Appendix C

The Use of an Airspace Flow Program in the National Airspace System

AFP Concept and Definition

Airspace Flow Programs (AFPs) were introduced to the National Airspace System (NAS) in summer 2006 and marked a significant new step in enroute traffic flow management. The principal goal for the initial deployment was to provide enhanced enroute flow management during severe weather events such as lines of convection or areas of turbulence. By definition, an AFP is a traffic management process that identifies constraints in the *enroute* system, develops a *real-time list* of flights that are filed into a *constrained area*, and distributes Expect Departure Clearance Times (EDCTs) to meter the demand through that area. Delay is distributed equitably to all stakeholders wishing to fly through the constrained airspace in order to allow the air traffic controllers the safe, yet efficient, delivery of aircraft throughput. The idea of the AFP is also to allow airspace users the ability to decide if they would like to take a delay and actually fly through the constrained airspace or fly a few more miles and route around it. Today, AFPs are used to manage constraints caused not only by weather but by such things as volume (demand), equipment outages, and special events.

History/Background

By the year 2000, air traffic volume in the United States was increasing steadily. Air traffic congestion was causing concerns to appear in enroute airspace in addition to the airspace around airports. Disruptions such as thunderstorms were creating increasingly difficult air traffic management problems. Air traffic volume was up and it was a significantly bad convective weather season that year. The Flight Schedule Monitor (FSM) had been in use for a few years to aid the implementation of Ground Delay Programs (GDPs) to airports in the NAS which were showing large overages in demand. It became increasingly obvious that a traffic management initiative smarter than miles in trail (MIT) would be needed to improve safety and efficiency through Air Route Traffic Control Center (ARTCC) airspace. The challenge was how to integrate tools already in use to view airspace

demand with the tool used to distribute equitable delay as in GDP scenarios? (fig. 1-1 and 1-2.)

Fig.1.1 – As a part of the Traffic Flow Management System (TFMS), the Traffic Situation Display (TSD) allows the traffic management specialist to graphically display the current position of all instrument flight rule (IFR) flights that are in the air. The software has the functionality which allows the Traffic Manager to graphically display future demand as well.

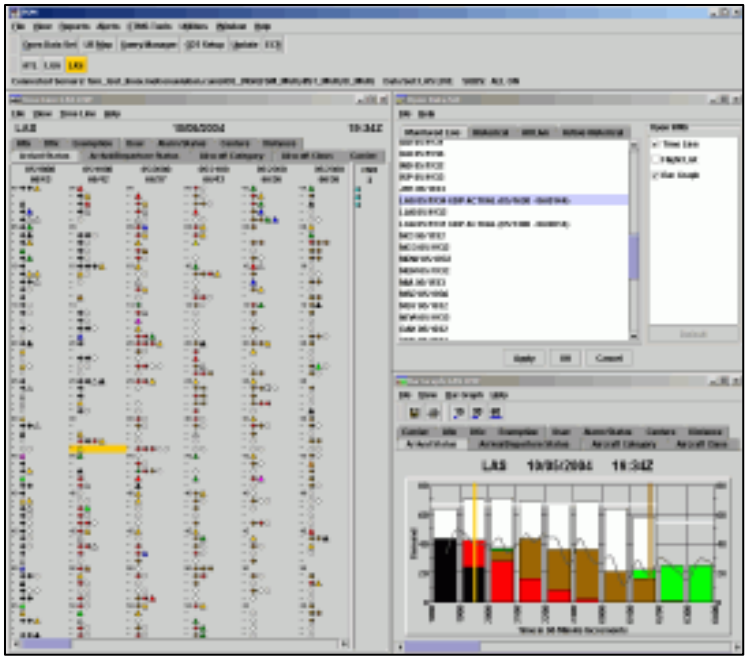

*Fig.1.2 – Flight Schedule Monitor (FSM) is the main tool for the traffic management specialist at the FAA David J. Hurley Air Traffic Control System Command Center (ATCSCC) to **monitor**, **model**, and **implement** Ground Delay Program (GDP) operations, and since 2006 Airspace Flow Programs as well.*

The Foundation of the AFP was the Integration of the Flow Evaluation Area/Flow Control Area (FEA/FCA) function of the Traffic Situation Display (TSD) *with* FSM.

A TSD is used in the NAS by traffic management specialists and by stakeholders to see a common picture of what is happening in any given area, real- time and in the future by looking at weather forecast models and scheduled flights. Flight data, shared and received through Collaborative Decision Making (CDM) data sharing agreements, can be searched and filtered using the FEA/FCA functionality within the Traffic Flow Management System (TFMS) software. Every day, traffic management specialists use this data to display query results on their TSD. It is basically a method to see into the future so that plans can be well laid out and discussions held. FEAs are created by virtually any user who wants to look at certain aspects of the NAS; i.e. an airway or airport or sector, at any given time to paint the picture of upcoming demand. FCAs are the same as FEAs but they are produced only at the ATCSCC (Air Traffic Control System Command Center) and are used to apply Traffic Management Initiatives (TMIs) such as required reroutes, miles in trail, or an AFP, to the examined area. The FEA/FCA tool is flexible and allows nearly any set of flight filters to be defined. An FEA/FCA

always has a physical basis, e.g., a line segment between two points, an area of airspace, a center, or a sector. (fig. 1-3)

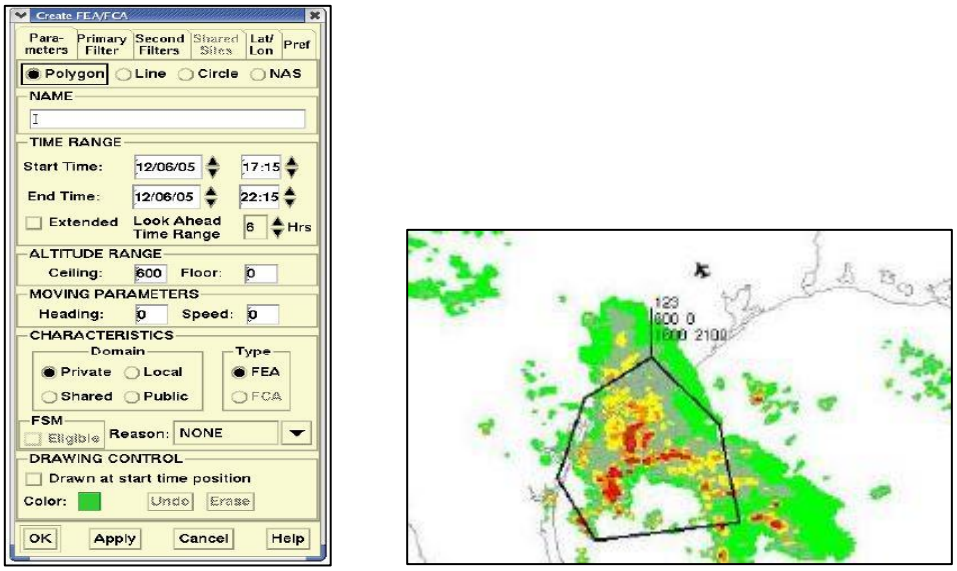

Fig.1.3 – On the left is the TFMS menu used to create an FEA/FCA with a drawn polygon shape on the TSD (right). There are numerous ways flight data can be searched and filtered to provide a list of aircraft to be included in an AFP. A polygon would be useful to capture flights routed through an area of current or forecasted convective weather.

As previously mentioned, it was in 2006 that the application of FCAs was expanded to manage enroute airspace through AFPs. The defining component of an AFP is the FCA itself. The definition (through filters) of the FCA establishes the flights that make up the Aggregate Demand List (ADL) used by FSM to run the delay program. The acceptance rate for an AFP applies to the rate at which flights should intersect the boundary of the FCA. AFPs and GDPs are similar in that they manage demand at a defined capacity rate through the issuance of estimated controlled departure times (EDCTs), keeping aircraft on the ground to spread out peaks in demand equally. The difference is the control element, GDPs are controlled to a threshold arrival rate at an airport, AFPs control to a geographical area or NAS element defined by the FCA. An AFP might be used, for example, to reduce the flow rate of flights through a center when that center has reduced enroute capacity due to severe weather, replacing mile-in-trail (MIT) restrictions or a required reroute.

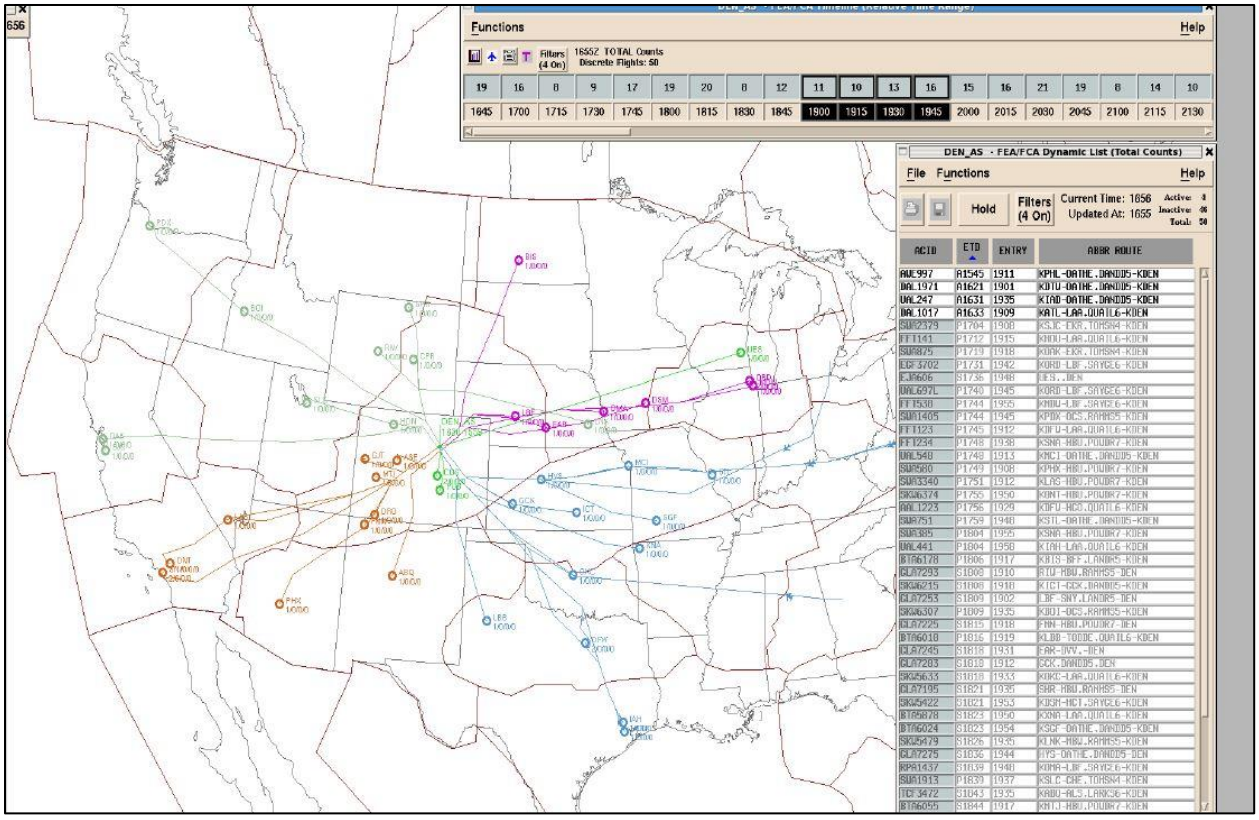

Fig.1.3 -- This is a screenshot of an examination of the demand picture in the 1900z hour for the Denver airport. If a constraint were expected to limit the airspace east of the field, an AFP for arrivals from the east might be a solution to slow down the rate of aircraft entering affected sectors.

In Today's NAS, How Do AFPs Work?

As traffic managers monitor traffic volume in the enroute portion of the National Airspace System (NAS), they are constantly looking for areas where the amount of traffic exceeds what that piece of airspace can handle at that time. To assist them in doing this, they utilize a tool called a Flow Evaluation Area (FEA), which is a function of the FAA's Traffic Flow Management System (TFMS). Basically, an FEA is a line in space that is drawn across a specific area. Traffic managers can then monitor the amount of traffic crossing that line. The FAA's Flight Status Monitor (FSM) application is used to help analyze the traffic volume and, if needed, model a program to help manage it. An "acceptance rate" is set for each FEA - the amount of traffic that ATC determines can be accepted through that airspace in any given hour, half hour, or quarter hour. Once the amount of traffic reaches a point where it is considered to be a potential issue, the FEA becomes a Flow

Constrained Area (FCA) at the ATCSCC. At this point, traffic managers begin looking at possible ways of metering the traffic across the FCA, to ensure that it does not exceed what ATC can actually handle. This may mean that ATC issues miles-in-trail restrictions, or reroutes designed to move traffic out of the constrained area. If volume reaches a point where these initiatives are not sufficient, the specialist may decide to issue an AFP. Once this happens, specialists in the Command Center utilize the FSM application to model the AFP, much like they would a ground delay program. The AFP is designed to bring the amount of volume in each hour below the acceptance rate by delaying traffic, which is accomplished by issuing EDCTs. Once an AFP is issued, the Command Center will send an Advisory that is accessible to stakeholders in the Advisories Database. The AFP will also appear on the Operational Information System (OIS) page to alert the users to its existence.

When Would an AFP Be Used?

It is important to understand the hierarchy of traffic management initiatives (TMIs). A ground stop is at the top of the hierarchy, since it is the most restrictive type of initiative and overrides any EDCT for a GDP or an AFP. A GDP is the second most restrictive program, so any EDCT for a GDP would, again, override an AFP. Note that, if a ground stop is lifted and the AFP is still in place, the flight will get a new EDCT for the AFP.

What if the predicted constraint doesn't materialize?

It is also important to note that the predicted demand through an AFP, and the weather impacting the area, may change substantially over time. When the conditions warrant, traffic managers will take steps to coordinate and implement revisions to the AFP, in an effort to reduce delays. In a revision, AFP entry slots are recomputed so that demand is again metered to meet capacity and new EDCTs are distributed. AFPs are also subject to adaptive compression, which can cause an EDCT to change numerous times during a program. These programs are continually monitored by stakeholders and the traffic management specialists at the ATCSCC.

What makes AFPs unique?

AFPs give the stakeholders of the NAS flexibility. To avoid the delays associated with an AFP, the options are fairly straightforward - adjust the flight times to before or after the AFPs is in effect, or route around the AFP (if possible).

How is the airspace rate set?

Just as in GDPs, AFP rates are decided through discussions with field traffic management specialists at ARTCCs, the ATCSCC, and with stakeholders. Every sector of airspace in the NAS has set rates for various weather scenarios, but when there is a significant constraint in which the field facility knows the rate will be somewhat less, discussions are held to come up with an agreed upon rate and duration of that rate.

In Summary

The ATCSCC is the only facility in the NAS that has the authority to use the FCA to publish an AFP. Similar to a GDP, an AFP is a national program. Using an FCA, the Command Center can set a rate of aircraft allowed to cross a line in space in a given hour. The TSD displays the "demand search" graphically and visually, and when paired with the displayed weather forecast, aids the user in decision making. If a stakeholder or a field traffic management specialist has evaluated some airspace by using an FEA and has a concern about predicted demand, their created FEA can be shared with others including the ATCSCC. Once alerted to the concern, the Command Center can begin the collaborative approach process and within minutes, if necessary, the concern can be discussed, the FEA can be converted to an FCA and the FCA can be used to propose an AFP with the FSM. The process mirrors the process used to propose a GDP with all concerned parties viewing the same data and deciding a program to slow the rate of aircraft through a region of airspace, by holding aircraft on the ground, is the best solution for the day.