Airspace Flow Programs (AFPs)

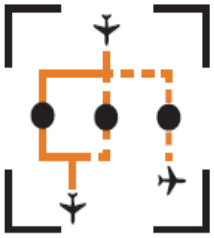
NE FEA/FCA Data

Presenter: DCC AFP workgroup

For:

Nov xx, 2020

Introduction:



Airspace Flow Program (AFPs)

For 2020, we will refine and adapt Flow Constrained Area (FCA) design using new tools to make timely, data-driven decisions. Where possible we will provide industry with options of FCA based reroutes as an alternative to AFPs. Improvements to the AFP process started in 2019 through re-evaluation and adjustments to reference rates of historical FCA applications in limited locations. The 2020 initiatives expand on that.

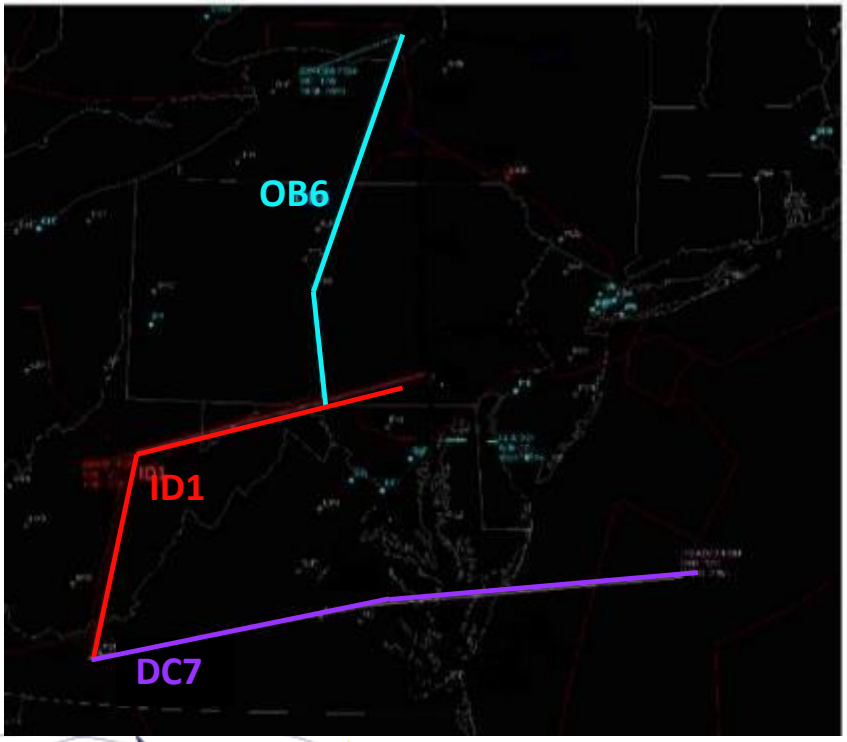
The first step in managing Enroute airspace and how constraints impact aircraft movements through it, is to:

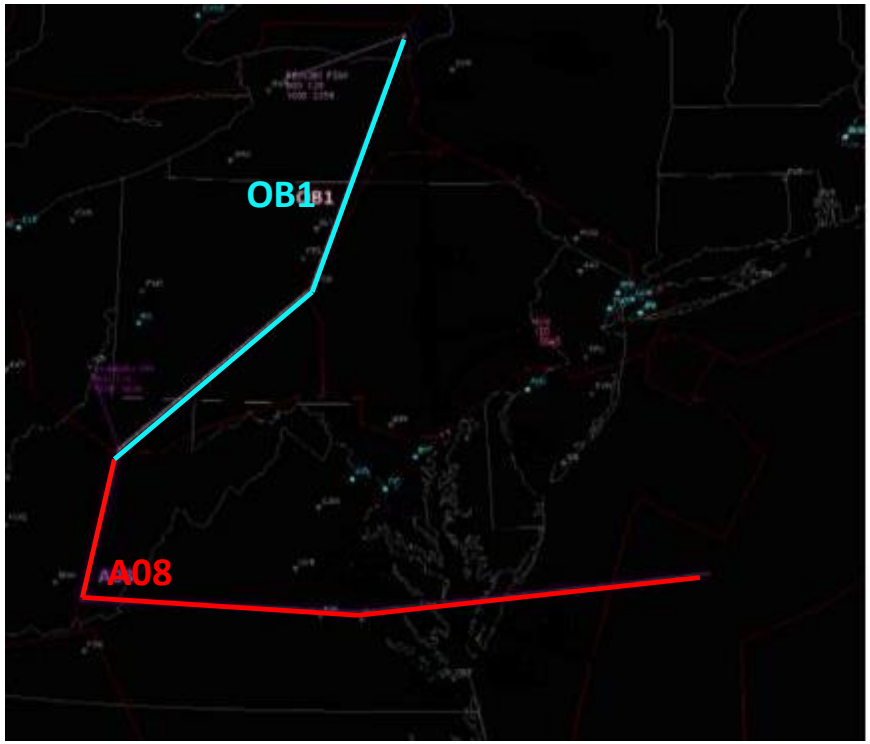
- Accurately count flights traversing the airspace during unconstrained conditions – **UFT** (Unconstrained FCA Throughput)
- Identify flight details – enroute, descending, climbing; to and from what destinations

Objective:

Quantify the UFT for the classic NE FCAs

(A08, BW1, DC7, ID1, OB1, OB6)





Old FCA Throughput Numbers

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Current Filters: ➢ 120 - FL600 ➢ Exempt: ZEU & Canadian LTFC	Current FCA Throughput (Starting DoO number)
A08	120
BW1	40
DC7	95
ID1	70
OB1	115
OB6	100

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Origin of Existing UFTs

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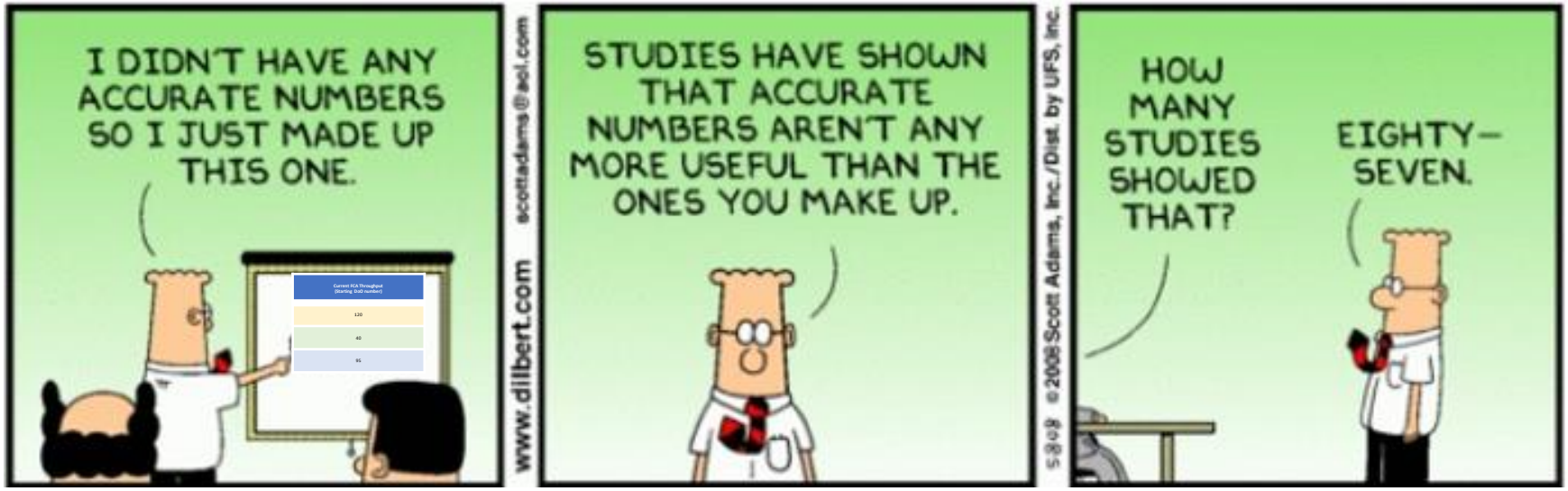

- The history of the existing numbers is no longer available
- AJR Leaders and Flight Operators support data driven decisions
  - Accurate data derived from a standard process is needed
  - AJR-G measured actual 2019 traffic crossing FCAs - UFT

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Data Source:

- AJR-G developed a capture strategy using all of 2019 PDARs data to measure the UFT
  - Measured actual traffic worked through each FCA
  - Retained original FCA parameters/filters so new data correlates exactly (no change in *what traffic* was measured)

Data Analysis:

AJR-G used two computations to determine UFT
(Retained current FEA filters with ZEU and Canada LTFC exempt):

- Average of the top 14 daily values using peak *15 minute* periods
  - Peak 15 minute periods - 12 peak 15 minute throughout a single day

- Average of the top 14 daily values using peak *hourly* periods
  - Peak hourly periods - 3 peak hours throughout a single day

Quarter Hour UFT

Altitude: 120 - FL600	¼ Hour UFT W/ Current Filters	Existing FCA (They Are Today)
A08: Not from ZBW ZNY ZDC ZOB ZEU CAN	164	120
BW1: Not from ZBW ZNY ZDC	56	40
DC7: Not from ZBW ZNY ZDC ZOB ZEU CAN	152	95
ID1: Not from ZBW ZNY ZDC	96	70
OB1: Not from ZBW ZNY ZDC	156	115
OB6: Not from ZBW ZNY ZDC	132	100

Hourly UFT

Altitude: 120 - FL600	Hourly UFT W/ Current Filters	Existing FCA (They Are Today)
A08: Not from ZBW ZNY ZDC ZOB ZEU CAN	153	120
BW1: Not from ZBW ZNY ZDC	49	40
DC7: Not from ZBW ZNY ZDC ZOB ZEU CAN	131	95
ID1: Not from ZBW ZNY ZDC	72	70
OB1: Not from ZBW ZNY ZDC	149	115
OB6: Not from ZBW ZNY ZDC	117	100

Data Table:

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Altitude: 120 - FL600	¼ Hour UFT W/ Current Filters	Hourly UFT W/ Current Filters	Existing FCA (They Are Today)
A08: Not from ZBW ZNY ZDC ZOB ZEU CAN	164	153	120
BW1: Not from ZBW ZNY ZDC	56	49	40
DC7: Not from ZBW ZNY ZDC ZOB ZEU CAN	152	131	95
ID1: Not from ZBW ZNY ZDC	96	72	70
OB1: Not from ZBW ZNY ZDC	156	149	115
OB6: Not from ZBW ZNY ZDC	132	117	100

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UFT Determination:

All of the data was based on actual traffic worked.

- The Hourly count demonstrates a *sustained* level of traffic that was worked
- The Quarter Hour numbers demonstrates that *occasional spikes* can be worked, but sustained spikes may have negative impacts

Field Facilities collaborated and concurred with the recommendation to use the Hourly counts for the new UFTs.

Process: Analysis to Outcomes:

- Measure and sort the actual traffic traversing each FCA
  - Daily count
  - Hourly count
  - Quarter hour count
- Field facilities (ZBW, ZOB, ZDC, ZNY) collaborated on the new UFTs
  - Ensure accurate process and count
  - Collaborate on which data set will be used for UFT
- Publish new UFTs
- Use new UFTs as baseline for any operational reductions due to constraints
- Provide Training/Briefing Material for use by ATCSCC, Field Facilities, and Flight Operators

Operational Use and Implementation

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Industry and FAA (CDM, VP+1) all want a Strategy for Use for AFPs and data driven rates to preclude over-control and unnecessary (and unrecoverable) delay

- An ATCSCC Strategy of Use document was developed and briefed – addresses all Systemic Constraints (Weather, Volume, Security, Environmental, etc)
- AFP Program Rates (PR) rates are made from new published baseline UFTs
- AFP discussions are about actual and/or forecast constraints
- Rate reductions are *subjectively quantified* – Facility/Flight Operator expertise, actual and forecast conditions (weather, timing, and location) and other documented constraints

Operational Use and Implementation

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What stays the same?

- Identify the constraints
  - Forecast or Actual or both
  - Air mass or lines and clusters
- Proximity to major markets and flows
  - Enroute impact, Terminal Impact or both
  - Impact to departures
- Timing
  - Before, during, or after peak traffic periods
- Other impacts
  - VIPs, Rocket Launch, COVID impacts – be specific

Operational Use and Implementation

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What changes?

- The starting point – now you know how many flights are affected
- Unintentional impact (over-control)

Example:

A confident forecast is made for impact in ZOB/ZNY area and a high volume of offloads are expected to go through ZDC. You collaborate and decide to run 3 hours at 95% for ZDC and then dial it back to 75%

Using the current (old) number of 120 for the A08, you let 114 flights/hour through. Actual flights (new numbers) are 153. Therefore, actual throughput is 75%, not the 95% you wanted.

Operational Use and Implementation

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What changes?

- Collaboration is the same process, but the impacts of the decisions you make are better defined
  - Collaboration is based on actual flights and necessary reductions
  - Managing the NAS is intentional; based on the actual numbers and unintentional over-control is avoided, i.e. NAS Performance Outcomes are what you want them to be
- Better data and better informed decision-making supports accurate Review, more appropriate Training, and contributes to overall Improvement.

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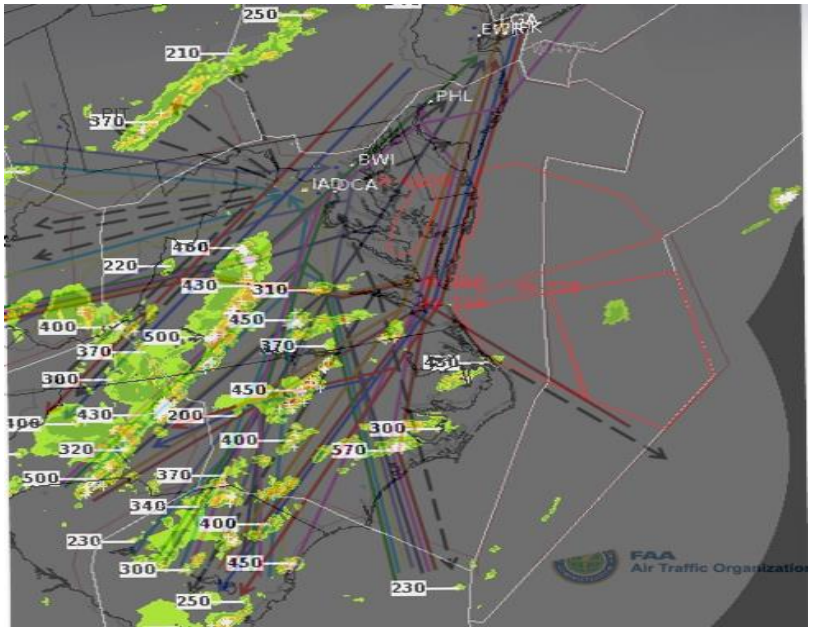
Strategy of Use Document

- **Objective:**
  The intent of the document is to **improve transparency** for all NAS users and FAA Facilities by documenting common weather scenarios, historical strategies, and supporting TMIs when Airspace Flow Programs (AFPs) are used to manage NAS convective weather constraints in the Northeast region.



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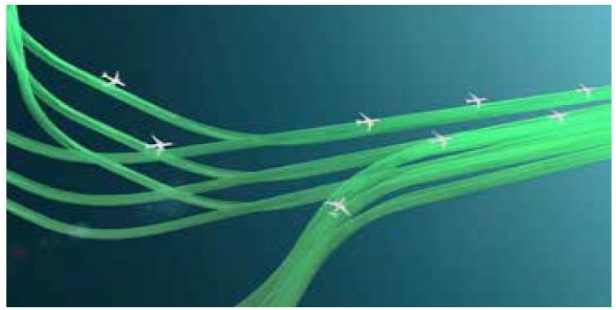
Strategy of Use Document

- **AFP Strategy –**
  The goal of the Air Traffic Control System Command Center (ATCSCC) during Northeast SWAP events is to **proactively manage the NAS without over-control.** AFPs are one of the **most impactful TMIs,** used when other TMIs won't be enough on their own, but are rarely used in isolation. AFPs should be considered **in conjunction with** multiple TMIs when developing a Day of Operations (DoO) plan to **maximize throughput, balance capacity with demand and ensure a safe enroute environment.**



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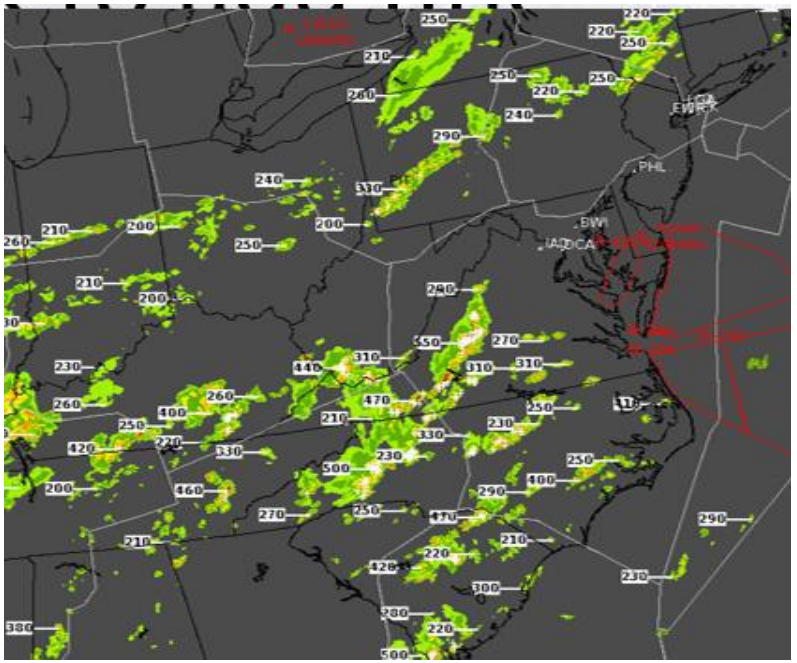
Strategy of Use Document

- **When to Consider an AFP Strategy:**
  1. *Significant Severe Weather is forecast or present mostly in Cleveland Center (ZOB) and Washington Center (ZDC) must absorb rerouted ZOB demand*
  2. *Significant Severe Weather is forecast or present mostly in ZDC and ZOB must absorb rerouted ZDC demand.*
  3. *Significant Severe Weather is forecast or present in ZOB, ZDC and New York Center (ZNY) and capacity in all three Centers is greatly reduced.*



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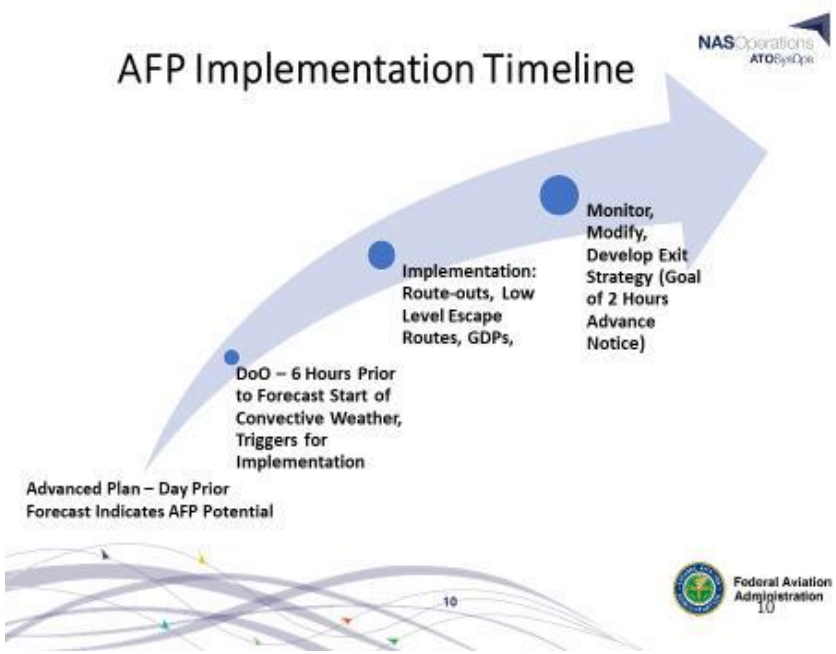
Strategy of Use Document

- **Timing of Northeast AFPs:**
  Because most severe weather events in the northeast begin in the early to late afternoon, the arrival demand departing the west coast in the morning (west coast time) must be addressed before 15z or it will be airborne. **The Critical Decision Window (CDW) for implementation is five to six hours prior to the forecasted convective weather activity.**



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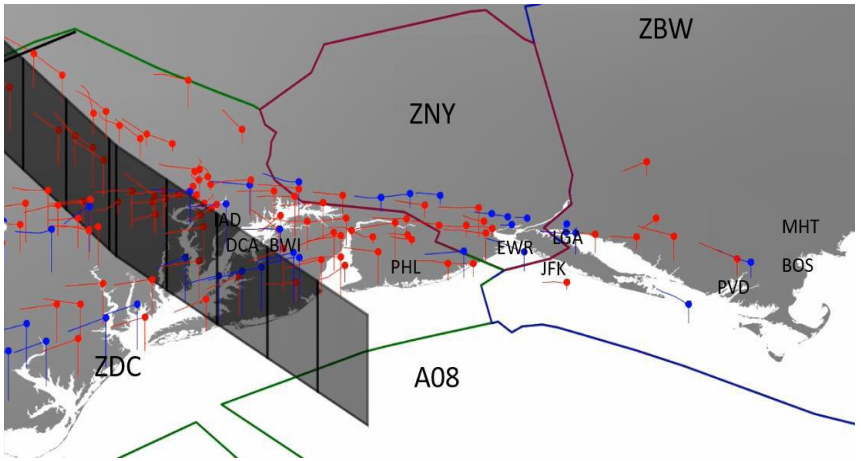
Strategy of Use Document

- **Ceiling and Floor Information:**
  All AFP ceilings and floors are set at FL600 and 120. Ceilings will not normally be lowered due to the close proximity to the NE regional airports. **Sequencing and spacing requirements** preclude aircraft from flying over the top of an AFP/constraint and descend into the regional airports. **However, DoO exemptions shall be given on a case by case basis.**



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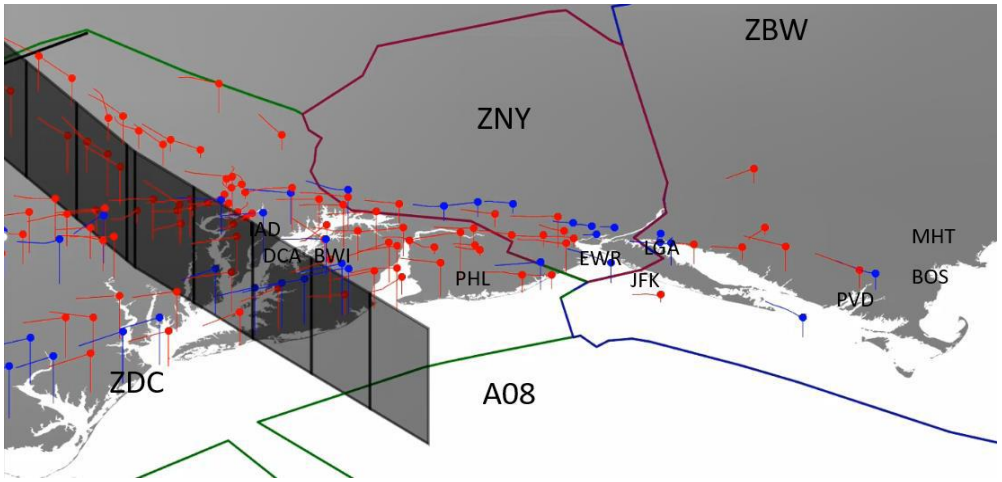
- **Ceiling and Floor Information (CONT'D):**
  The airspace AOB230 is generally used for escape routes and capping/tunneling which precludes the floor from being raised.



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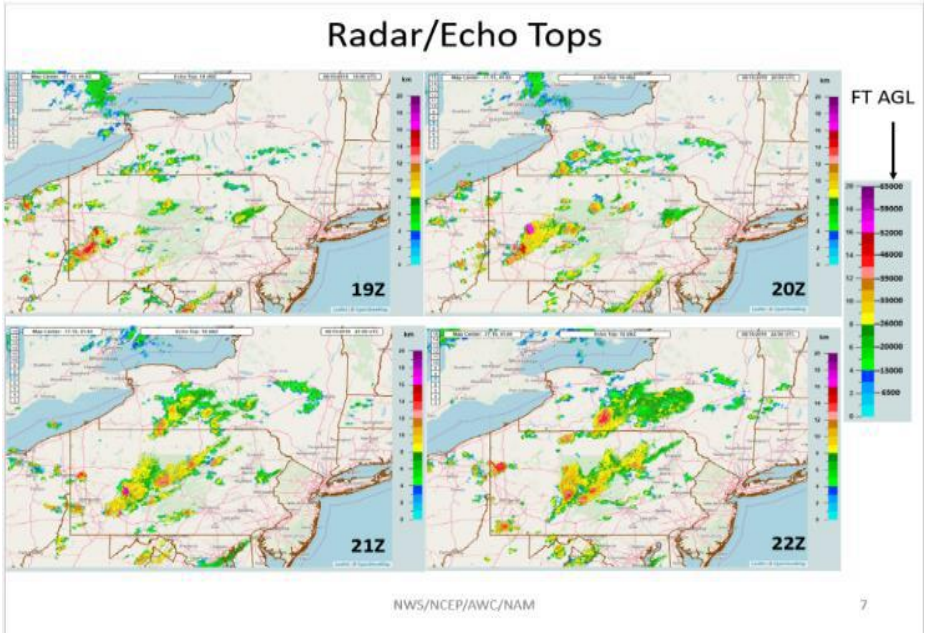
Strategy of Use Document

- **General Factors to Consider in Determining Rate Reductions :**
  Determining the correct capacity and throughput is not an exact science and requires intuitive knowledge of the airspace and the flows of traffic. Determining the available capacity based on weather forecasts can be subjective.



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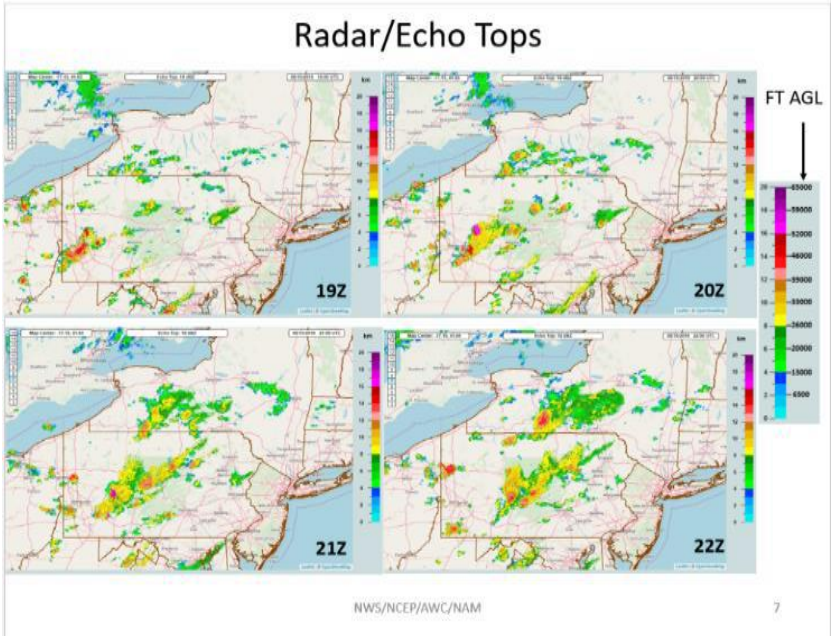
- General Factors to Consider in Determining Rate Reductions (Cont'd):
- Confidence in the forecast
- Location – well defined or broad brushed
- Severity – tops, coverage
- Timing – start, end, duration
- Permeability
- Type and speed of thunderstorms activity (air mass, line, clusters)



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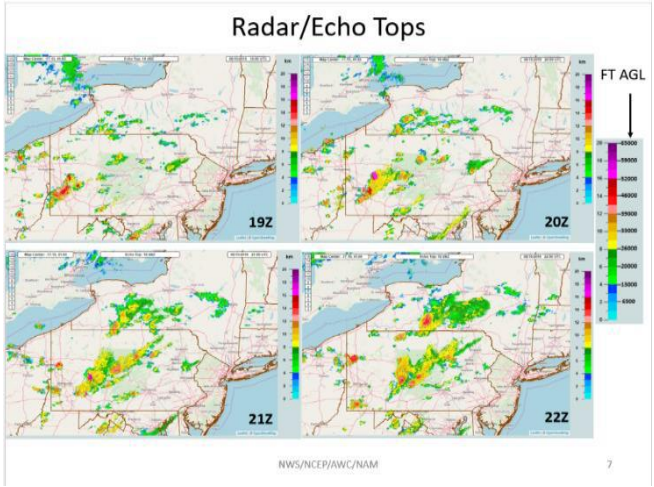
Strategy of Use Document

- General Factors to Consider in Determining Rate Reductions (Cont'd):
- Other WX impacts (turbc, arpt impacts etc.)
- Tstm impact on high density airways?
- Airspace usage (primarily in enroute vs. arrival/departure airspace)
- Favoring arrivals (Higher AFP rate) or departures (lower AFP rate)?
- Primary AFP (manage weather impact) vs. secondary AFP (manage volume/rertes)
- Other TMIs used in conjunction to AFPs



List is not all inclusive – if other factors affect AFP Rate, be sure to document in NTML

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Advance Planning Team Actions:

- Gathers and assesses available traffic, weather, and constraint data
- **Compares to similar days and NAS Strategies**
- Publishes draft plan including expected strategies and initiatives for the next day of operations (DoO)
- Collaborates with stakeholders on Planning Webinar
- Incorporates feedback and additional information into the draft plan
- May rank AFP probable impact as Low, Med, or High
- Publishes the Advance Plan for the next day

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Planner Actions on DoO:

- Review and Update Advance Plan – creates Ops Plan
- Publish initial Ops Plan prior to first DoO Planning Webinar
- Collaborate with flight operators, facilities and others on NAS Management Strategy, timing, expected TMIs, triggers, AFP probability and rank as Low, Med, or High
- Publish revised Ops Plan and repeat every two hours
- Collaborate with stakeholders to implement Strategy (including TMIs)
- Assess performance and modify as needed
- When able, develop and execute an exit strategy

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SVRWX:

- Clearly identify systemic constraints (weather, volume, security, environmental, etc), timing, and expected NAS impacts
- Obtain facility and flight operator input, differences or concurrence
  - Are AFPs, AFPs/GDPs, structured routes needed?
  - Timing
  - Rates (straight, variable)
  - Altitudes
- Implement or make an alternate plan prior to the CDW
- Decide! Waiting rarely works. Document the decision

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- **SVRWX – Determining Severity and the AFP rates**

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NE FCAs	Hourly Unconstrained FCA Throughput	Low System Impact AFP Rate Range	Medium System Impact AFP Rate Range	High System Impact AFP Rate Range
A08	153	122-153	92-121	91 or lower
BW1	49	39-49	20-38	19 or lower
DC7	131	105-131	79-104	78 or lower
ID1	72	58-72	43-71	42 or lower
OB1	149	119-149	89-118	88 or lower
OB6	117	94-117	70-93	69 or lower

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SVRWX Makes a Quick AFP Rate Calculation:

Find the critical points of $f(x,y) = \frac{x}{x^2+y^2+1}$ and classify them.

Solution

The derivatives are

$$f'_x = \frac{1-x^2+y^2}{(1+x^2+y^2)^2} \qquad f'_y = -\frac{2xy}{(1+x^2+y^2)^2}$$

The only way these can both be zero is if $y = 0$ *and* $x = \pm 1$. *The second derivatives are*

$$f''_{xx} = \frac{2x\left(x^2-3\left(y^2+1\right)\right)}{\left(x^2+y^2+1\right)^3} \qquad f''_{xy} = \frac{2y\left(-3x^2+y^2+1\right)}{\left(x^2+y^2+1\right)^3}$$

$$f''_{yy} = -\frac{2\left(x^3-3y^2x+x\right)}{\left(x^2+y^2+1\right)^3}$$

Important Considerations:

If not by a formula, how do you determine an AFP rate?

- Use the AFP UFT rate data to start the conversation
- ***Quantify*** the constraints.
  - Ask facilities and flight operators to say what they are, what they will impact, for how long, and what should be used to mitigate them
- ***Subjectivity*** still matters (There is a lot of experience among the participants)
- Merge it all into a Strategy and Rate, then . . . . . Log it!

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