

RESEARCH BRIEF

ANALYSIS OF DEMAND UNCERTAINTY EFFECTS IN GROUND DELAY PROGRAMS

The potential

This research has the potential to reduce flight arrival delays in the U.S.

The challenge

The Federal Aviation Administration and the U.S. aviation community have recently adopted new operational procedures and decision support tools for implementing and managing ground delay programs (GDPs), based on the Collaborative Decision Making (CDM) paradigm.

Each GDP produces a planned arrival sequence based on controlled times of arrival, which take into account the assigned ground delays. The actual arrival sequence, however, may differ substantially due to the uncertainty associated with flights.

Analyses of GDPs indicate that the primary sources of demand uncertainty are:

- Flight cancellations, which cause unexpected gaps in the arrival sequence;
- Pop-up (unexpected arriving) flights; and
- Drifts (flights that deviate from their assigned arrival times)

What is CDM?

CDM is a new way of doing business that brings together airlines, government, private industry and academia. With CDM, airlines share their latest schedule information with each other and the FAA to improve air traffic management decision making. This philosophy of collaboration promises to become the standard in aviation. CDM is considered a core technology in the FAA's transition to Free Flight. Ground Delay Program Enhancements is the first major thrust of CDM.

The research

This research determined the cost of the three forms of uncertainty, and the value of reducing

them. It also looked at whether changes could be made to GDP planning or execution to better mitigate demand uncertainties.

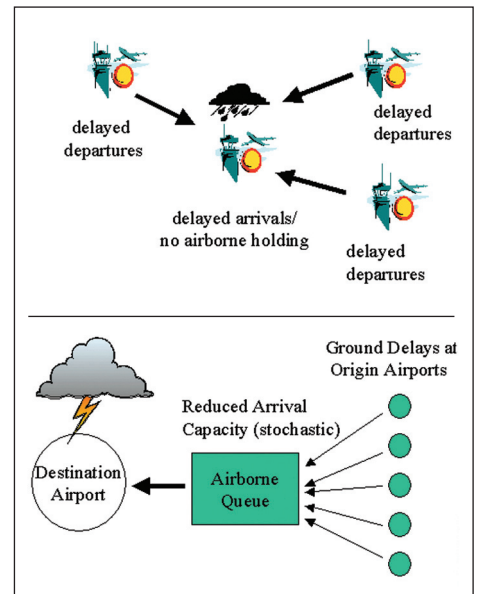
Conclusions:

- Airborne delays are necessary to ensure high utilization of airport capacity. The three forms of uncertainty increase the degree of airborne delay necessary to maintain the high level of airport utilization.
- Airborne delay can be reduced by decreasing the window of drift. The detrimental impact on delays of drift was larger than for other forms of uncertainty.
- While planned arrival rate patterns used today tend to be flat, an optimization model suggests that uncertainty effects can be better mitigated by "stair-stepping" arrivals.

Status

An optimization model and a simulation model have been developed that generate effective planning strategies for a stochastic demand and deterministic capacity scenario. These models incorporate uncertainty in demand by associating probabilities with the stochastic demand elements during GDPs.

Planned Airport Arrival Rates (PAARs) are the number of flights that are ordered to



A ground delay program (GDP) is a control action taken by the FAA to reduce arrival flow into an airport suffering from degraded arrival capacity or excess demand. ISR's research looks at the overall effects of demand uncertainty on GDP performance.

arrive in a time period at a GDP airport. The results from both models suggest that setting PAARs that exhibit “staircase” patterns can effectively mitigate the detrimental effects of demand uncertainties during GDPs. This significant finding opposes the current policy of setting “flat” PAAR patterns by air traffic specialists.

Research team

Thomas Vossen, Narender Bhogadi, Michael Ball (University of Maryland), Robert Hoffman (Metron Aviation)

Contact

Michael O. Ball

Professor
Robert H. Smith School of Business and ISR
4311 Van Munching Hall
University of Maryland
College Park, MD 20742

Phone: 301-405-2227

Fax: 301-314-9920

Email: mball@rhsmith.umd.edu

Web: www.isr.umd.edu/NEXTOR/index1.html