Federal Aviation Administration

Traffic Management Initiative Interaction

Background

Traffic Management Initiatives (TMIs) have evolved over several decades from being primarily tactical to becoming more proactive and strategic. The Collaborative Decision Making process of data exchange facilitates a shared approach between the FAA and Flight Operators in managing constraints within the National Airspace System (NAS). However, the automation developed to support this shared data is not a completely integrated process. The primary focus of development was to address immediate concerns resulting in significant savings and improved efficiencies to Flight Operators. By the practice of layering multiple TMIs, this fragmented tool development creates undesirable TMI interactions. Particular automation decisions were intentional as the complexity to program the automation was not practical. With this realized, the strategy was to manage the interaction issues through procedures and training.

This document is designed to describe and detail the more common TMI interactions. It is a supplement to the "Traffic Management Initiative Interaction Reference" that was published in Sept 2012.

There are many types of Traffic Management Initiatives. This document is focused on the automation and procedural application to manage the known interaction impacts. Three primary TMIs will be addressed: Delay programs (AFP, GDP, GS, TMA), Required Reroutes (RR), and Miles-in-Trail (MIT).

Delay Programs – Ground Delay Program, Airspace Flow Program, Ground Stops, Traffic Management Advisor.

The order of implementation of a TMI determines the type of interaction impact that may be encountered. There are several variations between GDP, AFP, GS, TMA, Reroutes application, and MIT which are described in the following examples.

Airspace Flow Program implemented, Ground Delay Program issued following
The automation prioritization makes the GDP a higher priority for control of the common flights between AFP and GDP. This will cause the control element to change from the AFP to the GDP, i.e. flight controlled by FCAA05 will be moved from the AFP to the GDP, the airport program EWR. There are two methods to how the flights currently controlled by the AFP will be managed in the initial issuance of the GDP.

Not exempt the AFP flights in an initial GDP.
This options is the default setting in the FSM setup panel when the issuing a GDP that has flight(s) controlled by an AFP. This approach will take the flights from the AFP and assign CTD/CTA (new EDCT) to the flight based on the available slots. This process is accomplished by FSM in how the flights are distributed in the Q order. The flights from the AFP will be allocated slots in the GDP prior to the flights not included in the AFP (i.e. Previously controlled). This order is; Q1 – Exemptions, Q2 – AFP flights, Q3 – Newly controlled flights.

The impact will be to the AFP. The flights previously controlled by the AFP are assigned slots to the airport GDP which changes the entry time into the AFP, this could be earlier or later than previous FCA entry time based on the GDP rate/delays. The delays distribution tends to be more equitable between the GDP flights. The flights that were not previously controlled by a

delay program will tend to have a higher delay assignment due to the ordering of flights in the FSM slot assignment logic.

The AFP may need to be revised after the GDP(s) have been issued due to the change in FCA entry times. The observed impact being, increased delays to the remaining AFP controlled flights due to the number of slots taken through the AFP by the GDP controlled flights.

Exempting the AFP flights in an initial GDP
This option will put the priority on the AFP allocation. Flights in the AFP will preserve there entry time to the FCA and will maintain their EDCT. This is done by placing the AFP controlled flights in Q1 – Exemptions during the slot allocation. This could cause an over delivery to the GDP. The flights not part of a AFP will be assigned the remaining slots. This could be less delay or greater delay than the AFP flights, depending on the GDP rate. The delay distributions may be skewed, i.e. avg delay for AFP exempted flights 30 minute, avg delay for newly controlled flights 90 minutes.

This option favors the AFP by maintaining the current entry time into the FCA.

Once the GDP is in place, there are no AFP exemption options for a flight if a GDP revision is issued. Any changes to the GDP will change the FCA entry time due to the GDP slot allocation. Any AFP revisions will not have an impact to the GDP CTAs.

Ground Delay Program followed by Airspace Flow Program
GDP controlled flights will always remain part of the program, an AFP that is issued after a GDP will not have influence on the current or future GDP assignment. Issuance of a AFP after the GDP exempts the GDP flights, FSM will work around the slots taken by the GDP flights in distributing the AFP ASLOTS.

The following are items to consider when applying this process:

- Delays could be lower/higher on the AFP depending on program rate(s) for the AFP and GDP(s).
- It is possible, depending on GDP rate and AFP rate, that the AFP program rate could be exceeded by the GDP controlled flights.
- GDP may need to be implemented earlier than normal, i.e. 4 to 6 hours prior to first controlled hour. This may cause challenges on GDP rate with forecast conditions.
- Airports with GDP, Flight Operators have an easier time maintaining connectivity between arrival/departure banks
    - Flight Operators can Sub based on airport program, not AFP(s).

The use of Integrated Program Modeling (IPM) should be considered when evaluating AFP or GDP to manage the constraint. IPM allows an evaluation between three different scenarios. If modeling the use of GDP and AFP in the same scenario, the GDP will be modeled prior to the AFP in the scenario.

If the GDP is a small percentage of the AFP flights, or the AFP controlled flights are a small percentage of the airport demand, then the interaction impact will be minimal. When the demand at the airport is significantly controlled by the AFP and there is concern for the airport to have constraint limitations, then the better practices would be implementing the GDP prior to the AFP. The program start time does not need to be the same between AFP and GDP(s).

Traffic Management Advisor (TMA) and Delay Programs (GDP, AFP)
TMA is a separate system from GDP/AFP. It does not communicate to TFMS. Delay times issued by TMA for scheduled departures or airborne delay are only known to TMA and HOST/ERAM. TFMS does not receive updates on flight's ETE from TMA. TFMS does supply the EDCT from a Delay program to HOST/ERAM which updates the estimated departure time used by TMA for scheduling flights.

When a flight calls to taxi to an airport that is Adjacent Center Metering, the tower personnel request a departure time from the Center, the Center TMC schedules the flight in TMA which generates the TMA assigned departure time. This is accomplished without regard to the GDP/AFP assigned EDCT that has been provided. This is referred to as a double penalty delay, one from GDP/AFP, second from TMA.

TMA is a good tactical TMI to get the best efficiency at the runway threshold based on many factors, including spacing requirement between aircraft class (i.e. Heavy, Large, and Small). The GDP/AFP is a good strategic TMI providing a longer range planning capability. The limitation of each TMI needs to be considered when developing the strategy to manage the constraint involved. The concept being, setup a good plan/flow with GDP/AFP to feed the TMA.

The interaction is one way, GDP/AFP into TMA, and it is important that the two TMIs are coordinated to achieve the same objective.

Required Reroutes and Delay programs (GDP/AFP)
The application of Required Reroutes (RR) TMI is used frequently with delay programs move flows around enroute constraints. To impact of the reroute is dependent on how it is implemented and what type of delay program it is interacting with. Required reroutes are issued by Departure (ETD), Arrival (ETA) or FCA entry time.

Airspace Flow Program:
When a RR is issued by **ETD or ETA**, all flights trajectories within the start and end time of the RR are adjusted to model the flight on the RR. Only flights with filed flight plans are left on their original route. Flight planned flights require manual action to re-clear the flight onto the RR. The impact on an AFP can be significant to the demand and Flight Operator subbing capabilities.

Example 1 – A flight that is modeled/filed to avoid the FCA would not have an EDCT (or ASLOT) for the AFP. If the RR is issued that put the flight into the FCA, the flight will now receive an EDCT and a Pop-up (DAS or UPD) delay assignment. This DAS assigned flights will be limited on how the flight can be subbed/swapped by the Flight Operator, this flight can only have delay reduced. The additional demand of Flight(s) being moved into the AFP could cause a revision.
Example 2 – A flight that is modeled/filed through the FCA would have and EDCT assigned and may be used by the FO in substitutions. If the RR is issued that pulls this flight out of the FCA, they may receive a longer reroute and the FO will lose the ASLOT the flight was assigned. This flight is flagged as a Drop Out (DO) in the FCA. This will remove demand from the AFP, which could create a need to revise the AFP.

When a RR is issued by **FCA**, all flights with trajectories that intersect with the FCA are adjusted to model the flight on the RR. Only flights with filed flight plans are left on their original route. Flight planned flights require manual action to re-clear the flight onto the RR. This method will have less

of an impact on an AFP as only the flight passing through the FCA would be assigned the RR. The benefit to the FO has a choice on filing to avoid the FCA for the AFP and the RR. They are not forced through the AFP and they can take action to manage the ASLOTs issued by the AFP before routing to avoid the AFP.

Ground Delay Program followed by a Required Reroute

The impact of a RR may not seem significant in a GDP, depending on the added flying time, it can require a revisions to the GDP. The GDP issued ASLOTS/EDCT based on the ETE of the flight at the time of issuance, when a RR is issued that increases the ETE, the flights will not receive a new EDCT assignment from the RR issuance. The flights would then depart on their EDCT and arrive late. This will create and under delivery in some time periods and over delivery in others. Additionally this could create higher demand on the arrival gate; further delaying the flights due to additional TMI's to meet the airspace capacity at an arrival fix.

After issuance of a RR, the demand shift will become apparent; the only solution is a program revision to reflect the new ETEs of the RR flights.

Mile-In-Trail (MIT) during a Ground Delay Program

A GDP is designed to deliver a programed number of flights to a runway threshold. The GDP does not meter multiple points of delivery and will not know if all the flights are over a single arrival fix. This automation design causes the need for facilities to apply MIT to the stream of flights through the airspace to maintain an efficient stream to the arrival fix. There are impacts to the GDP caused by the application of MIT:

- Airborne delays cause flights to miss their assigned arrival slot time. This will cause and under delivery in some time periods pushing the demand back into flights that may not have airborne delay from MIT. This will create an over delivery period in the GDP that may require a Ground Stop or airborne holding to manage.
- Flights in the 1st tier center or overlying center may receive added ground delay through a call for release to meet overhead stream volume and MIT spacing requirements. The additional delay will push the flights later in the program and cause an under delivery in one time period and an over delivery in a following time period. This may also cause a flight to taxi back if the extra call for release delay is lengthy.

Ground Stop into Ground Delay Program

There are two options in the Ground Delay Program Setup panel for transitioning from a Ground Stop (GS) into a Ground Delay Program (GDP). Depending on the scope of the GS and timing of the GDP issuance with the end time of the GS, the impacts on the GS flights and the GDP can be different. This assumes the GS has been put into the automation through FSM and is reflected in the FSM.

- **By Time +(XX minutes):** Airborne and international flights are exempt by default. The number of minutes becomes important. This application may be used when the number of GS flights is low, i.e. single center GS. ***Note: this is XX minutes from the ADL time being used to develop the GDP not the current clock time on the TSD***
    - If using the default 45 minutes, and you are less than 45 minutes from the end time of the GS, then this will make all the GS flight be exempt by departure time. This could cause the GDP to over deliver in the first couple hours.
    - If the GS flights are more than 45 minutes (or the time value put into the dialog box) the flights will not be exempt and will be ordered in Q2 ahead of the flights that were

not part of the GS. (*This assumes a new program and not a revision to the GDP.*) The GS will receive additional delay based on the Program rate of the GDP.

- **By Status:** Only flights that are active or international are exempt in the GDP. *(Recommended method for transitioning from a Ground Stop into a GDP when there is a significant number of flights in the GS, ie. 1st tier GS, as it provides proper ordering of the Ground Stopped flights in the slot allocation)*
    - All Flights will be eligible receive additional delay assignment, the GS flights will be ordered in Q2 with the non GS flights in a GDP revision. If this is a GS into a new GDP, then the GS will be ordered in Q2 and all other flights in Q3.
    - If the flights are at the gate, they may not be able to meet a new EDCT, this method assumes the GS flights are ready to depart and are being held close to the runway.

Diversion recovery in a GDP

Recovery of diverted flights into an existing GDP requires action by the flight operator and the specialist managing the GDP. A recovery flight retains the assigned ASLOT (CTA) until the GDP is revised. This will ensure proper priority is provided to the recovery flight in ASLOT assignment in Q2.

1. The first step is the change in destination from the original flight plan destination, this sets the divert flag in TFMS.
2. To complete the process, the flight operator needs to file a new flight plan from the airport diverted too back to the original destination with the same callsign. This will automatically set the flight as a priority flight in the FSM; match the flight to its CTA and IGTA at the time of diversion.
3. The last part is for the TMS managing the GDP to run a revision; this will allocate slots for the diversion flights giving them the highest priority in Q2.

- If flight operators do not update the ERTD or ERTA, the flight could be assigned and EDCT they cannot achieve. Flight Operators should consider turnaround time and appropriately set the ERTD to assure they receive achievable EDCT/ASLOT times.
- Until the revision is accomplished, the diversion airport does not have an EDCT to apply. Towers may have questions as to release times for the diverted flights.

Conclusion

The choice of TMI(s) type and the order of issuance is part of managing the NAS. Each TMI has various implications depending on the order of implementation, available capacity, accuracy of the flight data, and forecasted impact to the NAS. Identification of the most constrained (or forecasted most constrained) NAS element is important to selecting and understanding how the TMIs will interact together. While there is a lot of information to consider that influence a decision on TMI selection, the facts should be used to drive the decision, and not how it ran yesterday.

Supplemental Information
Some other considerations are methods of TMI application. A couple of the GDP/GS applications are highlighted.

Early Ground Delay program on forecast

- Predictability for customers to plan flight operations
- Missed capacity with bad forecast, difficult to generate tactical demand for available capacity
- TFMS sector demand predications reflect effects of EDCT

Low rate/Zero Rate Ground Delay Program

- Flights may encounter air borne holding or diversion
- Reactive revision of the program will increase program delays significantly
- Zero Rate may be to impactful pushing demand too far into the future
- Proactive issuance may cause loss of capacity if the forecast is inaccurate
- Proactive issuance allows flight operators EDCT to plan operation

Multiple Ground Stops (rolling GS)

- Customers do not know when they are going to depart
- Pushes demand causing greater need for GDP to recover demand
- NAS demand predictions are inaccurate
- Departure delays possible when recovering from backed up departure demand