ADVANCED AIR MOBILITY
IMPACT ANALYSIS

For the State of Oklahoma

2024-2045

NEXA Advisors
A NEXA Capital Company

Prepared for HNTB by NEXA Advisors, LLC
1765 Greensboro Station Drive
Tower 1, Suite 900
McLean, VA 22102
202-499-5056

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1. EXECUTIVE SUMMARY

NEXA Advisors was tasked by HNTB to perform an Economic Impact Analysis (EIA) for the State of Oklahoma pertaining to the introduction and operations of Advanced Air Mobility (AAM), and covering the years 2024-2045.

According to our findings, the potential economic impact and benefits to the State of Oklahoma by the AAM industry through 2045 could:

- Generate nearly $5.6 billion in new business activity and related stimulus.
- Generate an additional $2.2 billion in direct, indirect, and induced economic activity if an AAM aircraft manufacturer sets up shop in Oklahoma.
- Produce $1.15 billion in local, state, and federal tax revenues.
- Create over 4,600 new full-time aerospace industry and other jobs in the State.
- Create an additional 4,066 new full-time aerospace industry and other jobs if an AAM aircraft manufacturer opens a factory in the State.

In terms of AAM passenger use:

- By 2045, some 22 million passengers are expected to have traveled within Oklahoma using new AAM services over the 22-year forecast period.
- By the 2041-2045 time period, nearly 3 million passengers per year, or almost 8,000 passengers per day, are forecasted, equivalent to 12% of future commercial air traffic in the state (assuming 3% annual growth).
- By 2045, the forecasted cost per ticket could drop to under $90 on average, due to the introduction of flight automation and increased passenger volumes.

In terms of construction of vertiports—areas where electric Vertical Takeoff and Landing (eVTOL) aircraft take off and land—by 2045 Oklahoma will need to:

- Retrofit 18 existing heliports and small regional airports.
- Construct 12 new vertiports strategically located throughout the State, including a new terminal at each of the two largest airports (Will Rogers World Airport in Oklahoma City and Tulsa International Airport) that will focus solely on eVTOL operations.

Our business and economic models indicate that capital required for new vertiports is in the range of $127 million. The estimated capital expenditure (CAPEX) for creating an Advanced Air Mobility air traffic control system across the State of Oklahoma will cost about $67 million. Costs for setting up and operating a statewide AAM system will not be borne by the taxpayer but will be financed using other sources such as Public-Private Partnerships (P3s) and FAA Airport Improvement Program (AIP) grants. P3s involve collaboration between a government agency and a private-sector company that can be used to finance, build, and operate projects. These projects include hospitals, water treatment plants, convention centers and more, though the majority of P3s focus on public transportation networks such as roads, bridges, and airports. The AIP provides grants between 75% and 95% of costs to public agencies—and, in some cases, to private owners and entities—for the planning and development of public-use airports.

Covered in a separate paper, we estimate that at market maturity, about 2045, the market for sUAS (small Unmanned Aerial Systems, commonly called drones and including the systems that support them) will:

1. Generate an average Oklahoma annual payroll of commercial drone operators close to $69 million
2. Create 1,425 drone pilot jobs in the State total over the forecasted period, and a similar figure for software creators and analysts.
3. See a $100 million annual capital expenditure for new drones.

Between now and 2045, cargo revenues generated along the most active freight corridors (I-35, I-40, I-44, US-69, and I-240) will be slightly above $1 billion.

INTRODUCTION

For many reasons, the State of Oklahoma is poised to create a successful Advanced Air Mobility industry to generate economic growth and provide residents and business with new transportation options and conveniences:

- The State has a legacy of aviation innovation and success dating back more than a century.
- Oklahoma is the home of the largest DoD air depot and commercial airline MRO facility in the world.
- There are more than 1,100 aerospace companies in the State and some 120,000 experienced employees in the aerospace and defense industry ready to transition to new aviation technology
- Oklahoma is ranked #1 in preparedness for the drone industry.[1]

However, there is another requirement for Advanced Air Mobility success: the new industry must, within a few years, become economically viable to pay off investors as well as pay recurring costs such as equipment maintenance and upgrades, and employee salaries, and maintain public safety and convenience. To assess these major business elements of AAM, we must first determine the supply chains requisite for the industry to operate, and their estimated costs and revenues (Section 1.)

Secondly, passenger demand must sustain the eVTOL industry, and ticket prices must be reasonable enough to sustain passenger demand. Passenger demand for five major passenger use cases (airport shuttle, regional, business aviation, medical, and on-demand), which supports all four major supply chains, creates the AAM Business Case (Section 2.)

Cargo eVTOL demand is modeled separately and quite differently from passenger demand and entails delivery of time-sensitive goods and materials that must reach every corner of the State carrying those items for which time is of the essence (Section 3.)

sUAS also have unique econometric considerations, involve numerous markets across the State from powerline inspections to monitoring the health of agriculture and will expand exponentially when the FAA approves widespread Beyond Visual Line of Sight (BVLOS) operations by about 2030. (Section 4.) With the exception of special waivers, drone operations are currently extremely limited to Visual Line of Sight (VLOS), about several hundred yards horizontally and 120 yards vertically.

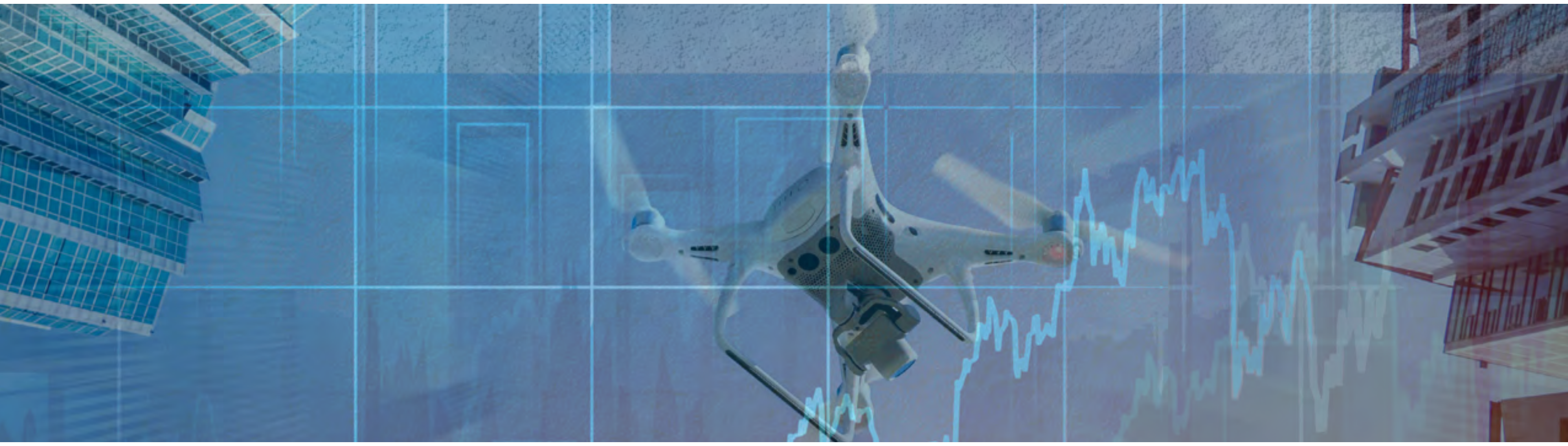
1 https://www.mercatus.org/research/research-papers/your-state-ready-drone-commerce-2022-state-state-scorecard

The business case of passenger and cargo eVTOLs and sUAS informs our jobs, increased GDP, and new revenue forecasts (Section 5).

For economic viability, AAM vertiports must be located as part of a multi-modal transportation system (at airports, train stations, bus depots, ports, etc.) in carefully selected areas that optimize efficiency and generate passenger demand to pay investors and costs (Section 6.)

A few words about our forecasts:

- Our model is a bottom-up forecast; beginning with data specific to the state or metropolitan area being focused on. Instead of looking at the entire AAM market as a whole (top-down approach), it focuses on the specific ArcGIS data as well as demographic characteristics of Oklahoma to determine its viability within the U.S. AAM market. This includes forecasted passenger demand from AAM mobility solutions, as well as ticket pricing, for 5 use cases that Oklahoma will experience.
- Across the board, our figures are more conservative than forecasts by industry titans including McKinsey, Goldman Sachs, and Morgan Stanley and consistent with other states NEXA has performed similar work for, including Ohio, Arkansas, Virginia and (Central) New York.
- Our forecasts received the endorsement of the U.S. Government Accountability Office which stated NEXA's projections were the most reliable the GAO could find in the industry.
- We work with the nationally renowned economic impact data provider IMPLAN to develop our AAM economic impact modeling.
- While it might be considered challenging to undertake an economic impact analysis of an industry that is not yet operational, there are standard econometric practices that guide us, as well as the fact that Advanced Air Mobility is a subset of aviation, which has been commercially operational for more than a century and is a global economic engine.



1. WHAT ARE THE MAJOR BUSINESS ELEMENTS OF AAM?

Bringing Advanced Air Mobility into operational status will require four value or supply chains (Figure 1) to assemble and operate this new transportation system. Each one of these supply chains will create jobs and revenues:

AAM Ground Infrastructure developers, and the necessary ecosystem to provide site preparation and construction, engineering, architectural services, lighting, beacon navigation nodes, and passenger amenities, etc.

UTM Traffic Management developers and operators and the ecosystem needed to provide high-density radar, network design, automation systems, weather information, computers and equipment, flight decision support tools, etc.

	TIER 2	TIER 1	TIER 0/OEM	Downstream Customers & Stakeholders
UAM Ground Infrastructure	Airspace designers, Structural Engineering, Transport Planners, etc.	Heliport Contractors Infrastructure Funds, Composites, etc.	UAM Ground Infrastructure Owners/Operators/PPP	Passengers
UATM Traffic Management	UATM Subsystems Beacons, comms & components, etc.	ATC Systems Integrators	UATM Metropolitan Traffic System Operators & Systems	Investors
eVTOL Manufacturers	Electronic Components, Software programs, etc.	Assembly Modules, Motors, Batteries, Avionics, etc.	eVTOL Developers, Designers & Manufacturers	Cities & Regulators
Certified eVTOL Operators	Pilots, Facilities, etc.	Maintenance Services	Helicopter Part 91, 121 & 135 Operators and others	Other Stakeholders

Figure 1 - The four key supply (or value) chains are essential for AAM to succeed in Oklahoma. Tier 3 suppliers (not shown) provide products directly to Tier 2 suppliers.

eVTOL Manufacturers and Tier 1/2/3 Suppliers (those companies selling products that end up in the final product) and the requisite ecosystem of manufacturers providing composites, precision machining, electrical systems, batteries, interiors, flight computers, simulators, testing and training equipment, etc.

Certified eVTOL/sUAS Operators, companies overseeing the operation of the aircraft, whether AAM passenger/cargo aircraft or sUAS. Those firms currently operating helicopters may be among the first AAM service providers as they already have type certifications and pilots and will gradually transition the new aircraft into their operational fleets.

1.1 Supply Chain 1: AAM Ground Infrastructure

While eSTOL (electric Short Takeoff and Landing) and eCTOL (electric Conventional Takeoff and Landing) aircraft can use airport runways, eVTOLs require vertiports. The easiest and most cost-effective way to create vertiports is to remediate existing heliports. The State of Oklahoma has 108 publicly-owned airports as well as 54 medical centers that are equipped with heliports. All airports also have the ability to operate as a heliport and can be retrofitted for eVTOL use. Remediating medical center heliports provides them with the ability to use AAM for emergency services.

The basic elements of a heliport are clear approach/departure paths, a clear area for ground maneuvers, a final approach and takeoff area (FATO), a touchdown and liftoff area (TLOF), a safety area, and a wind cone. This existing infrastructure can be updated for eVTOL aircraft by adding battery recharging stations and hydrogen fuel stations for hybrid aircraft, as well as perimeter security, shelters, and other amenities. Given the need to recharge batteries, the region's power grid becomes an essential factor in determining vertiport locations.

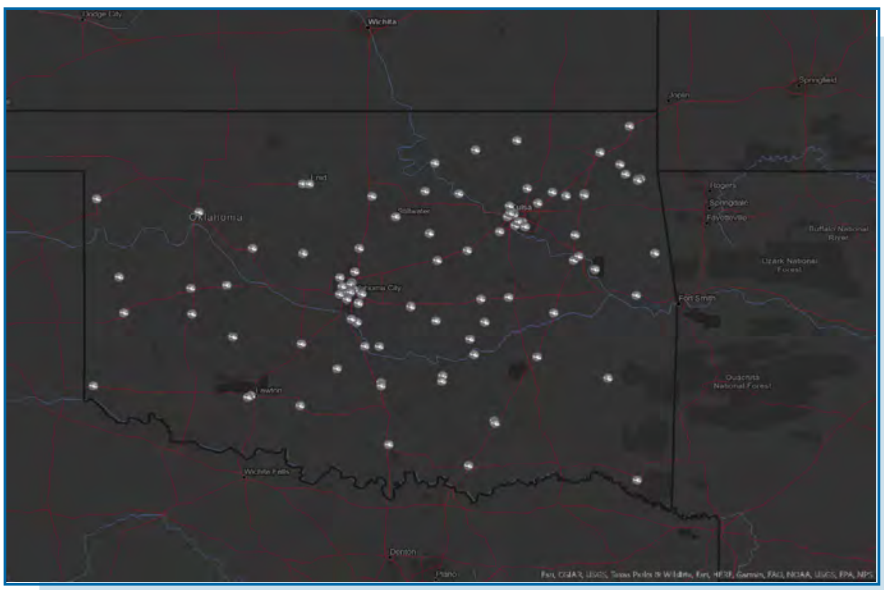


Figure 2 – Oklahoma heliports, many of which could be easily and inexpensively converted to vertiports for eVTOL aircraft.

While the technology is available to upgrade heliports to vertiports, regulators have not yet finalized standards. These regulations may be dependent on the types of aircraft selected, their footprint, weight, and electric or hydrogen charging requirements.

Globally, many cities have heliports that are rarely or no longer used. Helicopters are often seen as a nuisance by local communities due to their noise. Given the lower noise signature of eVTOLs, it is likely that some unused or underutilized heliports—particularly those near hospitals—may be renovated to utilize the new aircraft.

Fewer than half of the current inventory of heliports are in locations convenient to maximize AAM applications. Vertiport sites will require expansion into network configurations, with each node, or vertiport, carefully located and built to ensure passenger convenience and value.

Figure 3 – The roofs of office buildings, such as CityPlex Towers in Tulsa, may host vertiports.

Integrating an eVTOL aviation network into the existing system of public transportation modes, especially in urban areas, requires detailed planning and analysis. With the objective of implementing the greenest, most cost-effective, and commuter-friendly transit system possible, planners must consider the needs of all users when locating vertiports to enable practical end-to-end solutions for passengers.

In 2019, NEXA Advisors/UAM Geomatics launched a landmark global AAM study called **Urban Air Mobility: Infrastructure and Global Markets**, regularly updated to offer forecasting for 92 regions around the world through 2045. (Our assumptions and methodology are discussed in Sections 2.1 and 2.2, respectively.) We projected that by 2045 Oklahoma will need to do the following to take advantage of the full capabilities of AAM:

UTM Sample Vertiport Components (CAPEX and OPEX)	
Network design studies	Airport commercial eVTOL terminals
Environmental studies	Passenger shelters
Airspace flight design 3D visualization studies	Lighting systems
Concession agreements	CNS systems (ILS, beacons, etc.)
Secure project financing	IT and security systems
Purchase or lease land	Perimeter systems
Construction permitting	Parking
Architectural and engineering	Power grid updates
Site preparation and construction	FAA (etc.) permitting and certification
Foundation modifications	Recharging capability and systems
Platforms, Egress, walkways	Fire suppression systems
Elevators	Aeronautical chart preparation
Airport AAM passenger facilities	Operators, maintenance staff and related workforce

Figure 4 – Selected Ground Infrastructure Cost Elements.

- Remediate 18 existing heliports and small regional airports.
- Construct 10 new vertiports strategically located throughout the state.
- Construct a new terminal and vertiport facilities at each of the two largest airports (Will Rogers World Airport in Oklahoma City and Tulsa International Airport) focused solely on AAM operations.

A limited list of cost elements included in the estimates for building (CAPEX or capital expenditures) and operating (OPEX or operating expenditures) the vertiports is provided in Figure 4. These elements have been forecasted for Oklahoma's infrastructure improvements using specific intrinsic cost data unique to each city or region, such as land cost, labor cost, and so forth.

While certain aspects of vertiports remain to be determined, it is safe to say that the development of infrastructure to support an eVTOL network has significant cost advantages over heavy-infrastructure approaches such as roads, light rail lines, bridges, and tunnels. Compared to the billions of dollars required to extend highways and subway lines, for instance, the estimate for the capital requirement for new vertiports projected to operate in Oklahoma by 2045 (a mix of remediating existing heliports and building new ones) is in the range of $127 million.

1.2 Supply Chain 2: UTM Traffic Management Systems

UTM Sample ATC Infrastructure Components (CAPEX and OPEX)	
UTM interoperability standards and drone/eVTOL agreements.	Network design studies
UTM one-time facilities planning	Flight Plan and Flight Operations Database
Site/network optimization study	Network operations center
Systems specifications	RemoteID systems
Power grid studies	Power grid and backup systems
Cyber security architecture studies	Weather Information Systems
Physical security architecture	Micro Weather Detection Sensors
Facilities (offices rental costs	Beacon Navigation Nodes
Automation systems and stations	Resilient Bi-directional communication network
Flight Decision Support Tools	High Density Radars
Computers and Equipment	

Figure 5 – Selected UTM cost elements.

The second AAM value or supply chain is that of low or mid-altitude air traffic control (ATC) which ensures safe airspace coexistence for commercial and general aviation, drones, and eVTOL aircraft. (eCTOL and, to a certain extent, eSTOL, will operate under current airport ATC supervision.) Acronyms are constantly changing in this rapidly evolving industry: UTM usually refers to Uncrewed aircraft systems Traffic Management for drones, or Urban air mobility Traffic Management for passenger-carrying aircraft. Air traffic management can also be referred to by UATM—Uncrewed Aircraft Traffic Management or Urban Air mobility Traffic Management.

Currently, air traffic controllers guide airplanes and helicopters through airspace often surveilled by radar. It is likely that the first passenger AAM use cases—those eVTOL aircraft replacing and/or complementing existing aircraft operations such as Regional Air Mobility, Medevac, and helicopter operators—will rely on the FAA's existing ATC system staffed by today's air traffic controllers.

But the many new uses and routes of AAM aircraft—for passenger and cargo aircraft as well as for drones—would add hundreds, perhaps thousands of movements to each ATC regional system every day, overloading the FAA's air traffic management capabilities. NASA and the FAA are fully aware of this challenge and have been working for several years to define new ATC systems and capabilities to augment airspace management at low and medium altitudes, which are expected to be crowded with drone and eVTOL traffic. Selected cost elements necessary to implement UTM capabilities are shown in Figure 5. While ensuring safe vehicle separation using fully staffed facilities, the costs for Oklahoma will be affordable when considering their amortization over a period of decades, with user fees levied by operators.

Eventually, Advanced Air Mobility will need its own air traffic management system working in conjunction with the current FAA ATC system. Human controllers in a new local UTM facility may become airspace managers, focused on supervising automated systems and aircraft operations to ensure safety. At such a facility, a single controller could supervise many more aircraft movements than working in an airport ATC tower. A simple explanation is that aircraft will operate in layers of altitude with sUAS at the lowest level, eVTOL aircraft in the middle, and traditional aircraft at the highest, though they must also be safely guided through layers during take-off and landing (Figure 6).

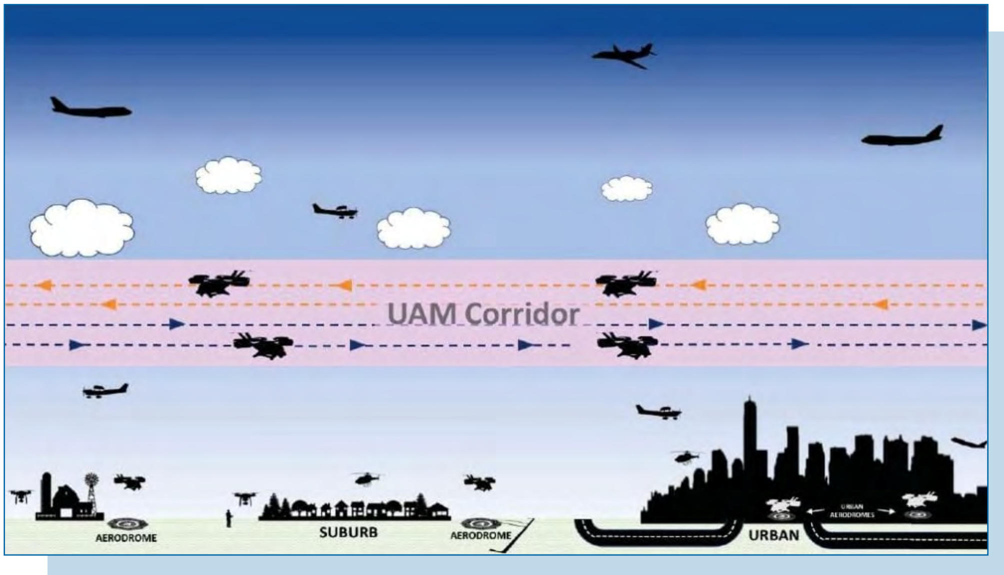


Figure 6 - Simplified FAA ConOps 1.0 concept of layering airspace above metropolitan areas for AAM. (Source: Avionics International)

Our models indicate that the estimated capital expenditure for creating an Advanced Air Mobility UTM system (CAPEX) across the State of Oklahoma could cost around $67 million. This amount factors in the need for a fully staffed Network Operations Center or NOC, which would likely be required, and would be overseen by FAA.

1.3 Supply Chain 3: Advanced Air Mobility Operators

Several AAM aircraft prototypes around the world are either in or nearing advanced stages of development and operational trials of one kind or another. Designs vary widely in terms of number of passengers, number of rotors, and distance traveled before recharging.

Most AAM aircraft currently in development are designed to be piloted, at least initially. The next two decades will see increasing use of automation and autonomy performing many functions traditionally performed by humans. Automation and autonomy offer the opportunity to reduce workload, lower costs of operations, and enhance safety for critical AAM missions and functions.

Aircraft noise is a key determinant defining the success and acceptance of eVTOLs that will operate in areas of higher population density at low altitudes (Figure 7). Smaller eVTOL aircraft are expected to fall well within current noise guidelines, and noise-reducing technologies hold promise for larger electric aircraft to be good neighbors as well.

To emphasize: AAM passenger and cargo flights are just around the corner. The global AAM aircraft leaders below predict the start of commercial operations in 2025-2026.

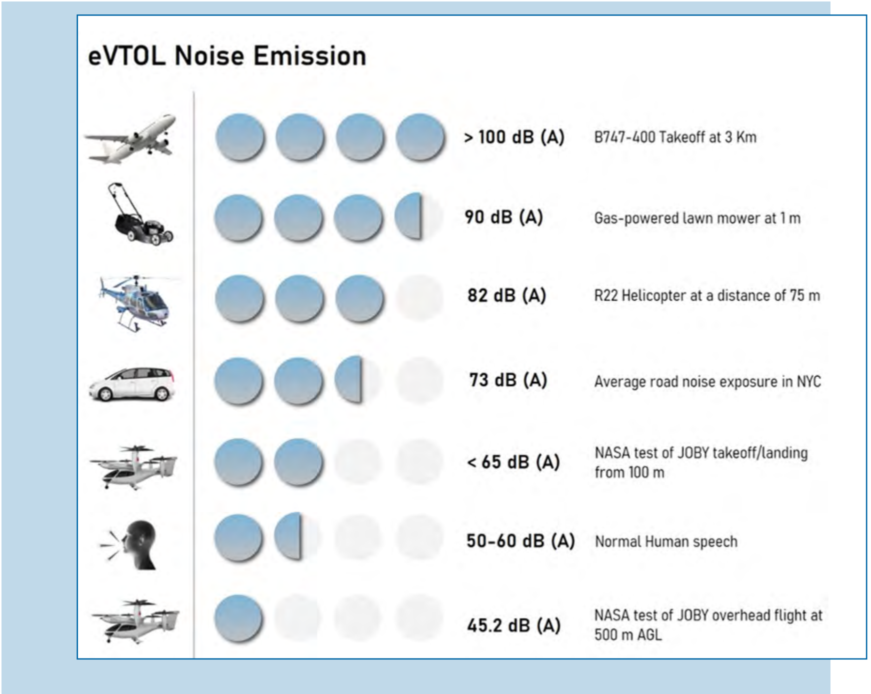


Figure 7 - eVTOL noise will be a key determinant of public acceptance.
The 2022 NASA test of the Joby aircraft confirmed its noise level was slightly lower than normal human speech.

Archer Aviation: The Archer Midnight, a seven-seater, is expected to have a range of 100 miles and reach speeds of up to 150 mph. Archer, based in California, is working with United Airlines to launch a commercial air taxi service in 2025, with one of its first routes a ten-minute flight between Newark Liberty International Airport and downtown Manhattan.

BETA Technologies: The Vermont company has designed the ALIA-250 aircraft with a 50-foot wingspan that can carry up to five people in addition to a pilot. The company's other electric aircraft, the CX300, is designed to take off from an airport and is expected to fly commercially in 2025. BETA Technologies also produces the Charge Cube, which provides power for both electric aircraft and ground-based electric vehicles. Some 14 airports on the East Coast have the cubes, with many more lining up to purchase them.

Joby Aviation: The company is developing the Joby S4, a 5-seater eVTOL aircraft with a range of 150 miles and speeds of up to 200 mph. Joby is working with Uber to launch a commercial air taxi service in 2025. The S4 is one of the most advanced eVTOL aircraft in development. It has been through over 10,000 flight tests and has received approval from the US Air Force to operate in controlled airspace.

Lilium: The Munich-based firm has designed a 7-seater eVTOL aircraft powered by 36 electric ducted fans, with a range of 155 miles and speeds of up to 175 mph. The FAA has issued a G-1 Certification Basis for the Lilium Jet, the first in the multistep type certification process which establishes the set of airworthiness and environmental standards that companies must satisfy with their aircraft through testing and demonstration. Lilium expects to begin commercial operations in 2025.

Volocopter: The Munich-based firm is developing a two-seater eVTOL aircraft called the VoloCity with a range of 18 miles and speeds of up to 62 mph, targeted towards inner-city and short-range travel. They are also developing a four-passenger eVTOL called the VoloRegion with a range of 62 miles, a maximum speed of 155 mph, and a cruise speed of 111 mph. Volocopter is working with a variety of partners to launch commercial air taxi services in cities around the world starting in 2024. The firm has conducted over 1,000 public test flights and has received approval from the German aviation authority to operate commercial air taxi services. Volocopter is also developing a cargo version of the VoloCity, which could transport medical supplies, food, and other goods.

Wisk: California-based Wisk is developing a four-seater eVTOL aircraft called Generation 6 with a range of 90 miles and speeds of up to 138 mph. Wisk is working with the FAA to certify the Generation 6 and expects to begin commercial operations in the mid-2020s. While many eVTOLs will likely transition to become autonomous—remotely piloted—by the 2030s, Wisk's Generation 6 is designed to fly completely autonomously.

In terms of eCTOL aircraft, **Heart Aviation**, based in Sweden, is developing the ES-30, a hybrid-electric 30-passenger regional airliner with a fully electric range of 124 miles or a 247-mile range when also using generators powered by aviation biofuel. Heart plans to have a proof-of-concept aircraft in 2024 and start flight tests in 2026, with an entry into service in 2028.

Electra Aero: in Virginia, is developing an eSTOL aircraft that can take off from an area smaller than a soccer field and fly up to 500 miles. It currently has some 2,000 international pre-orders and expects FAA certification by 2026.

1.4 Supply Chain 4: Certified eVTOL Operators

Current helicopter operators are today's vanguard for AAM services. Many police and civil agencies operate helicopters (Figure 8) despite their high costs and noise. Charter helicopter companies in Oklahoma such as Flex Air Aviation, Interstate Helicopter, Fly Tulsa Helicopter Tours, and Semper Fly have excellent longstanding safety records, trained pilots, weather dispatching expertise and systems, and quality and safety programs. They are also familiar with the regulations, terrain, and locations of the existing heliports and airports in the region.

Figure 8 – Many law enforcement agencies such as the Oklahoma City Police Department use helicopters. In the coming years, many will complement their fleets with quieter, greener, less expensive eVTOLs.

These charter helicopter services do not currently include scheduled operations (such as Tulsa to Oklahoma City), but rather executive charter transport, cargo delivery, tourism, chartered medical missions, and the like.

Drone operators can be independent individuals, small companies, state and federal agencies, real estate companies, and large players such as DroneUp, Amazon, FedEx, and Walmart. Their missions are diversified, and range from healthcare delivery (blood, vaccines, medical supplies, organs, isotopes, etc.) to package delivery, agricultural inspection, bridge and power line inspection, real estate promotion, and other useful applications.

2. THE BUSINESS CASE FOR AAM

Advanced Air Mobility must, within a few years, become economically viable to pay off investors as well as to support recurring needs such as landing fees, OPEX infrastructure costs, equipment maintenance and upgrades, and worker salaries across all supply chains.

NEXA Advisors and its subsidiary UAM Geomatics developed the business analysis tools illustrated in Figure 9 to assess AAM feasibility. A key goal for each of the four supply chains is to achieve a measure of commercial success. According to our forecasts, the four critical supply chains will all achieve this success for the State of Oklahoma, in turn attracting outside capital to fund each phase of the launch.

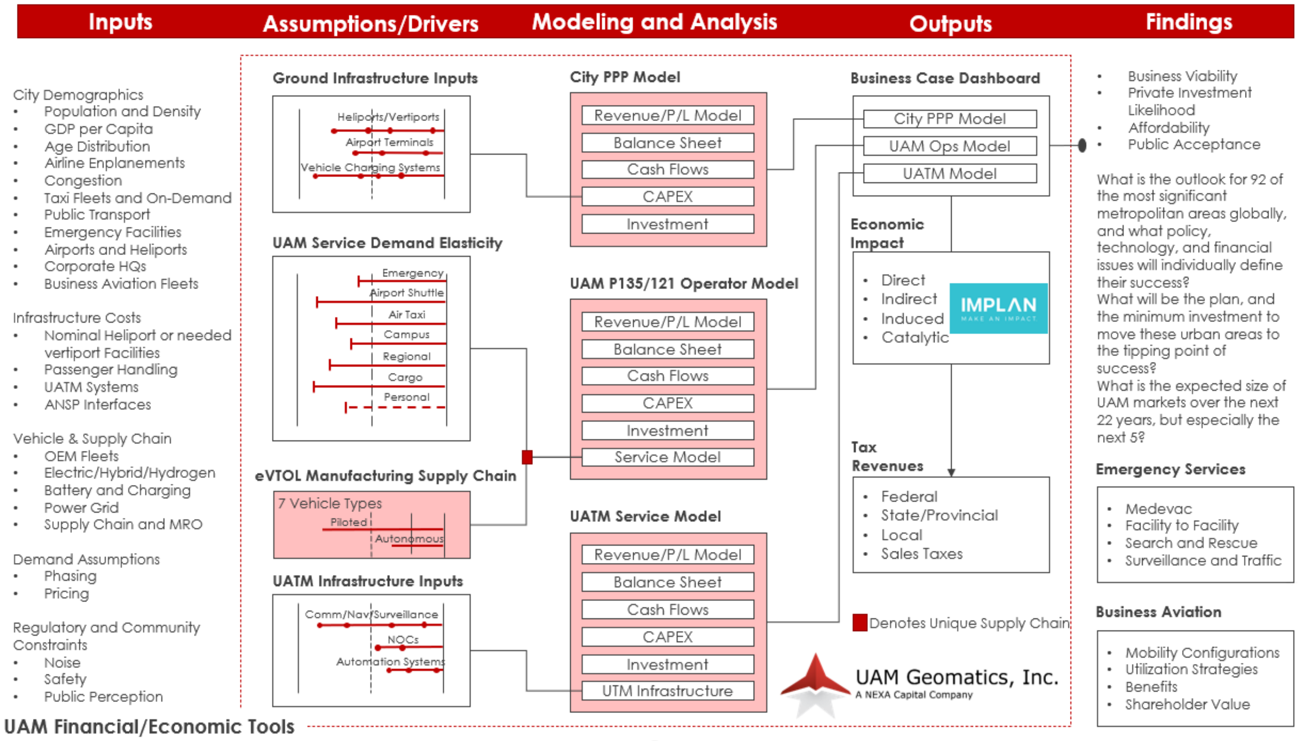


Figure 9 - NEXA Advisors/UAM Geomatics financial and economic tools analyze the four supply chains to assess AAM business viability, city by city. The entire State of Oklahoma has been analyzed using the tool set.

2.1 Estimated AAM Passenger Demand for Oklahoma

Analysis of the major use cases' passenger demand first required separation into price-elastic (sensitive to price) and price-inelastic (less sensitive to price) forecasts. Clearly, on-demand air taxi, airport shuttle, and regional air transport services are highly price sensitive, while business aviation and Medevac are not. Other factors are considered as well, including the ability of the traveling public to afford such services.

Factor	Demand Input	Description
1	Airport O/D Traffic	Historic and projected Origination & Passenger Traffic
2	Mobility Substitutes	Other options — Taxi, Public Transit, Private Vehicle Costs, Fuel
3	Per Capita GDP	Weighted input according to latest GDP (PPP) of each City
4	Distances & Congestion	Average travel distances, congestion, airports to city centers, road intrastructure
5	CIMI Human Capital Indicator	IESE Cities in Motion Index (CIMI) human capital score, ten factors including education
6	Population Density	Weighted to population density and proximity to city employment areas (downtown, industry, factories)
7	Livability	Cost of living, disposable income, taxation all weighted and averaged
8	Fortune 1000 Presence	Three ranked scores to determine passenger demand and high value transportation
9	Business Aviation Activity	Business aviation acitivty weighted across various cities
10	Existing Heliports	IMPORTANT data point: This is the starting point for AAM infrastructure

Figure 10 – NEXA methodology uses ten factors to analyze cities and regions for AAM success.

For these demand forecasts to be realistic, the analysis made use of ten factors—a methodology uniformly applied to all studies undertaken by NEXA Advisors/UAM Geomatics. These factors (Figure 10), adjusted to Oklahoma's unique demographics, estimate that by 2045, the peak forecast year, some 25 million passengers are expected to have traveled using new AAM services over the 22-year forecast period. About 3 million passengers per year, or almost 8,000 passengers per day, are forecasted by the 2041-2045 time period.

Affordability is a key factor when projecting passenger demand. Forecasted cost per ticket for the price-elastic use cases—Regional Air Mobility, airport shuttle, and on-demand air taxi—could drop to under $90 on average (Figure 11).

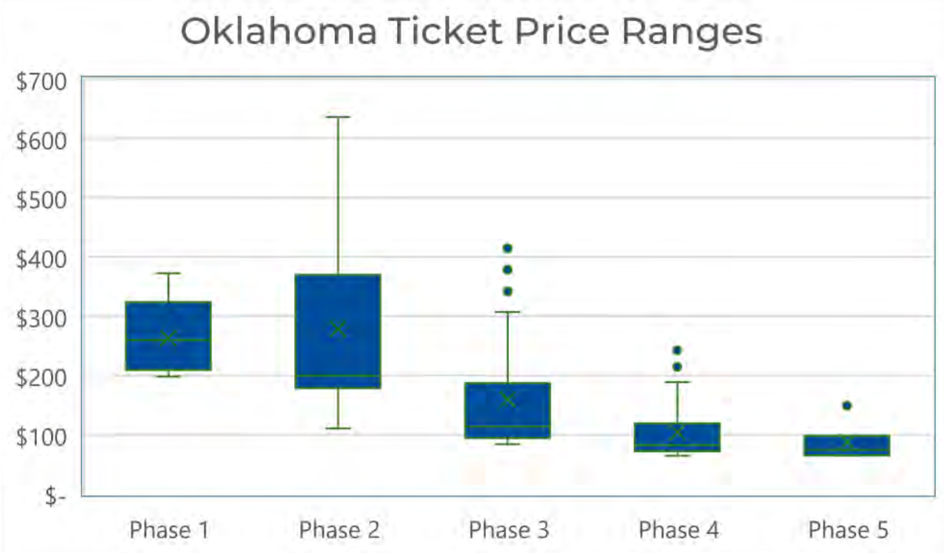


Figure 11 – Oklahoma ticket price boxplots for each phase. Phase 1 is 2025-25; Phase 2 2026-30; Phase 3 2031-35; Phase 4 2036-40; and Phase 5 2041-45.

2.2 Business Opportunity: Revenue and Pillars of GDP Growth

We separately examined six regions of Oklahoma, each with its own economy, demographics, transportation assets and needs, healthcare network, and industry, and combined them to obtain a statewide forecast (Figure 12).

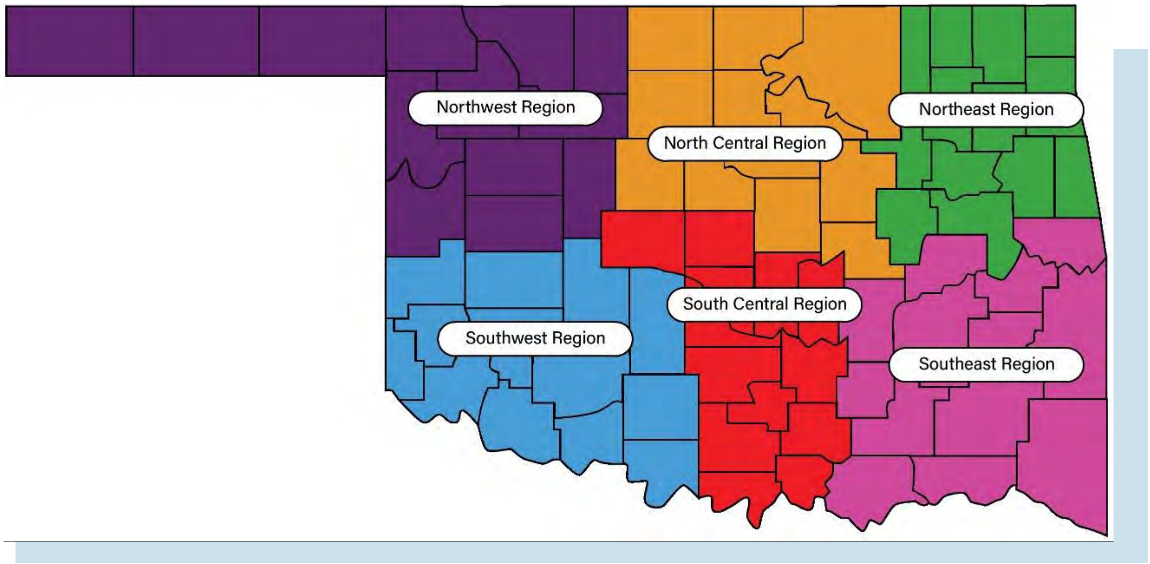


Figure 12 – The six regions of Oklahoma.

Using the five AAM use cases discussed above (medical, airport shuttle, business aviation, on-demand, and Regional Air Mobility,) Figure 13 shows the results of the extensive analysis provided by the financial and economic tools used in the NEXA Advisors/UAM Geomatics Urban Air Mobility study and produced in multi-year increments of revenue and capital investment estimates for the entire State. These financial estimates fall into four categories:

- **CAPEX:** Those capital expenditures funds used to acquire, upgrade, and maintain physical assets such as property, plants, buildings, and specialized facilities, technology, or equipment.
- **OPEX:** Costs that a business incurs through normal business operations. Operating expenses include rent, equipment, inventory costs, marketing, payroll, insurance, step costs, and funds allocated for research and development.
- **Revenues:** These represent per-passenger ticket revenues expected for eVTOL fleet operators and are based upon a rigorous demand elasticity model applied to the State.
- **Aircraft Fleet Purchases:** Fleet acquisition and maintenance costs to acquire and operate sufficient eVTOL aircraft to sustain the use cases identified.

The totals for the entire 22-year forecast period estimate nearly $5.6 billion in direct new (and fully incremental) business activity across the State of Oklahoma. The R/I (Return on Infrastructure), center right in the chart below, of 4.46, is extremely attractive to investors who generally look for a ratio above 3 or 4. R/I is calculated by dividing total revenue (AAM Operators) by the combination of total Ground Infrastructure and RTM/UTM costs, excluding vehicle costs.

Oklahoma Statewide 2023-2045 ($US) — **AAM Business Case EcoSystem**

	Year	2023-2025	2026-2030	2031-2035	2036-2040	2041-2045	SUM	Pillar Totals
Demand (Passengers)		Nascent	1,180,000	2,734,000	6,734,000	14,486,000	25,133,000	
Ground Infrastructure	Ground Infrastructure OPEX	$15,110,000	$75,820,000	$94,690,000	$109,000,000	$136,540,000	$431,160,000	$558,309,000
	Ground Infrastructure CAPEX	$33,690,000	$29,540,000	$33,980,000	$5,450,000	$24,440,000	$127,100,000	
RTM/UATM	RTM/UATM Cost OPEX	$4,308,000	$30,120,000	$66,777,000	$123,887,000	$231,763,000	$456,855,000	$523,935,000
	RTM/UATM Cost CAPEX	$8,711,000	$19,840,000	$7,017,000	$12,823,000	$18,690,000	$67,081,000	
UAM Operators	Passenger Revenues	Nascent	$313,269,000	$412,426,000	$668,104,000	$1,255,370,000	$2,649,169,000	$4,825,446,223
	MedEvac Revenues	Nascent	$187,711,000	$244,055,000	$336,976,000	$354,163,000	$1,122,905,000	
	eVTOL Cargo	Nascent	$80,013,275	$141,699,112	$282,636,984	$549,019,852	$1,053,369,223	
	Drone Services	Under Construction						
Vehicles	Vehicle Purchases	$55,728,000	$134,640,000	$144,147,000	$182,167,000	$211,571,000	$728,253,000	$728,250,000
Oklahoma Statewide Grand Total		**$117,552,000**	**$790,950,000**	**$1,003,096,000**	**$1,438,428,000**	**$2,232,545,000**	**$5,582,570,000**	**$5,582,570,000**
							R/I	**4.46**

Average eVTOL Passengers per Day	**N/M**	**647**	**1,498**	**3,690**	**7,938**
eVTOL Pax / Commercial Air Travel	**N/M**	**2%**	**3%**	**7%**	**12%**
Revenues per Passenger	**N/M**	**$265**	**$151**	**$99**	**$87**

Note: N/M - Not Meaningful

UAM Geomatics
A NEXA Capital Company

Figure 13 – Oklahoma's statewide business case: costs, revenues, passenger demand, and ticket prices.

Key forecast assumptions used to produce the Oklahoma AAM revenues are:

- Forecasts make use of collected geospatial data to account for Oklahoma's existing aviation and related infrastructure
- At least some eVTOL manufacturers will have FAA-certified aircraft available by 2026
- Industry and the FAA will agree on CONOPs (Concept of Operations) and standards for UTM by at least the end of 2024
- Multi-year CAPEX investment in urban ground and ATC infrastructure begins in 2025
- Operators begin services in Regional Air Mobility by 2026
- Operators begin services in all other AAM use cases, including Medevac, business aviation, airport shuttle, on-demand air taxi, and heavy cargo, by 2027
- Significant impact from flight automation takes hold around the 2030 timeframe, driving sector costs and passenger tickets much lower. Remotely piloted vehicles can sell an extra seat, benefit from reduced pilot costs, and enjoy added safety benefits.

If an AAM OEM (Original Equipment Manufacturer) opens a factory in Oklahoma, this would generate an additional $2.2 billion in economic activity.

With or without an OEM, the AAM ecosystem needs to provide excellent services to passengers at affordable prices at a point where the sector finds equilibrium, thereby becoming and remaining profitable. By definition this equilibrium is achieved when for a given region such as Oklahoma each of the four supply chains can reach and exceed cash flow profitability.

In this report's 22-year forecasts, the NEXA team used the following macro assumptions while estimating the cost and schedule for AAM ground infrastructure:

- A large percentage of existing public, private, and unregistered heliports are first remediated to provide a baseline to support early eVTOL services before expansive new construction is undertaken.
- Certain numbers of heliports and vertiports are built or retrofitted to provide hybrid aircraft refueling, electric charging, or fuel cell charging. The estimated costs of such charging facilities or services are rolled into the ground infrastructure costs.
- All airports within a given city's economic catch basin, whether commercial air transport or general aviation/business aviation, will receive investment in vertiport facilities and AAM traffic management services to permit safe passenger handling and eVTOL traffic volume.

3. CARGO FORECASTING

Oklahoma is populated by numerous freight-dependent industries; oil and gas, agriculture, mining, manufacturing, construction, and more, and has a robust freight system of rail lines, trucking companies, and major cargo highways across the State. It is an efficient system that will continue to move the bulk of freight even as AAM cargo aircraft begin operation. Given the greater expense of operations, AAM aircraft will only carry those goods that are: 1) time sensitive, 2) within payload capacity, and 3) high value.

To produce our cargo forecasts, we obtained existing air freight and trucking data from the Bureau of Transportation Statistic's Freight Analysis Framework 4 (FAF4) tool. The FAF4 tool provides both historical and projected freight movement data for the United States, categorized by commodity.

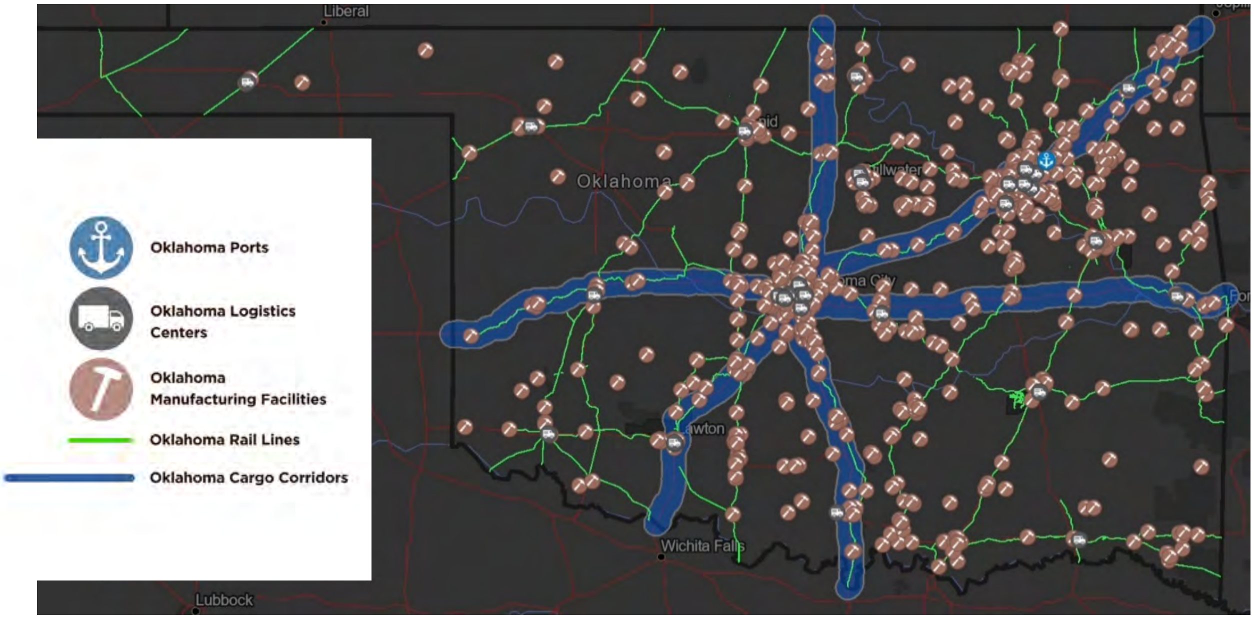


Figure 14 – Cargo logistics entails delivery of time-sensitive goods and materials that must reach every corner of the State.

Both air freight and truck freight projections were used as inputs for the eVTOL cargo market model. First, the inputs were sorted by commodity codes and filtered by only time-sensitive commodities. Of the initial Standard Classification of Transported Good (SCTG) codes, the commodity categories relevant to eVTOL operations were Precision Instruments, Electronics, Machinery, Pharmaceuticals, and Perishables.

Next, the subcomponents of each of the five commodity categories stated above were assigned to a weight class. Commodities over 1,000 lbs. or under 50 lbs. were not considered.[2] Each weight class corresponded to a market share percentage for each SCTG Code sub-component. These percentages based on weight class were applied to Oklahoma's freight projections to further sort for the eVTOL cargo market potential.

Finally, subcomponents were filtered by value classes. We assumed that eVTOL cargo operations would cater to high value goods, given the cost of eVTOL use compared to traditional freight modes. SCTG Code subcomponents were assigned a value class and a corresponding market share percentage that was applied to the inputs.

After sorting by time-sensitive and high-value goods between 50-1,000 lbs., we arrived at the AAM cargo market potential for the State's two major airports (Will Rogers World Airport in Oklahoma City and Tulsa International Airport,) as well as at freight logistics centers and along trucking corridors.

Cumulative revenues through 2045 for all major corridors are slightly more than $1 billion.

Corridor	(2022-2024)	(2025-2029)	(2030-2034)	(2035-2040)	(2041-2045)	Total by Corridor
I-35	**$**	**$26,613,413**	**$47,1330,891**	**$94,008,584**	**$182,610,845**	**$350,363,733**
I-40	**$**	**$21,790,683**	**$38,590,103**	**$76,972,890**	**$149,519,161**	**$286,872,838**
I-44	**$**	**$12,755,161**	**$22,588,688**	**$45,056,025**	**$87,520,931**	**$167,920,805**
US-69	**$**	**$7,125,021**	**$12,618,021,**	**$25,168,254**	**$48,889,112**	**$93,800,408**
I-240	**$**	**$11,728,997**	**$20,771,410**	**$41,431,231**	**$80,479,801**	**$154,411,439**
Total by Phase	$	**$80,013,275**	**$141,699,112**	**$282,636,984**	**$549,019,852**	**$1,053,369,223**

Figure 15 – Cargo eVTOL traffic looks to be robust on all 5 major state corridors.

2 Cargo under 50 lbs. is not considered because cargo of that size would fall under the responsibilities of drone operations.

4. ECONOMIC PRINCIPLES OF THE sUAS MARKET

Oklahoma is well-positioned to become a major hub for the rapidly expanding commercial drone industry. The State offers vast uncongested airspace, numerous infrastructure inspection needs, and key industries like agriculture and energy that can benefit enormously from drone technology.

The Choctaw Nation UAS Test Site in Durant is one of seven FAA-selected unmanned aircraft system test sites established in 2013. The site operates over 5,000 acres of restricted airspace with special use certifications from the FAA and serves as a test bed location to conduct research on how to safely integrate drones into the National Airspace System (NAS), focused on areas like Beyond Visual Line of Sight (BVLOS) UAS operations, night-time flights, and detect-and-avoid technologies.

To analyze the economics of the Oklahoma UAS market, we examined disruption, opportunity cost, supply and demand, and economies of scale and scope. We also explored the economics of regulation level. It is clear that BVLOS markets will offer much greater expansion and profitability than the current, FAA-mandated Visual Line of Sight (VLOS) restrictions. And while sUAS will not become the economic engine that AAM passenger and cargo flights will be, it will create significant efficiencies, conveniences, and increased profitability for the industries employing them and the public that benefits from them. Many inspection use cases will ensure the safety of employees who otherwise would have to undertake hazardous inspections at high altitudes, in traffic, or near power lines.

We examined the following major markets:

- **Agriculture:** Drones in agriculture conduct crop spraying, create prescription maps for fertilizer and pesticide use, monitor crop health, and survey fields. Advanced drones can detect plant diseases and irrigation issues.
- **Construction**: Construction drones perform aerial mapping of construction sites, survey topography, monitor projects, and inspect buildings, real estate, equipment and job sites. Drones improve worksite safety.
- **Delivery:** Delivery drones transport lightweight packages, food items, medical supplies, documents and other goods rapidly and at low cost. Companies like Amazon, Walmart and UPS are testing drone delivery in several US states.
- **Entertainment:** Media and entertainment drones are used for filming video, movies, commercials, and TV shows. Sports broadcasts use drones for overhead shots. Drones are used in journalism, weddings, and events.

- **Energy:** Energy drones conduct inspections on power lines, pipelines, platforms, and facilities. They survey sites, inspect equipment, and monitor environmental compliance. Drones enhance safety and cut costs.
- **Insurance:** Insurance drones inspect properties and sites to settle claims faster, assess damage, investigate fraud, and mitigate risks. Roof inspections are a major use case. Drones improve productivity.
- **Mapping:** Mapping drones survey and photograph land and buildings to create precise 2D and 3D maps. They're used in urban planning, construction, conservation, and mining. Drones update maps cost-effectively.
- **Public Safety:** Public safety drones support law enforcement, fire departments, emergency response, and search/rescue teams. They find missing persons, monitor disasters, and assess emergencies. Drones boost situational awareness.

For each market, we forecast the following:

- Total market size
- Absorption rates
- Technology adoption rate in the market
- Number of annual operations
- Number of operations personnel
- Expected annual salaries of personnel

The detailed methodology for sUAS forecasts in Oklahoma is found in a separate paper, "Drone Economics: The Economic Impact of Commercial Drone Industry Growth in Oklahoma 2024-2045" by Darryl Jenkins.

The paper emphasizes that an important facet of BVLOS is how many drones a single pilot will fly; pilot costs are one of the single largest operating expenses.

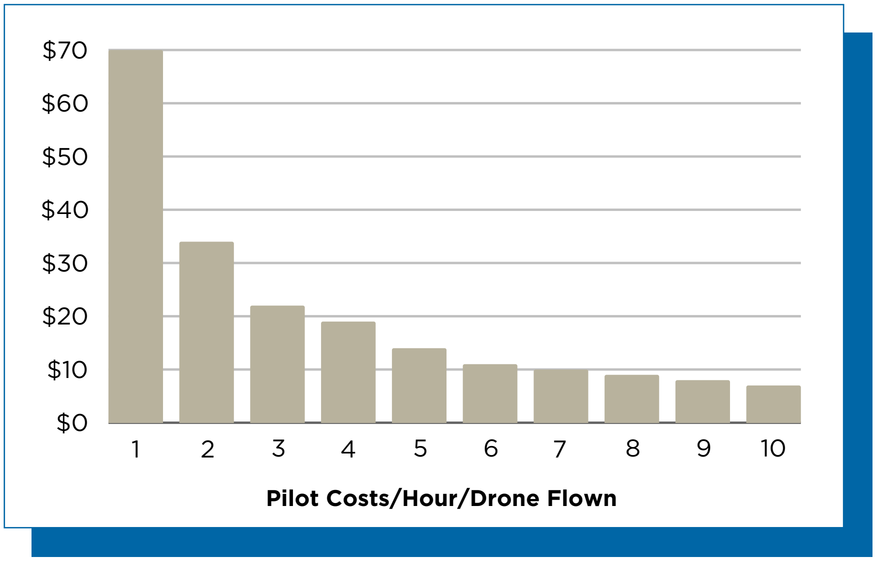


Figure 16 – Drone Pilot Costs (Source: Darryl Jenkins/Drone Economics)

Figure 16 shows how hourly pilot costs go down as the number of drones they can fly simultaneously increases. Over time, the role of drone pilots will change significantly as they become more hardware and software dependent. Drone pilots, in the future, will evolve to becoming flight supervisors, stepping in for off-nominal events, as command and control and other highly automated systems take over significant flight aspects. In a few years, one drone pilot might fly ten drones at a time which is why, as drone flights increase exponentially after BVLOS comes into play, new pilot jobs will grow much more slowly.

Our total drone market estimates used United States Department of Labor Statistics figures. First, we determined how many businesses exist in the State of Oklahoma. Then, we forecasted how much of the total market drones can capture and its likely growth rate. The same metric used to measure the total market was used at the county level to allocate market share according to the percentage of the businesses existing in the county to the total number of statewide firms. The Rogers Diffusion theory was used to allocate the total sales over a 22-year period. These figures also provided input into the IMPLAN[3] Economic Impact Model.

3 Go to www.implan.com for further information on this widely trusted economic impact assessment tool.

We concluded that:

At Oklahoma sUAS market maturity, around 2045, the average annual payroll of commercial drone operators will be at close to $69 million.

This will generate a total of 1,425 new drone pilot jobs over the forecasted period, and likely an equal number of software experts and analysts.

The annual capital expenditure for new and replacement drones will approximately be $100 million over the forecasted period.

The market segment with the largest number of daily operations will be package delivery and will dwarf all other market segments in terms of daily operations.

There will most likely be sufficient drone operators to accommodate the future growth given the increasing number of drones each pilot will supervise.

5. OKLAHOMA'S AAM ECONOMIC IMPACT FORECAST

Perhaps the most interesting forecasts for any state or region are those of new jobs, which not only provide residents with livelihoods, but support businesses, increase overall GDP, and create new tax revenues that local and state governments can use for schools, roads, law enforcement, etc. Data from the previous sections have been used in our Economic Impact Analysis of Advanced Air Mobility in the State of Oklahoma from 2024-2045 covering AAM aircraft other than drones.

We also used the IMPLAN input/output modeling tool—a recognized modeling tool used to study impacts on all sectors—in combination with NEXA's business case analysis model featuring six regions of Oklahoma: Northwest, North Central, Northeast, Southeast, South Central, and Southwest. The combination depicts the most accurate possible impact assessment of the benefits AAM will deliver to Oklahoma.

The forecasts may be analyzed and carefully considered by policy planners and stakeholders, as well as state and local governments interested in job creation and general economic growth. They may help mobilize public sector resources to act on the AAM opportunity and possibly seize a first-mover advantage in a $1 trillion global market meant to improve mobility and drive economic growth.

Figure 17 explains the inter-relationships between direct, indirect, induced, and catalytic economic impacts for the AAM sector, driven by the revenue, cost, and CAPEX and OPEX pillars of business activity. Figure 18 is a process flow diagram tying AAM business case outputs or pillar totals through IMPLAN's economic impact model.

In economics, an input/output model is a quantitative methodology that represents the interdependencies between different branches of a national economy or of regional economies. The IMPLAN input/output model depicts inter-industry rela-

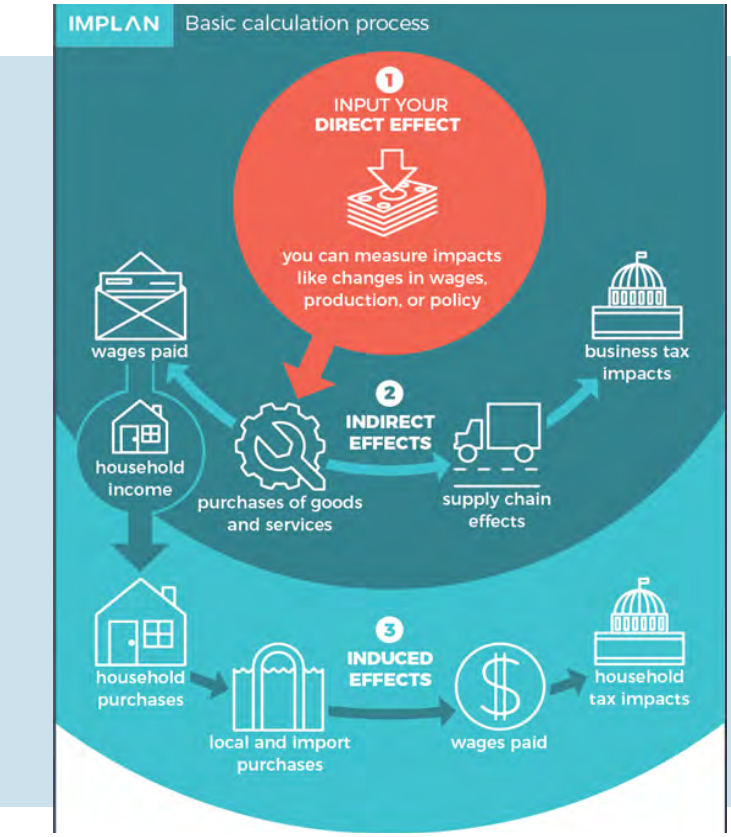


Figure 17 – IMPLAN's interrelationships of direct, indirect, and induced economic impacts.

tionships, showing how output from one industrial sector may become an input to another industrial sector.

In the inter-industry matrix, column entries typically represent inputs to an industrial sector, while row entries represent outputs from a given sector. This format shows how dependent each sector is on every other sector, both as a customer of outputs from other sectors and as a supplier of inputs. This inter-industry relationship is expressed in the form of industry coefficients, or multipliers, that depict the rate of change of output among a set of interdependent industries, from a one unit increase in output by one industry.

IMPLAN's definition of output is as follows: The output multiplier describes the total output generated as a result of 1 dollar of input in the target Industry. Thus, if an output multiplier is 2.25, that means that for every dollar of production in this industry, $2.25 of activity is generated in the local economy: the original dollar and an additional $1.25. Econometric and input-output models contain assumptions; after all, if every variable were known, we would have a list of facts and not a forecast.

The most important assumption derived from NEXA's business forecast for Oklahoma includes the insertion of an "inflection point," the introduction of highly automated flight systems requiring less human intervention. For example, an emerging view of AAM over the next 20 years is that cockpit automation will be necessary to improve the integrity and thus the safety of this new market sector. Automation should eliminate pilot error, enforce sense-and-avoid rules, and safely separate all aircraft, including eVTOLs and drones. Automation will reduce the cost of operations by freeing up a seat in the aircraft for a paying passenger, as well as reducing the demand for human operators. The cost structure of the entire industry will be dramatically impacted in synchronization with the expansion of vehicle and airspace capacity by the early 2030s.

The economic impact assessment (EIA) in this report accounts for the inflection point, as will be reflected in the economic charts examined later. This is done through the input phase, whereby the NEXA model factors in automation and its impact on the overall AAM business case.

EIAs assess the impact of an "exogenous shock"—new economic activity that stimulates growth—exploring its impact on a number of indicators such as GDP, job creation, and tax revenues. Some of these indicators will be further evaluated at three levels of analysis: direct, indirect, and induced effect.

Direct effects calculate the economic value that a business or industry generates by its own means through direct hiring of its own employees, revenue generation from sales, and the portion of its business activity that contributes to regional output. Direct effects include the initial change in expenditures by consumers/producers—the exogenous shock—producing the first round of economic activity in the form of new output, jobs, and revenues.

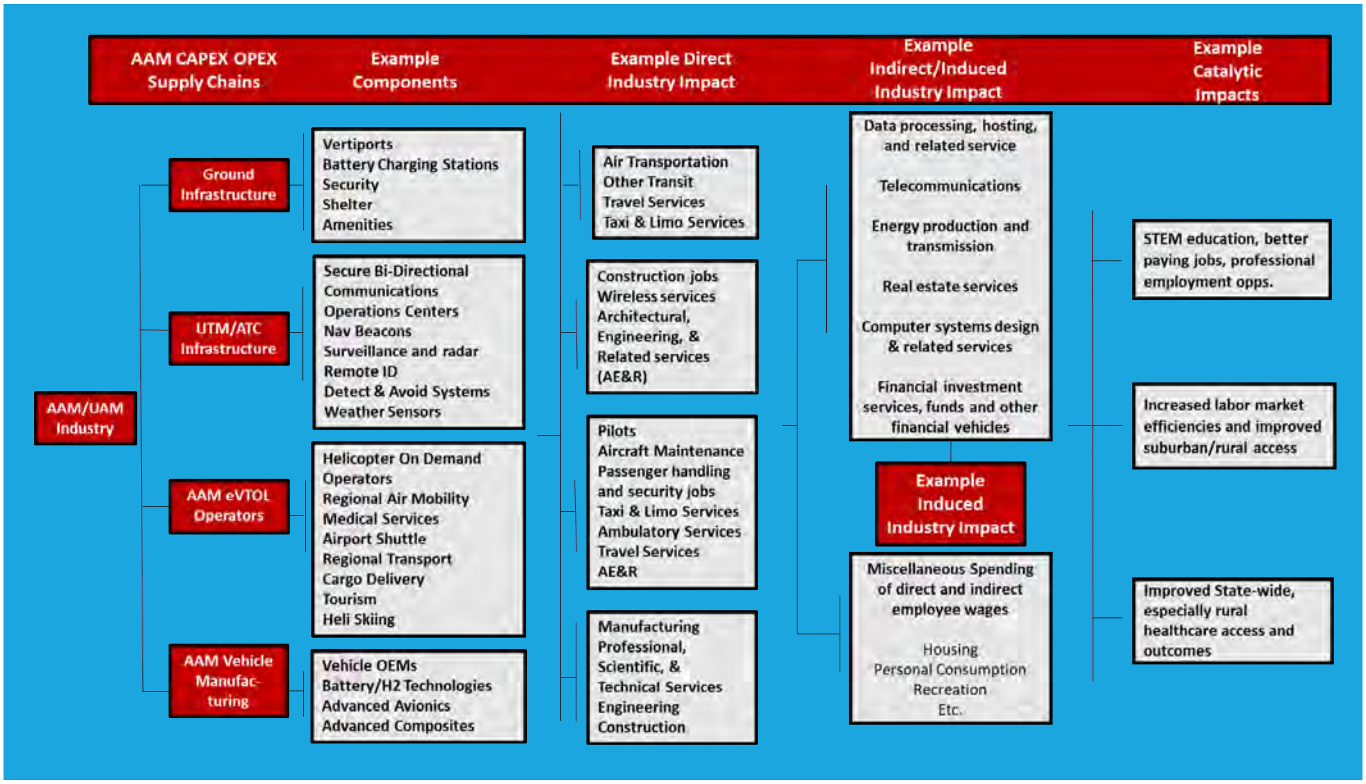


Figure 18 - Process flow diagram tying AAM business case outputs (pillar totals) through IMPLAN's economic impact model.

Indirect effects gauge the economic impact that results from demand created by the direct impact. Products and services are bought to support this new activity (i.e. supply chain companies). Finally, there's the **induced effect**, which measures the economic impact on the broader economy resulting from demand created by employees of the new activity (direct component) and its supporting businesses (indirect component). IMPLAN defines the induced impact as follows: "The values stemming from household spending of Labor Income, after removal of taxes, savings, and commuter income. The induced effects are generated by the spending of the employees within the business supply chain."[4] In other words, the new employees take their paychecks and go shopping.

In combining the business case totals, NEXA produced consolidated OPEX, CAPEX, and revenues along the four NEXA-defined supply chains. OPEX and CAPEX were generated for infrastructure and UTM, along with aircraft costs and revenue for the operators. These totals, or economic outputs, have been forecasted for each phase of AAM's development in Oklahoma through 2045.

4 https://blog.implan.com/understanding-implan-effects

5.1 Economic Impact: Gross Domestic Product

GDP, or Gross Domestic Product, is defined as the total value of all domestic final goods and services produced within a specified period of time (typically a year). It is also known as value added which, according to IMPLAN, is defined as the difference between total output and the total value of intermediate inputs throughout an economy during a specified period of time. In the case of AAM, total GDP Impact over 22 years, calculated using NEXA's business case analysis model, is $5 billion (Figure 19).[5] $2.3 billion is attributed to the direct impact; $1.3 billion is attributed to the indirect impact, and $1.4 billion is attributed to the induced impact.

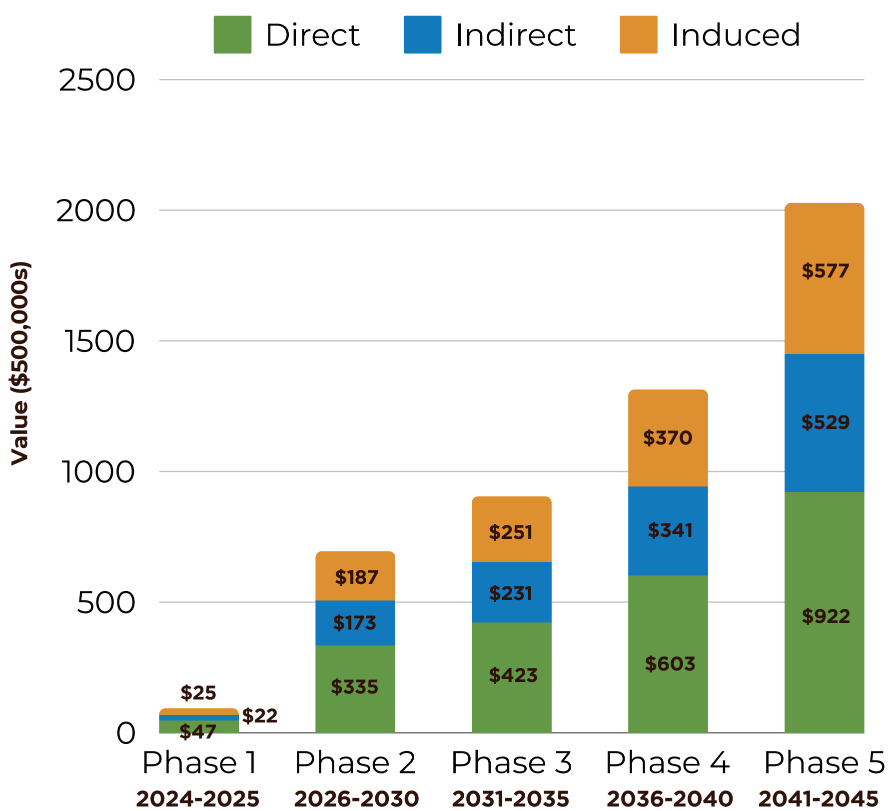


Figure 19 – AAM passenger and cargo use is likely to boost State GDP by $5 billion.

5 If an OEM (Original Equipment Manufacturer) of eVTOL aircraft opens up production facilities, an additional $2.2 billion in economic activity would be generated.

5.2 Economic Impact: Jobs and Occupations

Jobs were calculated first in terms of employment, which IMPLAN defines as including both part-time and full-time annual employment. In this study, employment was derived from the total output produced by AAM at the direct, indirect, and induced levels. Since the employment count does not differentiate between type of employee (full-time or part-time), a conversion to full-time equivalent (FTE) is necessary to capture a tangible estimate of the labor count. IMPLAN provided a conversion sheet to identify the corresponding FTE count.

The jobs captured in the impact come in three tranches: the direct (jobs gained directly from AAM,) the indirect (jobs gained indirectly by the supply-chain industries supporting AAM,) and the induced (the subsequent jobs gained from induced spending in all sectors of the economy.) Together, they represent the total impact on jobs for the State of Oklahoma.

The permanent FTE job numbers in Figure 20 reflect cumulative permanent full-time positions gained year over year. As the value of AAM increases every year, so does the labor required to support the increasing business activity. This means that by 2030 the value of AAM at the direct, indirect, and induced levels will require roughly 1,500 jobs to support it. By 2045, that number reaches over 4,600 FTE jobs.

If, however, an OEM opens an eVTOL factory in the State, this will generate an additional 4,066 jobs through 2045.

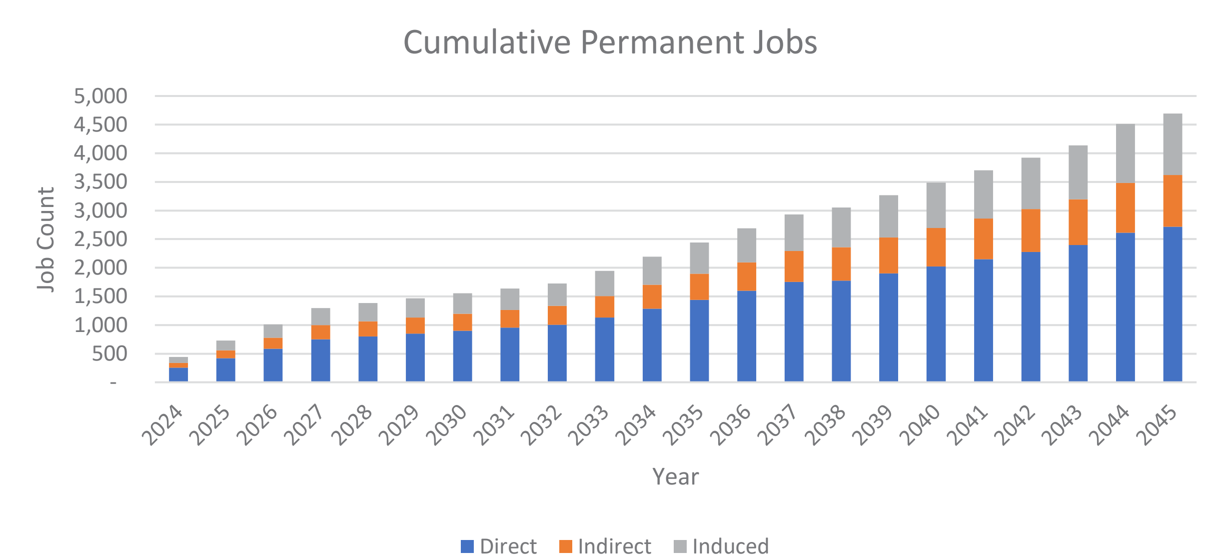


Figure 20 – AAM passenger and cargo use will bring over 4,600 cumulative permanent new jobs to Oklahoma through 2045.

Since the direct and indirect effects of AAM account for roughly 80 percent of the impact, we see that job types, or occupations, closely align with the industries tied to AAM. Some of these occupations are reflected in the US Bureau of Labor Statistics' Standard Occupational Classification system, such as business and financial operations. Other categories, like "Engineering, Intelligence, Transportation Systems," reflect an evolving technology sector that more accurately describes the type of jobs AAM will create.

The first two phases, or ten years of development, will see a focus on manufacturing and infrastructure development. This means jobs created to build vertiports, aircraft parts, software, and more. They will support both white-collar and blue-collar occupations such as software developers, mechanical engineers, electricians, construction laborers, technicians, and welders.

As the infrastructure to support and maintain AAM gets built out, the industry will then experience its expansion through operation of AAM services. In the latter three phases of expansion, therefore, we will see sustained growth in the flagship positions of aircraft operations. These include pilots (both commercial and cargo), freight handlers, travel agents, operation managers, and so forth.

Together, these jobs make up the entire AAM sector, reflecting impacts at both the direct and indirect level. Jobs are also created at the induced level but are less related to AAM and result from overall growth of the regional economy.

5.3 Economic Impact: Taxes

IMPLAN captures tax revenues at the local, state, and federal level. The local level in particular represents totals for townships, cities, and counties for the entire State. Increased government revenues generally translate into additional government expenditures, which allows the State to invest more generously in infrastructure, education, social programs, and so forth.

Figure 21 depicts these revenues at the local, state, and federal levels over each phase of growth. When accumulated, these values reflect total revenue of $1.154 billion gained over 22 years. The local and state governments account for $180 million and $275 million in revenue, respectively. Federal revenues account for about $699 million.

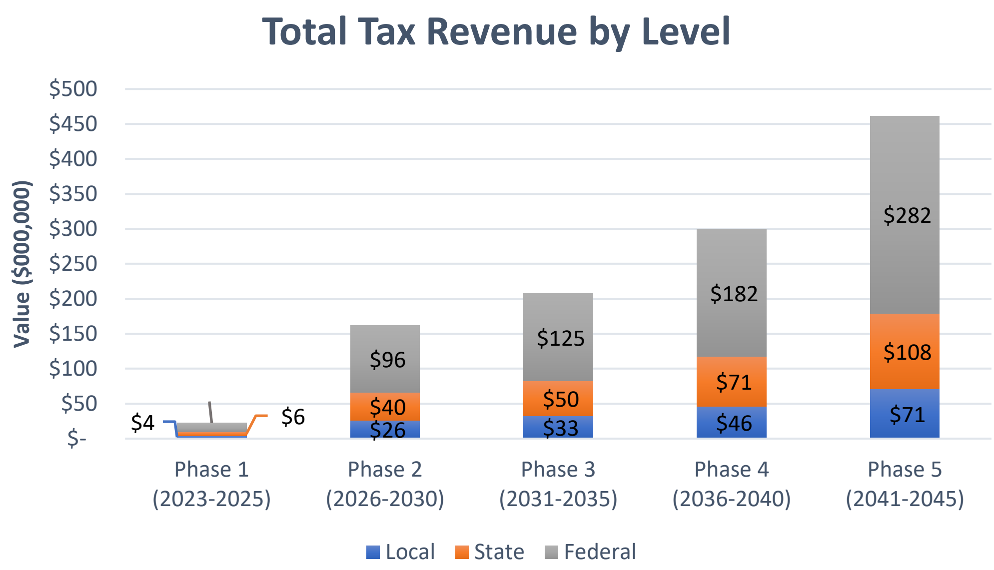


Figure 21 – Estimated future tax revenues from new AAM passenger and cargo activities in Oklahoma are more than $1 billion.

The most important take-away from this analysis is that Advanced Air Mobility will provide many returns, including a large contribution to the State's tax base.

5.4 Catalytic Business and Economic Impacts for Oklahoma

Figure 22 - Medi Flight of Oklahoma based out of Stillwater has provided essential lifesaving air medical services to the community since 1980.

Catalytic impacts include those effects such as spill-over that can benefit other areas of an economy but are not easily captured by input-output models such as IMPLAN. In air transport, catalytic impacts can sometimes create more jobs than direct employment. For example, employment and income generated in the local economy of an airport can boost the productivity of local businesses and attract economic activities such as investment and tourism.

Catalytic impacts are notoriously difficult to quantify, such as increased labor market efficiencies and suburban/rural access. While 97% of Oklahoma square mileage is considered rural, only 52% of Oklahomans live in rural areas, and 48% of Oklahomans live on the 3% of square mileage considered urban or suburban.

Ease of transportation from outlying areas to urban centers will expand job opportunities and increase the customer base for urban businesses, which in turn will generate revenues and help grow the economy. Securing America's Future Energy (SAFE), an energy policy research organization, cited the following in its 2018 study:

- A 1% improvement in accessibility to a region's central business district improves regional productivity by 1.1%.
- A 10% increase in average speed of transportation, all other factors being constant, leads to a 15-18% increase in the labor market size, resulting in a 2.9% increase in productivity.
- A 10% improvement in access to labor increases productivity and regional output by 2.4%.

Another catalytic impact is improved healthcare access and outcomes. Oklahoma has only two Level 1 trauma centers, one specializing in both adult and pediatric care and the other only focusing on adult care. Both are in the Oklahoma City area. Many Oklahoma residents travel outside the State to access the closest Level 1 trauma centers, and some residents have to drive 150 miles or more for Level 1 trauma care. Trauma centers, advanced hospitals, and health care centers are impossible to cost-justify in rural and low-density areas.

AAM augments existing EMS operational infrastructure for First Responder events. New AAM aircraft will bring patients to the larger, more urban facilities where staffing is robust, and at times they may be used to transport those providers and professionals to the rural areas when needed.

On the following page is a map showing those areas in which a patient can be transported by a ground vehicle to a trauma center within 30 minutes (purple) and those areas in which they can be transported by an eVTOL within 30 minutes (blue.) If eVTOLs were implemented at these trauma centers, the reachable area within 30 minutes would increase greatly, saving countless lives.

Figure 23 – eVTOL emergency patient transport (blue) can reach a far greater area within thirty minutes than ground vehicle transport (purple.)

6. OKLAHOMA VERTIPORT LOCATIONS

For a region to have a successful AAM system, vertiports must be placed in locations that optimize efficiency in areas of greatest passenger demand. Integrating an AAM aviation network within the existing system of transportation modes requires detailed planning and analysis. With the objective of implementing the greenest, most cost-effective, and commuter-friendly transit system possible, planners must consider the needs of all users when locating vertiports to enable practical end-to-end solutions as part of a sophisticated, multimodal transportation system.

NEXA subsidiary UAM Geomatics, Inc. developed a vertiport locating tool utilizing the power of ArcGIS and the GIS datasets created in its landmark study, **Urban Air Mobility 2023-2045, Infrastructure and Global Markets**, capable of locating vertiports for both passenger and cargo use.[6] First, the team created a series of heat maps that applied weights to the datasets determined to be influential to a given use case, which included layers such as airports, heliports, population density, demographic information, zoning, restrictions, income levels, job locations, power lines, and many more. Some factors are given a "pull", that is, they indicate the location is a good one for a vertiport. High employment in the vicinity and high income levels, for instance, are "pull." Others are "push," or negative factors, such as a largely elderly population which, surveys have indicated, will be more reluctant than younger people to fly in eVTOLs.

The weights applied to each of these layers were decided in a methodical and qualitative manner from discussions with transportation Subject Matter Experts. The team then applied and cross-examined the weights, revealing areas with the greatest potential for passenger value creation.

We must point out that this is the first step in a complex process for vertiport location. Once a likely vertiport site is identified by our tool, local, state, and federal regulations will come into play. Communities will have a say. Owners of suitable property may not wish to build a vertiport on it.

Vertiport planners will need to examine:

- Federal airspace regulations
- Ground obstacles and constraints like communication towers, commercial buildings, and electric substations
- Zoning regulations
- Noise Impact
- Public sentiment
- Land ownership and existing development

6 The UAM Geomatics, Inc. study ***Urban Air Mobility, Infrastructure and Global Markets 2023-2045*** forecasts revenues, passengers, costs, numbers of vertiports, and the likelihood of early AAM implementation for 92 cities around the globe. www.nexa-uam.com.

Some of these factors—for instance, obstacle obstruction—are already part of our analysis. The black dots shown in Figure 24 indicate obstacles such as substations or cell towers around which, for a certain distance, regulations prevent the construction of new buildings.

Other factors, however, cannot be quantified by our analysis, such as public sentiment, noise impact, and land ownership. These factors will require boots-on-the-ground surveying to determine if they will impact vertiport integration at that location.

6.1 Passenger Vertiports

Utilizing the unique weights given numerous factors affecting vertiport location, the layers are processed together and produce a single heat map that identifies hot and cold spots for vertiport development. The map below shows the final product created by the tool for passengers in the State of Oklahoma.

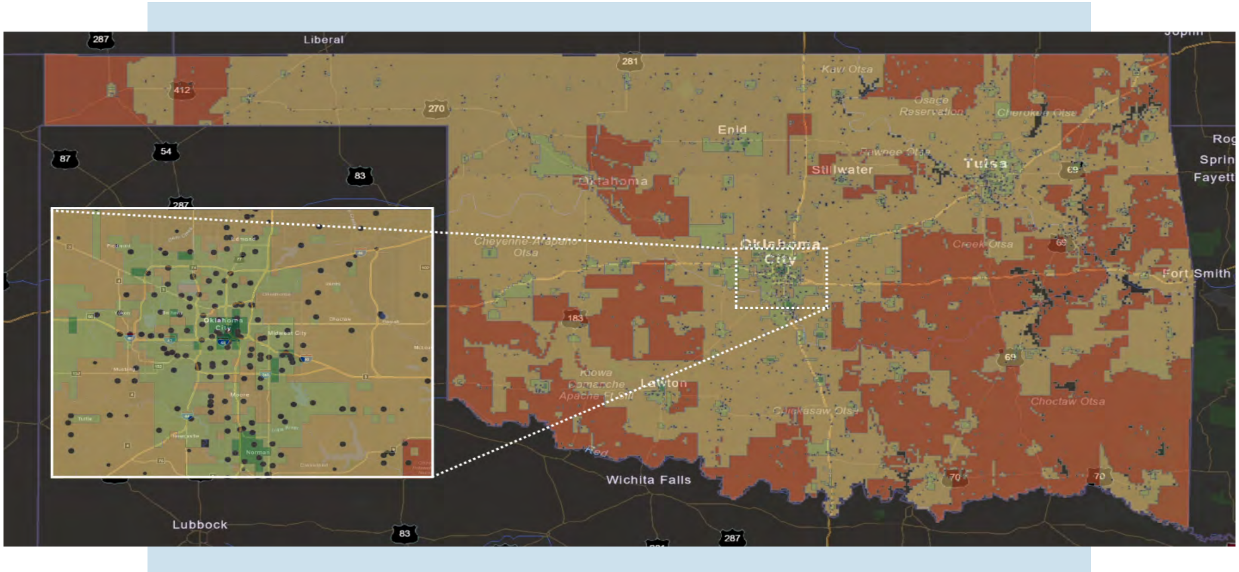


Figure 24 – Passenger vertiport locations identified by NEXA analysis and ArcGIS mapping.

The dark green areas represent areas that initially, at least, seem to be optimal locations for vertiports. Oklahoma City and Tulsa are predicted to be the best places for passenger vertiport expansion due to existing infrastructure and population density. Other places shown to have potential for vertiport integration are Lawton, Weatherford, Norman, and Stillwater. Locations marked in light green also indicate a potential for vertiport introduction into the communities, though they aren't as highly rated as the areas marked in dark green. Yellow is unlikely to be suitable in the near future, and orange is the least suitable. Further analysis of the maps has been conducted, and all potential sites can be located in the UAM Geomatics portal.

6.2 Cargo Vertiports

Cargo vertiports have a different set of "pull" or positive factors such as rail lines, logistics centers, cargo corridors, manufacturing facilities, and industrial zones.

Figure 25 shows the current map created by the tool for cargo vertiports in the State of Oklahoma.

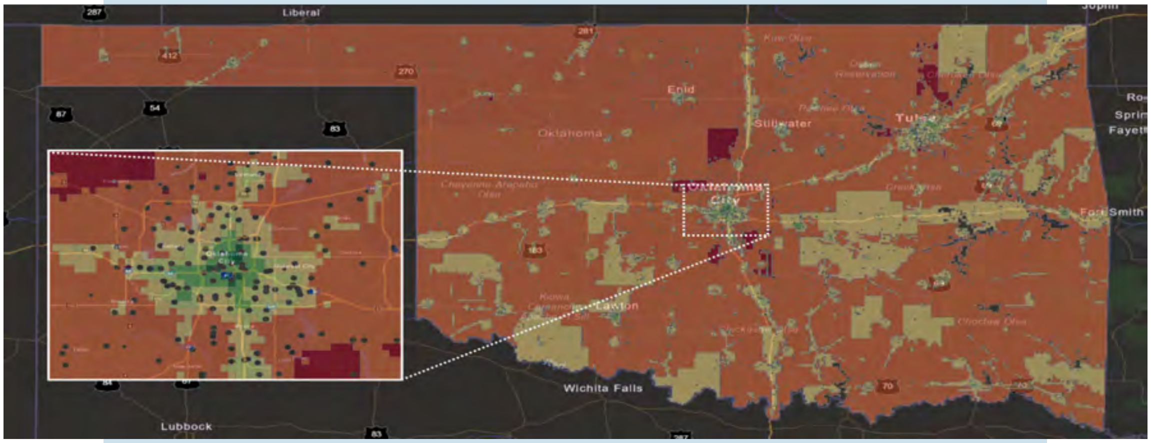


Figure 25 – Unlike passenger vertiports, cargo vertiports will be located in industrial areas, along cargo corridors, and near major manufacturing facilities.

The dark green areas represent areas indicated to be optimal locations for vertiports. Oklahoma City and Tulsa are predicted to be the most suitable for cargo vertiport construction due to existing infrastructure, logistic facilities, and manufacturing plants. Other places shown to have potential for cargo vertiport integration are Lawton, Shawnee, Ardmore, and Sallisaw. Locations marked in light green also indicate a potential for vertiport construction but aren't as highly rated as the areas marked in dark green.

Most of the regions identified by the weighted heat map follow the cargo corridors in the State. Easy access to interstate highways is vital for the movement of cargo, which is why many logistics facilities and manufacturing plants will be located near major highways. Further analysis of the maps has been conducted, and all potential sites can be found in the UAM Geomatics portal.

After these locations have been identified from the weighted heat map, the potential cargo vertiports must undergo the same validation process as potential passenger vertiports. The same factors for validation are relevant regardless of the use. Federal airspace regulations, obstacles, zoning regulations, noise impact, public sentiment, and land ownership still need to be evaluated in each potential vertiport location.

As with our passenger vertiport location analysis, the cargo analysis indicates obstacles and the restricted construction zones around them. Those areas are indicated in the map above by the black circles seen in the close-up heat map.

7. CONCLUSION

Having analyzed 92 cities and regions around the world for Advanced Air Mobility viability, we conclude that Oklahoma is well-positioned to create a sustainable, profitable AAM system for eVTOL and drone use cases to benefit State residents and businesses between now and 2045.

AAM will generate more than $5.5 billion in new business activity and related stimulus, produce $1.154 billion in local, state, and federal tax revenues, and create more than 4,600 new full-time aerospace and other jobs in the State.

These factors and others result in a return over infrastructure (R/I) of 4.46, an attractive number for investors whose funds will be necessary to build out AAM infrastructure.

While these figures point to a positive future for Advanced Air Mobility in Oklahoma, the State should also consider the consequences of not implementing it in a timely manner.

A slow start off the mark would result in:

- Lack of new jobs, taxes, and overall economic productivity that would otherwise occur.
- Lack of top tech talent that would move to other, more progressive states.
- Lack of investment capital that would flow to other states.
- Negative healthcare outcomes and possibly lives lost by not introducing eVTOL Medevacs and drone delivery of blood, organs, medication, etc.
- Reduction in efficiencies to several key Oklahoma industries such as agriculture and oil if drones are not used to inspect pipelines, refineries, power plants, and crops; to track livestock; and to deliver emergency parts.

It is likely, however, that given its long aviation history, its thriving aerospace industry, and its sensible legislation and regulation of sUAS so far, the State will embrace this cutting-edge technology to provide new transportation options, greater convenience, improved healthcare outcomes, and new jobs to Oklahoma residents and business well into the 21st century.

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