysis will cause assumptions that add to arrival fuel & inability to identify underlying problems

**Fuel Conservation: Who? Where?**

- Usually, viewed as primarily an issue for Flight Operations
- But, every organization in the airline affects fuel conservation in some way …
  - Finance
  - Fuel Purchasing
  - Fuel Hedge
  - Purchasing
  - Airport Customer Service
  - Airport Station Ops
  - Ramp Operations
  - Flight Operations
  - Maintenance
  - Spare Parts
  - Marketing & Sales
  - Revenue Management
  - Scheduling
  - Catering
  - System Operations Control
  - Dispatch / Weight & Balance

**All organizations require the right data to identify & correct their contribution to fuel wastage**