

# Intelligent Advanced Air Mobility

Responsible AAM Deployment Through Data-Driven  
Modeling and Simulation

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*wisk*

# Introduction

This paper introduces Wisk's proprietary microsimulation software architecture, called SCOPE (Simulation, Coordination, Optimization, Planning, and Engagement). The SCOPE platform supports Wisk's vision of saving people time by aiding in the efficient, thoughtful, and responsible deployment of Advanced Air Mobility (AAM).

With the SCOPE platform, Wisk can better understand and inform infrastructure and policy development, build stronger partnerships with industry and communities, and propel the AAM industry forward in an informed and socially responsible way.

*AAM is poised to revolutionize urban transportation by providing a safe, convenient, and sustainable air mobility option. Autonomy is the key that will help AAM reach scale and mass adoption, while unlocking affordability, accessibility, and the full potential benefits of AAM.*

At Wisk, our primary AAM use case is passenger transport through a multimodal air taxi service. This service envisions electric vertical takeoff and landing (eVTOL) aircraft flying passengers from point A to point B in a safe, efficient, and comfortable manner, bypassing congestion on the ground. Other potential early use cases proposed in the broader industry include cargo and medical transport, civilian first response, and military use.

## Uncharted Frontiers of AAM

AAM is expected to serve metropolitan areas across the world, with intracity and intraregional routes. AAM also has the ability to serve rural transportation deserts that currently have limited mobility options.



## Dynamic Markets Create Expected Challenges

There are many challenges to developing new forms of mobility, some of which are unique to the AAM industry and others that are not.

Incorporating market characteristics for a scalable operation makes AAM what's known as a "wicked" problem in transportation. In other words, it is a problem that is challenging to solve due to incomplete, contradictory, and constantly evolving requirements that can be difficult to recognize without the right tools.

While certain information can only be gleaned from in-market, real-time data, we are now armed with advances in technology and simulation that can help us make informed operational decisions and better understand the potential impacts of AAM.



# Wisk's SCOPE Platform Solution



Wisk has developed an advanced modeling and simulation tool known as SCOPE (Simulation, Coordination, Optimization, Planning, and Engagement). The SCOPE platform is powered by granular travel-demand data, machine learning, and large-scale GPU-based parallelization to create complex simulations and models that will help Wisk:

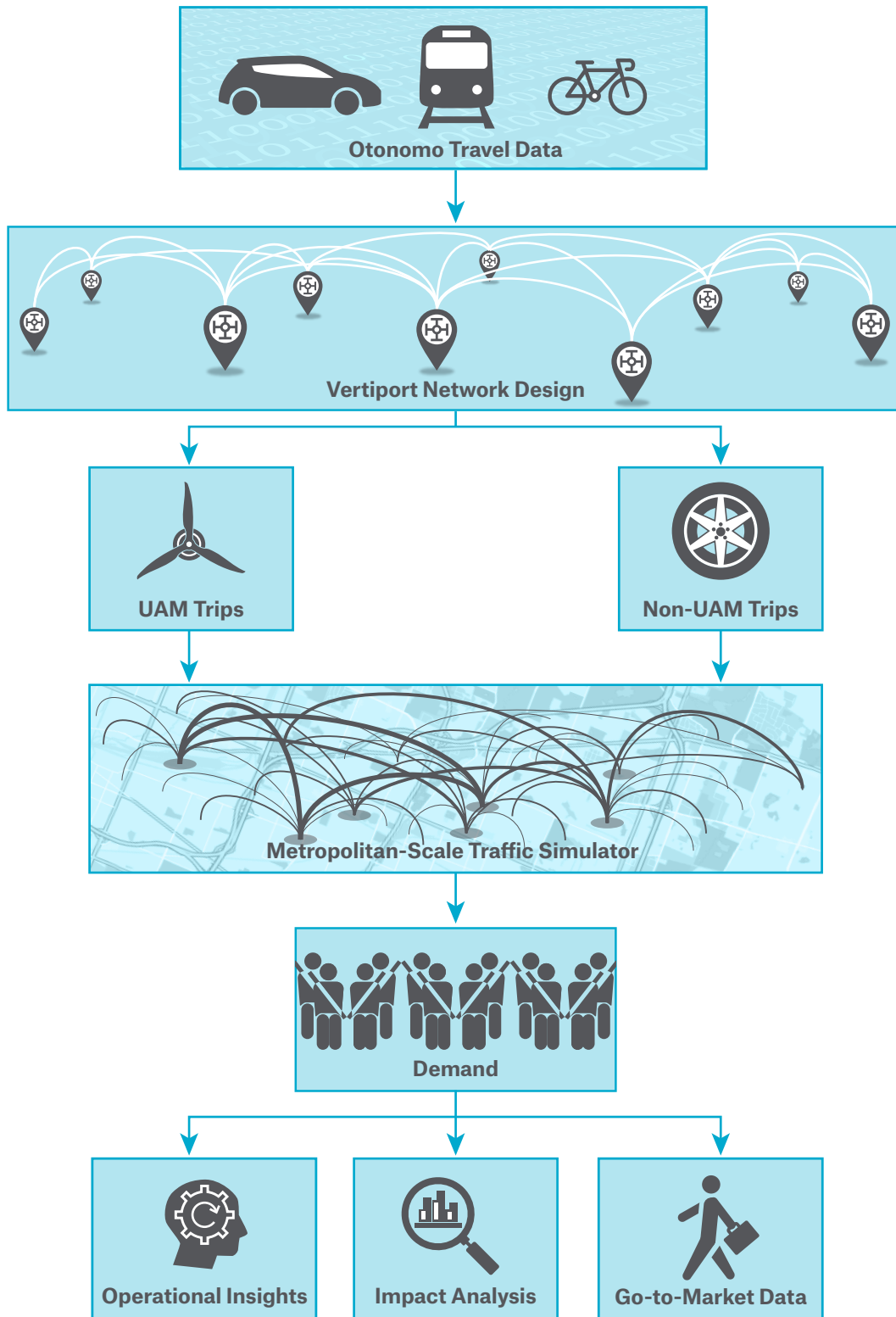
- Support partner engagement (technology, city/local government, and local communities)
- Provide guidance on the development of AAM infrastructure
- Inform route and network planning recommendations
- Accommodate sustainability and equity considerations across diverse sociodemographics and markets
- More accurately predict potential economic and financial impacts of AAM implementation
- Inform internal strategic business decisions, engineering strategy, and Concept of Operations (ConOps) development

Using the SCOPE platform, Wisk can simulate millions of real-world trips and model travel behavior in metropolitan areas across the world, while measuring the impact of AAM integration into the transportation network. The data gathered from these simulations are then used to inform and refine Wisk's strategy in relation to the areas listed above.

### **Metropolitan-Scale Simulation**

Wisk has sourced the high-quality travel-demand data required by the SCOPE platform from Otonomo, Inc. Otonomo's Urban Intelligence Mobility Solution provides visibility and insights into mobility patterns in specified areas, including information about anonymized origins and destinations, trip times, trip distances, trip purposes, as well as broader sociodemographics and willingness-to-pay metrics. Since the data granularity is at a neighborhood level, we can glean the most accurate insights about travel behavior, while also maintaining compliance with data privacy rights.

# Microsimulation and Analysis



# Industry Impact: Designing Better Systems

## Vertiport Network Design

One of the SCOPE platform's defining features is its ability to do optimal vertiport network design. While initial AAM operations will likely use existing aviation infrastructure, future vertiports will need to be built in locations that are tightly integrated with existing transportation modes to maximize access to travelers who can benefit from using AAM. Wisk's SCOPE platform can inform infrastructure provisioning now so that all components of the AAM ecosystem, outside of the aircraft itself, are in place as the system grows in scale and demand.

Two major components comprise the network design functionality: the optimal locations of vertiports and the optimal number of vertiports.

## Vertiport Location

When identifying optimal vertiport locations, Wisk's SCOPE platform considers parameters such as total demand, land use and zoning, area requirements, noise constraints, airspace, charging infrastructure constraints, and the aforementioned equity and sustainability issues. In addition, it considers area footprints as proxy for the necessary number of gates and final approach and take-off areas (FATOs) sites, as sites must support sufficient passenger and aircraft throughputs. Vertiports must also be placed in a manner that preserves equity and efficiency, such that it increases rider accessibility, avoids congestion bottlenecks for drivers, and does not pose undue noise or safety concerns.

### Vertiport Density

The SCOPE platform can adjust vertiport density based upon simulated demand to determine how many vertiports are needed to run at maximal efficiency. Such analysis furthers Wisk's efforts to provide affordable and carbon-free air mobility to the maximum number of people while minimizing infrastructure and the potential disruption to our local communities.

As shown in the following images, the SCOPE platform's algorithm adjusts the locations of the optimal vertiports based on demand and the number of vertiports.

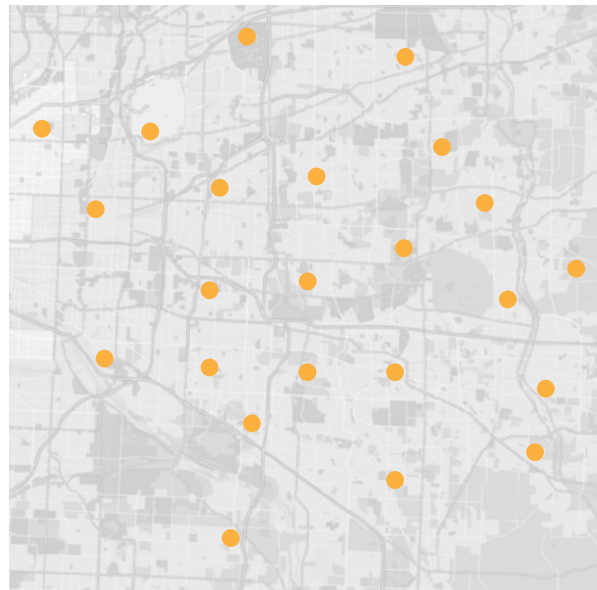
### Throughputs and Scheduling

Once an initial vertiport network has been identified, large-scale simulation provides insight into each individual vertiport's throughputs, both on the aggregate and at any given moment. This information then informs the costs of major operational components such as communications infrastructure, which consists of radios, towers, and wireless backhaul capabilities; ground autonomy personnel; and charging infrastructure at the vertiports.

**SIMULATION OF OPTIMIZED VERTIPORT LOCATIONS BASED ON THE NUMBER OF VERTIPORTS IN SERVICE**



A sample vertiport network that may use existing aviation infrastructure



A sample vertiport network using a combination of existing aviation infrastructure and newly built vertiports



## Route Design

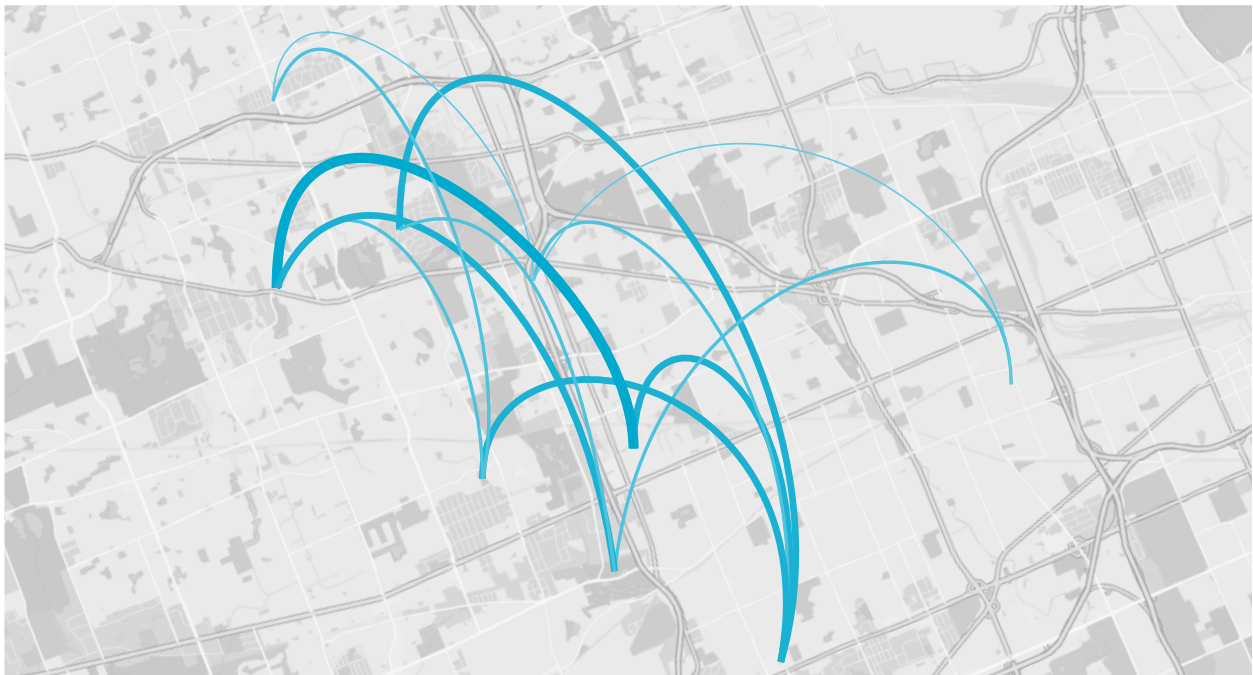
Every aircraft operating in metropolitan airspace must follow designated route guidelines. Routes must follow all ConOps procedures to qualify for approval by global regulatory bodies.

Precise routes for fully autonomous eVTOL travel are necessary for refining the ConOps as well as understanding our go-to-market strategy. By designing these routes to follow instrumental flight rule (IFR) procedures, Wisk can understand the off-nominal, real-world differences from as-the-crow-flies routing, which then affect the travel times, throughputs, and total operating costs.

In addition, by understanding operational constraints more accurately, Wisk can support external stakeholders in developing standards and procedures that support fully autonomous capabilities.

As Wisk's SCOPE platform software matures, its outputs can be used to optimize vertiport locations and networks, determine ideal network and fleet sizes, and find the right balance between accessibility and infrastructure. In the future, optimized networks have the potential to produce up to four times the demand of networks based solely upon existing infrastructure.

### SIMULATION OF AN OPTIMIZED VERTIPORT NETWORK



Optimization is adaptive and routes and networks can be modified to accommodate changes in demand and capacity.

## Supporting Equal Partnerships

Wisk recognizes that AAM is not immune to the difficulties faced by other transportation sectors. It is an ongoing challenge to optimize for efficiency and comfort while also considering sustainability and equity motives across diverse sociodemographics and markets. Implementing a new mode of transportation without due consideration can result in severe and negative impacts upon cities or specific populations.

A historic example of poorly considered transportation implementation is that of the automobile in the United States. From the 1920s to the 1980s, automobile infrastructure was built en masse across and through cities, often in minority and underrepresented neighborhoods. While the automobile has arguably improved mobility and convenience for select populations, it has also had undeniably negative impacts, particularly on vulnerable groups. Societal dependence upon automobiles has contributed to higher greenhouse gas emissions, poorer air quality, obesity, high blood pressure, and sprawled land use patterns that serve to further amplify this dependence, contribute to climate change, and decrease accessibility.\*



With this history in mind, Wisk seeks to provide data-driven analytics about the impact of AAM to support our collaborative partnerships with public stakeholders. Local buy-in is essential for the successful development and scaling of AAM. It is the responsibility of Wisk and others in the AAM industry to provide the appropriate data-driven information to cities and communities identifying the feasibility, benefits, and potential opportunity costs of AAM adoption prior to asking cities to allocate taxpayer money to AAM infrastructure.

\* Cars and obesity: <https://link.springer.com/article/10.1007/s13679-017-0238-y>

Cars and emissions: <https://rosap.ntl.bts.gov/view/dot/32254>, <https://www.sciencedirect.com/science/article/abs/pii/S0967070X12000522>

Cars and air quality: <https://ehp.niehs.nih.gov/doi/full/10.1289/ehp.1103440>

Cars and high blood pressure: <https://ehp.niehs.nih.gov/doi/full/10.1289/ehp.1103564>, <https://oem.bmj.com/content/64/2/122.short>

Cars and land use: <https://www.taylorfrancis.com/books/mono/10.4324/9781351048040/america-suburban-centers-robert-cervero>, <https://journals.sagepub.com/doi/abs/10.1177/0160017604273626>

1920s to 1980s urban renewal with highway construction: [https://link.springer.com/chapter/10.1057/9781137002440\\_8](https://link.springer.com/chapter/10.1057/9781137002440_8)

## Determining the Impact of AAM Integration

Once a city or metropolitan area has partnered with Wisk, the SCOPE platform can provide quantitative insights on the impact of AAM deployments on traffic congestion and economic productivity, including expected numbers of AAM travelers. Cities are increasingly sensitive to issues of transportation equity, and the SCOPE platform can provide data-driven metrics clarifying the impacts of AAM adoption on community members, including those that never adopt AAM.

Cities would also like to understand whether AAM will be a sustainable and socially responsible part of their transportation network. AAM is intended to augment current transportation networks and relieve some of the pressure on ground infrastructure that is over capacity.

Data provided by Otonomo, combined with the SCOPE platform's algorithms, help translate qualitative data into quantitative insights, gives us the ability to be more thoughtful and comprehensive in our approach to integration. Today, we anticipate avoiding the follies of Robert Moses, perhaps the most famous public official associated with automobile infrastructure in the name of urban renewal, by leveraging advanced simulation capabilities at the metropolitan scale to understand a new transportation mode like AAM.

**We want the SCOPE platform to be a data-driven tool that helps communities that we are exploring to understand how AAM and its deployment will impact and help them, regardless of whether they use the service. Our SCOPE platform strives to be realistic and holistic by taking inputs — often very qualitative inputs — and quantifying them in different ways so that they are fully considered. In doing this, the SCOPE platform can produce network designs, routes, and vertiport infrastructure that makes sense for everyone, not just the riders and stakeholders.**

Pavan Yedavalli—  
Head of Product Intelligence and Systems Simulation

# Just the Beginning

At Wisk, we believe we will be the first major AAM company to certify and fly a fully autonomous eVTOL air taxi in the United States. Our innovation doesn't stop here. We've designed the SCOPE platform with the ability to grow and scale, and to allow for new data inputs, meaning that the insights that we can glean from this platform are virtually endless.

We are committed to being a responsible member of the communities that we will serve and will make decisions that allow everyone to experience the benefits of AAM. At the end of the day, our primary mission is to deliver safe, everyday flight for everyone, and the SCOPE platform is one of the critical tools that we use to make that a reality.

## About Wisk

Wisk is an advanced air mobility (AAM) company dedicated to delivering safe, everyday flight for everyone. Wisk's self-flying, eVTOL (electric vertical takeoff and landing) air taxi, will make it possible for passengers to skip the traffic and get to their destination faster. Based in the San Francisco Bay Area and New Zealand, Wisk is an independent company backed by The Boeing Company and Kitty Hawk Corporation. With over a decade of experience and over 1500 test flights, Wisk is shaping the future of daily commutes and urban travel, safely and sustainably. Wisk is on a journey to deliver safe, autonomous, all-electric, everyday flight, join us online to learn more.



### Disclaimer:

Current network design simulations in Wisk's SCOPE platform are limited by the type of data, such as land use, available. Realizing the vision of autonomous AAM will require breakthroughs from the technical, regulatory, and public perception perspective, and to that end, the SCOPE platform will continue to be an evolving project. In addition, the SCOPE platform is designed to be both extensible and modular, enabling additional functionality as the specific use case requires.