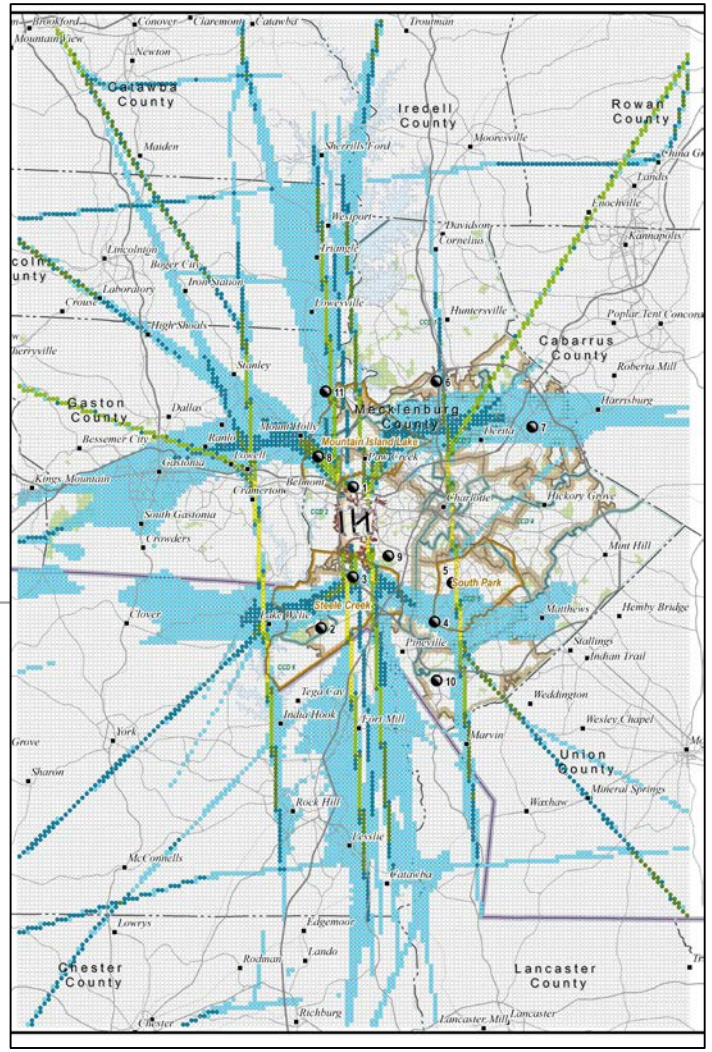
ACR Recommendations Analyses and Requests:

- *2018 Baseline with Expanded Grid*
- *6,000-foot Minimum Altitude on Arrivals Downwind*
- *Alternating Downwind Altitudes*
- *Investigation of FAA Press Release on Aircraft Turns above 3,000 to 6,000 Feet*
- *Altitude-Based Turn Recommendation*
- *Additional Review of Collective Analyses Groupings*

For ACR Review, Understanding, and Discussion

December 18, 2019

ACR Recommendation: 2018 Baseline with Expanded Grid



Request of the ACR at the

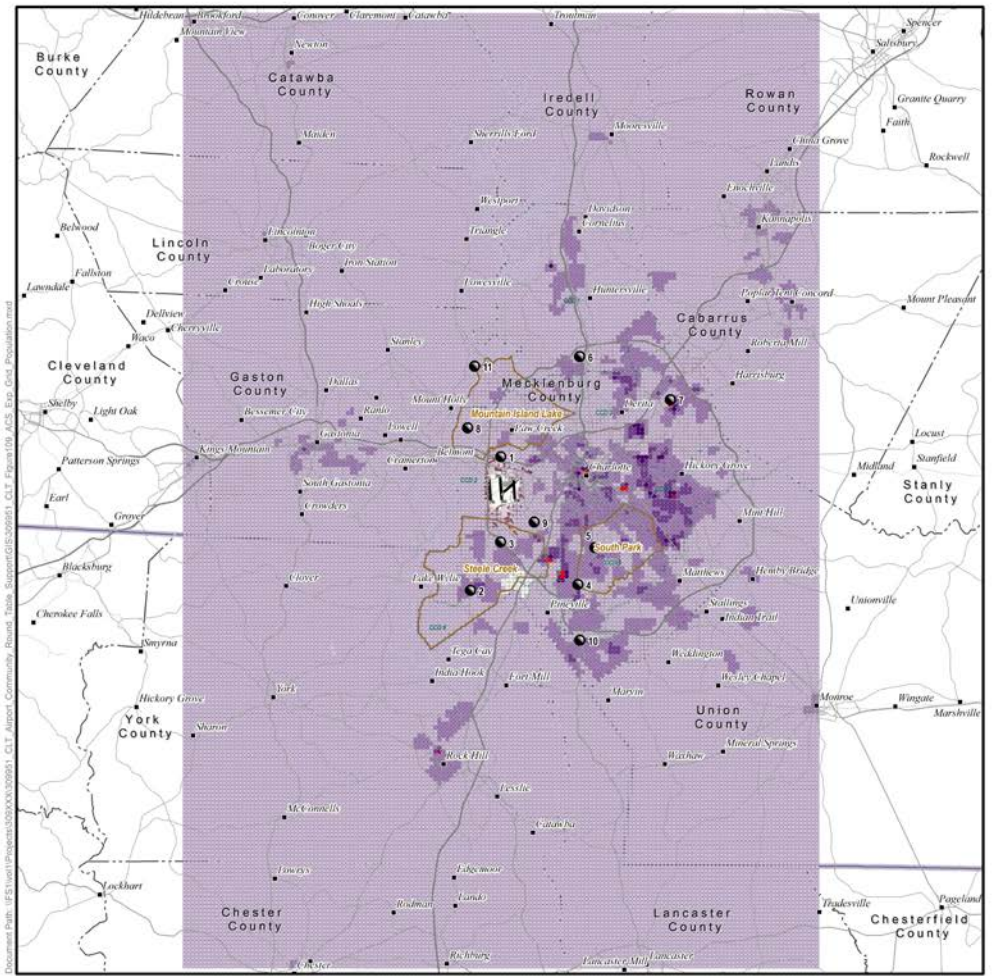
July 2019 ACR meeting

ACR Slate Recommendation–
2018 Baseline with Expanded Analysis Grid

- ACR requested expansion of analysis grid area at July 2019 ACR meeting
- Expanded grid was presented at August 2019 ACR meeting and endorsed by ACR for cumulative analysis
  - Intended to present changes in aircraft noise and overflights at greater distances from the airport, particularly north and south of the airport
  - ACR requested existing slate measures and the 2018 baseline be analyzed relative to the expanded grid
- Following slides presents the expanded analysis grid with:
  - 2017 American Community Survey (ACS) population data (replaces the 2010 U.S. Census data)
  - 2018 Baseline with number of average annual overflights and
  - 2018 Baseline with number of average daily noise events above 70 dB (N70)

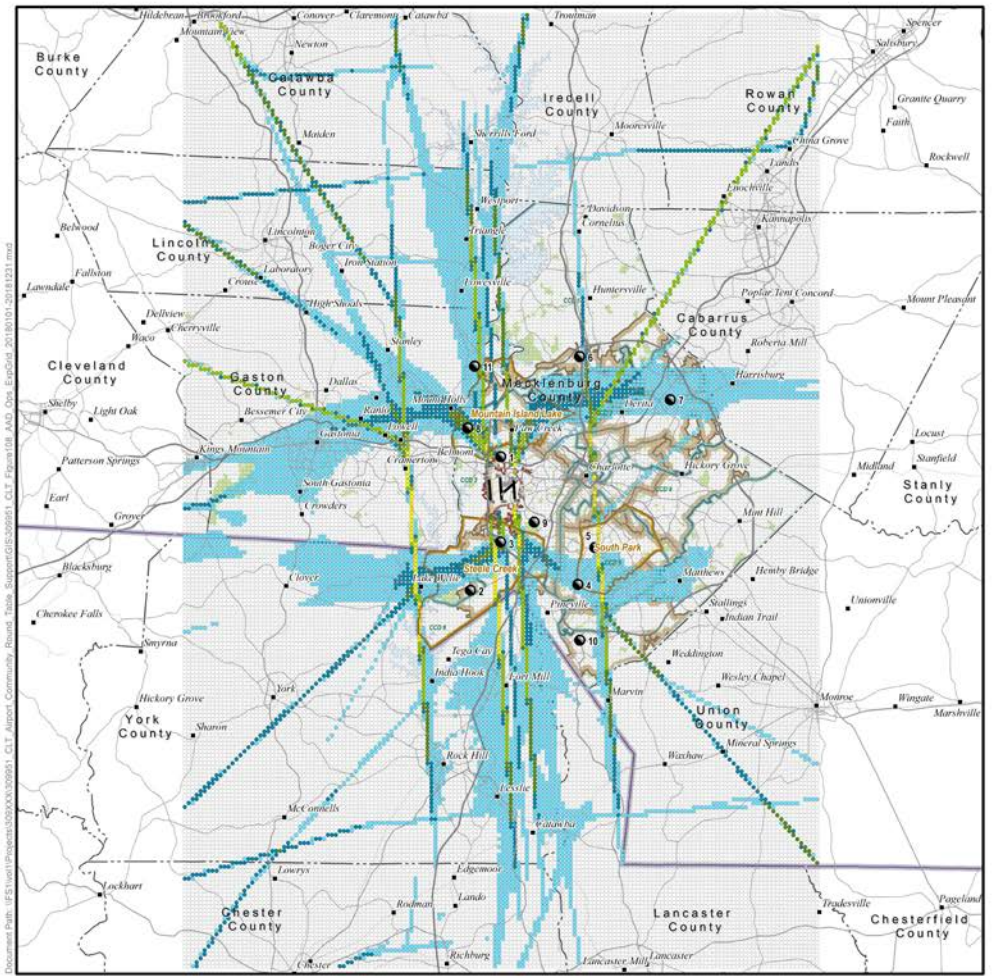
2017 American Community Survey (ACS) Population Levels at Expanded Analysis Grid Points

Population Interval	Count of Grid Points
0	37
1-200	35,795
201-400	2,143
401-600	277
601-800	37
801-1000	4
Greater than 1,000	8
Total	38,301
Total Grid Population	2,183,561



Annual Average Day Aircraft Overflights Analysis: 2018 Baseline Operations

Overflight Interval (Operations)	Count of Grid Points	Count of Population
Less than 5	30,442	1,565,736
6-15	6,713	452,644
16-30	1,157	81,555
31-60	440	31,991
61-120	434	37,908
121-240	115	13,727
241-360	0	0
Greater than 360	0	0
Total	38,301	2,183,561



CLT CHARLOTTE DOUGLAS INTERNATIONAL AIRPORT

Average Annual Day Operations Grid Analysis
January 1, 2018 through December 31, 2018
CLT Baseline Operations

Runway
Airport Boundary (Approximate)

Average Annual Day Operations
- <= 5
- 6 - 15
- 16 - 30
- 31 - 60
- 61 - 120
- 121 - 240
- 241 - 360
- >360

State Boundary
County Boundary
Highway
Minor Roads
Major Roads
Railroad
Charlotte Regions
City Council District Boundaries
County Commission Districts
Water / Stream
Open Space

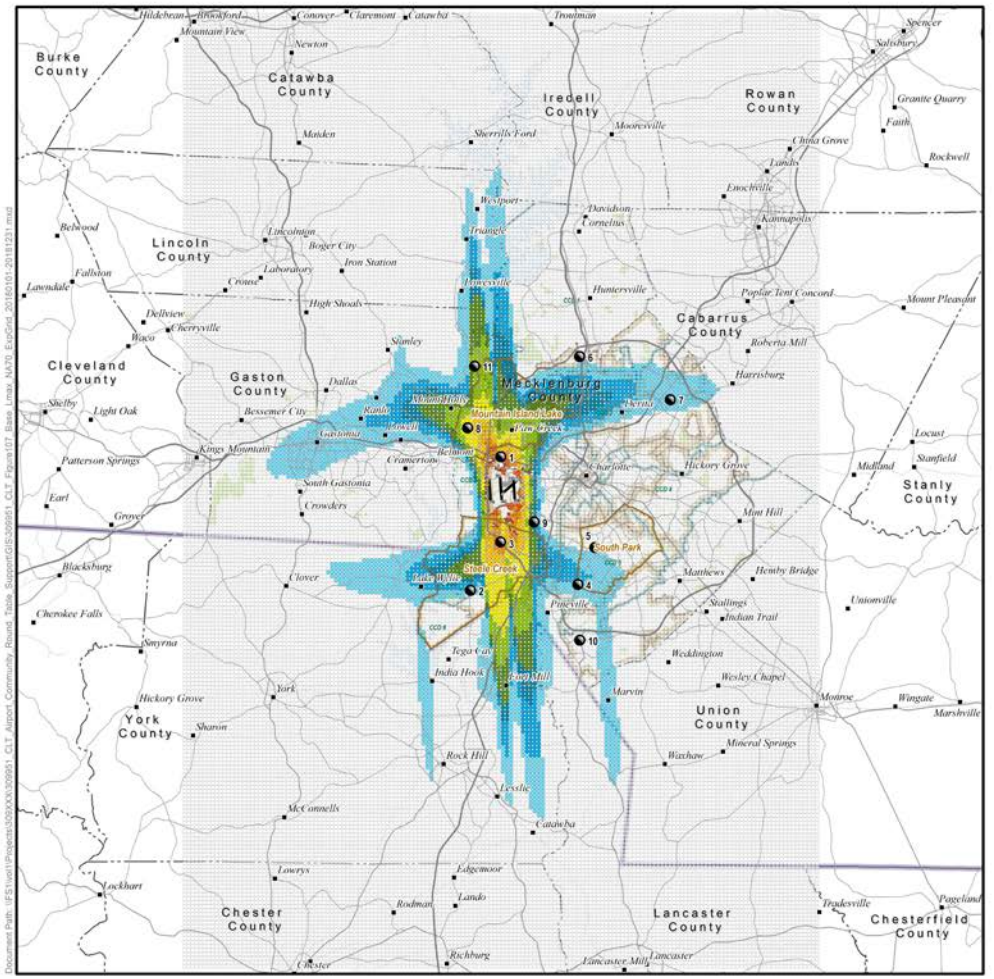
Landmark Locations
1 West Mecklenburg High
2 Southwest Middle School
3 Olympic Community High School
4 Quail Hollow Middle School
5 South Park Mall
6 NorthLake Mall
7 UNCC
8 US Whitewater Center
9 Renaissance Park
10 Ballantyne
11 Mountain Island Lake

Data Source: Mecklenberg County GIS, November 2018, (Parks, Community Points, Lakes, Ponds, Roads); Gaston County GIS, November 2018, (Parks, Community Points); York County GIS, March 2019, (Parks, Community Points); CLT, March 2019, (County Boundary, City Boundary, Charlotte Regions)

0 5 10 Nautical Miles

Number of Noise Events Above 70 dB (N70) Analysis: 2018 Baseline Operations

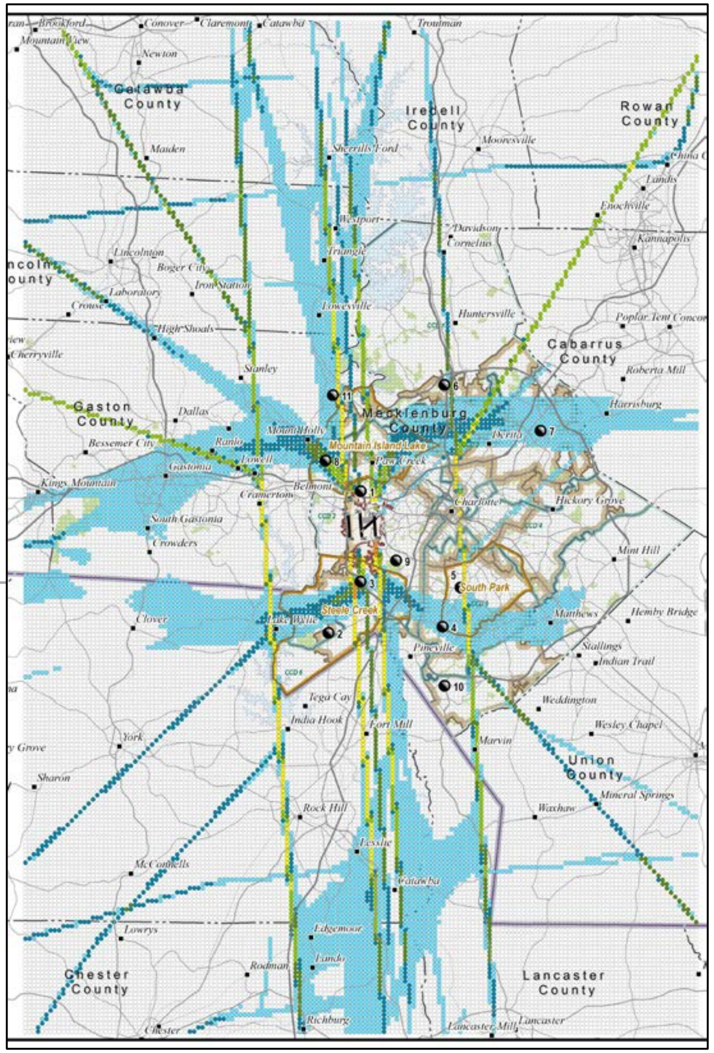
N70 Interval (Events)	Count of Grid Points	Count of Population
25 or Less	33,865	1,688,861
26-50	2,217	252,854
51-75	660	78,199
76-100	396	40,312
101-150	418	45,668
151-200	294	31,313
201-300	219	26,463
301-400	147	15,057
401-500	68	4,210
Greater than 500	17	624
Total	38,301	2,183,561



ACR Slate Recommendation Analysis: 6,000-foot Minimum Altitude on Arrivals Downwind

Request of the ACR at the

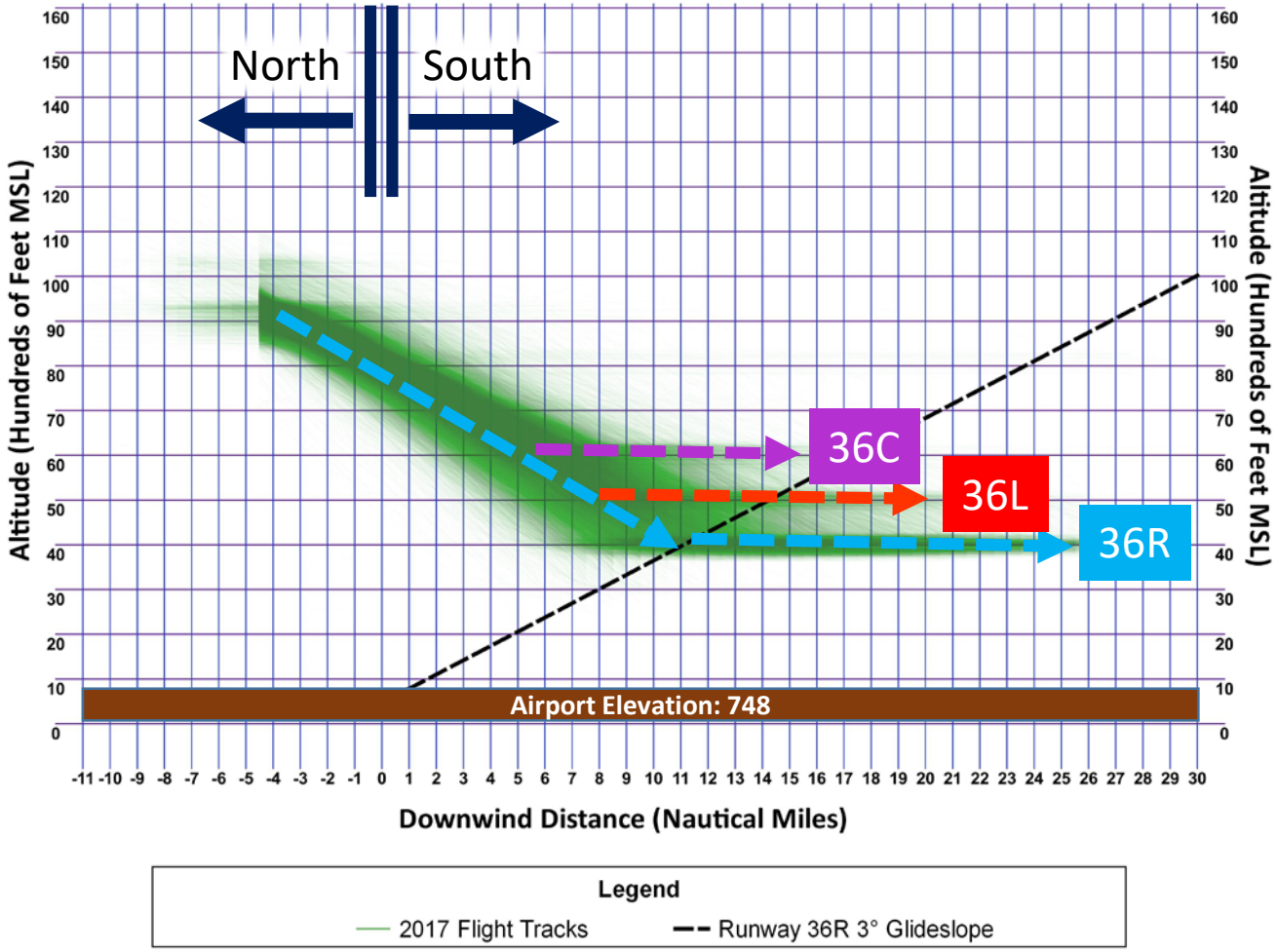
October 2019 ACR meeting



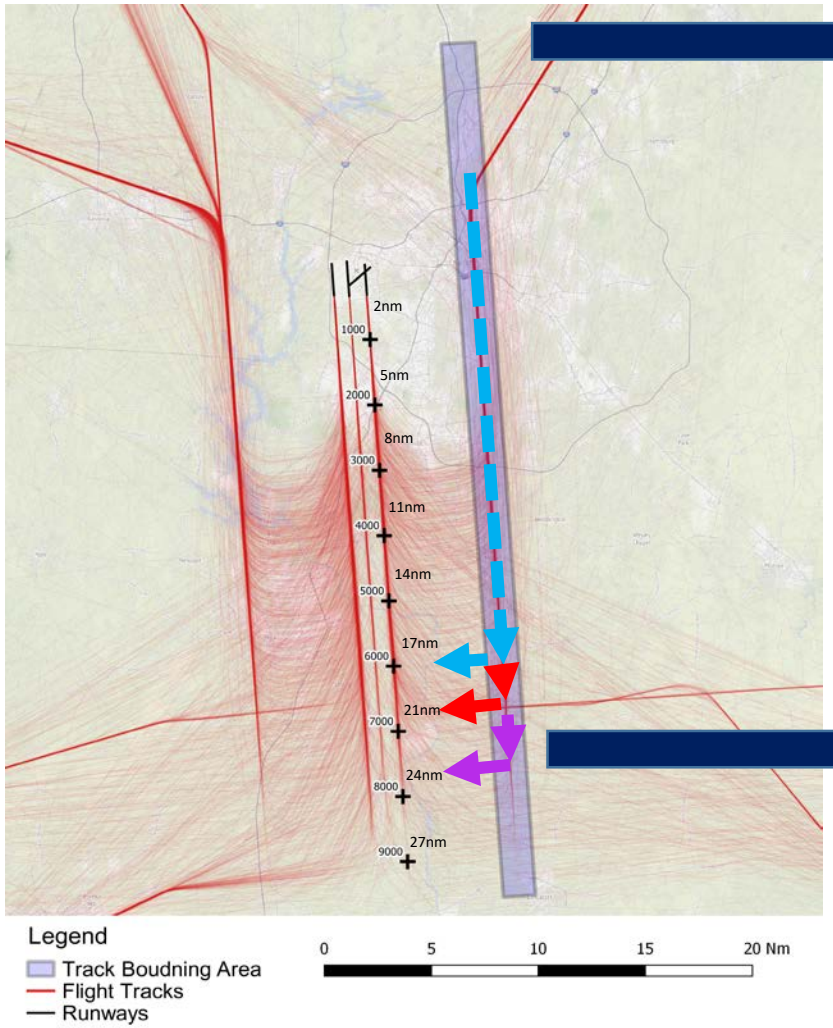
ACR Slate Recommendation Analysis: 6,000-foot Minimum Altitude on Arrivals Downwind

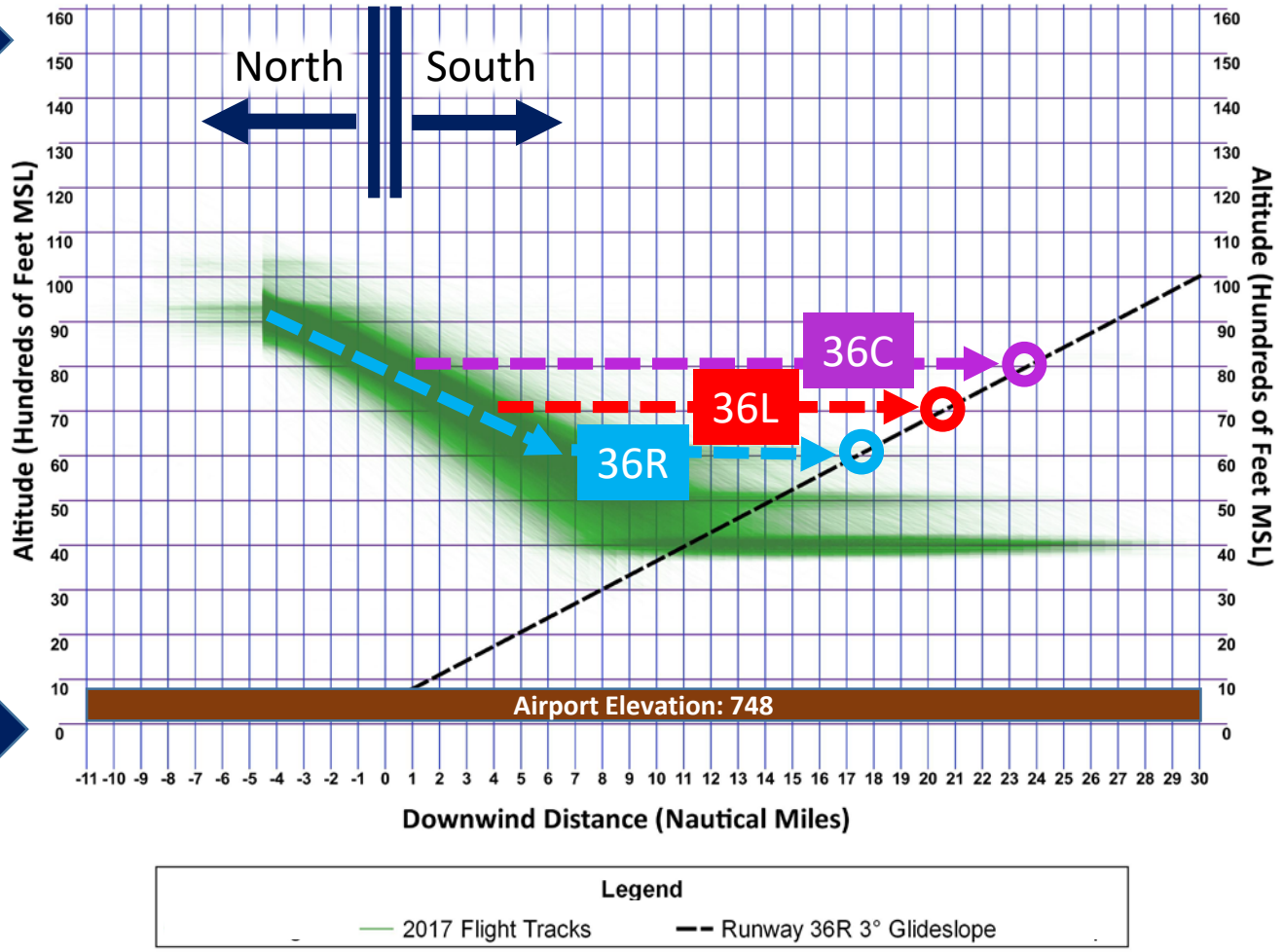
- HMMH presented initial analysis of increasing/maintaining aircraft altitudes on the arrival downwind of at least 6,000 feet at the November 2019 ACR meeting
- Modified calendar year 2018 aircraft arrivals so that aircraft would maintain altitudes of at least 6,000 feet on downwind based on the following:
  - North Flow:
    - 36L: 7,000 feet
    - 36C: 8,000 feet
    - 36R: 6,000 feet
  - South Flow:
    - 18L: 6,000 feet
    - 18C: 8,000 feet
    - 18R: 7,000 feet
- Altitudes chosen based on requirements to maintain aircraft separation as aircraft turn on to the final approach for parallel runways consistent with how aircraft are turned on to the final approach to maintain separation today

ACR Slate Recommendation Analysis: 6,000-foot Minimum Altitude on Arrivals Downwind



ACR Slate Recommendation Analysis:
6,000-foot Minimum Altitude on Arrivals Downwind



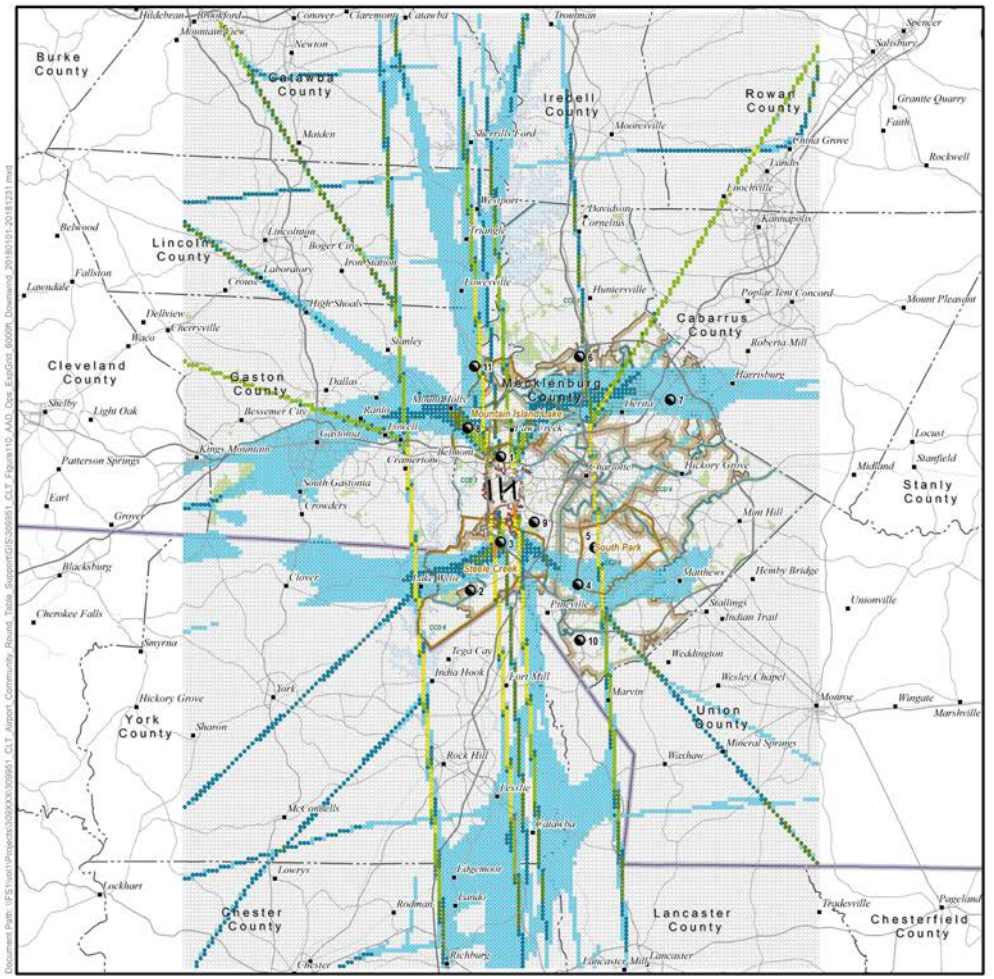


ACR Slate Recommendation Analysis: 6,000-foot Minimum Altitude on Arrivals Downwind

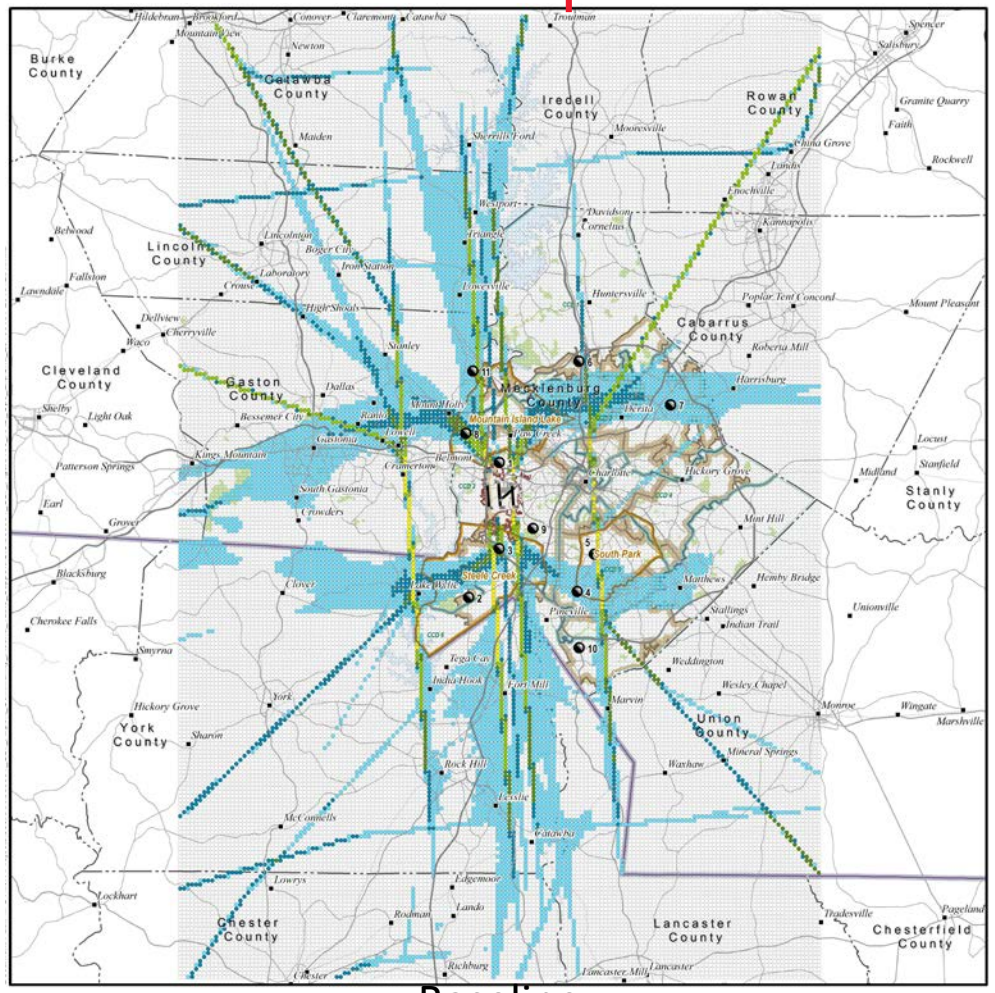
- Compared the modified results with the 2018 baseline results at each of the grid points (including population estimates at each grid point) in terms of:
  - Number of annual-average overflights
  - Number of average daily noise events above 70 dB (N70)
- Results are presented on the expanded grid and utilize updated 2017 ACS population data

Annual Average Day Aircraft Overflights Analysis: 2018 Operations with 6,000-foot Minimum Altitude on Arrivals Downwind

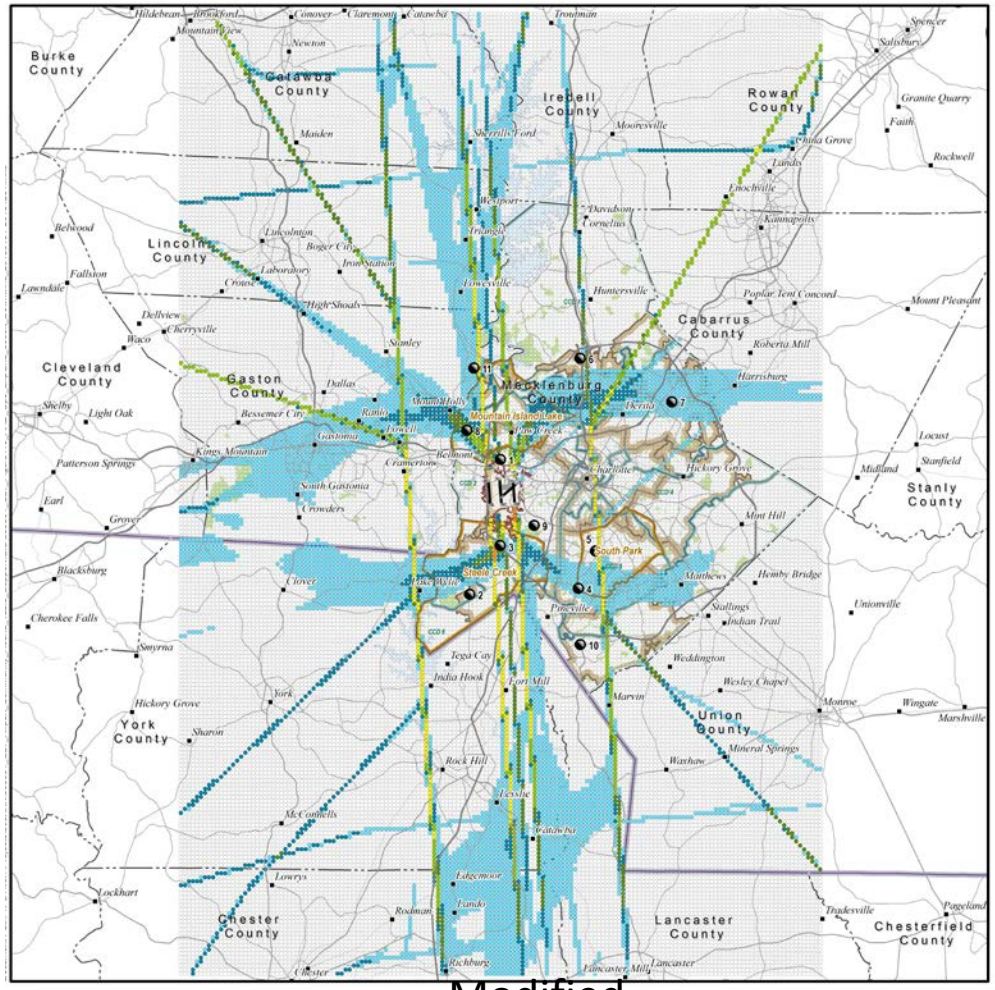
Overflight Interval (Operations)	Count of Grid Points	Count of Population
Less than 5	30,498	1,642,394
6-15	5,344	370,538
16-30	1,116	74,134
31-60	572	33,027
61-120	452	31,898
121-240	309	30,667
241-360	10	903
Greater than 360	0	0
Total	38,301	2,183,561



Annual Average Day Aircraft Overflights Analysis: 2018 Operations with 6,000-foot Minimum Altitude on Arrivals Downwind Compared to Baseline



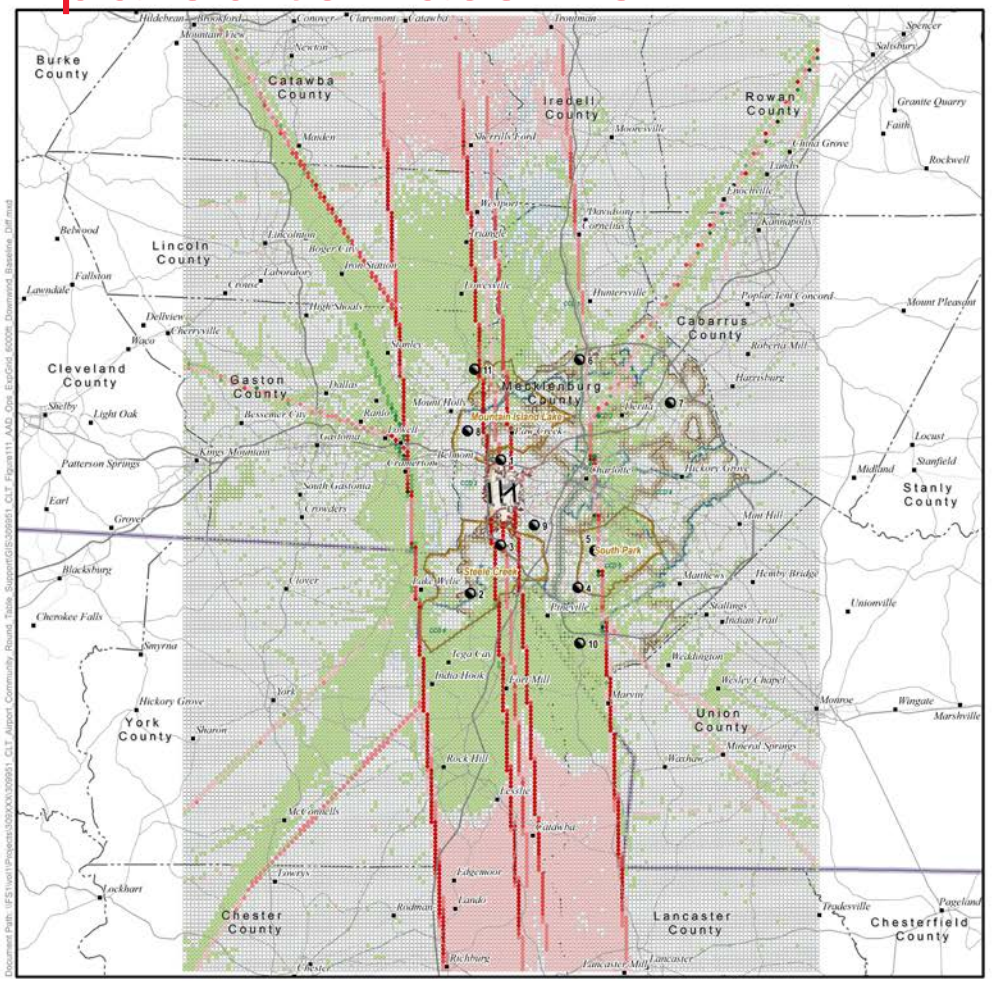
Baseline

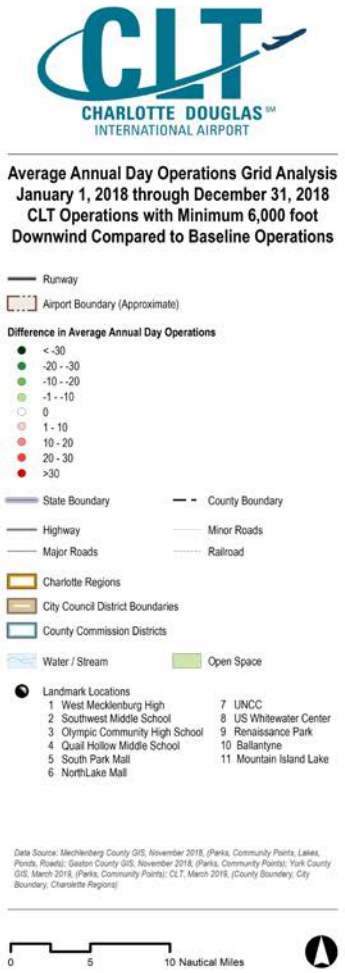


Modified

Annual Average Day Aircraft Overflights Analysis: Difference – 2018 Operations with 6,000-foot Minimum Altitude on Arrivals Downwind Compared to Baseline

Overflight Interval (Operations)	Count of Grid Points / % Change	Count of Population / % Change
Less than -30	11 / 0.0%	1,784 / 0.1%
-30 to -20	22 / 0.1%	2,038 / 0.1%
-20 to -10	65 / 0.2%	4,061 / 0.2%
-10 to -1	2,780 / 7.3%	217,728 / 10.0%
-1 to 1	30,288 / 79.1%	1,775,473 / 81.3%
1 to 10	3,842 / 10.0%	107,142 / 4.9%
10 to 20	467 / 1.2%	27,860 / 1.3%
20 to 30	298 / 0.8%	14,259 / 0.7%
Greater Than 30	528 / 1.4%	33,216 / 1.5%
Total	38,301 / 100.0%	2,183,561 / 100.0%

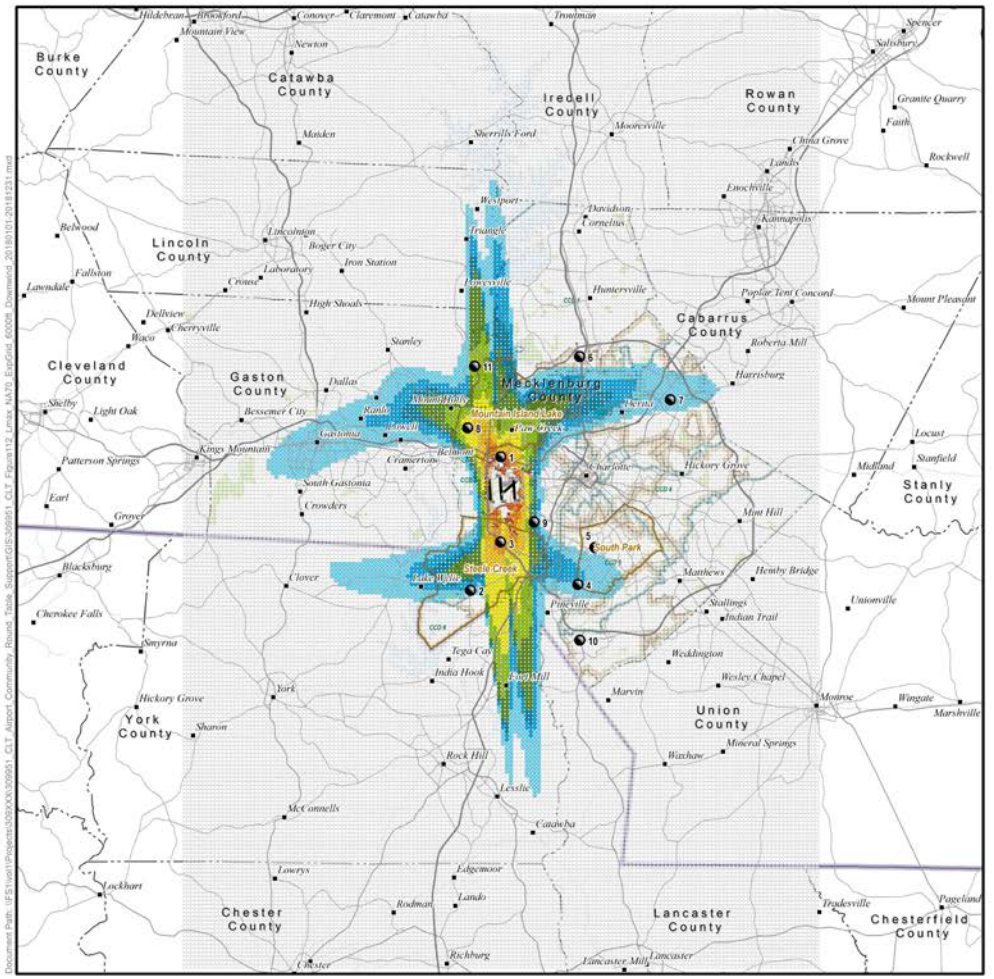




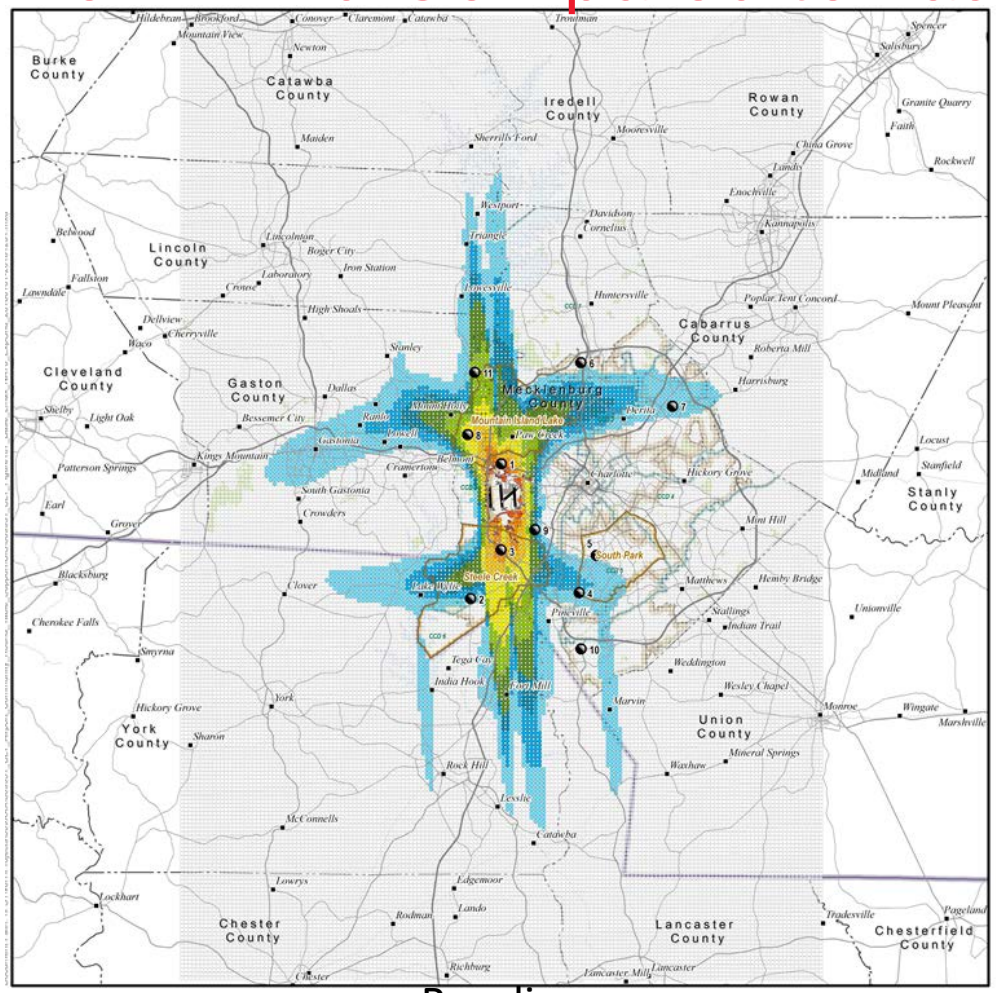
- **2,878 Grid points (7.6%) / 225,611 people (10.4%) would experience reduced numbers of overflights with minimum 6,000 foot downwind alternative**
- **5,135 Grid points (13.4%) / 182,477 people (8.4%) would experience increased numbers of overflights with minimum 6,000 foot downwind alternative**

Number of Noise Events Above 70 dB (N70) Analysis: 2018 Operations with 6,000-foot Minimum Altitude on Arrivals Downwind

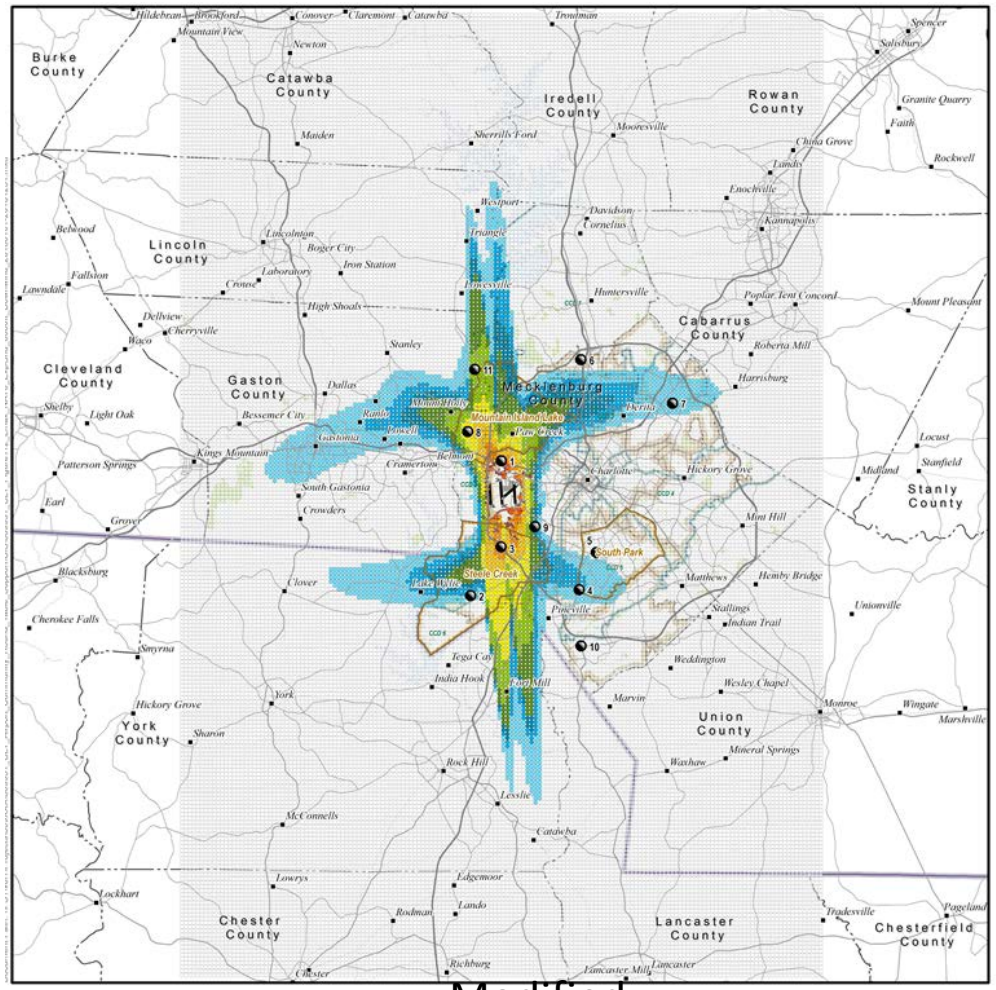
N70 Interval (Events)	Count of Grid Points	Count of Population
25 or Less	34,433	1,740,492
26-50	1,667	196,138
51-75	606	76,884
76-100	372	40,602
101-150	437	47,486
151-200	310	33,850
201-300	241	25,032
301-400	142	16,297
401-500	69	5,671
Greater than 500	24	1,109
Total	38,301	2,183,561



Annual Average Day Aircraft Overflights Analysis: 2018 Operations with 6,000-foot Minimum Altitude on Arrivals Downwind Compared to Baseline



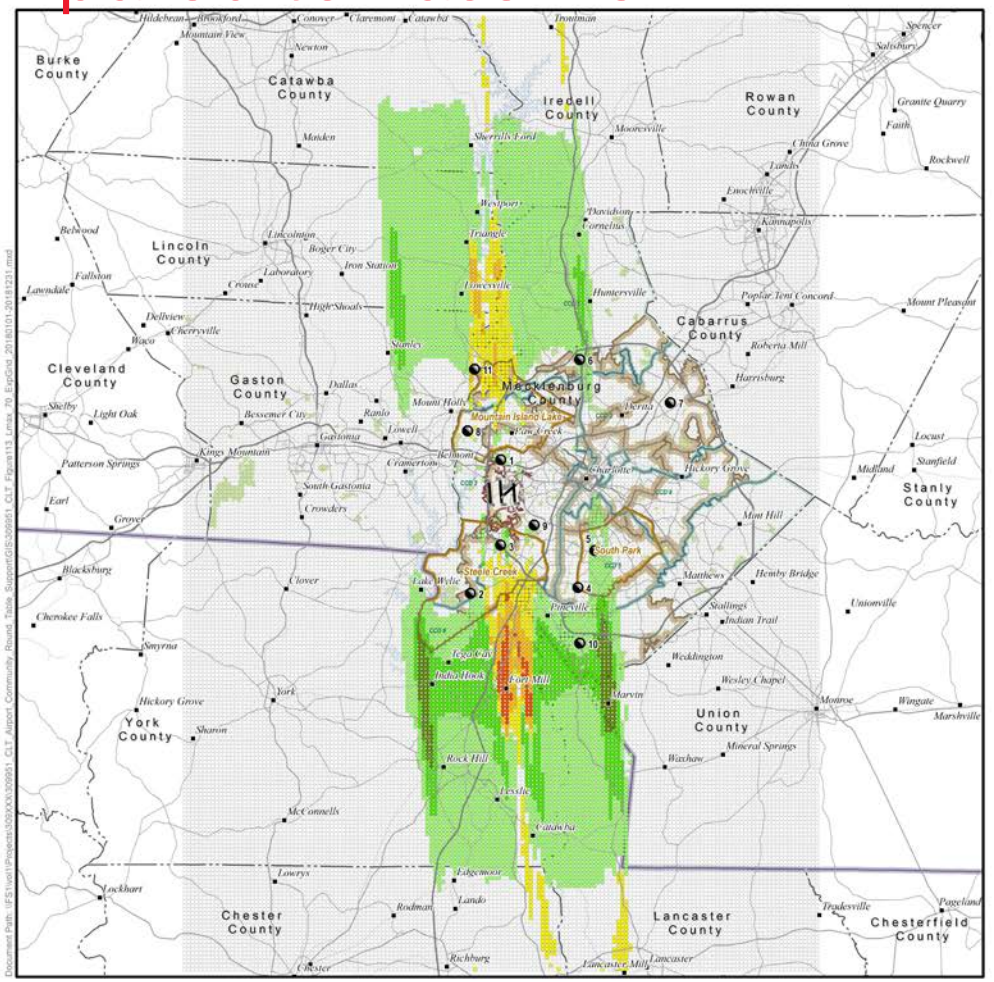
Baseline



Modified

Number of Noise Events Above 70 dB (N70) Analysis: Difference – 2018 Operations with 6,000-foot Minimum Altitude on Arrivals Downwind Compared to Baseline

N70 Difference Interval (Events)	Count of Grid Points / % Change	Count of Population / % Change
Less than -75	0 / 0.0%	0 / 0.0%
-75 to -25	171 / 0.4%	24,891 / 1.1%
-25 to -10	1,026 / 2.7%	104,983 / 4.8%
-10 to -1	5,050 / 13.2%	306,444 / 14.0%
-1 to 1	31,020 / 81.0%	1,687,147 / 77.3%
1 to 10	746 / 1.9%	39,856 / 1.8%
10 to 25	203 / 0.5%	14,309 / 0.7%
25 to 75	85 / 0.2%	5,931 / 0.3%
Greater than 75	0 / 0.0%	0 / 0.0%
Total	38,301 / 100.0%	2,183,561 / 100.0%



CLT CHARLOTTE DOUGLAS INTERNATIONAL AIRPORT

Number Above Lmax 70 Grid Analysis
January 1, 2018 through December 31, 2018
CLT Operations with Minimum 6,000 foot Downwind Compared to Baseline Operations

Runway
Airport Boundary (Approximate)

Lmax Difference Grid
- -75+
- -25 to -75
- -10 to -25
- -1 to -10
- -1 to 1 (No Color)
- 1 to 10
- 10 to 25
- 25 to 75
- 75+

State Boundary
County Boundary
Highway
Minor Roads
Major Roads
Railroad
Charlotte Regions
City Council District Boundaries
County Commission Districts
Water / Stream
Open Space

Landmark Locations
1 West Mecklenburg High
2 Southwest Middle School
3 Olympic Community High School
4 Quail Hollow Middle School
5 South Park Mall
6 NorthLake Mall
7 UNCC
8 US Whitewater Center
9 Renaissance Park
10 Ballantyne
11 Mountain Island Lake

Data Source: Mecklenberg County GIS, November 2018, (Parks, Community Points, Lakes, Ponds, Roads); Gaston County GIS, November 2018, (Parks, Community Points); York County GIS, March 2019, (Parks, Community Points); CLT, March 2019, (County Boundary, City Boundary, Charolette Regions)

0 5 10 Nautical Miles

- 6,247 Grid points (16.3%) / 436,318 people (19.9%) would experience fewer events above 70 dB Lmax with minimum 6,000 foot downwind alternative
- 1,034 Grid points (2.6%) / 60,096 people (2.8%) would experience more events above 70 dB Lmax with minimum 6,000 foot downwind alternative

ACR Slate Recommendation Analysis: 2018 Operations with 6,000-foot Minimum Altitude on Arrivals Downwind Observations

- Number of average daily overflights:
  - A greater number of grid points experienced an increase than decrease
  - More people experienced a decrease than an increase
- Number of noise events greater than 70 dB (N70)
  - A greater number of grid points and more people experienced a decrease than an increase
- Maintaining a minimum altitude of 6,000 feet on the downwind provides the greatest benefits for areas north and south of the airport between the extended runway centerlines and arrivals downwind, and disbenefit for areas north and south on runway centerline further away from the airport
- Potential noise increases in northern portions of the grid for the community of Mountain Island Lake
- Potential noise reductions in central portions of the grid for the community of South Park
- Potential noise increases in the central portions of the grid and reductions in the western portion of the grid for the community of Steele Creek
- May negatively effect operations throughput due to reduced flexibility to vector aircraft close to the airport
- Would, on average, increase flight miles

ACR Slate Recommendation Analysis: 6,000-foot Minimum Altitude on Arrivals Downwind Overall Analysis Considerations for the ACR

- Do the reported changes from the 2018 baseline to maintaining minimum 6,000-foot altitudes on the downwind meet the goals of the ACR?
- How does the potential negative effect on airport throughput and increase flight miles by having aircraft maintain minimum 6,000-foot altitudes on the arrivals downwind factor in to the ACR recommendations?
- Does the ACR want to recommend having aircraft maintain minimum 6,000-foot altitudes on the arrivals downwind for consideration of the final slate in the collective analysis?

ACR Request:
Alternating Downwind Altitudes

Request of the ACR at the

November 2019 ACR meeting

ACR Request:
Alternating Downwind Altitudes Overview

- ACR requested at November meeting to see if it would be possible/feasible to rotate or alternate downwind altitudes between 4,000 and 6,000 feet
- Intent to minimize aircraft at 4,000 feet and maximize aircraft at 5,000 and 6,000 feet within the framework of existing altitudes used for the arrivals downwind
- Potential alternative to 6,000-foot minimum altitudes on arrivals downwind
- Today altitudes are assigned on the arrivals downwind as follows based on arrival runway:
  - North Flow:
    - 36L: 5,000 feet
    - 36C: 6,000 feet
    - 36R: 4,000 feet
  - South Flow:
    - 18L: 4,000 feet
    - 18C: 6,000 feet
    - 18R: 5,000 feet

ACR Request:
Alternating Downwind Altitudes Feasbility Analysis

- It is possible to rotate the assignment of the downwind altitudes, but altitudes would need to be alternated for all aircraft based on arrival runway
  - Not possible to alternate arrival altitudes on an aircraft-by-aircraft basis due to complexity of maintaining aircraft separation during turn on to the final approach for parallel runways
  - Altitudes would need to be rotated over an extended time period to ease controller workload and training, likely on an annual basis
- Altitudes could be alternated such that arrival aircraft to Runway 18L/36R could fly at 5,000 feet versus 4,000 feet today, and aircraft to Runway 18R/36L could fly at 4,000 feet versus 5,000 feet today
- Aircraft assigned to Runways 18C/36C would need to continue to remain at 6,000 feet
  - Allow for separation to be maintained between the outside parallel runways by having aircraft fly over the final approach courses of each
  - Flying below final approach courses of outside parallel runways would increase controller workload due to difficulty maintaining separation with descending approach aircraft

ACR Request:
Alternating Downwind Altitudes Considerations for the ACR

- Does the ACR want to add alternating downwind altitudes to the slate of ACR recommendations and ask HMMH to conduct the noise analyses?

CLT Request:
Review FAA Press Release on Aircraft Turns above 3,000 to 6,000 Feet on Departure

Request of the ACR at the

November 2019 ACR meeting

CLT Request:
Review FAA Press Release on Aircraft Turns above 3,000 to 6,000 Feet on Departure

- ACR requested investigation of the following statement from a press release in May 2016:

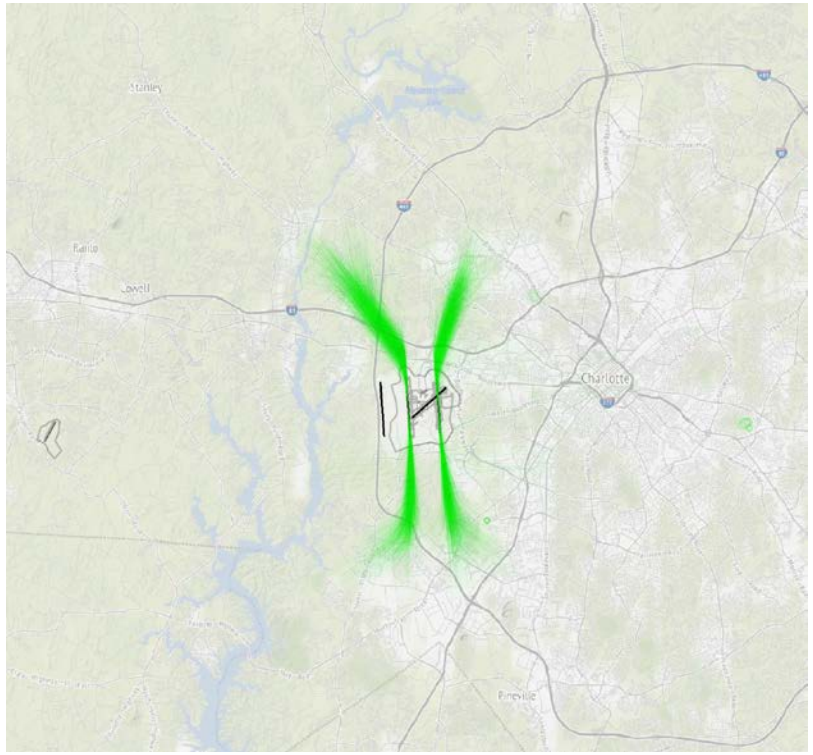
"They include three new Standard Instrument Departure procedures for flights heading to the northeast and southeast of the airport. The initial departure tracks are the same as aircraft fly today. However, the departure track splits into two different directions when the aircraft are at or above 3,000 to 6,000 feet giving air traffic controllers more options for directing flights. The third departure route combines two procedures into one."

- The full press release can be found at: https://airtrafficmanagement.keypublishing.com/2016/05/13/faa-to-brief-charlotte-on-metroplex-procedures/

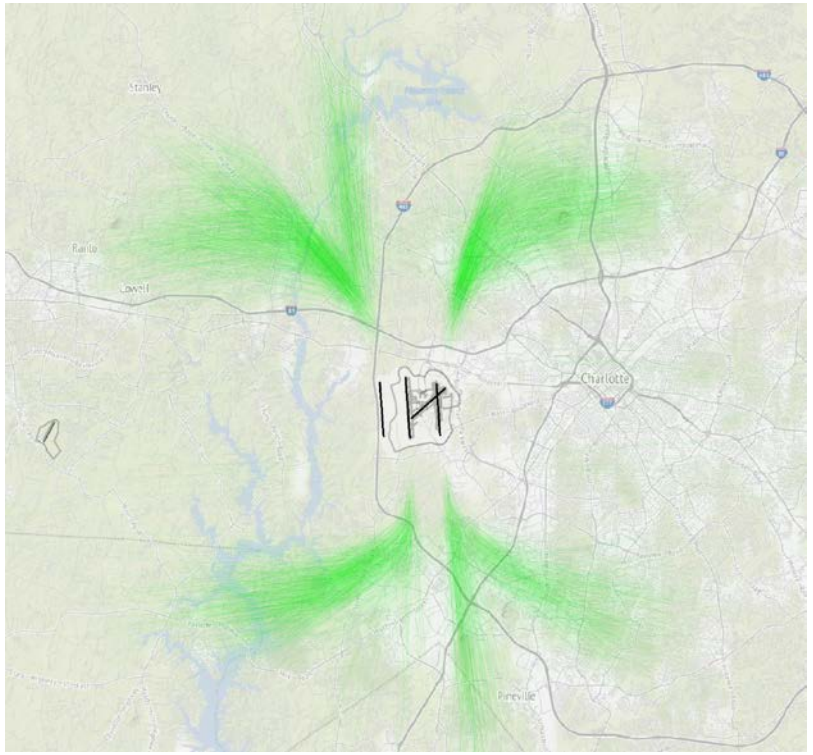
Analysis:
Review FAA Press Release on Aircraft Turns above 3,000 to 6,000 Feet on Departure

- HMMH reviewed radar data for randomized sample of calendar year 2018 departure operations to determine if aircraft are turning consistent with the FAA's May 2016 press release
- Filtered departure flight tracks from radar data based on following altitudes:
  - Surface to 3,000 feet
  - 3,000 feet to 6,000 feet
  - 6,000 feet to 18,000 feet

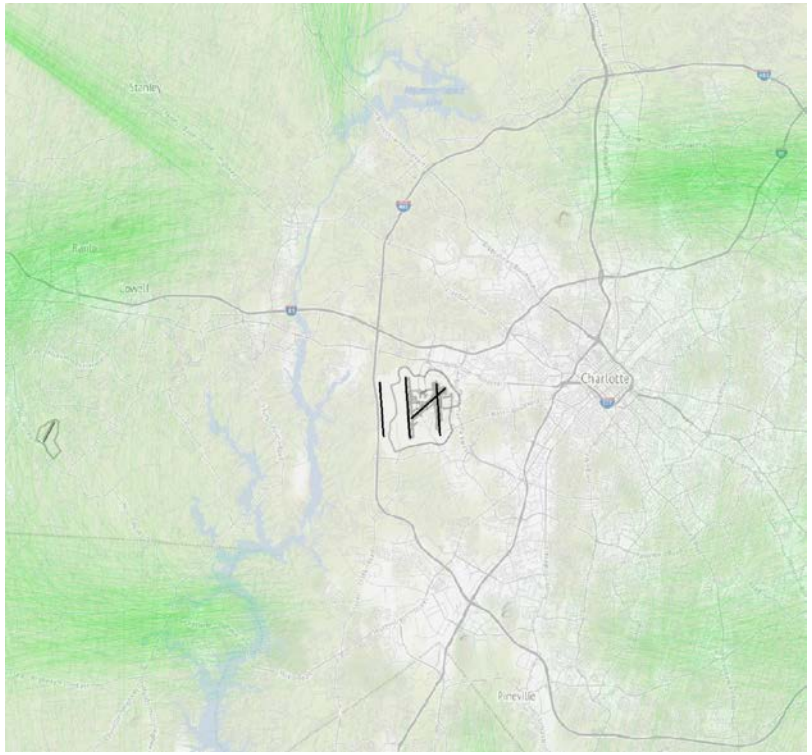
Analysis:
Investigation of FAA Initial Metroplex Plan



0-3,000 feet



3,000-6,000 feet



6,000-18,000 feet

Legend

Runways

Departures

Findings and Observations: Investigation of FAA Initial Metroplex Plan

- Most aircraft turn initially prior to reaching 3,000 feet
- Aircraft then subsequently turn a second time between 3,000 and 6,000 feet based assigned procedure into multiple different flows
- This is consistent with the FAA's press release from May 2016 but:
  - Statement could be easily interpreted such that it would be expected aircraft would turn initially at 3,000 to 6,000 feet
  - Could also be interpreted that no aircraft would turn below 3,000 feet
- Departure flight tracks are consistent with procedure designs as published in the CLT Optimization of Airspace and Procedures in the Metroplex (OAPM) Design Team Report and Environmental Assessment (EA)

ACR Request: Altitude-Based Turn Recommendation (departures)

Request of the ACR at the

November 2019 ACR meeting

ACR Request:
Altitude Based Turn Recommendation

- ACR requested HMMH review the altitude-based turns and recommend the altitude to model moving forward
- 2,000-foot turn altitude works the best for not infringing on the 4-mile divergence requirement as aircraft will turn closer to the airport
- 3,000-foot turn altitude will infringe on the 4-mile divergence requirement for many aircraft as most aircraft will not yet have turned prior to reaching 4-miles. This will result in a concentration of aircraft turning near the 4-mile point
- 2,500 feet represents a compromise between the 2,000 and 3,000 foot turn altitudes
  - Would work better than 3,000 feet in terms of not infringing on the 4-mile requirement as aircraft would turn closer to the airport than if turning at 3,000 feet
  - However, will still infringe more on the 4-mile requirement than using an altitude of 2,000 feet as some aircraft will not have turned prior to reaching 4 miles
  - Some concentration of flight tracks around 4-miles will occur due to aircraft not yet being at the required altitude and being forced to turn, but not as much as with a turn at 3,000 feet

ACR Request:
Altitude Based Turn Recommendation

- Turning altitude to model is a compromise:
  - The higher the altitude chosen for the turn the greater the chance departure aircraft will infringe on the 4-mile divergence requirement
  - A turn altitude of 2,500 feet would not infringe on the 4-mile requirement as much as 3,000 feet
  - More aircraft would violate the 4-mile restriction with a turn at 2,500 feet than if the 2,000 foot turn were used by virtue of the higher turning altitude
- ACR must determine if the benefits of having departure aircraft turn at an altitude of 2,500 feet and thus turning further from the airport outweighs the potential negative impacts of concentrating flight tracks around 4-miles due to aircraft infringing on the 4-mile divergence requirement

Collective Analyses Groupings

Continuation of discussion from October 2019 meeting

Potential/suggested collective groupings of ACR slate recommendations

ACR Collective Analysis Groupings: ACR Survey Results and HMMH Recommendations

- ACR was surveyed following November ACR meeting as to which collective groupings had the most interest from membership to analyze moving forward
- Based on survey results, ACR preferred the following four collective analysis groupings:
  - *Collective groupings #14, #15, #16 and #18*
- Independently, per request, HMMH further reviewed the collective groups for analyses and we recommend the following four groupings for ACR consideration:
  - *Collective groupings #13, #15, #18 and #19*

ACR Collective Analysis Groupings: ACR Survey Results and HMMH Recommendations

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- Based on survey results, ACR preferred the following four collective analysis groupings:
  - *Collective groupings #14, #15, #16 and #18*
- Independently, per request, HMMH further reviewed the collective groups for analyses and we recommend the following four groupings for ACR consideration:
  - *Collective groupings #13, #15, #18 and #19*
- A total of six collective groupings were recommended
- HMMH recommended at the November 2019 ACR to not include Noise Abatement Departure Profiles (NADP), Continuous Descent Arrivals (CDA), or alternating downwind rails in any of the collective analysis groupings

Six Collective Analysis Groupings: ACR Survey Results and HMMH Recommendations

- **Collective Grouping #13:** *Alternating downwind rails, altitude-based turns, change initial departure headings, and 6,000-foot downwind altitudes, and Continuous Descent Arrivals*
- **Collective Grouping #14:** *Alternating downwind rails, altitude-based turns, remove the two-mile restriction, change initial departure headings, 6,000-foot minimum downwind altitudes, and Continuous Descent Arrivals*
- **Collective Grouping #15:** *Alternating downwind rails, altitude-based turns, divergent departure headings, 6,000-foot minimum downwind altitudes, and Continuous Descent Arrivals*
- **Collective Grouping #16:** *Alternating downwind rails, altitude-based turns, remove the two-mile restriction, divergent departure headings, 6,000-foot minimum downwind altitudes, and Continuous Descent Arrivals*
- **Collective Grouping #18:** *Alternating downwind rails, divergent departure headings, removal of the 2-mile restriction, 6,000-foot downwind altitudes, and Continuous Descent Arrivals*
- **Collective Grouping #19:** *Alternating downwind rails, remove the two-mile restriction, change initial departure headings, and 6,000 foot downwind altitudes, and Continuous Descent Arrivals*

Six Collective Analysis Groupings: ACR Survey Results and HMMH Recommendations

- Collective Grouping #13: *~~Alternating downwind rails,~~ altitude-based turns, change initial departure headings, and 6,000-foot downwind altitudes~~, and Continuous Descent Arrivals~~*
- Collective Grouping #14: *~~Alternating downwind rails,~~ altitude-based turns, remove the two-mile restriction, change initial departure headings, 6,000-foot minimum downwind altitudes~~, and Continuous Descent Arrivals~~*
- Collective Grouping #15: *~~Alternating downwind rails,~~ altitude-based turns, divergent departure headings, 6,000-foot minimum downwind altitudes~~, and Continuous Descent Arrivals~~*
- Collective Grouping #16: *~~Alternating downwind rails,~~ altitude-based turns, remove the two-mile restriction, divergent departure headings, 6,000-foot minimum downwind altitudes~~, and Continuous Descent Arrivals~~*
- Collective Grouping #18: *~~Alternating downwind rails,~~ divergent departure headings, removal of the two-mile restriction, 6,000-foot downwind altitudes~~, and Continuous Descent Arrivals~~*
- Collective Grouping #19: *~~Alternating downwind rails,~~ remove the two-mile restriction, change initial departure headings, and 6,000 foot downwind altitudes~~, and Continuous Descent Arrivals~~*

Six Collective Analysis Groupings: ACR Survey Results and HMMH Recommendations

- Five (or 7) slate measures within the six collective groupings:
  - 6,000-foot minimum altitude on arrivals downwind – all 6 groupings
  - Altitude-based turns – groupings #13, #14, #15 and #16 (4 of 6)
  - Remove the two-mile restriction – groupings #14, #16, #18, and #19 (4 of 6)
  - Change initial departure heading – groupings #13, #14 and #19 (3 of 6)
  - Divergent departure headings – groupings #15, #16 and #18(3 of 6)
- Collective groupings #14 and #16 both contain four (or 6) of the five (or 7) slate measures contained within the six collective groupings
  - #14 includes change initial departure heading slate measure
  - #16 includes divergent departure headings slate measure
  - Collective groupings #13, #15, #18 and #19 are subsets of grouping #14 or #16

Six Collective Analysis Groupings: ACR Survey Results and HMMH Recommendations

- Based on the ACR member survey results, HMMH recommendations and analysis of both, HMMH now recommends the following two collective analysis:
  - **Collective Grouping #14:**
    ~~Alternating downwind rails~~, altitude-based turns, remove the two-mile restriction, change initial departure headings, 6,000-foot minimum downwind altitudes, and ~~Continuous Descent Arrivals~~
  - **Collective Grouping #16:**
    ~~Alternating downwind rails~~, altitude-based turns, remove the two-mile restriction, divergent departure headings, 6,000-foot minimum downwind altitudes, and ~~Continuous Descent Arrivals~~
- The difference between the two is the change in the initial departure heading vs. the implementation of divergent departure headings
- Together these two contain all the slate measures contained within the four collective groupings that resulted from the ACR member survey

Six Collective Analysis Groupings: ACR Survey Results and HMMH Recommendations

- Does the ACR members have the information required at this time to determine the collective groupings for HMMH to proceed with the analysis?
  - If yes, which collective grouping(s) do the ACR members wish to submit for analysis?
  - If not, please describe the additional information required.

Discussion

ACR Collective Analysis Groupings: Additional Discussion

- Collective Grouping #14: Altitude-based turns, change initial departure heading, remove 2-mile restriction, and 6,000 foot downwind altitudes
  - Pros:
    - Potential to better disperse departure turns based on turn altitude
    - Potential to turn departures closer to the airport
    - Potential to better disperse departures based on destination
    - Potential to reduce workload for air traffic controllers depending on procedure design
    - Ability to keep aircraft on downwind legs at higher altitudes
  - Cons:
    - Potential new communities exposed to departure noise
    - Lengthened arrivals downwind to overfly areas further north and south of airport
    - Reduced airport throughput for arrivals and potential to increase aircraft emissions and fuel burn

ACR Collective Analysis Groupings: Additional Discussion

- Collective Grouping #16: Altitude-based turns, divergent departure headings, remove 2-mile restriction, and 6,000 foot downwind altitudes
  - Pros:
    - Potential to delay and better disperse departure turns based altitude
    - Potential to turn departures closer to the airport
    - Potential to better disperse departures based on destination
    - Ability to keep aircraft on downwind legs at higher altitudes
  - Cons:
    - Potential new communities exposed to departure noise
    - Potential to decrease airport departure throughput for some headings due to longer time required for aircraft headings to diverge
    - Lengthened arrivals downwind to overfly areas further north and south of airport
    - Reduced airport throughput for arrivals and potential to increase aircraft emissions and fuel burn

ACR Collective Analysis Groupings: Additional Discussion

- Collective Grouping #13: Altitude-based turns, change initial departure headings, and 6,000 foot downwind altitudes
  - Pros:
    - Potential to delay and better disperse departure turns based on turn altitude
    - Potential to change areas overflown by departures
    - Ability to keep aircraft on arrivals downwind at higher altitudes
  - Cons:
    - Potential new communities exposed to departure noise
    - Lengthened arrivals downwind to overfly areas further north and south of airport
    - Reduced airport throughput for arrivals and departures and potential to increase aircraft emissions and fuel burn

ACR Collective Analysis Groupings: Additional Discussion

- Collective Grouping #15: Altitude-based turns, divergent departure headings, and 6,000 foot downwind altitudes
  - Pros:
    - Potential to delay and better disperse departure turns based on turn altitude
    - Potential to better disperse departures based on destination
    - Potential to change areas overflown by departures
    - Potential to reduce workload for air traffic controllers depending on procedure design
    - Ability to keep aircraft on arrivals downwind at higher altitudes
  - Cons:
    - Potential new communities exposed to departure noise
    - Lengthened arrival downwind to overfly areas further north and south of airport
    - Reduced airport throughput for arrivals and potential to increase aircraft emissions and fuel burn

ACR Collective Analysis Groupings: Additional Discussion

- Collective Grouping #18: Divergent departure headings, removal of the 2-mile restriction, and 6,000 foot downwind altitudes
  - Pros:
    - Potential to better disperse departures based on destination
    - Potential to turn aircraft closer to the airport
    - Increased airport departure throughput
    - Ability to keep aircraft on arrivals downwind at higher altitudes
  - Cons:
    - Potential new communities exposed to departure noise
    - Lengthened arrivals downwind to overfly areas further north and south of airport
    - Reduced airport throughput for arrivals and potential to increase aircraft emissions and fuel burn

ACR Collective Analysis Groupings: Additional Discussion

- Collective Grouping #19: Change initial departure heading, remove 2-mile restriction, and 6,000 foot downwind altitudes
  - Pros:
    - Potential to change areas overflown by departures
    - Potential to turn aircraft closer to the airport
    - Increased airport departure throughput
    - Ability to keep aircraft on arrivals downwind at higher altitudes
  - Cons:
    - Potential new communities exposed to departure noise
    - Lengthened arrivals downwind to overfly areas further north and south of airport
    - Reduced airport throughput for arrivals and potential to increase aircraft emissions and fuel burn