Documentation of the Elevation Selected to Model Helicopter Noise at HTO

The elevation of helicopters 4 miles from HTO airport varies greatly, from 200 feet to more than 3,000 feet. When modeling the noise of the aircraft, elevation is critical, because noise decreases with distance. Using only one elevation in modeling essentially loses much of the data available, providing less accurate results, particularly when assessing noise using an events- above-a-threshold metric. Using multiple flight path elevations captures more of the data and the results better correlate with actual levels experienced on the ground, but the process is more time consuming and expensive.

It was determined in consultation with YES, NPC, and the Noise Abatement Committee Chair that two existing (in the modeling) elevations would be used to model the elevation of each departure and arrival, given the limited time and preliminary scope of the project. Those elevations were the INM default of 1,000 feet and the Noise Abatement elevation of 3,000 feet.

Elevation and flight path modeling inputs were retrieved from AirScene flight path data for HTO from 2013. AirScene did not distinguish the type of aircraft (H, J, T, P) in most cases. Only 617 helicopter operations were identified by Airscene in 2013 out of a total of 24,780 total operations. 20,932 operations were unknown. The Landing Fee database (with all arrivals registered by East Hampton Airport in its billing records) indicated 5,728 helicopter operations (assuming that each helicopter that lands also takes off).

The small sample size in the AirScene helicopter data concerned YES and NPC, particularly because it was only one helicopter type. The concern was that the small sample might have biased the results in some way.

The AirScene flight path data did, however, capture tail numbers of many aircraft. Using the Landing Fee database, a lookup table of tail numbers and aircraft type was created. The look up table was used to populate the unknown aircraft types in the AirScene data. As a result, approximately 4,500 helicopter operations were identified. Approximately 600 of those were fragmented and labeled touch and go operations by AirScene. These were not used (although the data can be cleaned up and used in the future).

There were 22 AirScene N-numbers that didn't match any landing fee data. They were checked against the national registry of N-numbers and 22 additional aircraft and 44 operations were identified. This small number of operations didn't justify the work to import those 44 operations, since it is a small part of the 24,780 operations. Therefore they were not used.

Comparing the national registry data with the AirScene data confirmed the reliability of the AirScene tail number data. While AirScene picked up only about two thirds the N-numbers, it did not appear to invent or misstate N numbers.

The AirScene flight path data was both fragmented (as describe above) and truncated. Of the approximately 3,900 helicopter operations that were easy to use, only 2,884 had data 4 miles from the airport. 4 miles was chosen because most helicopters are at level flight at 4 miles and because the number of helicopters with data decreases with distance. There were 3,660 operations that had flight path lengths of at least 2 NM.

Figures 1-4 show the flight tracks of 3,910 helicopter operations at HTO recorded by AirScene. The noise abatement routes are in purple. The 10 mile radius from the airport is also shown. Each point is a 1 second flight path data point from AirScene data. Since the data near the airport overlap, a "heat map" was created to display the density of the data points. Red has a higher density than blue.

There were 1830 helicopter arrivals and 2080 departures in the AirScene data.

Table 1

Flight Path - Arrivals	Count	Percent
Jessups Neck	843	46.07%
Georgica	622	33.99%
28 Scatter	197	10.77%
North Scatter	94	5.14%
East Scatter	74	4.04%
	1830	100.00%

Flight Path - Departures	Count	Percent
Georgica	683	32.84%
Barcelona	605	29.09%
Jessups Neck	334	16.06%
28 Scatter	147	7.07%
Barcelona - North	132	6.35%
2/3 Barcelona/West Scatter	130	6.25%
East Scatter	49	2.36%
	2080	100.00%

Figure 1 shows all arrivals. Three representative flight tracks are shown. They are Jessups Neck from the northwest, 28 from the west, and Georgica from the south. Table 2 (found after Figure 4 in this report) gives the (x, y) coordinates of the vertices of each path. For modeling purposes, all paths are 1.5 NM wide (.75 NM either side of the path) except Rwy 28 that is 2 NM wide (1 NM either side of the path). These paths account for 91% of arrivals. The remaining 9% are scattered to the north and east. The best modeling fit to the data occurs when Jessups Neck is scattered from a point 5 NMs from the airport. The three "Scatter" routes should scatter widely at 1 NM.

Figure 1. Arrivals

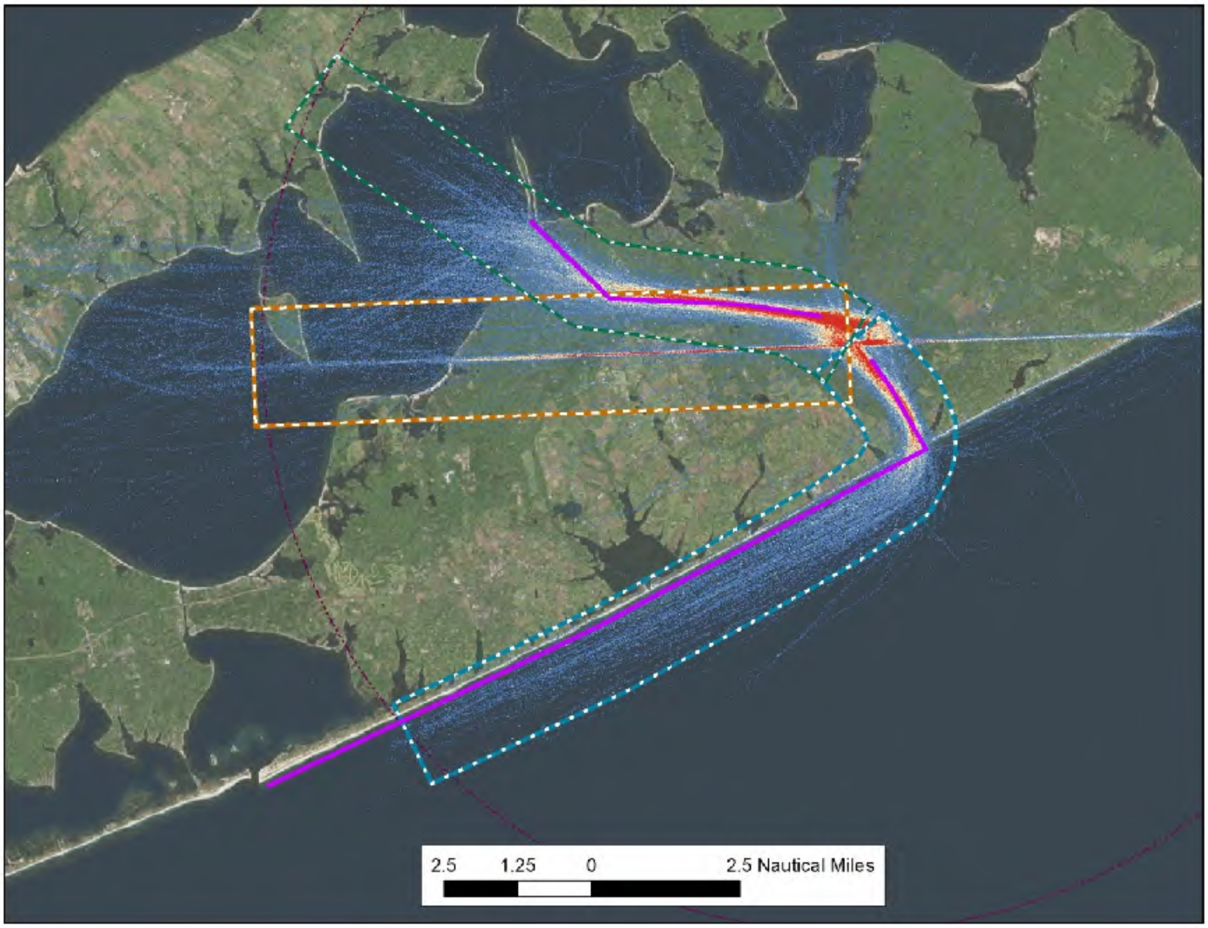


Figure 2 is the same image as Figure 1, but zoomed in on the vicinity of the airport to allow for more accurate modeling of flight paths close to the airport. The locations of the runways are included because the image of the runway is obscured by the data. Note in particular the loops to the east of the airport.

Figure 2. Arrivals Zoomed in on Airport

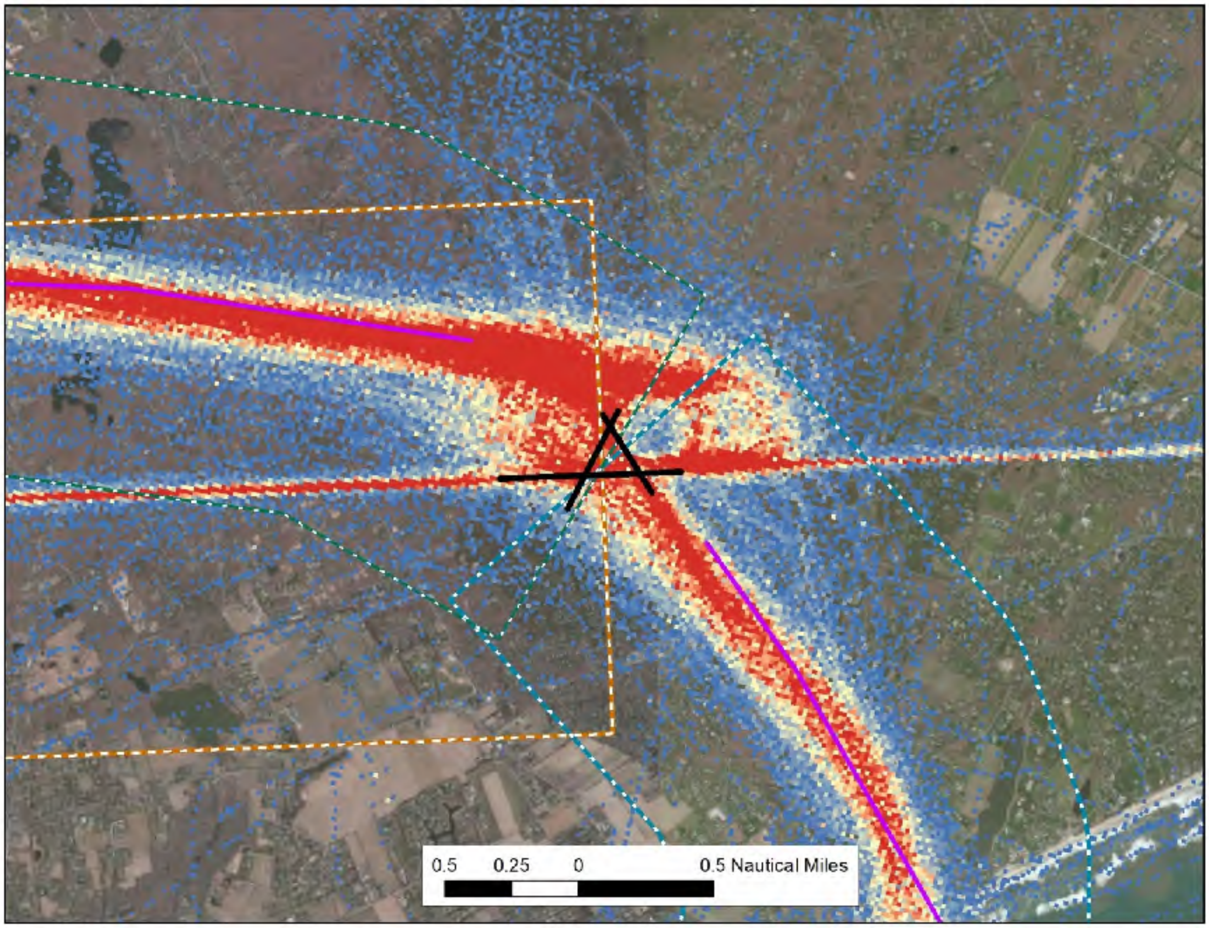


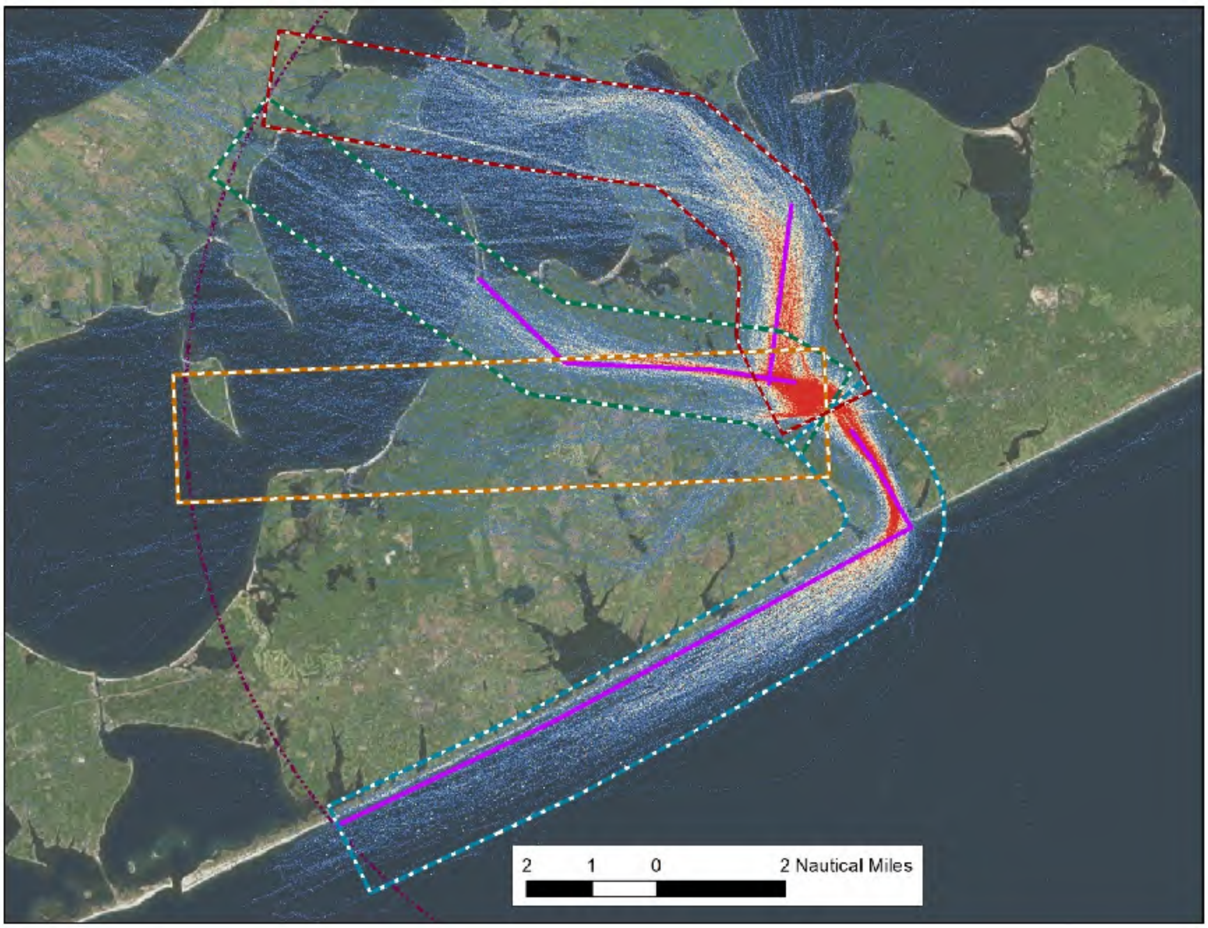
Figure 3 shows departures. Four representative flight tracks are shown. They are Barcelona to the North, Jessups Neck to the northwest, 28 to the west, and Georgica to the south. Table 2 gives the (x, y) coordinates of the vertices of the path, as well as the width of the path. The Noise Abatement paths of Barcelona and Georgica account for only 68% of the flights.[1] It should be noted that a large percentage of aircraft cut the corner of the Barcelona track. Moreover, only 20% of the flights on the

[1] Those flights percentages are: Georgica (32.84%), Barcelona (29.09%) and Barcelona scattering north (6.35%).

Barcelona track that turn west actually go over the Peconic Bay.[2] 80% are over land. Consequently, the modeled flight path should be south of the Peconic Bay as shown in Figure. Alternatively, a wide scatter from a point south and west of Barcelona Point could also be used. In addition, 6% of flights scatter to the west from a point approximately 2/3 of the way along the Barcelona path. For this 6%, a narrow scatter should be used. Also, 6 % of flights scatter north from Barcelona point in a wide pattern.

Other observations include: Jessups Neck had relatively heavy departing traffic for an inbound route (16%) and departing aircraft tend to cut the corner on the Georgica route. The 28 and East Scatter routes should scatter 1 NM from the airport.

Figure 3. Departures



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[2] A line was drawn from Shelter Island to the 28 flight track, just east of the Highway 114 ferry crossing and vaguely parallel to 114. Of the 610 operations with data west of Barcelona Point, 45 operations were over land north of the water (the Peconic Bay), 122 were over the water, and 443 were over land south of the water. 440 were within the drawn Barcelona flight path. 127 operations were south of the proposed Barcelona flight path.

Figure 4, like Figure 2, is zoomed in on the data near the airport.

Figure 4. Departures Zoomed in on Airport

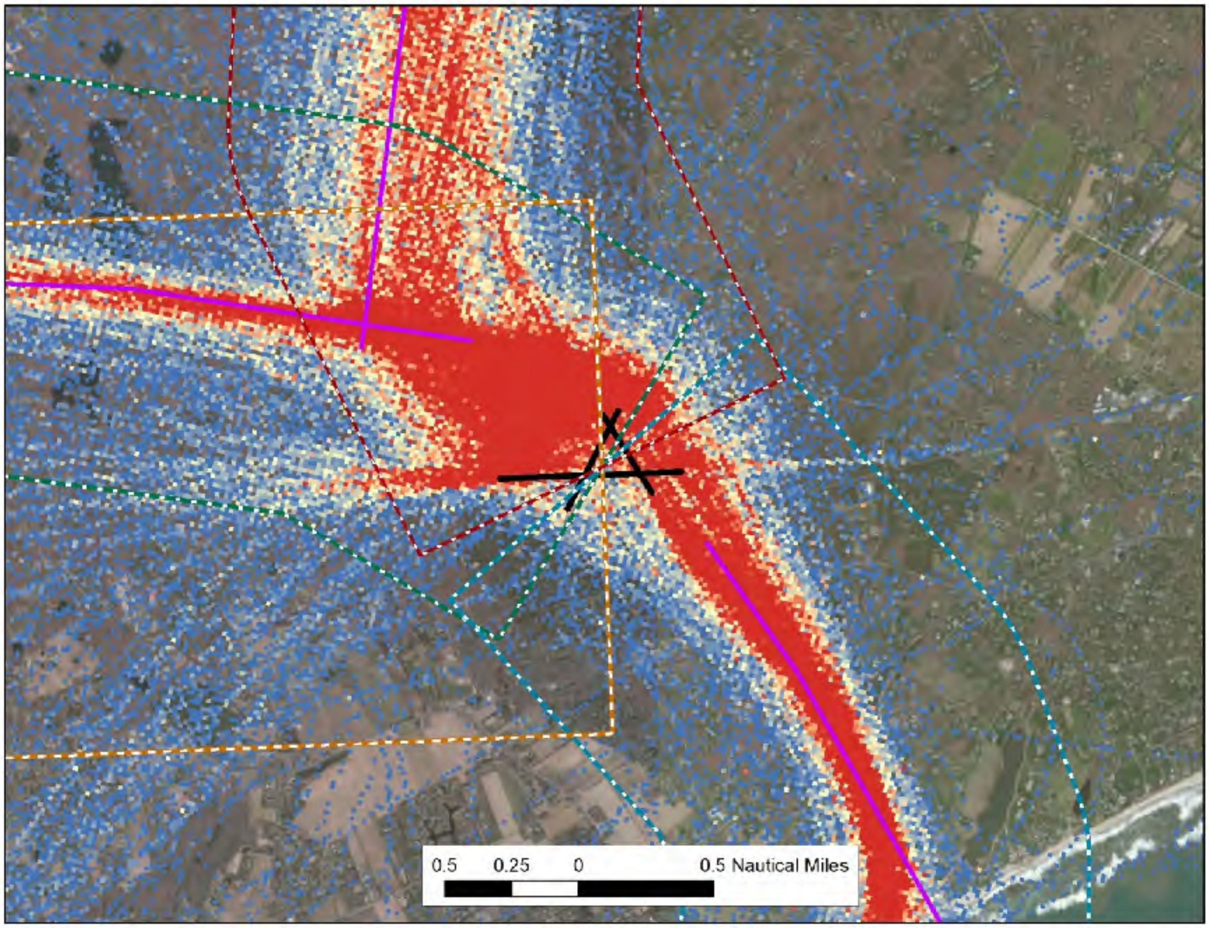

Table 2. Flight Path Vertices

PathName	Longitude	Latitude	XVal	YVal
Georgica	-72.2518	40.95954	0.004364	-0.00228
Georgica	-72.2329	40.94295	0.862198	-0.99705
Georgica	-72.2291	40.93486	1.032548	-1.48191
Georgica	-72.2293	40.92982	1.025452	-1.78428
Georgica	-72.2306	40.92646	0.967146	-1.98605
Georgica	-72.2357	40.91962	0.7359	-2.39592
Georgica	-72.2588	40.9086	-0.31678	-3.05653
Georgica	-72.2968	40.89292	-2.04756	-3.99652
Georgica	-72.3452	40.8737	-4.24941	-5.14714
Georgica	-72.373	40.8641	-5.51372	-5.72158
Georgica	-72.4169	40.84923	-7.5149	-6.60984
JessupsNeck	-72.2518	40.95954	0.004364	-0.00228
JessupsNeck	-72.2721	40.96891	-0.91844	0.559822
JessupsNeck	-72.3472	40.97769	-4.33446	1.088578
JessupsNeck	-72.4502	41.03354	-9.00788	4.445538
Barcelona	-72.2518	40.95954	0.004364	-0.00228
Barcelona	-72.2652	40.98094	-0.60486	1.281179
Barcelona	-72.2635	40.99902	-0.53081	2.365142
Barcelona	-72.271	41.01063	-0.86822	3.061363
Barcelona	-72.3007	41.03023	-2.21602	4.236968
Barcelona	-72.3546	41.03667	-4.66481	4.625314
Barcelona	-72.4389	41.04847	-8.49109	5.339671
28	-72.2518	40.95954	0.004364	-0.00228
28	-72.4735	40.95595	-10.0768	-0.20475

The 28 flight path was 1 NM on either side of the line defined by the vertices, for a total width of 2 NMs. All other flight paths (Georgica, Barcelona, and Jessups Neck) were 0.75 NMs on either side of the line, for a total width of 1.5 NMs.

To choose the flight elevations for modeling, a distribution of the maximum height of each aircraft on each flight path and operation was made. Two different data sets were used: the 2,880 flights that crossed the 4 NM mark from the airport and the 3,660 flights with at least 2 NM of data.

Since noise from aircraft does not decrease linearly with distance, the aircraft were weighted according to their impact. One aircraft at 750 feet is weighted as equivalent to 4 aircraft at 1,500 feet, since it would take 4 aircraft at 1,500 feet to equal the noise of 1 aircraft at 750 feet.[3]

The median weighted elevation of the data sets were 1,200 feet in the first data set and 1,100 feet in the second data set. The distribution of flights between the model's 1,000 foot path and 3,000 foot path to equal the 1,200 foot median values are 50% at 1,000 feet and 50% at 3,000 feet. The distribution of flights between the model's 1,000 foot path and 3,000 foot path to equal the 1,100 foot median values are 67%% at 1,000 feet and 33% at 3,000 feet.

For the annual average study noise study, the variation in the data is not significant. For the above a threshold modeling, using the latter is probably better since the 3,000/1,000 heights will undercount the impact of aircraft below 1,000 feet as well as the impact of mid-range flights.

The problem with the elevations in the model is that only about 9% of flights actually achieve 3,000 feet and only about 10% of flights are at or under 1000 feet. The existing elevations in the modeling are closer to the extremes than is ideal. Moreover, using 3,000 feet will significantly under count exceedances of the Noise Ordinance noise levels on the ground, in both the 50-50 and 67-33 splits. Flights at 2,000 feet, for example, would be modeled at 3,000 feet.

Remarks and future work

Having closely examined the data, I would recommend choosing 3 elevations as the best balance between time invested and accuracy of the noise estimates returned in the future. The three elevation groups should be 500-1,000 feet, 1,000-2,000 feet, and 2,000-4,000 feet and three representative elevations chosen from each group. Also, determining an elevation split for each path would be beneficial. Time does not allow such work right now, but such work would greatly increase the accuracy of the modeling.

[3] Noise level estimates are a first order approximation using only spherical spreading.