Quantification of Benefits of Aviation Weather

A discussion of benefits

Federal Aviation Administration

Presented to: Friends and Partners in Aviation Weather

By: Leo Prusak, FAA Manager of Tactical Operations

Date: October 24, 2013

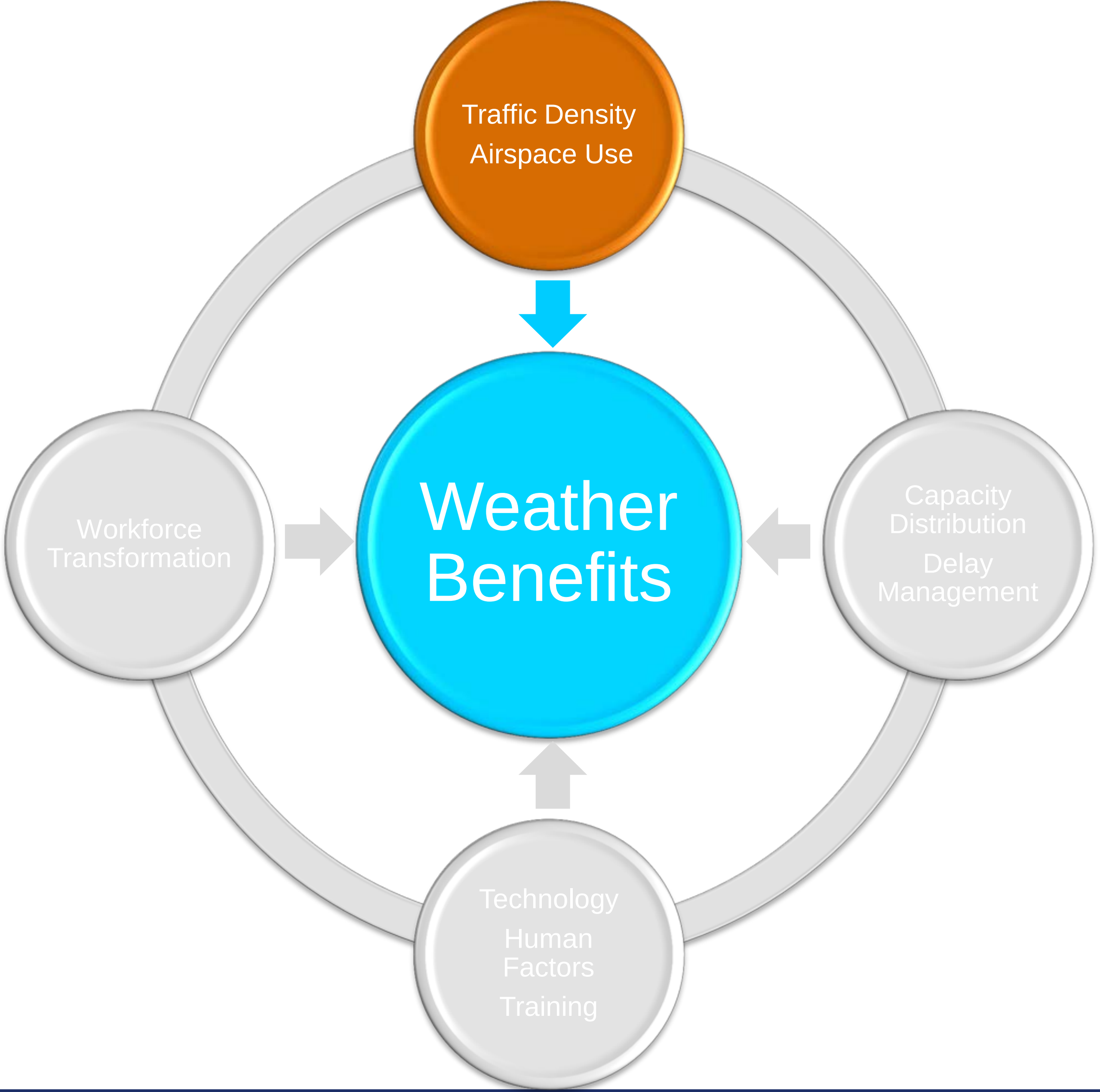
Talking Points

Before we get to benefits, we need to understand what capacity is lost to weather.

Weather forecasting must predict the loss of capacity that results in delay that cannot be mitigated.

Having valid impact mitigation choices can provide scalable benefits.


Traffic Density
Airspace Use
Workforce Transformation
Weather Benefits
Capacity Distribution
Delay Management
Technology
Human Factors
Training


Traffic Density
Airspace Use
Weather Benefits
Workforce Transformation
Capacity Distribution
Delay Management
Technology
Human Factors
Training

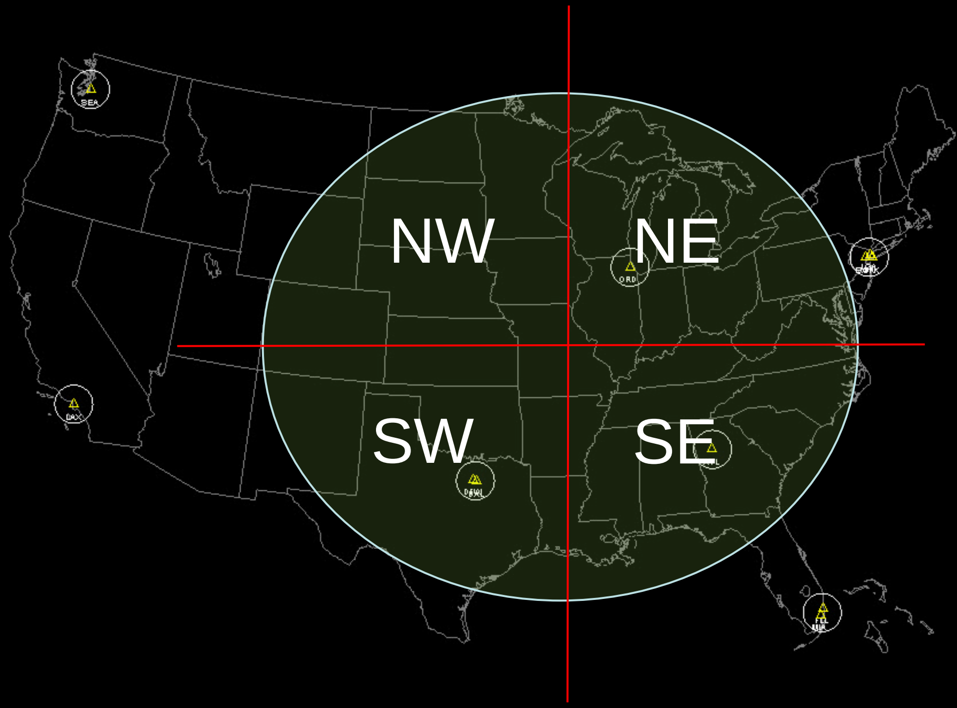
Understanding Airspace Density

We analyzed 7 major markets to determine how airspace is used and how traffic demand is distributed.

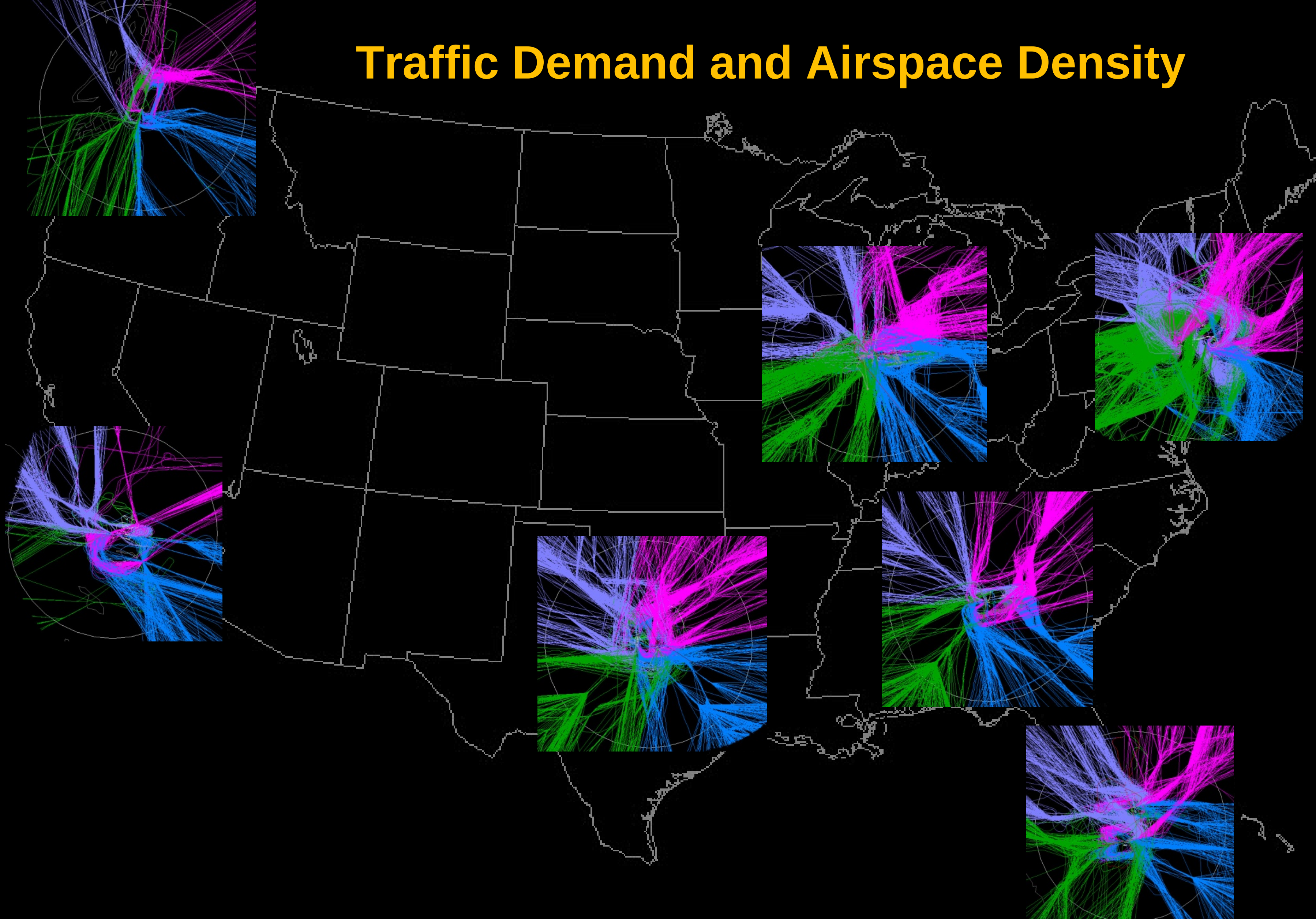
We picked 4 “corner” markets; NY, MIA, LAX, and SEA and 3 internal markets; ORD, DFW, and ATL.

We divided the airspace into 4 quadrants and measured all flight tracks at 50 NM.

This “big picture” analysis provides a perspective of airspace density and traffic demand which ultimately has significant implications related to severe weather impacts and delay.

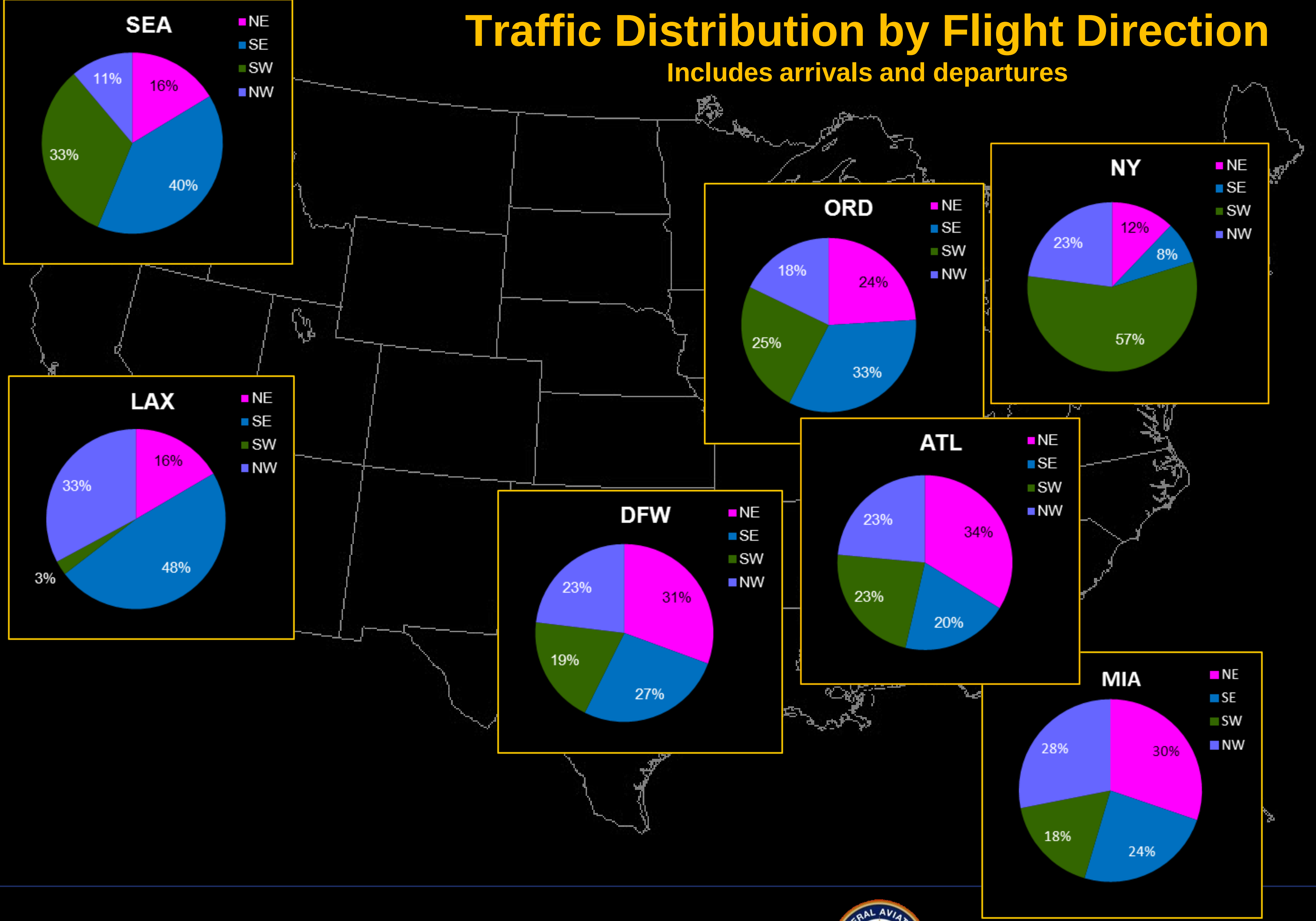


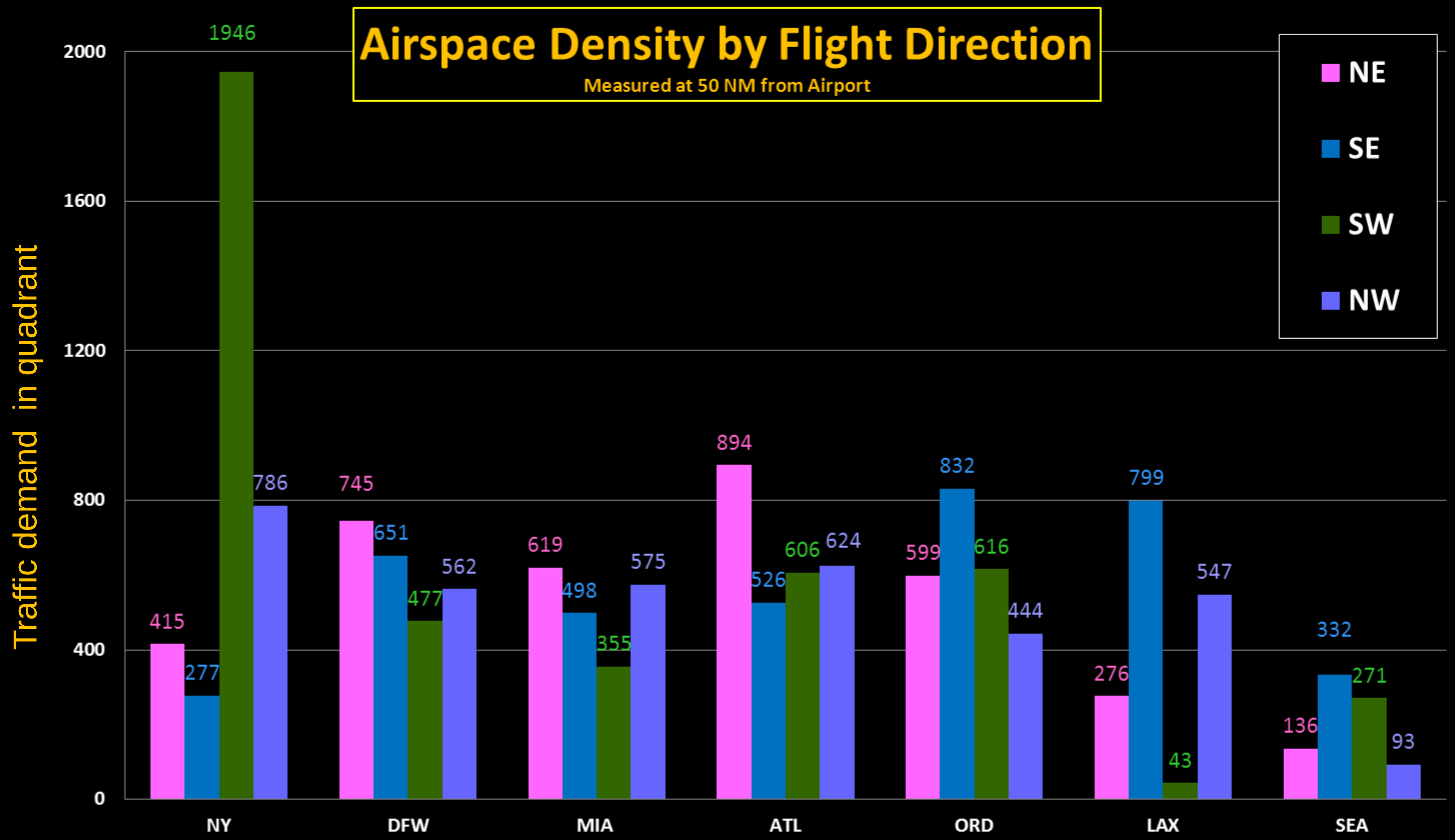
Traffic Demand and Airspace Density



Traffic Distribution by Flight Direction

Includes arrivals and departures





Federal Aviation Administration

Airspace Density and Severe Weather Impacts

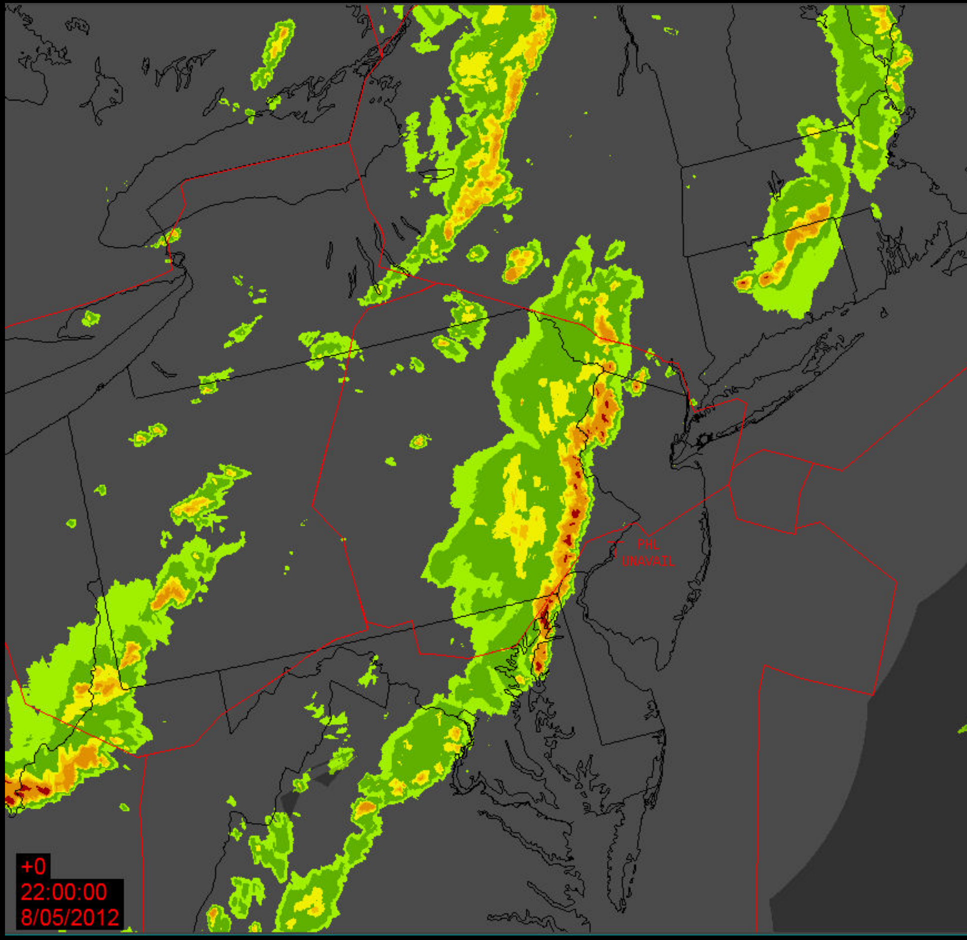
New York is geographically disadvantaged from a traffic demand and airspace use perspective in general.

Airspace structure and traffic demand measured together equal airspace density.

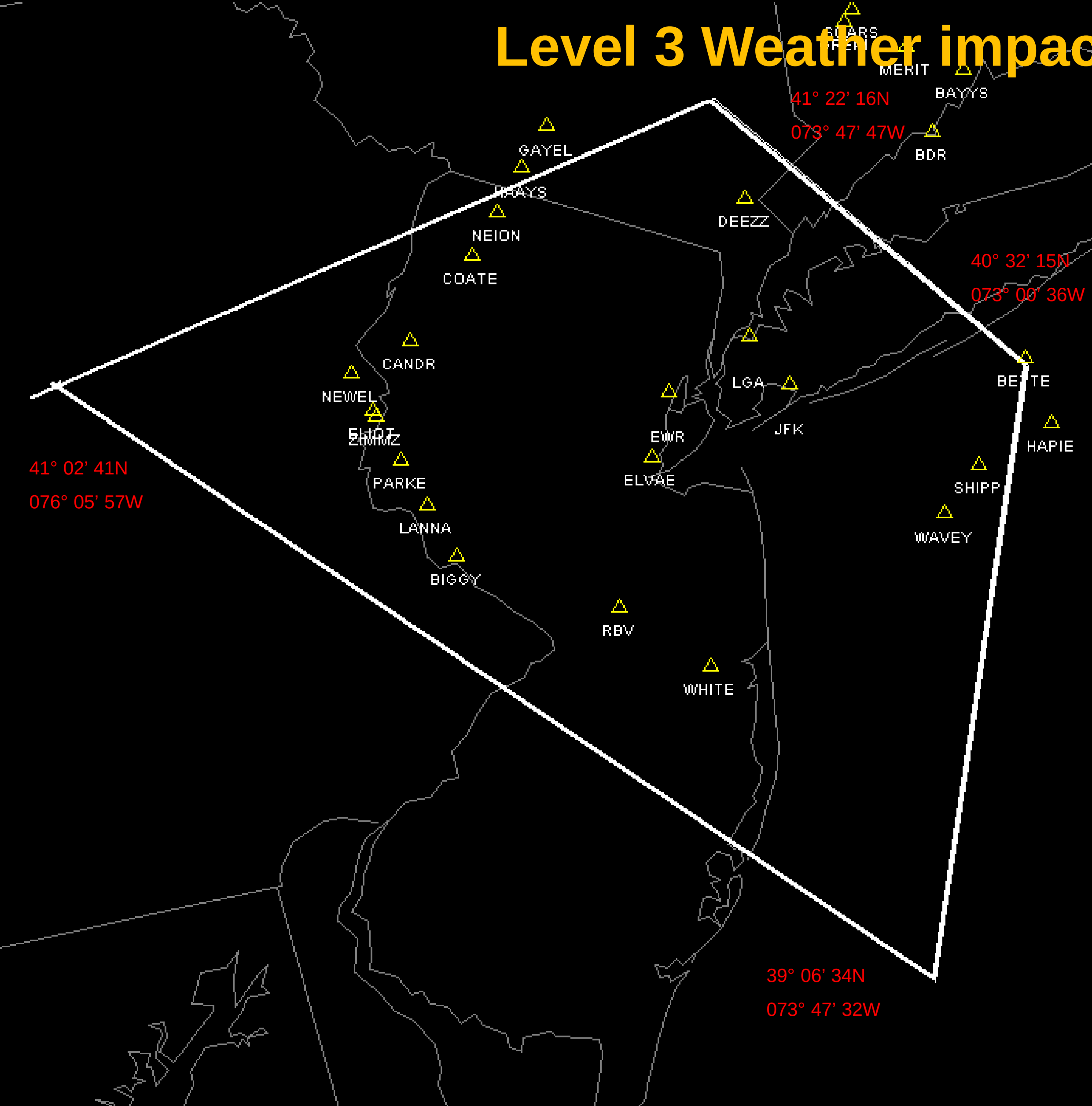
Severe weather intensity, coverage, location, relative movement, time of day, day of week, and orientation to major markets determine delay impact.

In a macro sense, airspace density and severe weather are two of the most important factors in determining this type of delay in the NAS.

Because of these factors in NY, severe weather impacts are disproportionate to any other market in the NAS.



Level 3 Weather impact Area



Previously, Level 3 weather was loosely defined as weather of moderate or greater impact within 50 NM of NYC.

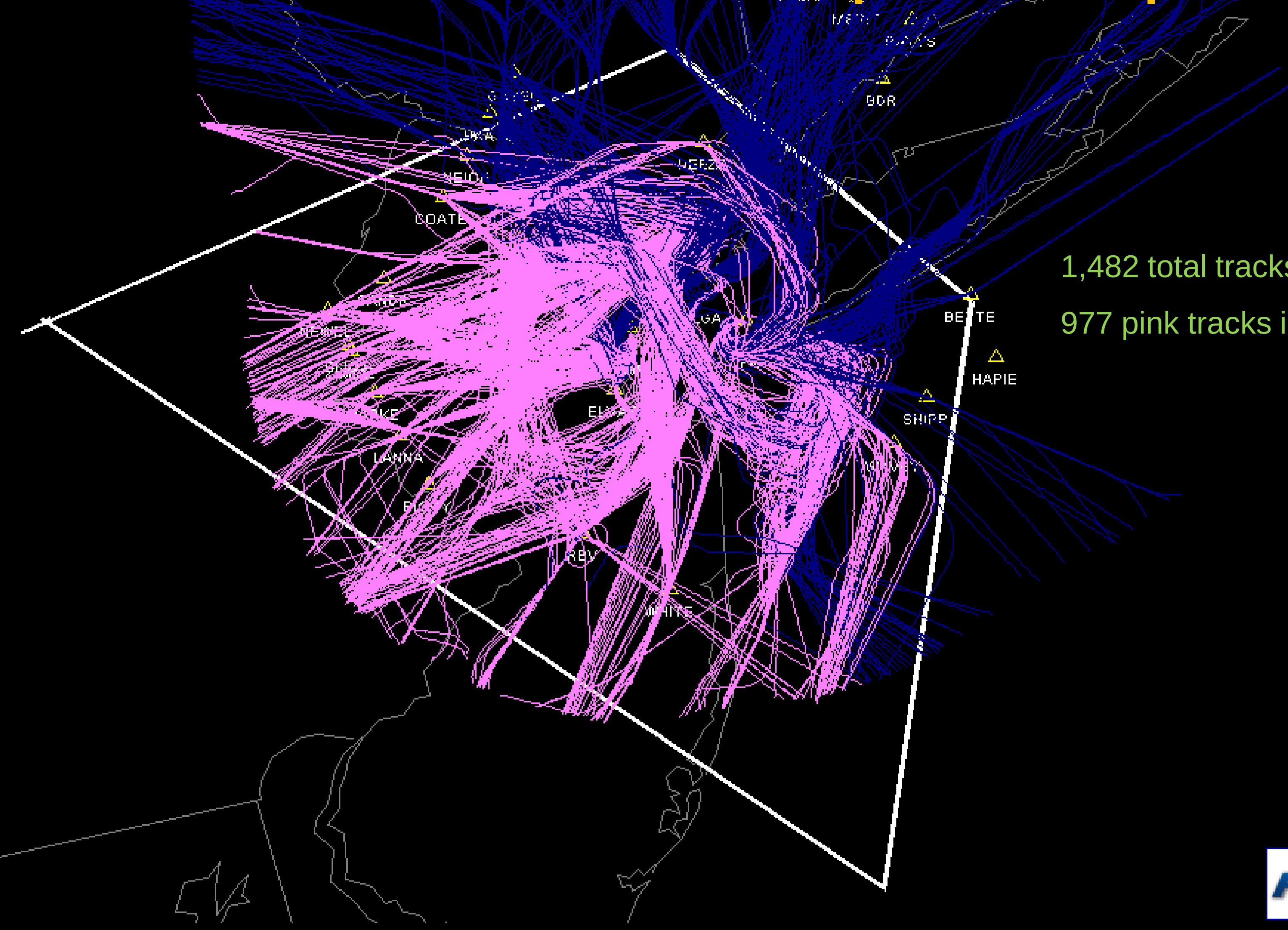
Further analysis indicated the 50 NM area was poorly correlated to airspace density and should be redefined to focus on delay potential.

For guidance, this area would exist:

1. In SWAP season, April 1- Sept 15
2. Daily between 12 noon -7:00 p.m.

The whole essence of the NYAP is little more than a ***search for the convergence*** of severely impacting weather, during times of high traffic volume, within this airspace.

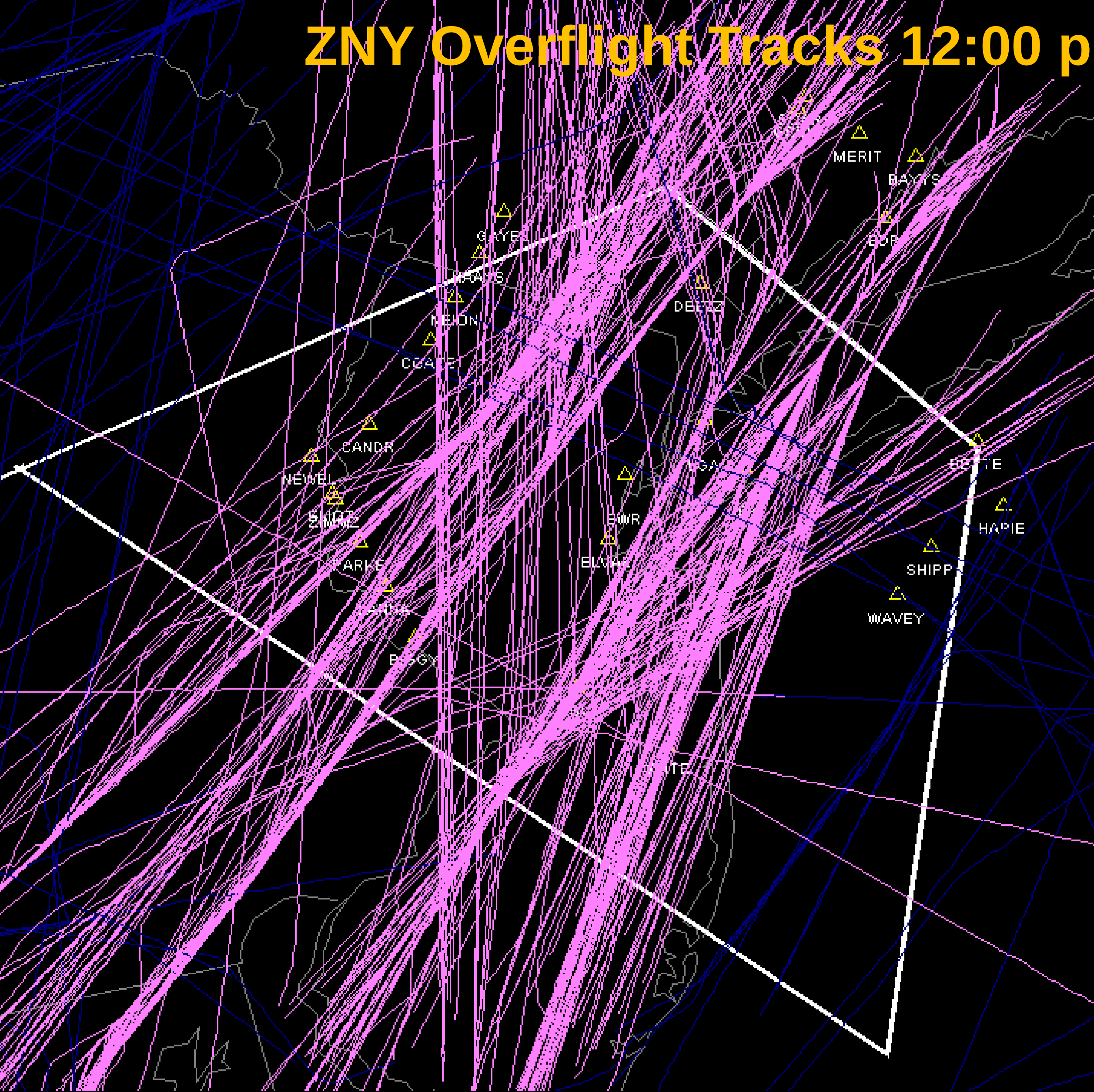
JFK, EWR, and LGA Arrival and Departure Tracks 12:00 p.m. – 7:00 p.m.



1,482 total tracks (blue and pink)

977 pink tracks in Level 3 box (65%)

ZNY Overflight Tracks 12:00 p.m. – 7:00 p.m.



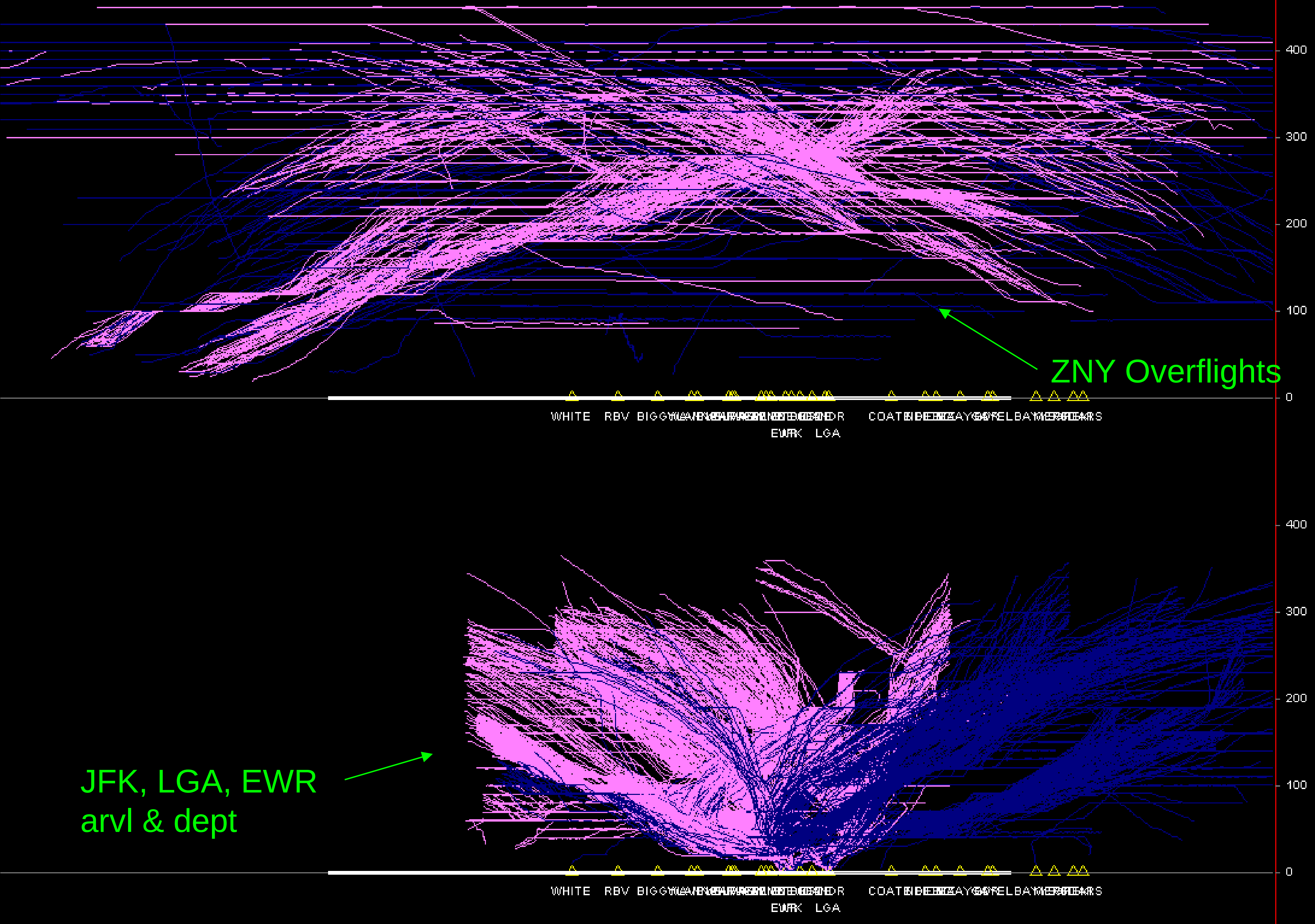
582 total tracks (blue and pink)

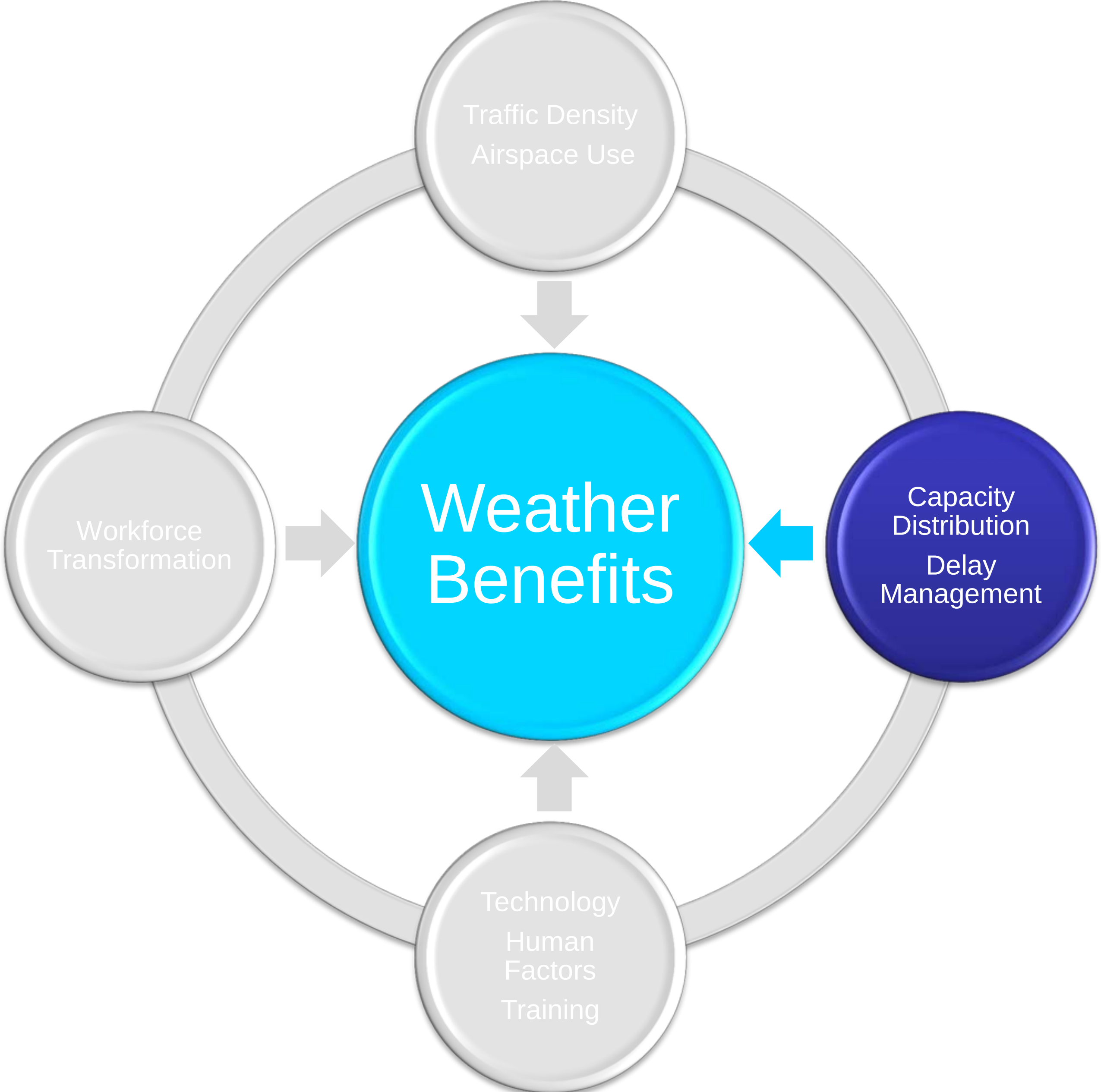
378 pink tracks in Level 3 box (64%)

This is a very limited data set to communicate impact. It does not include all flights.

It is critical to understand, during a Level 3 weather event, not only are NY arrivals and departures affected, but so are all flights traversing the "BOX".

Profile view of Tracks 12:00 p.m. – 7:00 p.m.




Traffic Density
Airspace Use
Workforce Transformation
Weather Benefits
Capacity Distribution
Delay Management
Technology
Human Factors
Training

Thunderstorms cause significant delay and disruption in the NAS, particularly at New York area airports.

Most often this weather occurs between 1:00 p.m. and 9:00 p.m. local between April 1 and September 15.

During this time period, scheduled operations at EWR, JFK, and LGA are close to the airports VFR capacities on optimal runway configurations. Some level of delay is experienced at all three airports under the best of circumstances.

We use GDP's, AFP's, Mile-in-Trail, and reroutes to manage significant delays and disruption in the NAS. We experience numerous undesirable, unplanned, and unpredictable events that further determine operational outcomes including ground stops, off route deviations, airborne holding, diversions, departure stops, and DOT-3 taxibacks.

The delay and disruption on severely impacted weather days may be best expressed as a capacity distribution or capacity usage problem. Undesirable and unpredictable outcomes are remnants of poorly distributed capacity. Air traffic demand must be skillfully managed to match useable capacity.

Basic premise and assumptions:

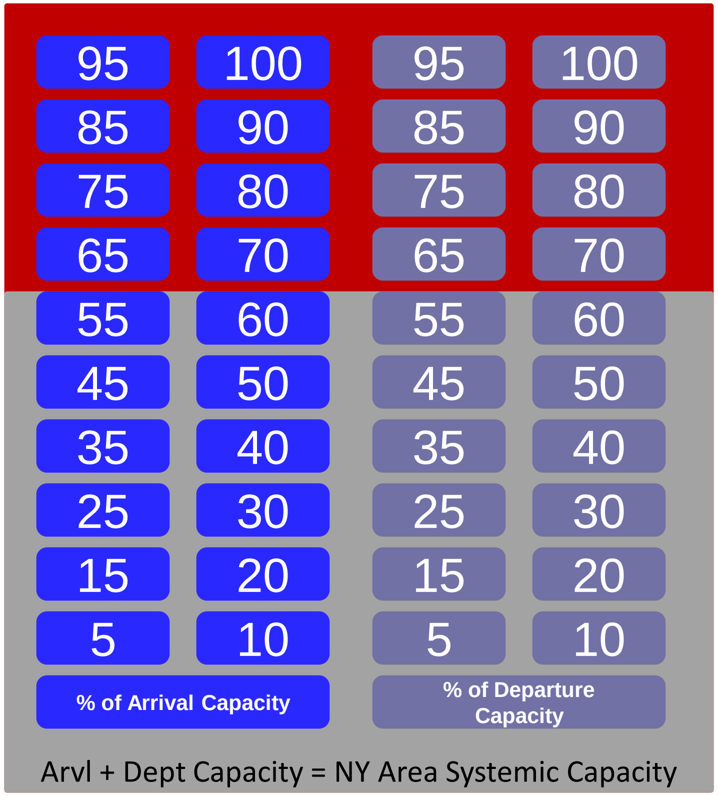
1. EWR, JFK, and LGA are scheduled to and operate at 100% capacity for discussion purposes.
2. Capacity is systemic and is shared equally between arrivals and departures over a longer time scale.
3. Thunderstorms in close proximity to the airports cause a direct and unrecoverable loss of capacity.

Capacity distribution and usage over *x* hours

95	100	95	100
85	90	85	90
75	80	75	80
65	70	65	70
55	60	55	60
45	50	45	50
35	40	35	40
25	30	25	30
15	20	15	20
5	10	5	10
% of Arrival Capacity		**% of Departure Capacity**	

Arvl + Dept Capacity = NY Area Systemic Capacity

Impact of Thunderstorm on Capacity



Thunderstorms in close proximity to the NY airports causes a loss of capacity.

In the figure to the right, "red" represents a 40% loss of systemic capacity.

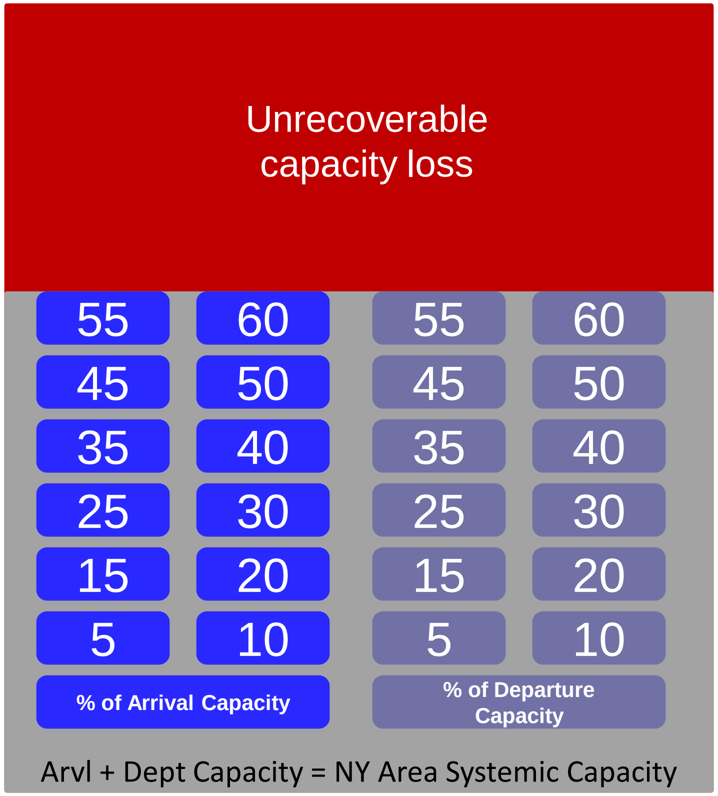
The loss of capacity, if forecast early enough, can be managed to an operational outcome that does not:

1. Have significant airborne holding and diversions
2. Create an impression that the operational plan is not effective
3. Exhaust air traffic operational and airline personnel
4. Saturate airport surfaces

Proportionate capacity distribution

The capacity loss on severely impacted weather days is not “arrival” or “departure” capacity. It’s systemic in nature.

In order to acknowledge and address the linear capacity loss, we must act aggressively and earlier to respond to forecast conditions.



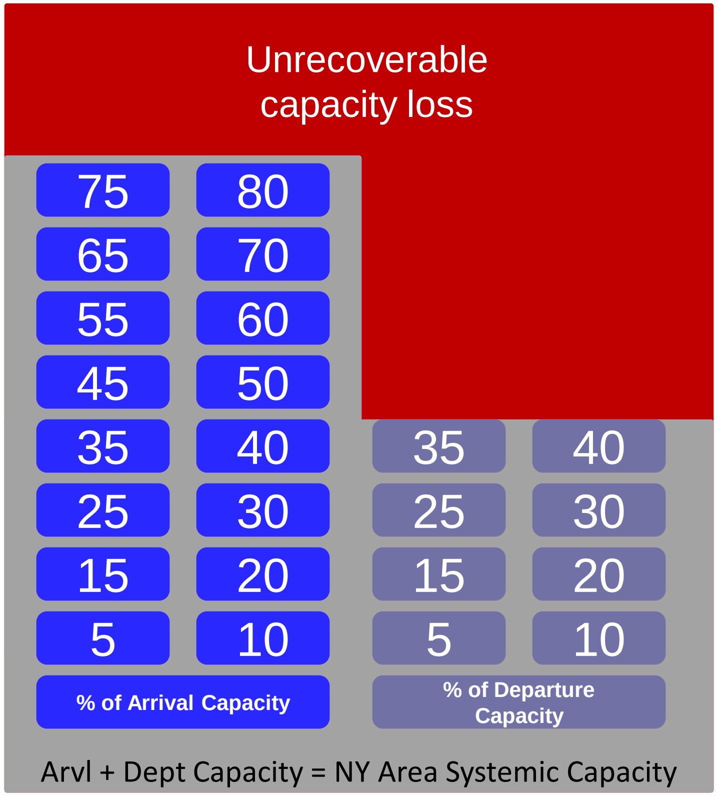
Imbalanced capacity distribution

If we do not act to reduce arrivals early enough, the resulting imbalance will be managed later with inefficient traffic management initiatives such as, ground stops, airborne holding, and diversions.

Systemic capacity is aggregated across the arrival and departure operations and trade-offs occur when there is an imbalance.

Operational remnants of imbalance give the impression we're doing good with arrival traffic but not departures.

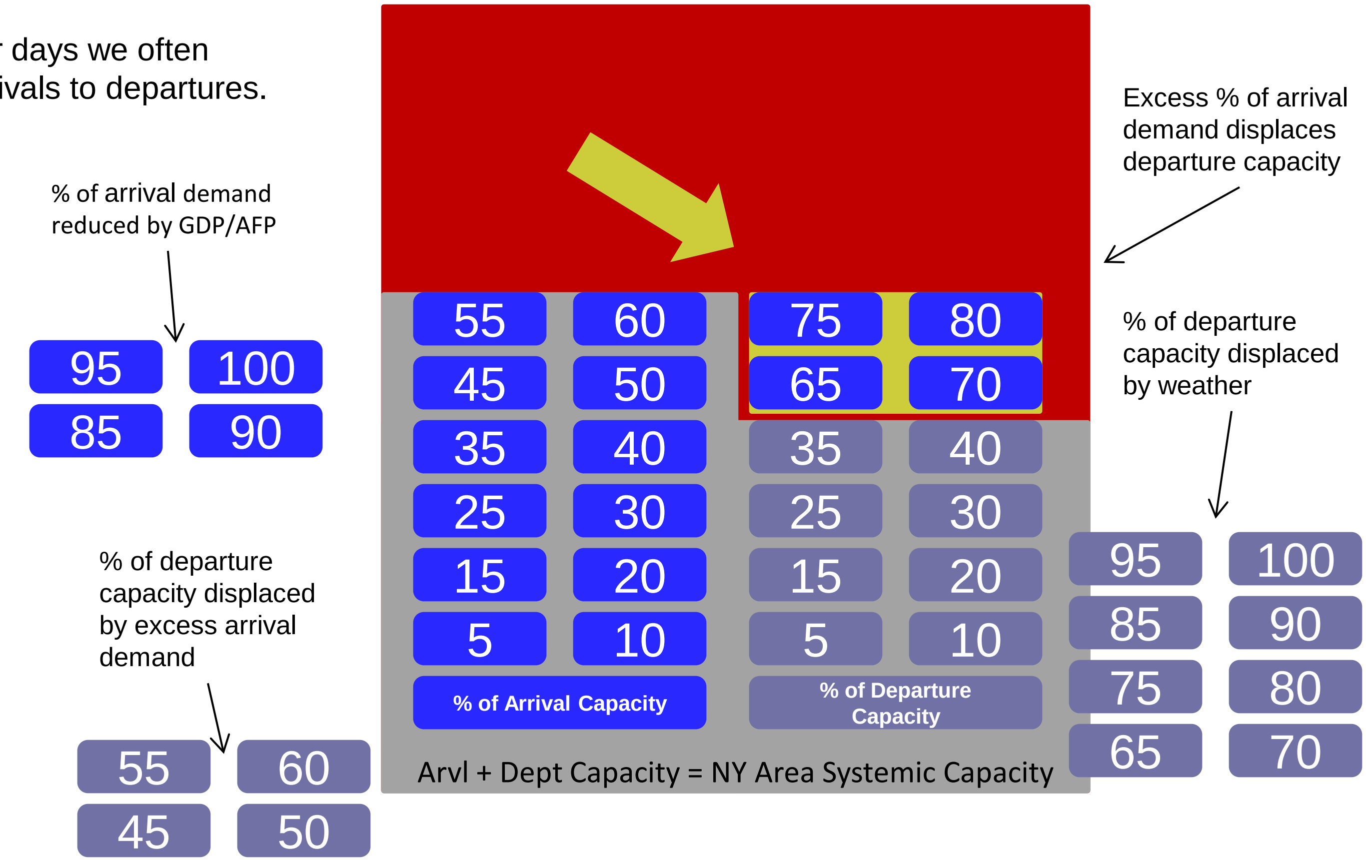
However, a closer look at system disarray and disruptions seems to prove otherwise.

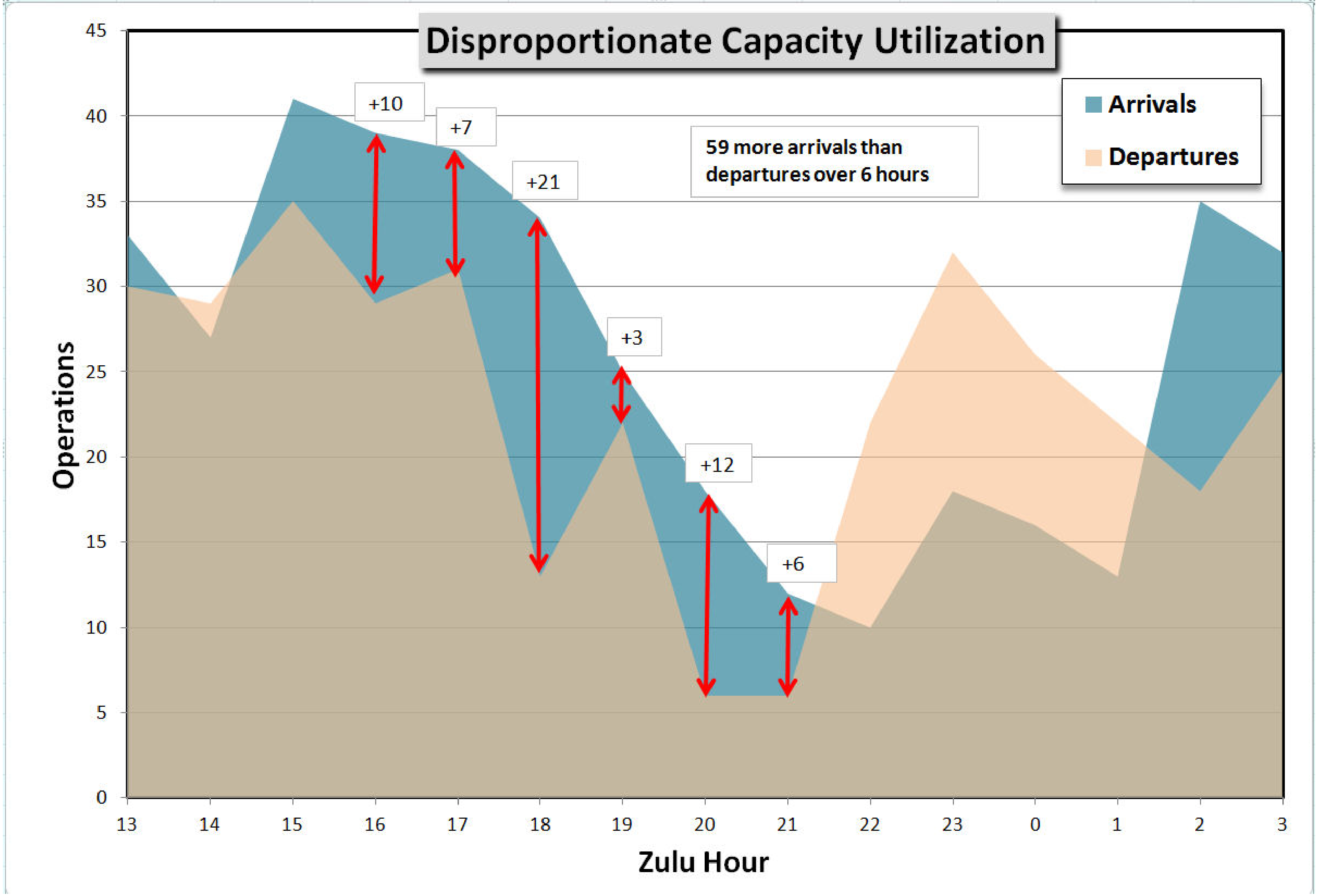


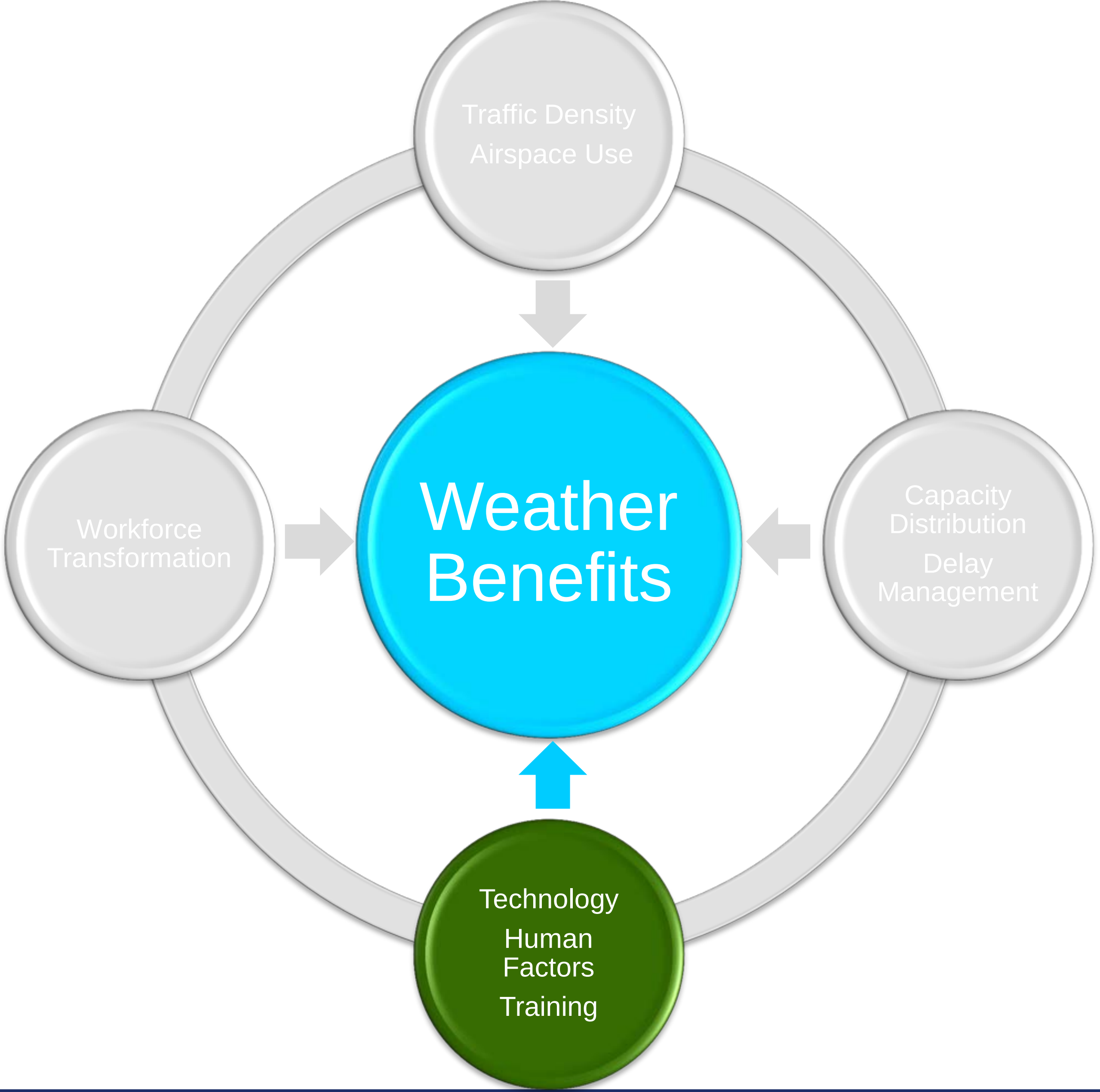
Typically, we use AFP's and GDP's to reduce arrival demand. If we reduce arrival demand by 20% when system capacity is reduced 40% we have an imbalance. The imbalance causes ground stops, airborne holding, diversions, surface congestion and departure stops.

On severely impacted weather days we often experience a 2 to 1 ratio of arrivals to departures.

Today's typical distribution of system capacity



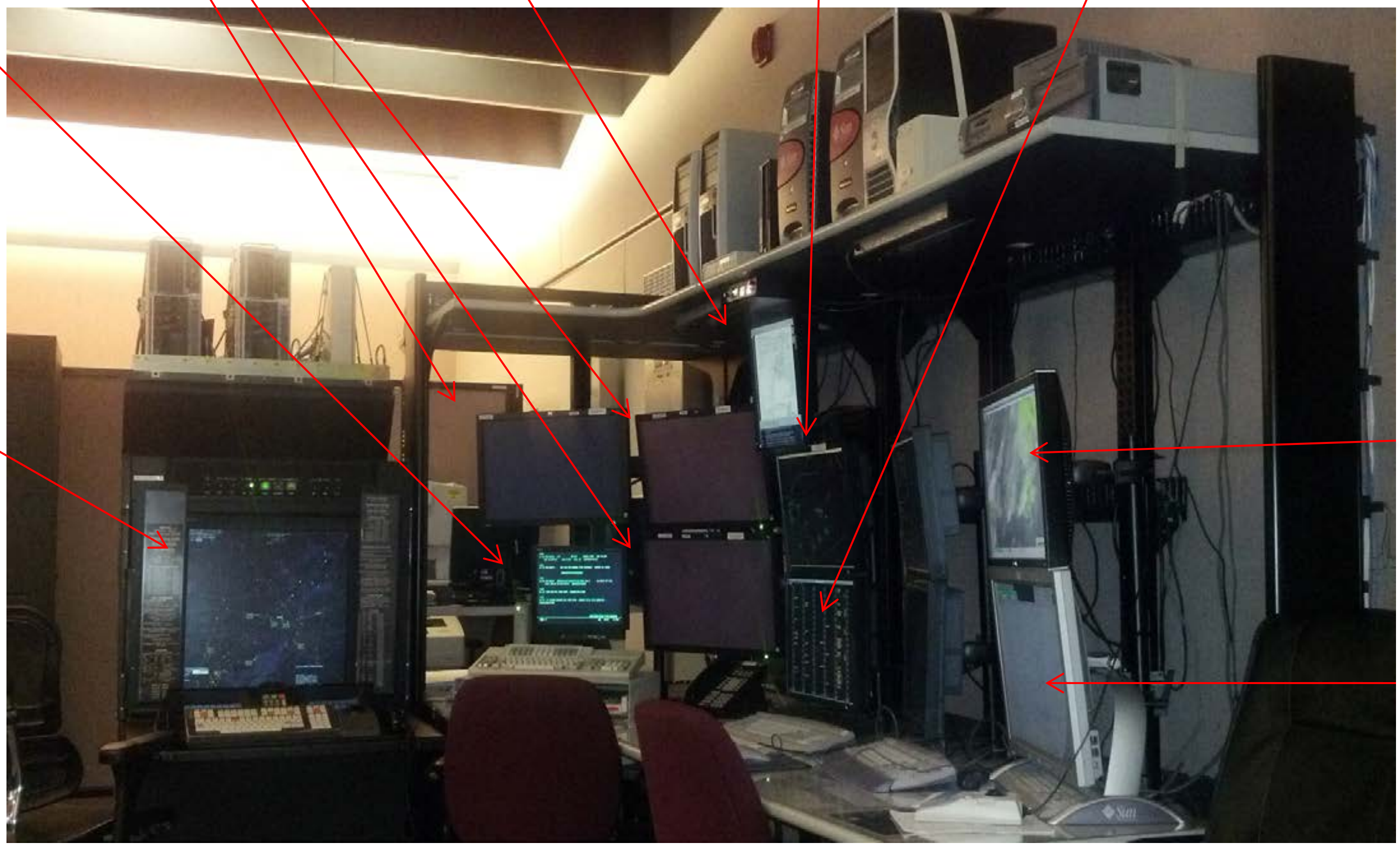

Disproportionate Capacity Utilization
Arrivals
Departures
59 more arrivals than departures over 6 hours
+10
+7
+21
+3
+12
+6
Operations
0
5
10
15
20
25
30
35
40
45
13
14
15
16
17
18
19
20
21
22
23
0
1
2
3
Zulu Hour

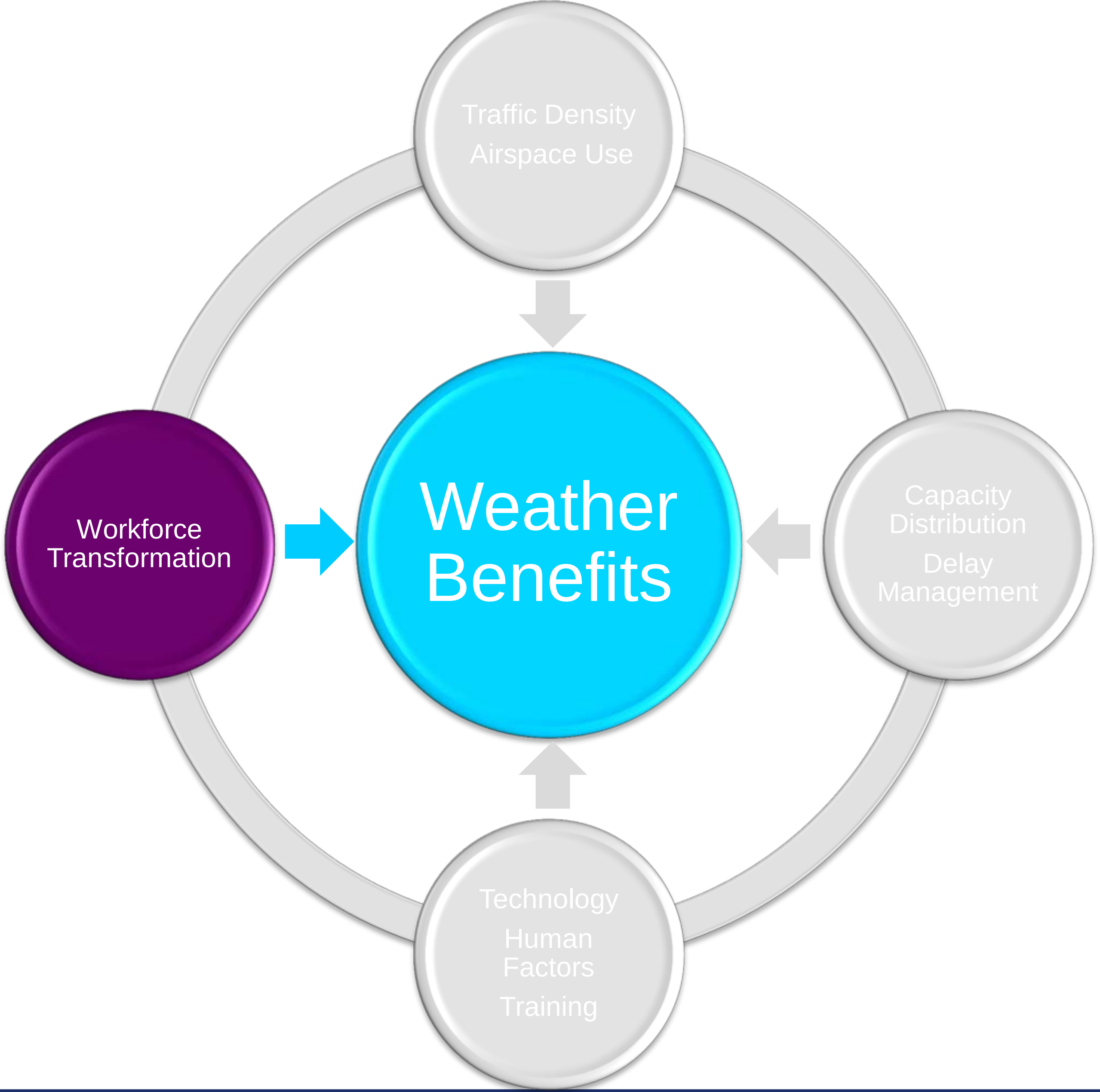

Traffic Density
Airspace Use
Workforce Transformation
Weather Benefits
Capacity Distribution
Delay Management
Technology
Human Factors
Training

Current Traffic Management Tools

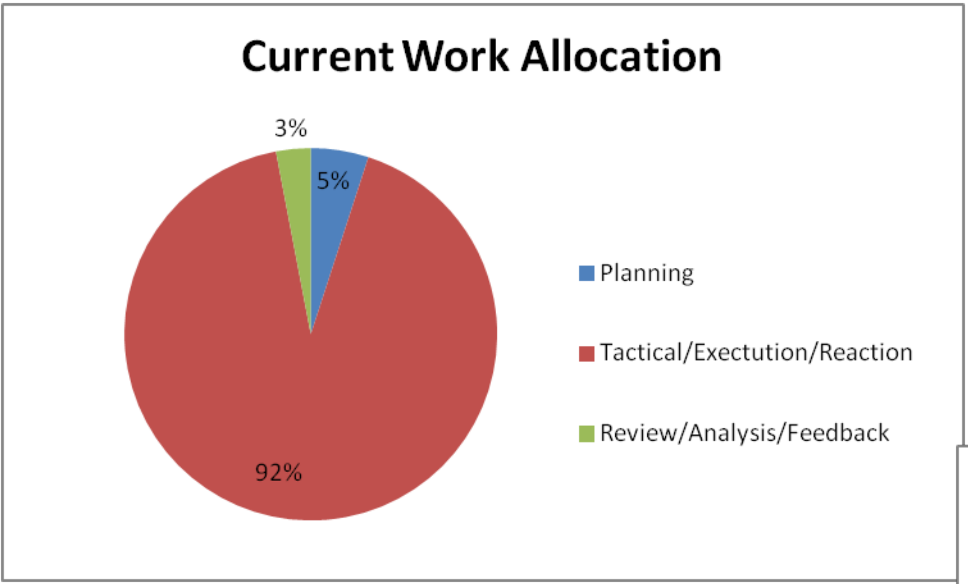
What is it?			Where is it located?				What skills are necessary and what type of data is it?							What does it serve?		
TFM Tool/Program		Type	TMU	ATCSCC	Control Room	Office	Constant vigilance	Heightens awareness	Need to interpret	Analysis	Pre-planning	Absolute	Uncertainty	Arrivals	Departures	Enroute
		TFMS														
* Airport Arrival Rate Tool	AAR/ADR	TFMS	TMU					Y			Y	Y		Y	Y	
Airport Demand Chart	ADC	TFMS	TMU	ATCSCC	Control Room					Y		Y		Y		
* Collaborative Routing Coordination Tool	CRCT	TFMS	TMU						Y							Y
Diversion Recovery Web Page	DRWP	TFMS	TMU	ATCSCC						Y		Y				
* Departure Spacing Program	DSP	TFMS	TMU				Y	Y					Y		Y	Y
Coded Departure Routes	CDR'S	TFMS	TMU	ATCSCC	Control Room			Y			Y	Y			Y	Y
Flow Evaluation Area/Flow Constraint Area	FEA/FCA	TFMS	TMU	ATCSCC	Control Room				Y		Y		Y			Y
Flight Schedule Analyzer	FSA	OIS	TMU	ATCSCC										Y		
Flight Schedule Monitor	FSM	TFMS	TMU	ATCSCC	Control Room	Office	Y	Y	Y	Y	Y		Y	Y		
Airspace Flow Program	AFP	TFMS	TMU	ATCSCC	Control Room	Office	Y	Y	Y	Y	Y		Y			Y
Unified Delay Program - (UDP/GDP)	UDP	TFMS	TMU	ATCSCC	Control Room		Y	Y	Y		Y		Y	Y		Y
Intergrated Program Modeling (IPM)	FSM	TFMS	TMU	ATCSCC				Y	Y	Y	Y		Y	y		y
Monitor Alert	MA	TFMS	TMU	ATCSCC	Control Room	Office		Y	Y				Y			Y
National Traffic Management log	NTML	TFMS	TMU	ATCSCC		Office	Y				Y	Y		Y	Y	Y
Route Management Tool	RMT	OIS	TMU	ATCSCC		Office	Y					Y			Y	
Create ReRoute		TFMS	TMU	ATCSCC							Y	Y		y	y	y
ReRoute Monitor	RRMT	TFMS	TMU	ATCSCC	Control Room		y	Y	Y					y	y	y
Runway Visual Range	RVR	OIS	TMU	ATCSCC	Control Room			Y	Y				Y	Y		
Special Use Aispace Management System	SAMS	TFMS	TMU	ATCSCC					Y		Y	Y				Y
Spacing Efficiency Tool	SET	TFMS	TMU		Control Room					Y				Y		
Strategic Planning Telcon	SPT	TFMS	TMU	ATCSCC				Y			Y	Y				
Traffic Situation Display	TSD	TFMS	TMU	ATCSCC	Control Room	Office		Y	Y			Y		Y	Y	Y
		TBFM														
* Adjacent Center Metering	ACM	TBFM	TMU		Control Room		Y		Y				Y	Y		Y
Enhanced Departure Capability	EDC	TBFM	TMU				Y		Y				Y		Y	
Time Based Flow Mangement	TBFM	TBFM	TMU	ATCSCC			Y	Y	Y					Y		Y
Traffic Management Advisor	TMA	TBFM	TMU	ATCSCC	Control Room		Y		Y				Y	Y		Y
		Weather Products														
Aviation Impact Guidance for Convective Weather	AIGCW	Weather Products	TMU	ATCSCC	Control Room			Y	Y	Y	Y		Y			Y
Collablorative Convective Forecast Product	CCFP	Weather Products	TMU	ATCSCC	Control Room	Office		Y						Y	Y	Y
Corridor Integrated Weather System	CIWS	Weather Products	TMU	ATCSCC	Control Room	Office		Y	Y	Y			Y	Y	Y	Y
Consolidated Storm Prediction for Aviation	CoSPA	Weather Products	TMU	ATCSCC	Control Room			Y	Y	Y			Y	Y	Y	Y
Extended Convective Forecast Product	ECFP	Weather Products	TMU	ATCSCC	Control Room		Y	Y	Y		Y					Y
Integrated Terminal Weather System	ITWS	Weather Products	TMU		Control Room			Y	Y					Y	Y	
Localized Aviation MOS Product	LAMP	Weather Products	TMU	ATCSCC	Control Room			Y						Y	Y	Y
Route Availability Prediction Tool	RAPT	Weather Products	TMU	ATCSCC	Control Room			Y	Y	Y			Y		Y	Y
Weather and Radar Processor	WARP	Weather Products	TMU		Control Room			Y						Y	Y	Y
		Surface Mangement														
* AeroBahn	AeroBahn	Surface Mangement	TMU		Control Room			Y	Y					Y	Y	
* Airport Resource Mangement Tool	ARMT	Surface Mangement	TMU		Control Room		Y								Y	
Airport Surface Detection Equipment	ASDE-X	Surface Mangement	TMU		Control Room			Y	Y					Y	Y	
Integrated Departure Route Planning	IDRP	Surface Mangement	TMU		Control Room		Y		Y						Y	
* Surface Decision Support System	SDSS	Surface Mangement	TMU		Control Room			Y							Y	Y
		Status Displays														
Enroute Information Display System	ERIDS	Status Displays	TMU		Control Room			Y				Y		Y	Y	Y
Enhanced Status Information System	ESIS	Status Displays	TMU		Control Room			Y				Y		Y	Y	Y
Information Display System	IDS	Status Displays	TMU		Control Room			Y				Y		Y	Y	Y
Operational Information System	OIS	Status Displays	TMU	ATCSCC	Control Room	Office		Y		Y		Y		Y	Y	Y
Radar ARTS Color Display	RACD	Status Displays	TMU		Control Room		Y									
		Analysis														
Comprehensive Electronic Data Analysis and Reporting	CEDAR	Analysis	TMU	ATCSCC	Control Room	Office				Y				Y	Y	Y
Reroute Impact Assessment	RRIA	Analysis	TMU	ATCSCC						Y				y	y	Y
Integrated Reporting Information System	IRIS	Analysis	TMU	ATCSCC		Office				Y						Y
Integrated Collaborative Rerouting	ICR	Analysis	TMU	ATCSCC						Y						Y
Performance Data Analysis and Reporting System	PDARS	Analysis	TMU	ATCSCC		Office				Y						
Spacing Over and Above Required	SOAR	Analysis	TMU			Office				Y				Y		

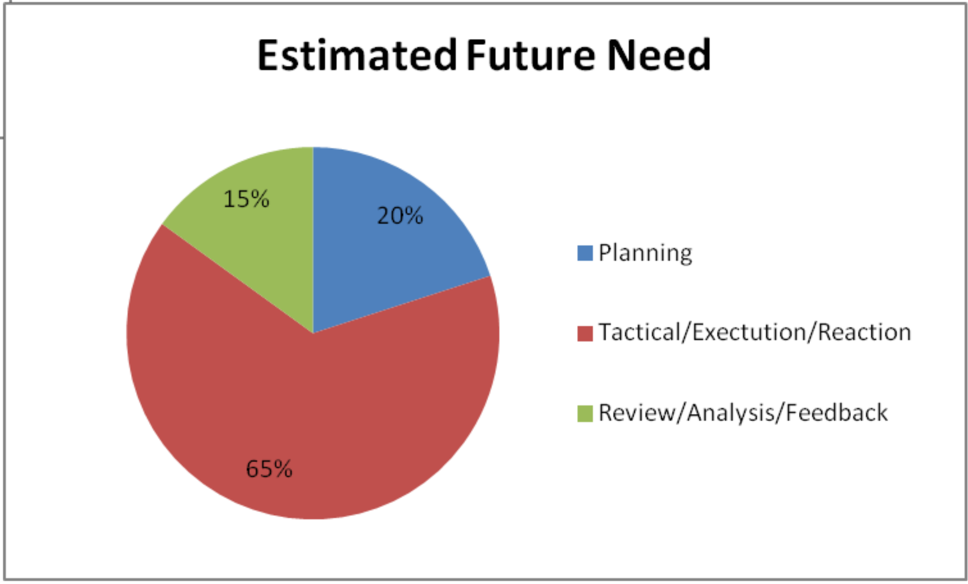
ZBW Metering Position

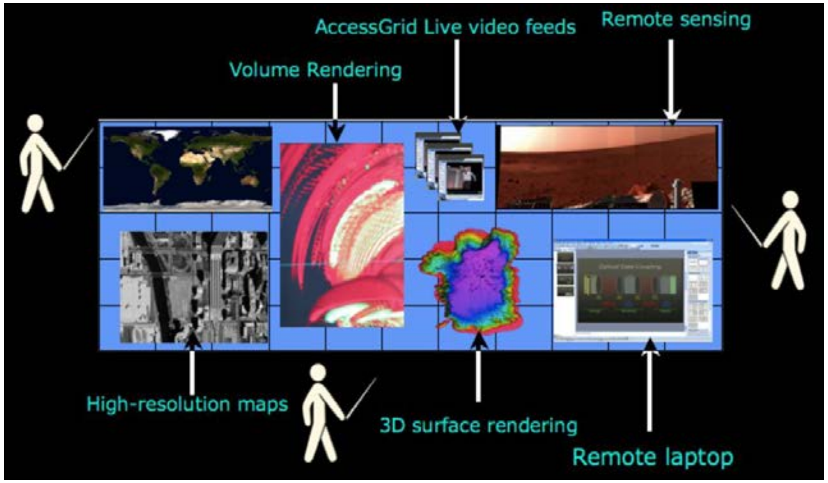



Traffic Density
Airspace Use
Workforce Transformation
Weather Benefits
Capacity Distribution
Delay Management
Technology
Human Factors
Training

How do we keep up with technological evolution?






AccessGrid Live video feeds
Remote sensing
Volume Rendering
High-resolution maps
3D surface rendering
Remote laptop


Traffic Density
Airspace Use
Workforce
Transformation
Weather
Benefits
Capacity
Distribution
Delay
Management
Technology
Human
Factors
Training