# Bird Strikes Avoidance for Vertiports in Los Angeles

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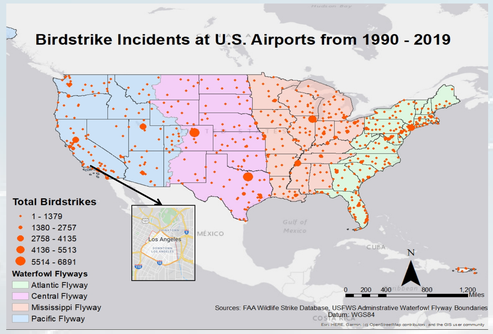



## Introduction:

As the number of flights in the US increases and as intracity travel in single-occupant Vertical Take-Off and Landing vehicles (VTOL) becomes a possibility, cities could benefit from higher connectivity and a decrease in ground level traffic congestion but may face the detriment of increased collisions between birds and aircraft. As the Hudson River plane crash in 2009 shows, even for large planes, birds can pose a hazard.

Our goal was to locate areas in Los Angeles for vertical taking and landing pads (or also known as vertiports) for these vehicles. To this end, we decided to update a previous map regarding bird strikes and waterfowl migratory pathways across all U.S airport locations. We then focused on finding suitable vertiports in the city of Los Angeles. To do so, we used bird strike data collected by the Federal Aviation Administration (FAA), as well as various data concerning birds and potential population of VTOL to build a suitability model of LA. We then used this suitability model as a weighted factor in our network analysis to find where the vertiports would best serve the population.

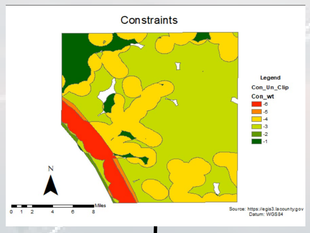
## Client:

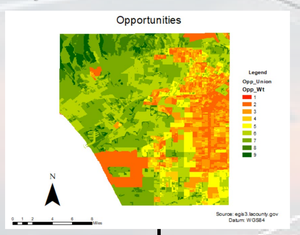
Our client is Dr. Jasenka Rakas and NEXTOR II. We were asked to suggest suitable locations for vertiport locations.

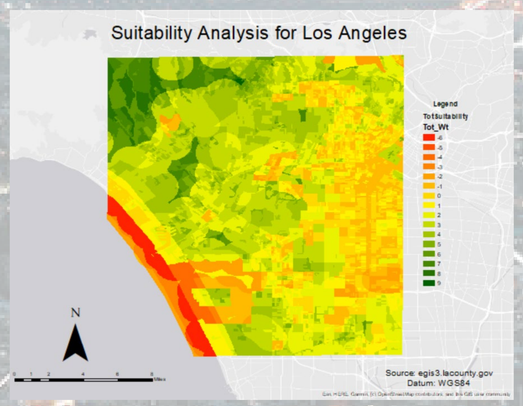
## Research Questions:

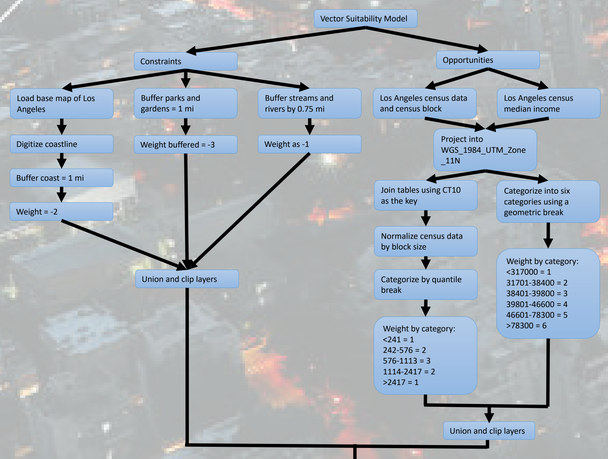
Where are the best locations for vertiports that can minimize the number of bird strikes and serve at least 25% of the potential population in LA?

# Suitability Analysis




## Analysis:

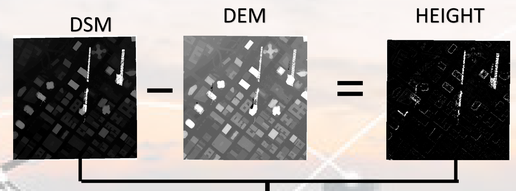
We chose a suitability model as we decided that this was the best way to perform an elementary selection of suitable areas.

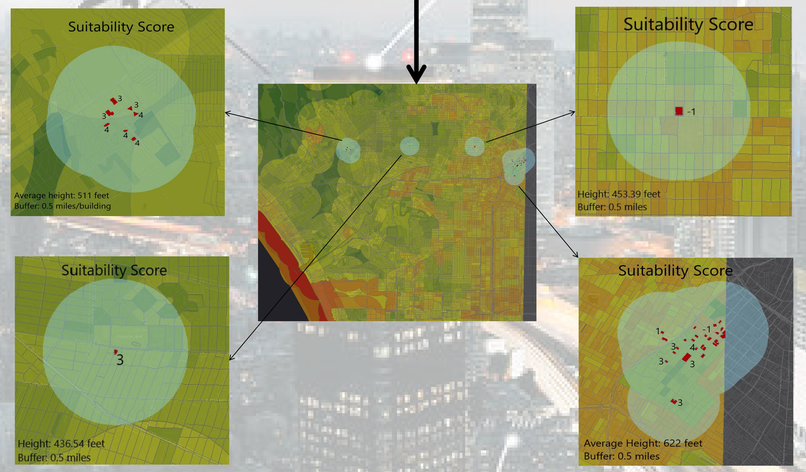
Regarding the constraints layer, we asked UC Berkeley Ph.D. candidates what some factors in bird locations, and thus strikes, may be and we decided to look at areas in Los Angeles that were optimal bird habitat, such as parks and the coast. To create the coast layer, we digitized the coastline as visible on a basemap. All constraints features, parks and gardens, coast, and streams and rivers, were buffered as the birds can leave these areas, but are most frequently around them. We chose to weight these areas based on the percentage of birdstrikes in the area were caused by different types of birds. We weighted the coast as -2 as some, but not many sea birds that were hit. We weighted the parks and gardens as -3 as the majority of birdstrikes were pigeons. We weighted the streams and rivers as -2 as they are also prime bird habitat.

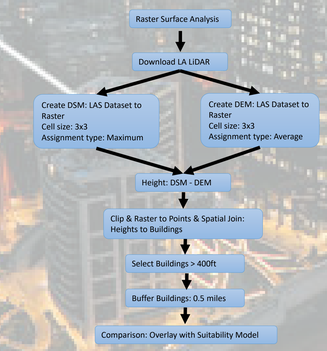
As to the opportunities layer, we looked at population density normalized over area and at median household income. We wanted the vertiport to be accessible to that greatest number of people and we thought that VOTL vehicles may be cost prohibitive to many people thus would be more useful in areas with higher average incomes.

We determined that the most likely areas were in the north-western corner of the map, where people live, particularly more wealthy people. We used this information to decide where to start our network analysis.

# Surface Analysis




## Analysis:

Our parameters:

1. Buildings over 400ft
2. Surrounding building height: shorter than vertiport building
3. Distance to another vertiport building: 0.5 miles

We downloaded the LiDAR data for the region of Los Angeles we were interested in. We subsequently clipped all data layers to the region of our suitability analysis. We used the Digital Surface Model and Digital Elevation Model to establish the building heights in the area. We focused on buildings taller than 400ft as that was a parameter given by Dr. Rakas for vertiports. We looked at the suitability analysis score for the selected buildings. These are buildings that are in areas with suitability scores of 3 and 4.

## Conclusion:

The areas on the suitability map with the highest scores (>7) were in the north-western part of the map. These are areas where people live, particularly those with greater wealth.

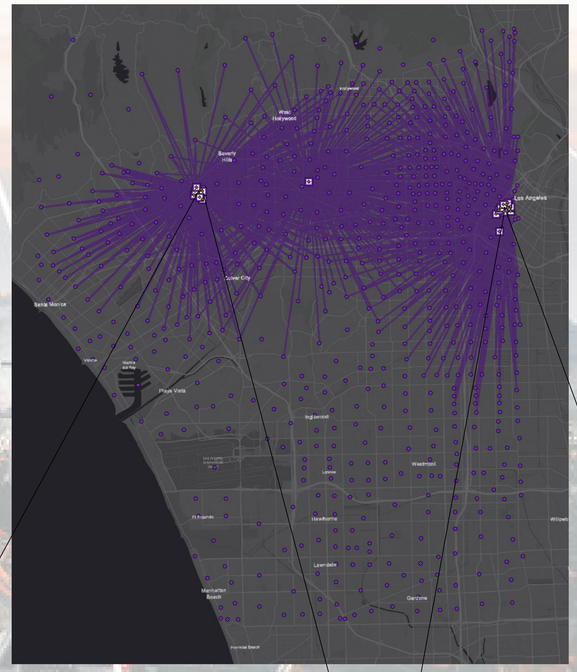
We created a network analysis to find which of these high-scoring sites would be able to serve the greatest percent of the market share based on how many wealthy people they could serve ..

We found that the areas with the highest scores in our suitability analysis did not have buildings that fit our criteria of a height greater than 400 feet; however, the areas with lower suitability score such as 3 and 4 do meet at most 2 criteria of our indicated parameters of height and buffer zone. We were able to establish building heights using LiDAR data for these areas. Further more, the buildings that meet the height requirement with the highest suitability score of 4 did not meet the buffer zone requirement. There is a trade off between height, buffer zone distance and suitability score.

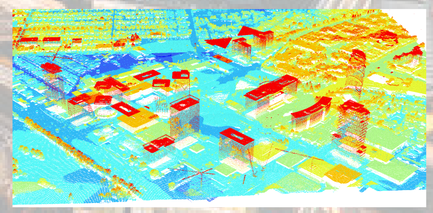
If we favour higher suitability score for buildings, then the best area for a vertiport would be the Century Apartment, JR Entertainment, ICM Partners, Fox Home Entertainment and Aon Center – Downtown LA buildings.

We learnt through discovering the limitations of placing Vertiports in Los Angeles. This is one of the first few GIS case studies for Urban Air Mobility VTOL as it is still an emerging idea. The Airport Design - CE153 team at UC Berkeley deduces that "reducing bird strikes for VTOLs may prove uniquely challenging. It may be easier to design VTOLs to be more resilient to bird strikes than to reduce the frequency of strikes in urban environments."

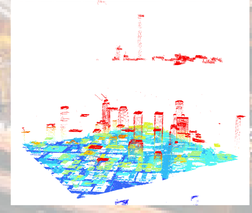
# Network Analysis

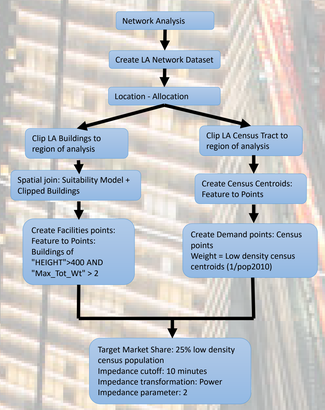



## The Century Apartment, JR Entertainment, ICM Partners, Fox Home Entertainment



## Aon Center – Downtown LA






## Analysis:

Ideally, we would keep the cost minimal while serving a large portion of the market share. Our target population lives in a low-density area with wealthier households/individuals. These are potential customers who would most likely be able to afford the starting price of VTOL aircraft.

We initially chose target market share of 75%. We chose twenty facilities with a suitability analysis score of 3 or higher and areas of low population density. The model returned a maximum 25% target market share achieve as the maximum market share possible given 20 facilities.

We then zoomed in on facilities with the highest suitability score (a 4). The result showed possible buildings in Century City and Downtown Los Angeles. While these buildings meet the criteria of being over 400 feet tall and have a higher suitability score, they are surrounded by a half-mile buffer of shorter buildings.

In our LiDAR analysis however, there were two buildings that stood alone with no other tall buildings within the buffer zone. However, these buildings have a poor suitability score: -1 and 3.

## Data:

Bird strikes data: https://wildlife.faa.gov/home

Flyway boundary: https://catalog.data.gov/dataset/usfws-administrative-waterfowl-flyway-boundaries

Airport locations: https://www.arcgis.com/home/item.html?id=9508e6804576469ba8857de7add4d168

LiDAR: https://viewer.nationalmap.gov/basic/

NAIP DEM 1/3 arc imagery: https://viewer.nationalmap.gov/basic/

LA parks & gardens, streams and rivers, coastis, median income, census blocks: http://egis3.lacounty.gov/egis/

LA buildings: http://geohub.lacity.org/datasets/813fcdfde1f64b2091310b7b26a8909f_0

LA Job Density: https://onthemap.ces.census.gov/