The Growing Congestion in the National Airspace System (NAS): How Do We Measure It? Are Current Plans Sufficient To Constrain Its Growth? If Not, What Else Can We Do?

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Air transportation, involving both passengers and cargo, is well recognized as having a disproportionate impact on the health of the nation’s economy. The anticipated future congestion at airports and (to a lesser degree) in the airspace threatens to constrain aviation growth below the levels forecasted. The likely result of such a constraint is a slowing in the economy’s growth. Various Government organizations (e.g., FAA, NASA, local airport authorities) are currently pursuing measures aimed at redressing congestion over the coming decade. While these measures will significantly help in lowering congestion growth, they will not be sufficient to handle the forecast demand in the next decade and beyond [GAO, 2001]. This paper shows in simple terms why this is likely to happen, and quantifies the implications for the nation’s economic growth if additional measures are not developed and implemented. It suggests that now is the time for re-thinking how best to handle the nation’s future high-speed, long-range transportation needs.


Methodologies for Analyzing the Principal Factors that Affect National Airspace System Performance

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Past studies of the National Airspace System (NAS) have typically focused on measuring and describing the characteristics of NAS performance, rather than on identifying the underlying causes. However, without a proper understanding of causal factors, even seemingly straightforward questions about NAS behavior can prove difficult to answer completely. Among the various NAS performance characteristics, our focus is on delays, an element of NAS performance that deservedly has received a great deal of attention. We discuss the differences between several key measures of delay, and three methodologies for applying these measurements to the investigation of causal factors: 1) Accounting tools, 2) Statistical models, and 3) Simulation models. While simple accounting tools and statistical models have great utility, far more insight can be gained from system-wide regression and simulation models. In particular, a simulation-based approach can give insight into the interactive effects of causal factors not likely to be identified through other techniques. We present preliminary results from each of these approaches, noting the strengths and limitations of each. An analytic toolset that includes all three of these modeling techniques offers the possibility of untangling the causes of the many complex, interconnected, and sometimes counterintuitive effects that result from changes to the NAS.

Concepts to Improve Air Traffic Management System Performance

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Demand on the air traffic management system continues to grow. The Federal Aviation Administration is faced with the challenge of increasing capacity to meet the rising demand. Several concepts are being researched that seek to improve system performance in the areas of capacity and efficiency. This paper presents these research endeavors and how they affect air traffic system operations. The four concepts under investigation are focused on various system domains—airports, terminal/transition airspace, and en route airspace. The concepts presented include the Departure Enhanced Planning and Runway/Taxiway-Assignment System (DEPARTS), relaxation of the altitude-for-direction (AFD) rule at higher altitudes, the Transition Airspace Controller Tools (TACT), and capacity enhancements for converging runway configurations. The research objectives for each of the above concepts is discussed including results from studies and experiments and the expected operational impacts these enhancements have on air traffic management system performance.


Pricing-Based Solutions to the Problem of Weather-Related Airport and Airway System Delay

Kevin Neels

This paper explores the applicability and feasibility of using pricing-based mechanisms for allocating capacity and managing demand in the airport and airway system during periods of weather-related disruption. It begins with a general analysis of the economics and dynamics of congestion-related delay that identifies to efficiency gains that are potentially realizable though better management of the congested traffic stream. It then explores the causes of delay within the airport and airway system. Three forms of congestion are identified: scheduling practices that concentrate more takeoffs and landings during key time periods than an airport can accommodate; stochastic fluctuations in the traffic stream that cause demand for some system component to temporarily exceed its capacity; and disruptions—primarily weather related—that temporarily reduce the capacity of system components. Although the published literature on the use of congestion pricing in the aviation context has focused almost exclusively on overscheduling, review of operational data suggests that weather related disruptions are a far more significant source of delay. The paper reviews the procedures currently used within US airspace to manage traffic during periods of disruption, and identifies inefficiencies attributable to the failure of those procedures to allow a full set of trades between airlines that may have different need for immediate use of the limited capacity that is available during such periods. The paper concludes with an exploration of some of the operational issues associated with the use of pricing on a real-time basis to allocate limited system capacity. This review draws on the experience of another industry—the electric power industry—that has developed workable procedures for using pricing signals to balance supply and demand within a complicated system on a real-time basis.

A Practical Perspective on Airport Demand Management

Terence P. Fan and Amedeo R. Odoni

This paper presents a practical perspective on the subject of airport demand management, primarily in the context of policies that might be viable for the United States. It first summarizes a survey of airport demand management systems currently in use around the world. These systems rely on either a purely administrative procedure or, in a few cases, on hybrids of administrative and economic measures. It then describes briefly the US environment and uses a review of events at New York’s LaGuardia Airport (LGA) during 2000 and 2001 as a starting point for discussing the potential effectiveness of demand management measures in reducing delay costs and the magnitude of the externalities associated with airport congestion. Some of the “market-based” demand management systems that were suggested in 2001 for adoption at LGA are also reviewed briefly. Based on these considerations, it is concluded that any demand management systems that may be adopted in the United States in the next several years will be hybrids of economic and administrative rules. They will use economic mechanisms as their primary instrument for allocating capacity, but will be supplemented by provisions aimed at maintaining connections to small communities, ensuring access by general aviation, new entrants, and smaller carriers, and encouraging continuity of service. Moreover, these systems will have rather complex rules, require significant resources for their implementation, and be supported by extensive technical analyses. Only a few, but important, airports appear to be good candidates. As long as the principal objective is congestion relief, these are airports that generally serve a large number of competing carriers with no dominant carrier present.