Appendix B

The Use of a Ground Delay Program in the U.S. National Airspace System

General

The Traffic Management System mission is to balance air traffic demand with system capacity to ensure the maximum efficient utilization of the National Airspace System (NAS). A safe, orderly, and expeditious flow of traffic while minimizing delays is fostered through continued analysis, coordination, and dynamic utilization of traffic management (TM) initiatives and programs. One such program is the Ground Delay Program (GDP); a traffic management process administered by the Air Traffic Control System Command Center (ATCSCC). A GDP is used when other initiatives are decided by consensus, through collaborative discussions, to not be enough to support the TM mission and limit airborne holding.

History/Background

In the United States, demand began to exceed the capacity of airports and airspace initially in the northeastern US in the 1970s. That decade saw the first central flow control office begin to control departure times and routes to make the system more efficient. Up until the creation of a central flow office, each air traffic control facility, (towers, TRACONS, and centers) were initiating their own restrictions that were often conflicting with each other and actually causing the flow to slow down too much. In the decades that followed, collaborative discussions to increase efficiency yet allow the air traffic to flow safely, led to what we have today, known as the CDM process. CDM (Collaborative Decision Making) is an innovative concept designed to enhance NAS safety and efficiency by transitioning from a centralized command and control system to a distributed planning system. It is a joint government/industry initiative aimed at improving air traffic management through increased information exchange, common situational awareness, equitable resource allocation, and performance analysis.

The Definition of a GDP

A GDP, which in its first form, began in the 1970s, is an initiative whereby aircraft are held on the ground in order to manage capacity and demand at a specific location, by assigning arrival slots. Today, it is a flexible program and may be implemented in various forms depending upon the needs of the air traffic system. A GDP's flexibility is possible because of the software platform, the Flight Schedule Monitor (FSM). This software is utilized throughout the entirety of the ground delay program; from the analyzing stage through the termination and

documentation phase. Everyone involved in the collaboration throughout the day in which GDPs are in use can model input with the FSM and look at it during discussions.

What is the Flight Schedule Monitor?

The FAA uses software called Flight Schedule Monitor (FSM) that compiles scheduled flight information and flight plans from the Air Route Traffic Control Centers (ARTCC) to calculate and then display graphically the known demand for arrival and/or departures at airports. When an overage of demand (arrivals) versus capacity is noted for an airport, a GDP is modeled through the FSM software. FSM assigns arrival "slots" to aircraft based on the available capacity and flight arrival times, and adds delays in sequential order until demand equals capacity. As a result of this process (fig. 1.1), expect departure clearance times (EDCTs) are issued to individual flights to ensure they arrive at the constrained destination airport when they are supposed to. EDCTs are printed on each aircraft's flight progress strip. Air Traffic Control Specialists (ATCS) ensure that flights with an EDCT depart within five minutes (+ or -) of their EDCT.

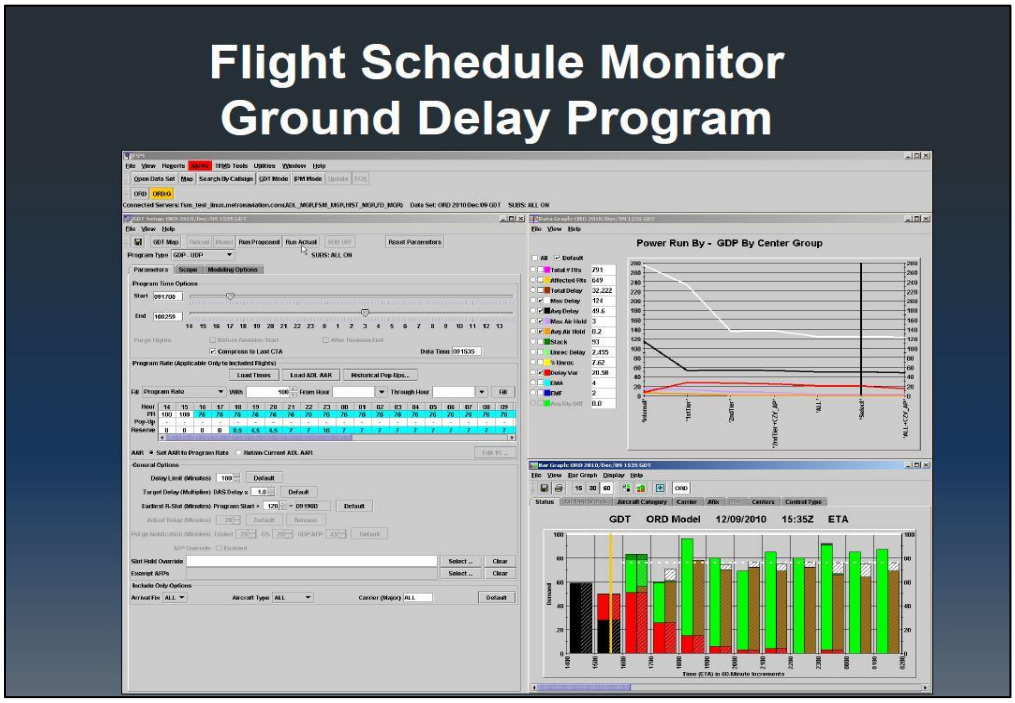

Fig.1.1 -- Flight Schedule Monitor (FSM) was used in CDM's first major thrust, Ground Delay Program Enhancements, and the FAA has continued to use it since it went in to prototype operations in January 1998.

EDCTs Further Explained

The EDCT is calculated based on the estimated time enroute and the arrival slot. It is basically the runway release time assigned to an aircraft in a ground delay program and shown on the flight progress strip. For the GDP to succeed, it is important for aircraft to depart as close as possible to the EDCT to ensure accurate delivery of aircraft to the impacted location. The entire system of air traffic controllers is involved in ensuring each aircraft assigned an EDCT departs within an acceptable window (11 minutes) of the assigned time. The software programming, however, does allow airlines to make substitutions among their flights. Direct conversations with specialists at the ATCSCC allows other considerations to be dealt with. Again, it is a flexible program; EDCTs generated by GDPs provide for equitable assignment of delays to all system users.

How Do GDPs Work?

With so many conditions that impact the ATC system, Traffic Management Coordinators (TMCs) must use programs that not only balance capacity and demand, but also distribute delays equally to all customers. A GDP definitely does this. As explained later, there are metrics displayed in FSM that show exactly how equitable the program is behaving. Transparency and flexibility utilized are key to a successful program. As mentioned above, the FAA uses software, called Flight Schedule Monitor (FSM) that compiles scheduled flight information and flight plans to determine when an overage of demand versus capacity exists for a specific airport.

How is a GDP implemented?

The first step is for an Airport Acceptance Rate (AAR) to be set. The AAR is the number of aircraft an airport can accept in a one-hour period. The Aviation System Airport Performance Metrics, which takes into consideration the runways in use, weather conditions, and NAVAID limitations, sets a baseline rate for all of the nation's busiest airports. By rule, the tower/terminal TMC considers these metrics, all other aspects, to set and adjust the actual AAR. TMCs employed at towers and terminals are chosen for their jobs based on the amount of experience they have as an ATCS (controller) at their specific facility. Their experience is what greatly enhances their ability to choose an accurate rate based on the known factors constraining the airport.

The TMC uses the FSM software to model a GDP and aircraft are assigned arrival "slots" based on the available capacity and flight arrival times. Aircraft are issued delays in sequential order until demand equals capacity for each hour of the program. Screenshots from the FSM software best illustrate this. In the image below (fig. 1-2), flights indicated in black have already arrived, those in red are airborne, those in light green are scheduled, and those in dark green are past their scheduled departure time. As can be seen in this screenshot, spikes in

demand at EWR (Newark, New Jersey) occur beginning in the 1600z hour. In the 1800z hour, EWR is expecting 47 arrivals while the Airport Acceptance Rate (the horizontal white line) is only 32. Flattening these spikes is necessary.

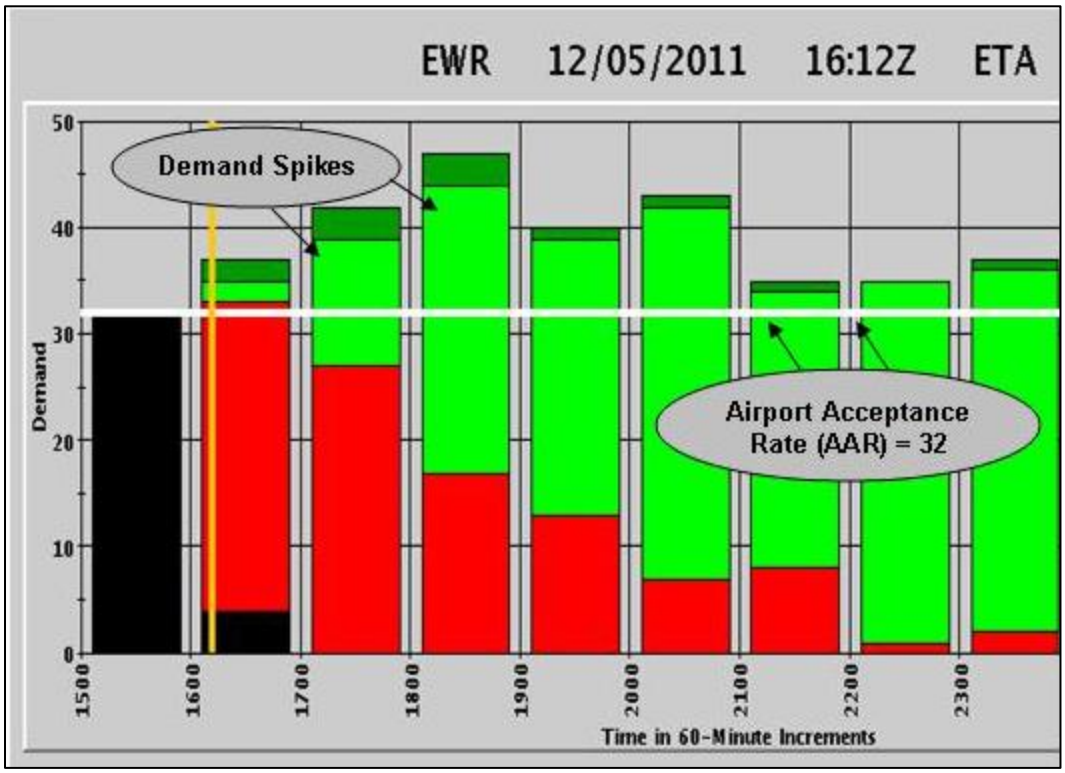

Fig.1.2 -- Bar graph screenshot from the FSM – pre GDP

In the next image (fig. 1.3), a EWR specialist has implemented a Unified Delay Program (UDP) mode GDP beginning in the 1700z hour. The AAR has been set at 34, increasing to 38 in the 2000z hour. Now that the program has been run, the demand spikes have been leveled out by spreading the demand over the program hours into the future. Those flights in the GDP (indicated in brown) have all been issued EDCTs. You may ask why the rate (white horizontal line), during the 8+ hour GDP, changes from 34 to 38 aircraft at 2000z. This dynamic input was most likely decided upon collaboratively with all stakeholders and TMCs at EWR tower, NY TRACON, NY Center and the ATCSCC coming to a consensus that the airport would be able to land a few more aircraft per hour after that time. The software

also allows for a few open slots in this screenshot, placed there by the UDP programming in the FSM to allow equally delayed space for aircraft who file their flight plans after the start of the GDP.

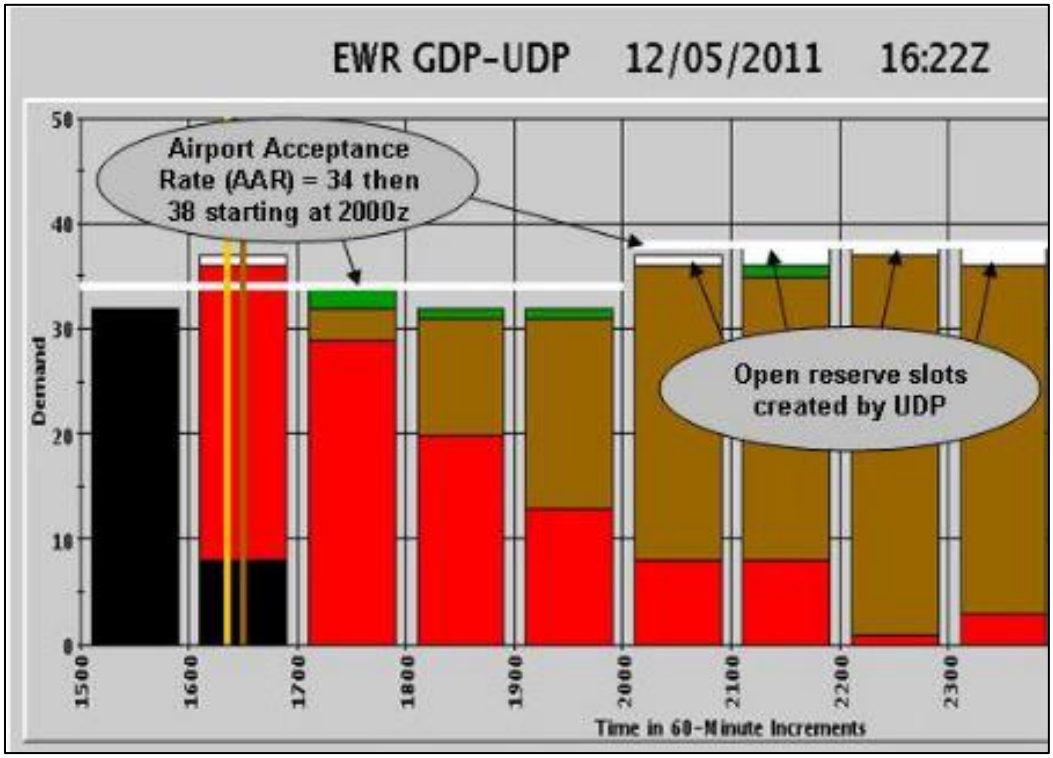

Fig. 1.3 -- Bar graph screenshot from the FSM – post GDP initial workup. Notice the few available "white" slots for late filing aircraft. They get delay times (EDCTs) also which are based on the historical amount of late flight plan filers set in the program.

How Do We Know It's Equitable?

Instantaneously. The FSM runs numbers for display so each stakeholder and TMC can see certain metrics as the GDP is being built. Notice the information shown in the screenshot below (fig. 1.4), in numerical display on the left, and as an axis graph on the right. Total affected flights, total minutes of delay, average minutes of delay, and the Equity Metric for Airlines (EMA) are just a few metrics shown. The EMA is a metric that indicates (as a whole) how equitable, or fair, the proposed initiative is for the airlines. The lower the EMA value, the better.

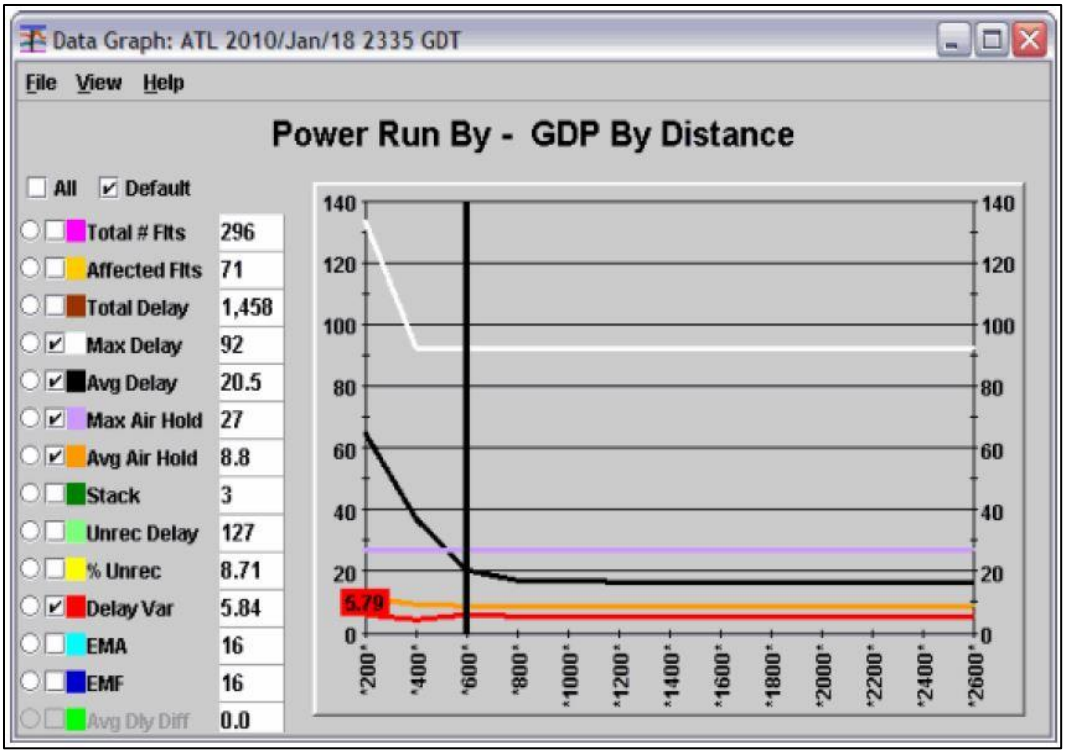

Fig.1.4 -- GDP Delay Statistics change as a GDP is worked up to allow the collaborators to pick the most favorable length and scope of the program in relation to desired outcomes.

Continually Monitored GDP – The Purpose and Scope of FSM

In Monitored Live mode, the ATCSCC can monitor airport/airspace capacity and demand information for flights in various FSM components. FSM updates demand data approximately every five minutes. FSM provides information that supports detailed flight data and various types of demand count lists. A GDP is continually monitored, discussions are held with field facilities, users, and weather specialists throughout the duration. When conditions improve, or when demand decreases, the ATCSCC begins running compressions. This causes EDCT times to change and decreases delays. The ATCSCC can send out immediate advisories to the stakeholders to check for updated EDCT times (fig. 1.5).

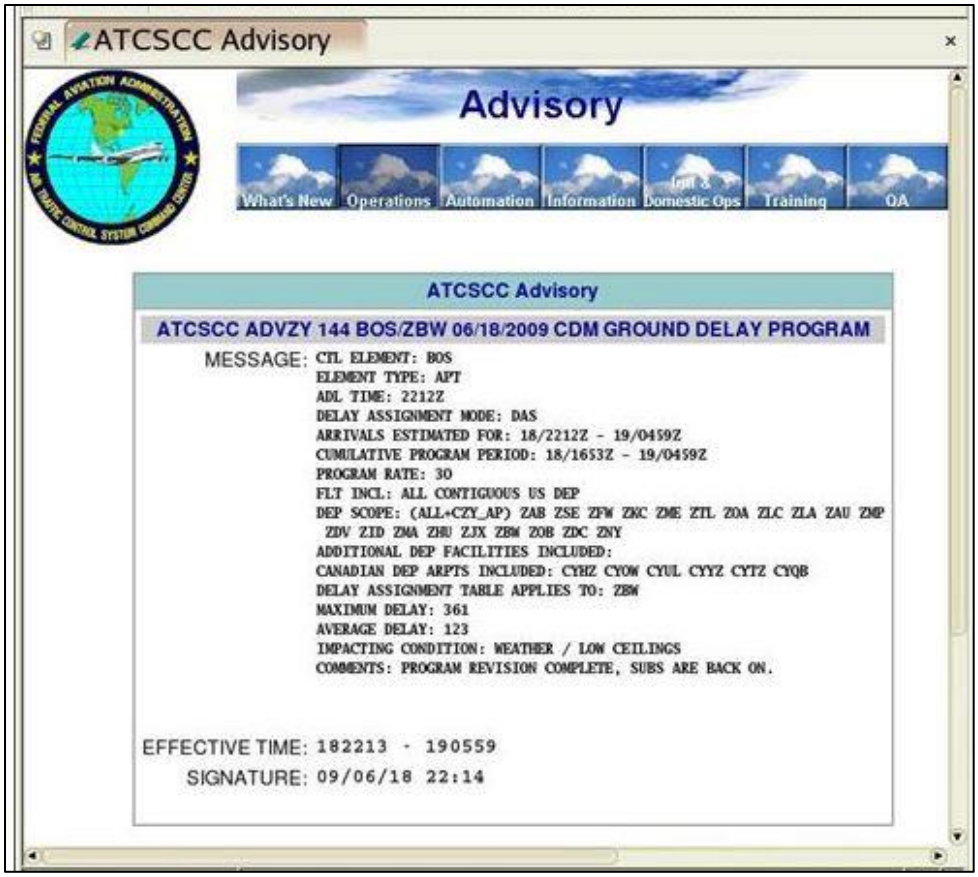

Fig.1.5 – Program Revision Complete Advisory: New EDCTs are automatically sent out if weather dramatically improves and through discussions it is deemed to be useful to compress the program.

Advisories such as the one above are also transmitted when a GDP is proposed and in its planning stages, and when it is terminated. A GDP usually ends when planned; however, it may be terminated early depending on the circumstances.

In Summary

GDPs have been used in the US since the mid 1970's. Technology in place today allows for them to be utilized almost daily now for whatever the NAS constraint may be. When deciding to use a GDP, TMCs and stakeholders utilize the many functions of FSM to analyze the situation at an airport, develop the plan, implement it by making it "go live" at the push of a button, monitor how it's going, and finally document outcomes and telcons via the use of writing space on the FSM cover sheets. The whole package for the day's GDPs can be stored and used later in quality assurance discussions.