Vertical Flight Society

AVIATION WEEK NETWORK

CCI CROWN CONSULTING, INC.

esri

JETNET >> Know More.

Gannett Fleming

Excellence Delivered As Promised

NBAA NATIONAL BUSINESS AVIATION ASSOCIATION

MULTI-CLIENT STUDY PROSPECTUS

FOR CHARTER SUBSCRIBERS

DELIVERY DATE: THIRD QUARTER 2019

URBAN AIR MOBILITY -

ECONOMICS AND GLOBAL MARKETS

DETAILED AND ACTIONABLE FORECASTS FOR 72+

METROPOLITAN AREAS: 2020 – 2040

POLICIES ■ TECHNOLOGIES ■ MARKETS ■ INFRASTRUCTURE ■ ECONOMICS ■ JOB CREATION

NEXA Advisors
A NEXA Capital Company

Featuring:

- Business Intelligence the Industry Needs to Make Appropriate UAM Investment Decisions
- The Inflection Point Facing Growing UAM Markets, Emphasizing Urban Infrastructure Development/Finance
- Opportunities and Impacts of UAM on 70+ of World's Largest Metropolitan Centers
- Disruptive and Rapidly Emerging Technologies Enabling UAM and UAS Traffic Systems
- Overcoming Obstacles, Including Regulatory Barriers, Noise, Public Perceptions, and More

About the Underwriting Sponsors

UAM - Economics and Global Markets is a joint undertaking by respected aerospace industry organizations, researchers, publishers and financial advisors. The comprehensive work herein requires the deep expertise that these organizations enthusiastically bring together. The lead underwriting sponsor is NEXA Advisors, a NEXA Capital company with a well known record performing "Multi-Client" research for the aerospace sector.

What is a "Multi-Client Study"?

UAM - Economics and Global Markets provides subscribers with volumes of relevant information and in-depth analysis of new economics, markets and specific business and investment opportunities. To a subscriber, the cost of undertaking this work from a top-tier consultancy could be $1-2 millions of dollars. A "Multi-Client" project, on the other hand, shares costs among multiple subscribers. NEXA Advisors has an enviable track record of producing such studies.

Obtain a sample of another NEXA Multi-Client Study - In 2012 a comprehensive multi-client study was performed for 20 leading aerospace companies. Go to https://www.nexaadvisors.com/ to download and examine our 500-page Air Traffic Infrastructure (ATI) Global Markets 2012 Report.

Version 25, printed June 19, 2019

For Further Information please contact:

Eleanor Herman
Principal Editor
NEXA Advisors, LLC
Tel: 202-499-5056
Email: eleanor@nexaadvisors.com
Web: www.nexaadvisors.com

Michael Dyment
Managing Partner
NEXA Advisors, LLC
Tel: 202-321-0389
Email: michael.j.dyment@nexacapital.com
Web: www.nexaadvisors.com

Table of Contents

Urban Air Mobility – Quotes from Industry Leaders

"It's time to look at autonomous aircraft. The addressable market is $1.5 Trillion in our base case by 2040. Logistics is leading the way."
Morgan Stanley Research, December 2, 2018

"Imagine pulling out your phone, opening up a transportation app and summoning your own personalized ride by air taxi. That sci-fi vision of the future is actually much closer than you might think."
Brian Krzanich, CEO, Intel Corporation

"Urban air mobility could revolutionize the way people and cargo move in our cities and fundamentally change our lifestyle much like smart phones have."
Jaiwon Shin, NASA Associate Administrator for Aeronautics

"We think cities are going to go vertical in terms of transportation, and we want to make that a reality."
Dara Khosrowshaki, Uber CEO

"We can only scale if we are accepted by the [metropolitan] community."
Nikhil Goel, Uber head of product aviation

"If you are targeting urban areas, battery technology is good enough today to get the ranges to serve 80-90 percent of all missions."
Zack Lovering, Vahana project executive at Airbus A3.

"The final frontier in 'mobility-by-air' remains urban centers, long captive to surface transportation, especially cars, buses and mass rail transit."
Michael Dyment, Managing Partner, NEXA Capital Partners

"This is a great concept but is a big challenge, no question about that."
Paulo Cesar Silva, Embraer CEO

"The simplification of the technology, combined with the sophistication that can be pushed into the software, has completely changed the landscape of what you can do with these flying vehicles."
Eric Allison, Uber Elevate

"Don't forget, five or six years ago, it was hard to imagine a world where you'd rent out your house or apartment, so once people get the idea that this is the future, I see no reason why this won't be prevalent in the next few years."
Carter Reum, Co-Founder M13

"Airbus is working on different concepts for urban air mobility and is actively engaging with cities and other stakeholders."
Vassilis Agouridas, Airbus Mobility

URBAN AIR MOBILITY - ECONOMICS AND GLOBAL MARKETS STUDY OBJECTIVES

As Aerospace Companies rush to develop products and services for the next frontier in transportation - Urban Air Mobility - very few executives or investors know the business case. Cities also want to attract new forms of transportation for liveability, job creation and economic development. **UAM - Economics and Global Markets** will give these decision-makers the information they need to make appropriate investment decisions.

Overview

Air transportation provides a service highly favored by a global economy: mobility. Assets have to move. Information, people, knowledge, capital, resources—in a global economy, everything has to flow, from one site to the next, one market to the next, one organization to the next, one country to the next. For a company's most important asset—its people—mobility typically means air travel. For the people who make business work— executives, engineers, customers, suppliers, and specialist teams— the quality of that mobility impacts their success navigating the global economy.

The final frontier in air mobility remains urban centers, long captive to heavily congested surface transportation from automobiles, buses and mass rail transit. Never sitting still, driverless autos promise to further cripple areas where congestion is already a plague.

A new wave of innovation has begun with Urban Air Mobility. Rapid development of enabling technologies including miniaturization of power systems, lighter weight batteries, powerful electric motors, automation and artificial intelligence-based control systems are helping make the jump to urban shuttle services and urban air taxis using "electric vertical take off and landing" (eVTOL) craft. The revolutionary concepts and systems in development today have the potential to transform our modern world, boosting the liveability of our cities, and improving our way of life. This new wave in aviation brings to mind the last such leap, some ninety years ago, when aviation consisted almost solely of military and mail planes, and visionaries such as the Guggenheim family wanted to develop the first passenger airlines. The path was strewn with fierce resistance in many circles. Obstacles included funding,

There is currently a yawning gap of market and economic intelligence in the rapidly-evolving Urban Air Mobility sector. **UAM - Economics and Global Markets** will answer these critical questions (and much more):

- What is the outlook for 72+ of the largest UAM metropolitan areas globally, and what policy, technology and financial issues will individually define their success?
- What will be the plan, and the minimum investment to move these urban areas to the tipping point of success?
- What is the expected size of UAM markets over the next 20 years, but especially the next 5? What are the key drivers that are absolutely essential for UAM market expansion?
- Which regions, governments, institutions and industries will control the most pivotal UAM modernization programs?
- What economic and social benefits will UAM bring to cities? Reduced congestion? Jobs? New industries? Tax revenues?
- For urgently needed UAM shuttle services, where, how and why will metropolitan and suburban airports rapidly implement UAM solutions?

Figure 1 – Critical Questions Will be Answered

political, regulatory and safety issues. Similar barriers stand in the way today, and must be resolved for aviation to take the next leap to Urban Air Mobility.

Market projections for Urban Air Mobility use cases promise tens if not hundreds of billions of dollars of cumulative economic activity. New mobility applications can solve urgent problems facing society, such as reducing traffic congestion, lowering carbon emissions, improving industrial productivity, and passenger safety, etc. The demand for UAS package and heavy cargo delivery is also growing rapidly as consumers demand faster delivery and companies strive to lower last-mile cost. Following on the coat tails of urban helicopter taxi services (Brazil in particular), Urban Air Mobility services should begin to demonstrate entry into service within just a few years' time. These sectors have been forecasted to reach an economic break-even point in the next decade, and somewhat later for ubiquitous on-demand air taxis.

Numerous studies have speculated on the size and economic viability of Urban Air Mobility, with some high-profile organizations making public pitches for its acceleration. Uber has been an industry leader in this regard. Recently the National Aeronautics and Space Administration (NASA) produced market-forecasts, and companies such as Goldman Sachs have weighed in showing robust economic growth and investment opportunities.

Stakeholders have varying visions for drone/UAS and UAM opportunities. Some view UAM as a version of highways in the sky that mirror ground vehicle traffic. These visions often forecast UAM coming in the form of air taxis and connected commuter vehicles, picking up passengers on request or on a schedule as part of an on-demand urban network. Passengers will be able to book flights using mobile app technologies, have the nearest on-grid vehicle sent directly to a convenient pickup location, and be fully integrated with other mobility modes such as airports or train stations.

An important extension of UAM is first-responder transport of injured victims to local emergency centers. Smaller, less expensive, and some would argue, safer than helicopters, drone/UAS transport could improve survivability as much as 85 percent by getting the injured to emergency facilities within the golden hour after the accident. These and other predicted models boast significant societal benefits in economic productivity and passenger safety.

For all its future promise, major barriers stand in the way of ubiquitous UAM usage, including:

- Formation of adequate capital investment for development and commercialization of eVTOL air vehicles, their control systems including ground UAS/UAM traffic management systems (UTM or UTM systems), and operational air taxi and flight operations business models. While venture/corporate/institutional funds are available today, and over 100 companies are developing electric air vehicles, large scale investment in manufacturing and service/supply chain networks can only be forthcoming if supported by business cases with reasonable cash-on-cash returns within sensible timelines.
- Infrastructure investment to fund components such as UTM systems that integrate UAM operations into the current Air Traffic Control and Air Traffic Management systems, package delivery warehouses and drop-points, and vertiports to facilitate cost efficient and convenient passenger access. Unlike surface transportation system infrastructure, UAM infrastructure is expected to be far more affordable.
- Sufficient market demand at a wide range of price points, paid by business, commercial, industrial and individual customers, where cost may be secondary to value delivered.
- Public acceptance of these new systems and services, driven by positive perceptions of safety, mobility value, cost effectiveness, and affordability. Privacy, environmental impact such as noise and, in some cases, property rights will weigh in this dimension, often at the local level.
- Regulations to facilitate and reduce time to market for vehicle manufacturers, fleet opera-

Figure 2 -Vahana eVTOL Flying Taxi by Airbus

tors and infrastructure/facilities managers, while at the same time imposing extremely high levels of safety for users and the benefitting public.

These elements and their associated risks are equally critical. The upfront investments for UAM will require tens of billions in capital between today and 2040. To ensure that the new market opportunities succeed, investment funding is the most essential. Significant capital will be needed across several industry fronts, and first in line at that.

Unclear business case factors pose significant risks that investment capital will identify and will seek to mitigate or simply pass upon. **UAM - Economics and Global Markets** will be an essential tool for business strategists, top executives and urban planners alike, providing facts and insights that will support business planning and investment decision-making. Packed with information on the UAM eco-system, **UAM - Economics and Global Markets** does the heavy lifting. It provides comprehensive opportunity assessments of UAM markets in 72+ or more urban centers and countries within each of ten UNSD regions. Of tremendous value, **UAM - Economics and Global Markets** lays out the new economics of UAM finance. This study will be a Must-Have for top executives, providing the factual foundation for answering key questions (Figure 1) to support their strategic decision-making.

The Urban Air Mobility Eco-System

Figure 3 presents the major segments and stakeholders (participants) of the Urban Air Mobility ecosystem. Included in the figure are sample value drivers that will create continued opportunity for economic and market growth needed to sustain a healthy and vibrant UAM opportunity.

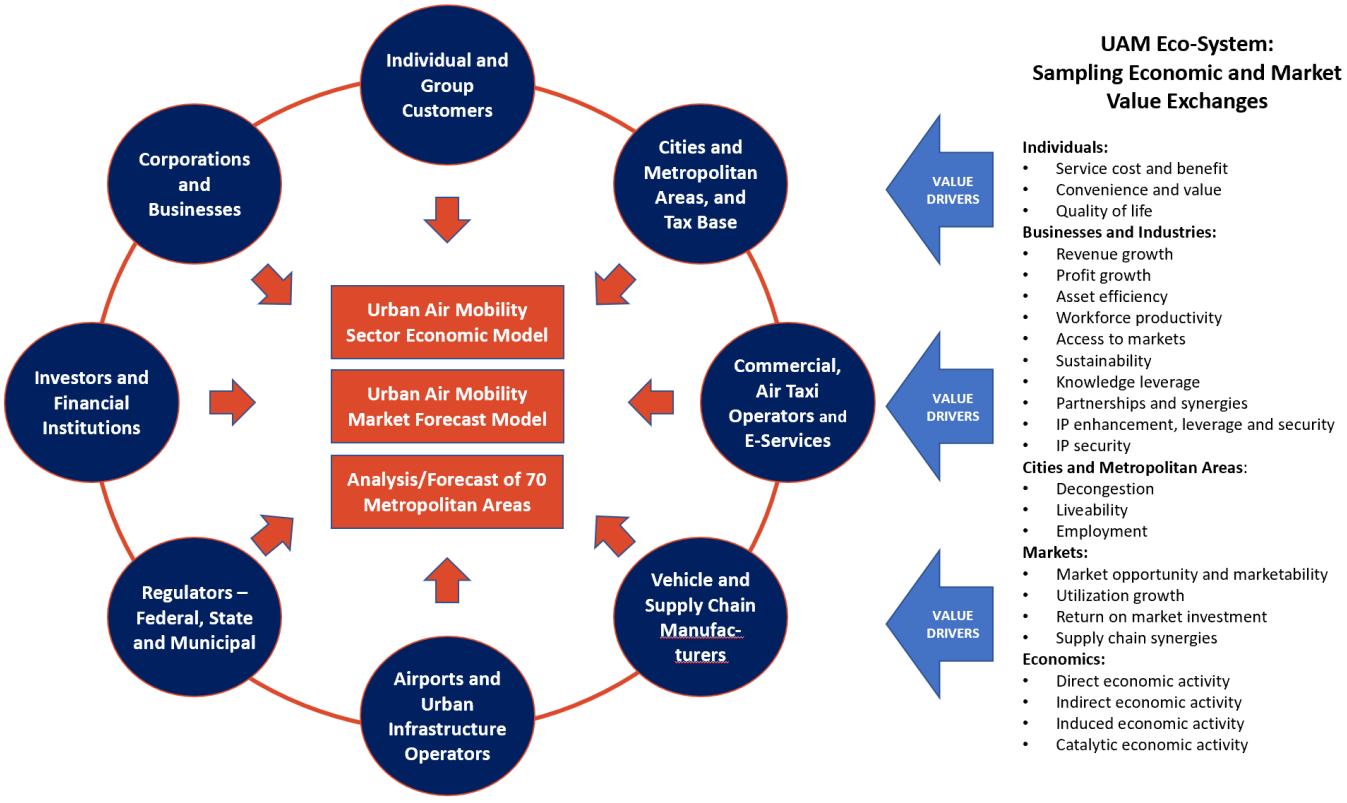


Figure 3 - The UAM Eco-System and Sample Value Exchanges Generating Market and Economic Forecasts

UAM and Business Aviation

UAM - Economics and Global Markets will carefully dissect and study how a new branch of business aviation will quickly emerge, driven by the same mobility value formulas that sustain the $150 billion global opportunity represented by organizations such as the National Business Aviation Association and the General Aviation Manufacturers Association.

Figure 4 - Joby eVTOL Tilt Rotor Flying Taxi

The world's most successful companies use business aviation for a variety of reasons. Top executives—whose every minute counts—benefit from time savings and improved productivity. Additionally, business aviation offers strategic transaction acceleration, the protection of intellectual property, increased personnel retention, and improved customer relations. The past five years have seen a 34 percent increase in business aircraft operations globally, and experts estimate that flight hours will double over the next 20 years.

Business aviation users, while reaping advantages traveling from one airport to another in their own aircraft, are still stranded on congested roads with everyone else to and from their airports. The BA community, with funds already earmarked for efficient travel, will be a major early user of UAM. The nation's most important corporations will own their own UAM vehicles for quick trips over jammed roads from downtown offices to the airport where their jets are waiting, and, upon arriving at their destination airport, will use another UAM to fly quickly and efficiently to the site they are visiting.

UAM, Livable Cities and Congestion

The headquarters of most of the 1,000 largest corporations in the world are embedded in the top 72+ metropolitan areas studied in **UAM - Economics and Global Markets**. Market value drivers such as revenue growth, asset efficiency and knowledge integration will find powerful extensions from the UAM sector. The drive by cities and metropolitan areas to attract corporate headquarters (consider the recent search for an East Coast headquarters for Amazon) will create powerful, willing partners and partnerships among the stakeholders listed in Figure 3. The study team will develop the comprehensive economic and market forecast models based upon these and other value exchanges so mapped.

Transportation is a key driver of any city's attractiveness to residents and employers alike. The Economist[1] recently developed a global liveability survey, ranking cities in accordance with their best and worst living conditions. The availability of safe, efficient and ubiquitous transportation modes was an important ranking, measuring the quality of road networks, public transportation and international (air) links. Congestion and its costs have been identified along with more than 30 qualitative and quantitative factors across five broad categories: stability, healthcare, culture and environment, education, and infrastructure. This study will explore the hypothesis that UAM and associated VTOL fleets can flip a city's liveability standings within a few years of UAM service introduction.

Figure 5 lists the 70 most populated urban areas, ranked by their economic GDP (Brookings 2014). Combined, these metropolitan areas control over US$24 trillion in GDP (annual economic output).

NEXA has added several new cities to the list in Figure 5, however. Smaller cities with important roles to play in Urban Air Mobility development and testing, such as Salt Lake City and Syracuse, will be further studied. Others may be added as time and funding allows.

[1] THE GLOBAL LIVEABILITY INDEX 2018, Economist Intelligence Unit, 2018

Rank	City/Metropolitan area	Country	UNSD Region	Brookings (2014) PPP-adjusted GDP ($BN)	Population	Per Capita Income	Number of Airports	Total P121 Flight Operations	Fortune 1000 / Major HQ/Operations
1	Tokyo	Japan	East Asia	1,617	38,000,000	$59,197	2	653,474	51
2	New York	United States	North America	1,403	23,600,000	$64,146	3	1,259,695	114
3	Los Angeles	United States	North America	860.5	18,600,000	$42,042	5	1,474,050	17
4	Seoul	South Korea	East Asia	845.9	25,600,000	$42,793	2	506,561	11
5	London	United Kingdom	Northern Europe	835.7	14,000,000	$57,185	6	1,193,421	60
6	Paris	France	Western Europe	715.1	12,400,000	$62,443	3	741,266	27
7	Osaka–Kobe	Japan	East Asia	671.3	19,300,000	$35,285	3	341,765	19
8	Shanghai	China	East Asia	594	34,000,000	$19,671	2	700,000	23
9	Chicago	United States	North America	563.2	9,500,000	$34,689	4	1,181,378	62
10	Moscow	Russia	Eastern Europe	553.3	12,500,000	$20,500	5	751,390	8
11	Beijing	China	East Asia	506.1	24,000,000	$16,920	1	606,086	52
12	Rhine-Ruhr	Germany	Western Europe	485.2	10,700,000	$33,850	4	400,844	12
13	Houston	United States	North America	483.2	6,300,000	$30,080	2	653,173	46
14	Washington, DC	United States	North America	442.2	6,000,000	$45,545	3	855,128	30
15	São Paulo	Brazil	South America	430.5	12,100,000	$18,182	2	483,934	20
16	Hong Kong	Hong Kong	East Asia	416	7,400,000	$48,829	1	420,000	25
17	Dallas-Fort Worth-Arlington	United States	North America	412.7	7,200,000	$47,974	2	881,877	38
18	Mexico City	Mexico	North America	403.6	20,900,000	$20,400	1	449,664	19
19	Guangzhou	China	East Asia	380.3	25,000,000	$24,311	1	435,231	33
20	Tianjin	China	East Asia	372	15,400,000	$17,126	1	169,585	25
21	Singapore	Singapore	South-East Asia	365.9	5,600,000	$69,283	1	373,201	50
22	Nagoya	Japan	East Asia	363.8	9,100,000	$28,165	2	139,040	18
23	Shenzhen	China	East Asia	363.2	23,300,000	$25,000	1	340,385	58
24	Boston	United States	North America	360.1	4,600,000	$57,000	1	401,371	23
25	Istanbul	Turkey	Western Asia	348.7	15,000,000	$25,000	2	666,656	
26	Philadelphia	United States	North America	346.5	6,100,000	$62,817	2	447,169	26
27	San Francisco	United States	North America	331	4,700,000	$110,418	3	852,858	24
28	Taipei	Taiwan	East Asia	327.3	8,500,000	$21,571	2	305,455	
29	Jakarta	Indonesia	South-East Asia	321.3	30,000,000	$14,570	2	507,390	
30	Amsterdam	Netherlands	Western Europe	320.6	2,400,000	$49,760	1	496,748	9
31	Milan	Italy	Southern Europe	320.6	1,300,000	$69,130	3	382,796	8
32	Buenos Aires	Argentina	South America	312.1	13,600,000	$20,036	2	193,346	20
33	Bangkok	Thailand	South-East Asia	306.8	14,600,000	$14,301	2	607,268	17
34	Atlanta	United States	North America	294.4	5,800,000	$32,055	1	879,560	27
35	Toronto	Canada	North America	276.3	5,900,000	$45,771	2	591,342	24
36	Seattle	United States	North America	267.5	3,700,000	$77,273	1	416,124	15
37	Minneapolis/St. Paul	United States	North America	267.5	3,600,000	$22,685	1	416,213	26
38	Miami	United States	North America	262.7	5,600,000	$43,605	2	726,050	13
39	Madrid	Spain	Southern Europe	262.3	6,600,000	$44,487	1	387,566	7
40	Brussels	Belgium	Western Europe	254.3	2,100,000	$69,748	2	312,926	19
41	Sydney	Australia	Oceania	223.4	5,100,000	$59,259	2	570,316	45
42	Munich	Germany	Western Europe	219.9	5,200,000	$46,377	1	404,505	10
43	Detroit	United States	North America	207.5	4,300,000	$56,142	1	395,357	11
44	Phoenix	United States	North America	207.1	4,700,000	$45,745	2	659,336	13
45	San Diego	United States	North America	202.5	3,300,000	$31,043	2	259,563	5
46	Vienna	Austria	Western Europe	183.7	2,600,000	$55,868	1	224,568	11
47	Manila	Philippines	South-East Asia	182.8	12,900,000	$8,132	2	217,866	19
48	Melbourne	Australia	Oceania	178.4	4,900,000	$60,220	4	578,871	30
49	Abu Dhabi	United Arab Emirates	Western Asia	178.3	1,100,000	$95,000	1	207,486	12
50	Rio de Janeiro	Brazil	South America	176.6	12,300,000	$16,341	2	226,809	22
51	Lima	Peru	South America	176.5	12,100,000	$12,000	1	178,578	9
52	Baltimore	United States	North America	173.7	2,800,000	$38,731	1	261,707	8
53	Kuala Lumpur	Malaysia	South-East Asia	171.8	7,200,000	$19,653	2	486,189	32
54	Santiago	Chile	South America	171.4	6,300,000	$25,328	1	124,799	16
55	Barcelona	Spain	Southern Europe	171	5,400,000	$34,821	3	358,814	20
56	Denver	United States	North America	169.7	2,800,000	$56,286	1	582,486	19
57	Riyadh	Saudi Arabia	Western Asia	163.5	7,600,000	$32,369	1	200,000	6
58	Rome	Italy	Southern Europe	163.2	4,300,000	$55,385	2	351,727	10
59	San Jose	United States	North America	160.3	2,700,000	$77,000	3	852,858	31
60	Bogotá	Colombia	South America	159.9	10,200,000	$10,270	1	304,330	5
61	Portland	United States	North America	158.5	2,400,000	$35,290	1	228,949	4
62	Berlin	Germany	Western Europe	157.7	6,000,000	$41,900	1	275,014	17
63	Montreal	Canada	North America	155.9	4,100,000	$38,867	2	288,367	21
64	Tel Aviv	Israel	Western Asia	153.3	3,900,000	$37,400	1	136,956	36
65	Mumbai	India	South Asia	150.8	20,700,000	$7,005	1	320,689	11
66	Tampa	United States	North America	130.3	3,100,000	$43,807	3	406,372	7
67	Vancouver	Canada	North America	109.8	2,500,000	$49,174	1	330,839	10
68	Nashville	United States	North America	95	1,900,000	$50,425	1	205,802	10
69	Las Vegas	United States	North America	93.9	2,200,000	$22,060	1	542,994	7
70	Dubai	United Arab Emirates	Western Asia	82.9	5,600,000	$35,000	1	418,220	12

Figure 5 - Selected Global Metropolitan Areas Under Study

Figure 6 – 72+ Cities Examined in UAM Global Markets 2020-2040

Despite significant increases in connectivity and advances in digital technology and infrastructure, traffic congestion across the world remains a costly problem. According to the transportation consulting firm INRIX, congestion costs $305 billion to the U.S. alone in 2017. European losses are estimated at $110 Billion. Adding to the economic woes, congestion also represents an increase in transportation costs resulting from delays in shipping goods, wasted fuel and electricity, the wear and tear on public infrastructure, and an additional toll on the environment.

Worldwide, there are currently some thirty megacities (defined as those with ten million inhabitants or more) with a combined population of almost 500 million affected by the worst congestion (Figure 7). The average Londoner, for example, loses 74 hours a year sitting in congestion, and the average San Franciscan 79 hours. In Los Angeles and Sydney, residents spend seven working weeks each year driving to and from work, of which two weeks are caused by excessive traffic. Clearly, the commuter's lost time results in increased stress (a study in the American Journal of Preventative Medicine found that commuting more than ten miles a day increased the chances of higher blood pressure) as well as lower productivity at work, and less time to unwind and spend with family and friends. By 2030, some five billion people will live in urban areas, 60 percent of the global population. Congestion is typically alleviated by public transportation, but in many of the world's most congested cities the public transportation infrastructure falls short of meeting residents' or business community demand. Buses get stuck in the same congestion as cars, and aging and decaying subway systems are seeing a sharp increase in delays, emergencies, and unscheduled as well as scheduled repairs.

Costs, too, have restrained public investment in improved transportation systems. The average cost of new highway can be more than $10 million per mile, while an underground train line costs on average $200-$500 million per mile (although a project in Manhattan recently cost $2.6 billion per mile.)

UAM will take commuter transportation using eVTOLs into the third dimension; the skies. Sao Paolo, for instance, makes extensive use of helicopters with its 150 helipads, 700 aircraft, and one of the world's only dedicated helicopter air traffic control systems. While efficient for the wealthy few (these helicopters cost, on average, well over a thousand dollars per hour), they are far out of reach for the bulk of commuters. Despite significant congestion in many cities, commuters still choose to drive, and they are doing so increasingly: U.S. commuters travelled a combined 3.2 trillion miles in 2017.

The National League of Cities (NLC) identifies personal mobility as central to individual prosperity, as well as to commerce and to the growth of communities. The work of cities requires attention to both the existing transportation networks and emerging trends that will shape the future. NLC's resources in this area focus increasingly on ways in which technology will shape tomorrow's urban transportation systems.

At least 15 of the cities and metropolitan areas in Figure 5 currently support and foster UAM development programs. Dubai, ranked 70th by GDP in Figure 5, has one of the most aggressive UAM programs on the planet, and invests heavily in the future promise of affordable air taxi and private electric air vehicle services.

UAM - Economics and Global Markets will carefully examine the implications and the business case support for UAM tied to specific urban populations and job-creating industries, tying them to regulatory and economic factors. For each city, country, and region we will analyze:

- Population and population density by urban zone (heat maps)
- Per capita income, demographics, education (knowledge economy), income disparities and crime
- Infrastructure in place and projected needs for vertiports, heliports, charging stations, airport modifications
- Corporate head offices and forecasted job creation sectors
- Number of commercial and business aviation airports, and factors such as departures, the number of business and commercial aircraft and helicopters based therein
- Profiles of passenger vehicles, taxi vehicle fleets, public transportation, and UAM substitutes
- Trade and commerce attributes that drive mobility value
- Measures of transportation congestion
- Outlook for autonomous vehicle operations
- Regulatory propensities, privacy and property rights, at federal and municipal levels

U.S.	Hours Per Year in Traffic
Los Angeles	102
New York City	91
San Francisco	79
Atlanta	70
Miami	64
Washington, D.C.	63
Boston	60
Chicago	57
Seattle	55
Dallas	54

Source: Inrix

Excluding USA	Hours Per Year in Traffic
Moscow, Russia	91
Sao Paulo, Brazil	86
Bogota, Colombia	75
London, England	74
Paris, France	69
Bangkok, Thailand	64
Jakarta, Indonesia	63
Istanbul, Turkey	59
Mexico City, Mexico	58
Medellin, Colombia	57

Source: Inrix

Figure 7 - Leading Congestion Cities

- Ability of national ATC systems to provide near and long term UAM vehicle traffic control

UAM - Economics and Global Markets will produce economic and market forecasts to assist urban and transportation development managers to frame and analyze the business case for UAM services, including eVTOL service costs and fees, and infrastructure investment, in each of the 70 metropolitan areas identified in Figure 5.

New Infrastructure Will Be Key to UAM Viability

UAM infrastructure to support eVTOL operations will become an important enabler to sector success. **UAM - Economics and Global Markets** will place significant attention on this association. As with other forms of transportation, UAM has specific infrastructure needs, which will also drive economic development and business investment. Research has shown that this is even more significant in global economies where economic opportunities have been increasingly related to the mobility of people,

goods and information. A relation between the quantity and quality of transport infrastructure in urban areas and the level of economic development is apparent. High density transport infrastructure and highly connected networks are commonly associated with high levels of economic growth, market development, and GDP output.

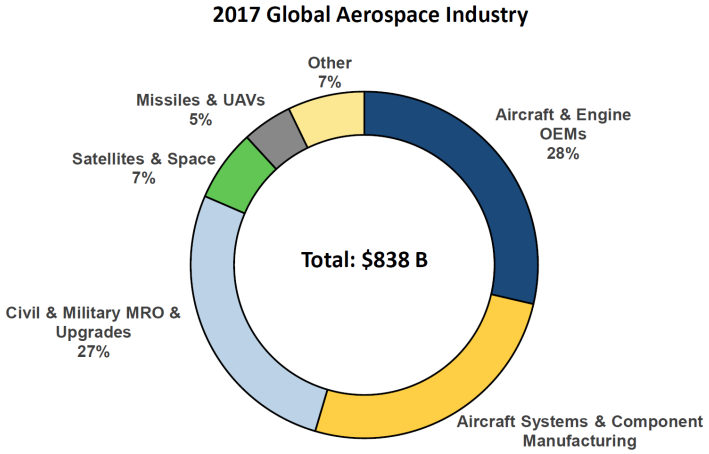
UAM infrastructure costs will be estimated for a viable ecosystem to be able to sustain itself, and this will be done as part of this study. We will estimate, for each of 72+ metropolitan areas, the entire life cycle costs for sustainable operations. Beginning with the estimate that a single vertiport platform can be built at a $500,000 cost, other cost elements will include UTM infrastructure service, passenger facilities, lighting and weather systems, airspace planning, and certification cost.

Urban air mobility can provide a wide swath of benefits covering consumers and businesses, and supply chains dependent upon logistics. **UAM - Economics and Global Markets** will identify the requirements and costs for densely placed heliports and vertiports in urban areas, as well as those suburban and exurban areas that will benefit from improved linkages within and between nodes. Importantly, airport elements will be identified at commercial, business and general aviation airports, and at seaports and rail merge points.

Heliports and Vertiports

The development of infrastructure to support an urban eVTOL network should have significant cost advantages over heavy-infrastructure approaches such as roads, rail, bridges and tunnels. Uber Elevate proposes that building rooftops (figure 9), repurposed tops of parking garages, existing helipads, and even unused land surrounding highway interchanges could form the basis of an extensive, distributed network of "vertiports" (eVTOL hubs with multiple takeoff and landing pads, as well as charging infrastructure) or single-eVTOL "vertistops" (a single pad with minimal infrastructure). As costs for traditional infrastructure options continue to increase, the lower cost and increased flexibility provided by these new approaches may provide economically viable low cost options for cities.

Vehicle charging systems will become essential public infrastructure in the future world of UAM. Electric air vehicles will need to move off the landing pad at vertiports to accommodate other eVTOLs if they also need to recharge, or if another passenger trip isn't already scheduled. However, as reported by Uber Elevate studies, if energy is sufficient and if passengers are ready, then the eVTOL will only stay on the pad long enough to deplane and enplane passengers. Achieving a minimum turnaround time may be important to achieve high vehicle productivity. Batteries will need to be recharged or swapped between flights to achieve maximum utilization. The infrastructure to satisfy this requirement poses many questions dependent upon factors such as the vehicle in service, vehicle mix, space adjacent to operations and other things. **UAM - Economics and Global Markets** will analyze these factors closely in its market and economic analyses.



- **Civil and military aircraft and engine OEMs and their extended supply chains account for nearly half of the global aerospace economic activity**
- **Maintenance, repair, overhaul, and upgrades generated 27% (just over $200B) in economic activity**
- **Other activity, including simulator manufacturing, defense electronics not otherwise captured, and research performed by government or non-profit associations accounts for just over 7% of activity**

Figure 8 – Global Aerospace Industry Forecast (Teal Group 2018)

UTM Traffic Management Infrastructure

UAS traffic management systems necessary to safely sustain Urban Air Mobility are being studied today by NASA and a collection of the world's most capable system integrators. UTM solutions will provide the same functionality of air traffic control systems at higher altitudes. Under current systems, the air traffic controller can effectively talk to about 15 aircraft at a time. The number of eVTOL aircraft projected to be making daily flights will quickly surpass this capacity.

Another component of required infrastructure is a buildout of higher precision tracking systems that work in low-altitude urban environments. These systems must accommodate simultaneous and instantaneous tracking of a high number of aircraft flying in close proximity to one another and to buildings. With the emergence of urban drone usage, separation between the two will be critical.

eVTOL Capable Airport Infrastructure

Finally, tying city centers to airports will become a dominant high-value application of UAM. Specific airport infrastructure needs and costs will be examined as part of our economic and market study. A well-run airport will be looking towards capitalizing UAM to maximize the utility and convenience of its facilities. Airports are the logical point of ingress for eVTOLs into an urban transportation network. Early on, airports will be the only locations with ATM systems required for low volume flights. However, as UAM becomes more prevalent, airports will be required to build out vertiport facilities, battery charging stations, and people moving systems, as well as isolating the UAM activity from, and integrating passenger flow, with conventional airport operations.

Figure 9 - Urban Air Mobility Vertiport

Aerospace Economic Engine: Global Leadership in UAM

According to the venerable Teal Group[2], the global aerospace industry was worth a staggering $838 billion in 2017. Figure 8 (prior page) shows the various sectors, with aircraft and engine OEMs accounting for 28 percent of activity, and aircraft systems and component manufacturing coming in at 25 percent.

The U.S. has by far and above the largest aerospace industry in the world, some $408.4 billion, accounting for 49 percent. In second place is France, generating $69 billion. The U.S. has the largest:

- Civil airframer (Boeing)
- Military airframer (Lockheed Martin)
- Engine OEM (GE), and
- OEM (UTAS/RC)

This goes along with high levels of space systems innovation and development. Additionally, the U.S. is the world leader in UAVs in terms of dollar volume, variety of systems, and technology.

This industry, so well-established in terms of R&D and manufacturing, will drive Urban Air Mobility from the vehicle and supply chain direction. eVTOL developments are outside the U.S. as will be analyzed in **UAM - Economics and Global Markets.**

Always on the lookout for new growth opportunities, the aerospace sector has already become the principal catalyst in eVTOL developments and propulsion systems. Due to the complexities of highly regulated and certified vehicles, systems and operations, the sector is best suited to evolve UAM in its many configurations. The sector will rapidly accelerate UAM in its full components and configurations.

[2] ***The Global Aerospace Industry – Size and Country Rankings***, The Teal Group, Fairfax, VA, USA, July 16, 2018

Developers of eVTOLs and Hybrid Vehicles

Currently about 80 companies are developing or have successfully flight tested an eVTOL for commercial or personal use (Figure 10). Vehicle design types include multirotor, ducted fan, fixed wing with rotors, vectored thrust, and others, mostly with all electric or hybrid-electric propulsion systems. All vehicles designed for UAM are capable of vertical take-off and landing, or eVTOL, to ensure suitability for helipads and dense urban environments. Most vehicles aim to seat 2-6 passengers and come in various configurations, with some designs opting for a modular build that allows for greater flexibility among travel needs. Vehicles aim to satisfy distances as short as 10 miles, but many can accommodate longer distances in the hundreds of miles on a single journey.

Figure 10 – XTI Trifan 600 Hybrid Electric eVTOL

Manufacturers range from established aerospace manufacturing companies like Boeing and Airbus, to automotive companies like Aston Martin, to start-ups like XTI Aircraft or Vickers, and even government agencies like NASA and DARPA. Many manufacturers do not plan on operating their UAM vehicles at scale but aim to become part of a larger UAM ecosystem, such as the Uber Elevate initiative. This diversity in manufacturers and in vehicle designs adds complexity to the UAM ecosystem from a supply chain and technological governance standpoint, furthering the need for standardization of UAM concepts and specifications.

UAM - Economics and Global Markets will provide detailed analysis of the anticipated UAM applications and opportunities vehicle developers are driving toward. In particular, the study team will examine, by vehicle development maturity level:

- Vehicle performance characteristics by market application (and customer type)
- Technology strengths and dependencies
- Special supply chain and support needs

The results will be presented to inform potential operators and other customers of near-term partnering opportunities.

eVTOL Supply Chain

Advances in aerospace technologies and manufacturing have allowed for the possibility of UAM to happen at scale, and supply chain challenges and the high-barriers to entry for aerospace manufacturing remain.

The UAM supply chain will include third party suppliers of motors, batteries, flight control systems and other eVTOL technology. This supply chain is a new aerospace business opportunity. Because electric propulsion is new, the OEM's will probably play a much greater role in maintenance, repair and overhaul (MRO) of new eVTOL fleets. New MRO support methods and on-board diagnostics systems will ensure high UAM aircraft dispatch, reliability, and on-time performance.

Those UAM vehicle manufacturers without existing aerospace manufacturing capabilities or infrastructure are at a disadvantage, pressured to produce aircraft with revenues generated from pre-sales and/or investor capital. Their development strategies often require proprietary processes, material sourcing, or strategic subsidies to remain economically viable while prototypes are being produced, tested and certified. If they can survive the initial research and development cycle to produce a fully-certified and economical aircraft, they should begin to benefit from economies of scale. This landscape will be studied in detail in **UAM - Economics and Global Markets.**

Operators of eVTOL fleets will need to support them to the highest safety level possible, and likely in accordance with regulations including FAR 121, 135, 145 or their equivalents. The analysis of such supply chain capabilities will be an important part of **UAM - Economics and Global Markets.**

Electric Propulsion is Key

If the future were a color, it would be green. Cities already struggling with poor air quality will only welcome urban air vehicles with minimal emissions. Currently, transportation emissions represent the largest source of U.S. greenhouse gas emissions, some 28.5 percent, or more than 1.8 billion metric tons. Over 90 percent of the fuel used for transportation—cars, trucks, buses, ships, trains, and planes—is petroleum based. Currently, aviation fuel is the largest source of U.S. lead emissions. Electric propulsion promises a significant reduction in maintenance costs and energy costs (fuel) resulting in direct operating costs that are up to three to four times less than today's small aircraft and helicopters. Additionally, each short UAV trip will remove one or more gasoline-powered, ground-based vehicles from the roads for a more significant time period.

Some of the problems with all-electric flight are nearing their solution: Instruments, wiring and monitors are becoming smaller every year, while materials to build interiors, like carbon fiber, are lighter yet stronger. Other factors are somewhat behind these: higher powered electric propulsion systems are still too heavy to use in large passenger or freight aircraft.

NASA has been at the forefront of electric propulsion research for UAM operations and has shared extensive amounts of technical data from its X-57 Maxwell project, an all-electric propulsion experimental research plane, for UAM manufacturers to study and use. NASA has already begun working with regulators to determine how electric propulsion systems for UAM can best be certified by the FAA. The analysis of such supply chain capabilities will be an important part of **UAM - Economics and Global Markets.**

Batteries and Charging Systems

A major component of the hybrid-electric or all-electric propulsion systems for UAM vehicles is the batteries and charging systems that will power flight on individual trips and throughout the day. While electric vehicle batteries have made significant strides over the past decade and benefitted from research and development expenditures from major auto manufacturers like GM, Ford, Toyota, Nissan, and most notably, Tesla, there are still concerns about the cost of operation, speed of charging, cost of replacement, and raw materials required to make electric batteries at scale efficient from both cost and operational standpoints.

Increases in range for electric vehicle batteries can alleviate some of the concerns for operators, but they still face decisions on how to best implement the battery technology: should batteries be replaced on vehicles as they lose charge, or should they be tied to individual aircraft and re-charged like current electric cars? Environmental concerns around battery inputs and disposal of used electric vehicle batteries also persist and need to be addressed by UAM stakeholders before widespread implementation can take hold.

Figure 11 – Volocoptor 2X Flying Taxi

Particularly exciting are recent Department of Energy (DOE) investments which support eVTOL priorities. The DOE Battery 500 project is spending $50 million over the next few years to develop high capacity batteries and chargers. This collaboration between DOE labs and universities is focusing on lithium-metal batteries, overseen by an industry panel board including Tesla, IBM, and PNNL to ensure manufacturable solutions. If new cost thresholds can be achieved, the cycle life would be highly acceptable.

Trends in battery development and timelines for availability of nascent but promising technologies will be carefully analyzed in **UAM - Economics and Global Markets.**

Traffic Management Systems

There is perhaps no greater complexity of the proposed UAM ecosystem than that of traffic management at scale across cities. Unmanned Aircraft System Traffic Management governing low altitude airspace will be crucial to ensure the safety of all participants and residents of urban areas. UTM must consider not only the UAM vehicles, but other commercial and civilian drones, commercial aircraft, business and general aviation aircraft, emergency response aircraft, and anything else that could occupy low altitude airspace, as well as weather conditions and large-scale events.

Figure 12 – Airbus VTOL

Beyond visual line of sight (BVLOS) flight, aircraft communications and surveillance, aircraft security, the buildout of infrastructure, and heliport capacity management are all challenges UTM must address as well. Many experts believe that artificial intelligence will be used to autonomously solve these problems as they arrive and plan UAM travel to a degree that solves or minimizes many issues, in ways similar to how air traffic control handles commercial aviation. NASA is currently undertaking an extensive study into UTM, going through four "Technological Capability Levels" (TCL) of increasing complexity with industry and academic partners, detailing their research results with the expectation of handing them over to the FAA in 2019 for further testing.

UAM - Economics and Global Markets will extensively review and analyze options for developing (and funding) UTM at the national and metropolitan levels, with due consideration to ideas and models that delegate capability from the central to the vehicle level.

UAM Infrastructure Investment

One of the biggest questions surrounding the various UAM initiatives around the world is the question of who will pay for extensive infrastructure needs. On the ground, there is the need to build heliports – places where mass passenger exchange can take place – as well as the need for additional localized helipads and drop-off/pick-up vertiports in dense urban areas. Additionally, sensors, radars and monitoring technology will need to be installed and operated in the UAM airspace to ensure safety of passengers and residents alike.

NEXA believes that infrastructure costs can be contained by embracing modern materials like composites, and as well, smart city approaches to transportation. Special analysis will be undertaken to treat these topics in **UAM – Economics and Global Markets.**

Yet the business case has eluded analysis. While there are many potential sources of investment – from the leaders of initiatives themselves like Uber or Airbus, to local or federal governments – a business case must be made that stands up to professional scrutiny.

Innovative financing solutions or "systems-as-a-service" funded by groups of third-party investors, including prominent investment banks and private equity firms, are possible. Each metropolitan area will need to determine its overall cost of investment, adopting its own approach to financing the needed infrastructure. **UAM - Economics and Global Markets** will organize an approach to infrastructure financing that will tackle the business case and identify the most likely sources of funding for these cases to proceed.

UAM and Emergency Services

An estimated 400,000 patients are transported by rotor wing aircraft every year, in the United States alone. These flights comprise a large part of an urban area's daily helicopter operations. 54 percent of MedEvac flights in the US are simple inter-facility transports.

These hospital to hospital ferry flights originate and terminate on well-established helipads that would be early candidates for the new generation of eVTOL aircraft.

These ferry operations are also likely candidates for early adoption due to the tremendous amounts of flight information gathered over the thousands of trips previously conducted by helicopter pilots along the exact route.

The benefits of using these new eVTOL aircraft, including significantly lower energy (fuel) and maintenance costs, would immediately be seen in these operations. In addition, the low noise and emissions characteristics of eVTOL aircraft make them well suited to serve hospitals located is densely populated areas.

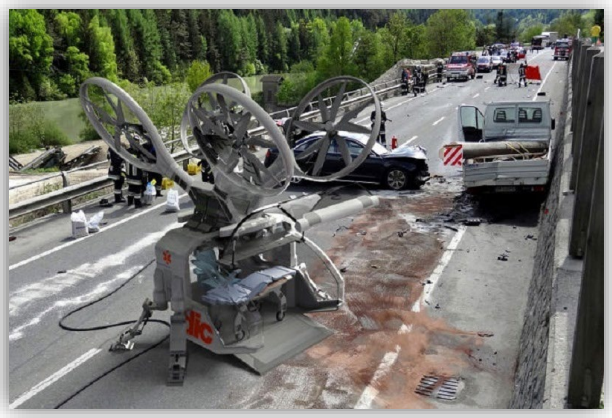


Figure 13 – Argo Design "Ambulance Drone" concept

Traditional MedEvac flights cost hospitals, (as well as patients, insurance companies and government healthcare providers) thousands of dollars. The average MedEvac in the US costs $25,000. Comparatively, an eVTOL alternative would save financially strained hospitals and healthcare systems millions of dollars.

The introduction of advanced avionics and autonomous technology on eVTOL aircraft and sophisticated ATM systems will help improve MedEvac aircraft safety and reliability.

Nearly 50 percent of all emergency personnel who are killed on the job in the United States die in MedEvac crashes. These new systems would allow for safer flight operations in a wide range of terrain and weather conditions as well as reducing the hazards associated with landing at an unprepared site to pick up a patient requiring urgent medical attention. Cutting edge sensors will allow for obstacles in the landing zones and en-route to be detected and avoided.

Response times would also see a dramatic drop when autonomous flights are introduced after collecting data from thousands of MedEvac flights. A vehicle could take off within seconds to respond to an incident.

UAM - Economics and Global Markets will extensively examine the potential for e-VTOL operations within the medical transportation operations in each of the more than 72+ cities.

URBAN AIR MOBILITY - ECONOMICS AND GLOBAL MARKETS STUDY APPROACH AND METHODOLOGY

Study Audiences

UAM - Economics and Global Markets will focus on, and provide value to, a wide range of audiences in several industrial sectors identified in Figure 13 below.

Research Methodology

NEXA's research program is built on our years of experience supporting business investment and strategic planning for institutional investors and some of the largest aerospace companies in the world. We apply this approach to ensure that subscribers achieve a balanced view of the global marketplace and can make informed strategic decisions to reach their business and investment objectives. The method of market research chosen for **UAM - Economics and Global Markets** will identify major issues and trends in a market characterized by technological innovation, competition, industry standards, government regulation, global economic and political turmoil, public perception, and impacts from fluctuation in factors such as energy prices. We will present data quantitatively so that the analysis results can be used to judge the impact of policy, finance, market and industry trends on UAM business strategies and tactics.

Our research for **UAM - Economics and Global Markets** focuses on the following dimensions:

- **Technical:** Technology and systems information that examines existing as well as emerging UAM technologies, new R&D programs, technology forecasting and supporting analysis.
- **Economic:** In-depth research focused on timely and critical global, regional and country-specific trends, including the political, demo-

UAM Industry and Global Supply Sectors	Municipal, Government and Academic Sectors	Institutional and Financial Sectors
Aircraft and eVTOL Manufacturers	Municipalities and City Governments	Private Infrastructure Banks
Helicopter Charter and On-Demand Service Operators	Metropolitan Transportation Authorities	Public Infrastructure Banks
UAM Component Manufacturers	Economic Agencies	Investment Banks
UAM-Related Artificial Intelligence Leaders	Air Navigation Service Providers	Commercial Banks
Architectural Firms	Civil Aviation Authorities	Private Equity Funds
Communication System Providers and Manufacturers	Airport Authorities	Equipage Funds
Battery Developers and Manufacturers	Revenue Authorities in Counties and Municipalities	Insurance Companies
Electric Motor, Micro-Jet Engine and Related Power System Suppliers	Legislative Bodies	Pension Funds
Airlines and Charter Operators	Space Agencies	Sovereign Wealth Funds
Multi/Inter Modal Companies	Research Academia	Financial Advisors
Airport Service Companies	Market Research Companies	
Associations	Technical Research Libraries	
Urban Planning Consultants	Economic Think Tanks	

Figure 14 – UAM - Economics and Global Markets Will Draw Facts From, and Provide Value to, a Wide Audience

graphic and socioeconomic landscapes that influence or impact UAM developments.

- **Market:** The Study will provide UAM market drivers and restraints, market trends, regulatory changes, competitive insights, growth forecasts, industry challenges, end-user perceptions and strategic recommendations. Over 72+ metropolitan areas in all ten UNSD regions will be included (Figure 5).
- **Financial and Investment:** The Study will consider new capital models – engines of investment for UAM infrastructure that power opportunities in the sector by metropolitan area.

The mix of primary market research, secondary market research, and supporting analysis, is explained below.

Primary Market Research

Primary market research will include the collection and analysis of industry and market data from industry and informal expert interviews. Always an important part of NEXA's methodology, we will hold these research sessions and interviews with a cross-section of academics, government agencies/ANSPs (federal, local and international), aerospace and defense experts, regulators, equipment suppliers, private/public funding and international financial sources.

Secondary Market Research

Secondary market research includes investigations that focus on secondary sources of information, such as census data, econometric studies, technical and market literature, trade journals, syndicated databases, etc. Topics of relevance in the international context will be analyzed by user or industry benefits, with the most detailed data summarized.

- **Syndicated Data Sources:** Secondary research sources are varied and rich in facts as they pertain to all aspects of the global UAM markets and industries. Critical to this part of the research is the participation of Aviation Week Network, which owns some of the industry's largest and deepest databases exist. Also, JETNET offers one of the aerospace sector's most comprehensive datasets on aircraft and helicopters.
- **Physical Libraries:** NEXA will reach out to academic institutions and trade associations for studies and data that provide further clarity on the subjects contained in the draft outline of **UAM - Economics and Global Markets** provided in this prospectus. The World Bank and affiliated economic repositories will be researched for global economic data. In addition, NEXA will seek the latest available data from the libraries of the FAA, the U.S. National Center of Excellence for Aviation Operations Research (NEXTOR), NASA, ICAO, IATA, SESAR and other organizations whose resources are relevant.

Figure 15 – NASA's Concepts for UAM Involve Safe Inter-Operability for eVTOLs and Drones

Market and Economic Forecasts

Market outlooks and forecasts are essential to provide strategic understanding of the long-term trends and perspectives within **UAM - Economics and Global Markets**. NEXA and its partners including Aviation Week Network will forecast the emerging trends and global market opportunities in UAM vehicles, systems, services and infrastructure. We will explore new concepts in UAM products and services, and develop future revenue forecasts. The study will utilize econometric forecasting to determine the size, composition and probity of the markets by country and urban area.

The analytical framework for UAM – Economics and Global Markets is presented in Figure 16 below.

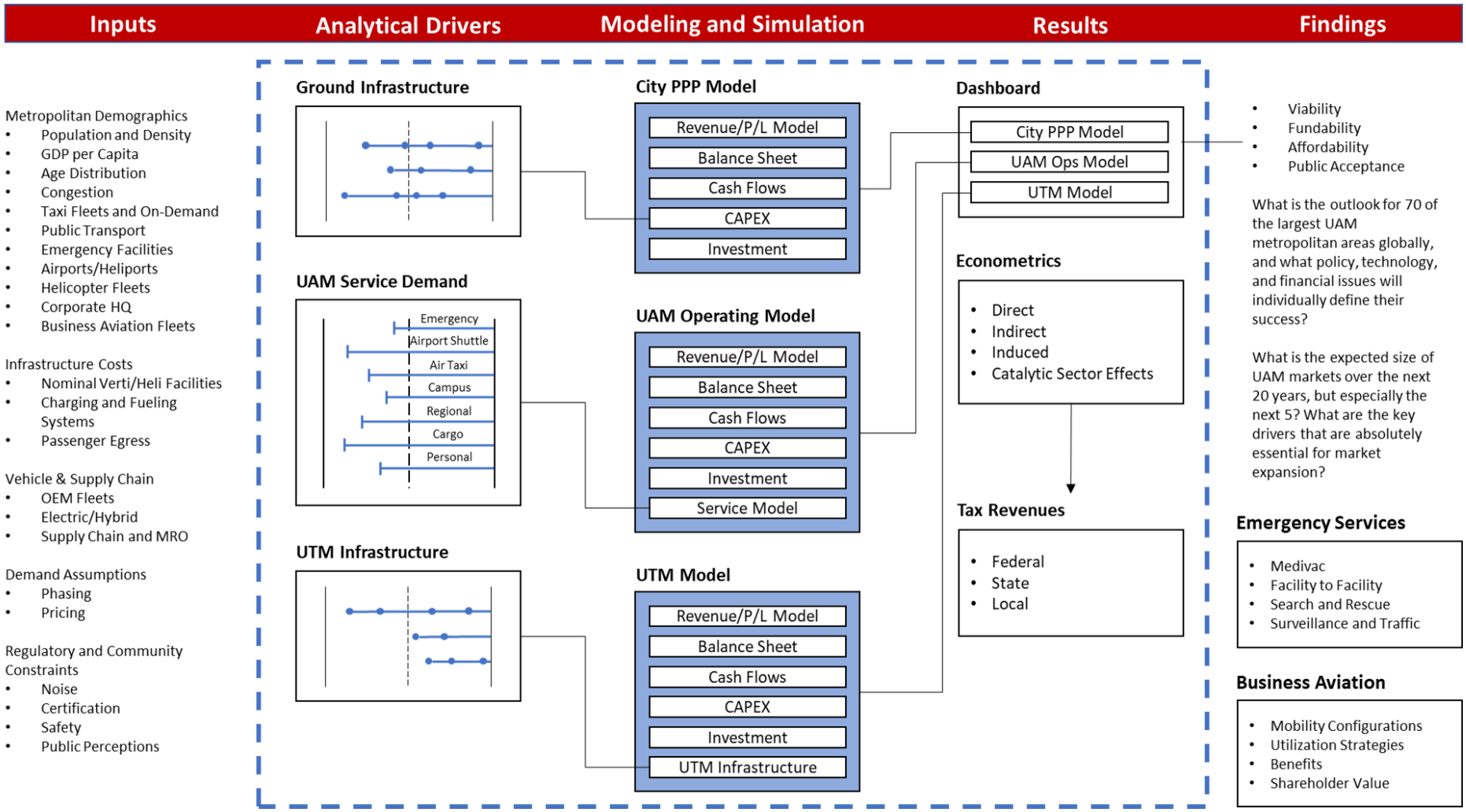


Figure 16 – NEXA Analytical Toolset for Urban Air Mobility – Economics and Global Markets

More than 28 Layers of Data

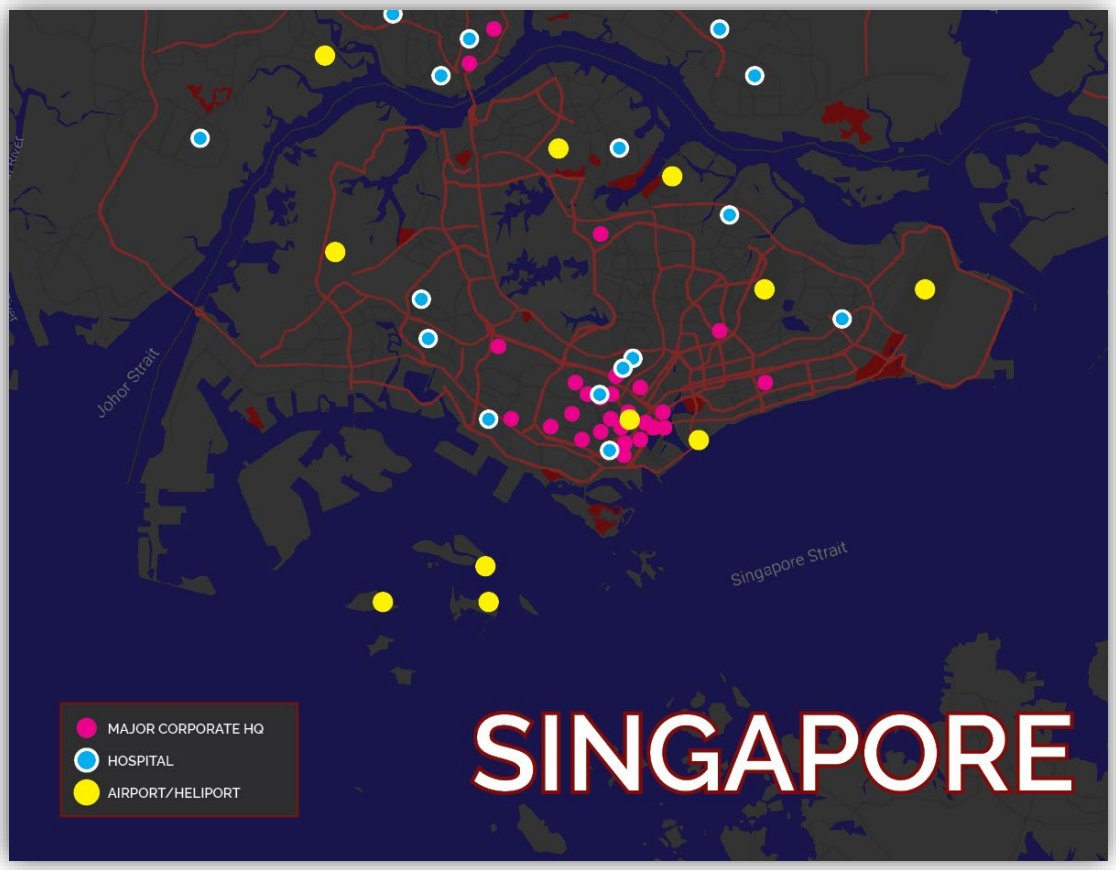


Figure 17 – Existing UAM Features of Singapore

28+ Layers of Data	
■ Hospitals	■ Ferry Ports
■ Commercial Airports	■ 5G Deployment
■ GA Airports	■ Future Infrastructure Projects
■ Major Corporate Headquarters	■ Military Bases
■ Train Stations	■ Existing Airspace Classifications and zoning
■ Heliports/Helipads	■ Weather
■ Congestion Data	■ Future UAM Transportation Operations
■ Light Rail/ Subway Operations	■ Future UTM Infrastructure
■ Government Centers	■ Future UAM Vertiports
■ Sporting Arenas	■ Average Income
■ Concert Venues	■ Air Cargo Operations
■ Shopping Centers	■ Airport Shuttle Services
■ Population Density	■ Emergency Services Operations
■ Job Density	■ Corporate Jet Fleet Data

Figure 18 – UAM - Economics and Global Markets Will Draw Conclusions from a Wide Range of City Features

URBAN AIR MOBILITY - ECONOMICS AND GLOBAL MARKETS CHARTER SUBSCRIBER PROGRAM

Deliverables and Timing

NEXA will produce a comprehensive study with the depth necessary to help Subscribers in their Urban Air Mobility investment decision-making. We will index and extensively footnote topics and provide a reference list for further research. This Prospectus provides a draft outline of **UAM - Economics and Global Markets** in the pages below. Supporting financial and economic models and market forecasts will be provided in Excel format for inclusion in the deliverables to subscribers.

Figure 17 below illustrates study timing. **UAM - Economics and Global Markets** will be available to subscribers in July of 2019 and then a summary will be made publicly available late in September 2019. The charter subscription period will close May 31, 2019 to allow for added research topics to begin quickly.

Charter Subscribers will enjoy substantial benefits, including an opportunity to help define the study. Charter Subscribers will be assured of exclusivity to this study for a six-month period, and only 30 charter subscriptions will be made available. By completing the subscriber form without delay, a reservation will be assured for your company or organization. As explained in Figure 1 of this Prospectus, **UAM - Economics and Global Markets** is a multi-client study and will provide exceptional value for Charter Subscribers.

Order Placement

Charter Subscribers are urged to place their order prior to **May 31, 2019**. A "Charter subscriber Order Form" is found at the back of this prospectus.

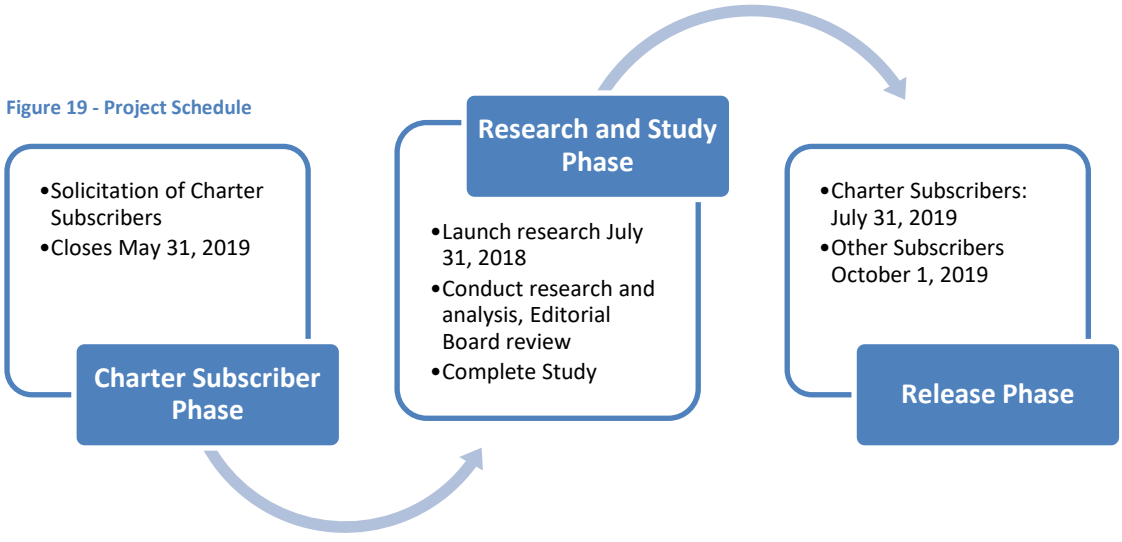
Topics for Additional Study

Charter Subscribers will have an opportunity to define content that will form part of the final **UAM - Economics and Global Markets**. You can recommend specific additions during the subscription process to be addressed in the final report.

Confidentiality

All subscribers may, if requested at the time of subscription, have their names withheld and kept confidential from all other Subscribers and the public.

Figure 19 - Project Schedule



Delivery

All deliverable items, including ***UAM - Economics and Global Markets*** itself, companion databases, worksheets, etc., will be made on or before July 31, 2019.

Method of Payment

Payments of US$19,995 per subscription can be made by check or wire.

If by check, make payable to NEXA Advisors, LLC and scan/email along with completed subscription form to:

NEXA Advisors, LLC
1420 Spring Hill Road, Suite 600
McLean, VA 22102 USA
Tel: +1-202-558-7417

Attn: administrator@nexaadvisors.com

Account Name:	NEXA Advisors, LLC
Bank Name and Address:	HSBC National Bank USA 1800 Tysons Blvd Suite 100 McLean, VA 22102
ABA Number:	USA: 021001088 Outside USA: SWIFT Code - MRMDUS33
Account Number:	767020677

URBAN AIR MOBILITY - ECONOMICS AND GLOBAL MARKETS STUDY AUTHORS

UAM - Economics and Global Markets is sponsored by three of the aerospace sector's most capable and insightful analysis and market forecast companies.

Underwriting Sponsors

About NEXA Advisors

NEXA Advisors is the analytics subsidiary of NEXA Capital Partners LLC, an investment bank and financial advisor serving the aerospace industry. Founded in 2007, NEXA has provided structured finance services for companies and projects, from M&A to project financing. With expertise in aviation infrastructure, NEXA helped finance the Aireon satellite system, a billion-dollar project which used the SpaceX launch vehicles to provide global ADS-B navigation coverage. Through ITT/Exelis, NEXA arranged financing for the FAA ADS-B network, which provided the 550 broadcast stations to blanket the U.S. and serve airline and GA customers. NEXA was also the founder and sponsor of the NextGen Equipage Fund and the NextGen GA Fund, using federal loan guarantees to secure financing to accelerate NextGen equipage.

In 2018 NEXA provided consulting support and expertise to the National Aeronautics and Space Administration, to advance its commercial understanding of the long term potential of UAM markets. Among many other topics, NEXA's team researched the investment and regulatory hurdles facing UAM and the drone sector in the United States.

NEXA's 2012 **"Air Traffic Infrastructure Global Markets 2012"** examined market opportunities for CNS/ATM and air traffic infrastructure for over 50 countries. This multi-client study was sponsored by 20 leading aerospace companies including Lockheed Martin, Harris Corporation, Serco, Thales ATM, Rockwell Collins, Airbus and others. NEXA has also developed special analytics used to justify capital investment in business aircraft, on behalf of the National Business Aviation Association.

About Aviation Week Network

The Aviation Week Network (AWN) is a division of Informa Inc., an information services and marketing company with decades of market intelligence experience. The Aviation Week Network is best known for its flagship magazine, ***Aviation Week & Space Technology***. A multi-channel service provider, decision engine and marketplace, with deep databases and integrated workflow tools that support action, the Aviation Week Network brings the industry the power to prevail in a challenging and fast-paced industry.

AWN's global staff of more than 50 editors and analysts delivers an unsurpassed portfolio of information products and services for all sectors of the aerospace and defense industry. The AWN provides intelligence that informs and enables the global aviation, aerospace and defense industry and provides professionals with a strategic business advantage.

About JETNET

Business aviation is a critical dimension studied as part of **UAM – Economics and Global Markets**. JETNET researchers capture, on average, 500 major database "Research Event" changes per day, working worldwide to maintain records, spec sheets, documents, and photos for about 6,500 aircraft. Evolution Marketplace is JETNET's flagship web-based information service designed for the active researcher, dealer, broker, or financial professional. Marketplace LIVE instantly enables the NEXA team to access the crucial market intelligence needed to make well-informed decisions as urban air mobility begins its journey into the business aviation sector.

About National Business Aviation Association

UAM has valuable potential for NBAA's 11,000 members on a number of practical levels. Specifically, it is clear that UAM could boost the efficiency of

business travelers' "final miles" – the ones employees must drive to and from airports – often, over very congested roadways – to reach their aircraft for traditional business aviation missions. NBAA well recognizes this reality: in the past year alone, the association has explored the matter in its bi-monthly magazine, at its annual convention and in its focus on how congressional lawmakers are considering UAM from a policy perspective. NBAA has connected companies that are developing plans to operate UAM with business aircraft flight department leaders to discuss synergies, perceived risks/concerns, and opportunities. Through its work with NEXA in support and sponsorship of **UAM – Economics and Global Markets,** NBAA intends to continue building on the organization's thought-leadership role in this space, and the forthcoming NEXA study offers a valuable opportunity to do so. NBAA recognizes NEXA as a leading world expert in business aviation and shareholder value creation. At a strategic level, the study will look carefully at the implications of UAM technologies for companies relying on business aviation to meet their transportation needs.

About Esri and ArcGIS

Environment Systems Research Institute (Esri) was founded to help solve some of the world's most difficult problems. Esri supports its users' important geospatial work with a commitment to science, sustainability, community, education, research, and positive change. With employees in 73 countries, and 11 dedicated research centers, Esri is the global market leader in Geographic Information Systems, providing powerful software tools including ArcGIS, enabling **UAM – Economics and Global Markets** to examine urban environments with deep and enriched data. ArcGIS is NEXA's preferred platform to create, manage, share, and analyze spatial data of relevance to UAM, UTM and UAS applications.

About Blue Raster

Since 2002, Blue Raster has partnered at the senior level with leading global organizations, helping them share their unique stories through the powerful visual medium of interactive maps. Blue Raster makes organizational visions a reality, moving beyond dots on a map. Blue Raster works with many of the biggest global organizations and government agencies in the fields of Transportation, Urban Design, Conservation, Health, Government, Global Affairs, and Education.

Blue Raster's development and design team is comprised of experienced professionals with a wide range of expertise in web, graphic, and spatial technologies.

Blue Raster works closely with Esri, the world leader in GIS software. It has certified Esri developers on its team and its developers make regular visits to Esri's Redlands, California, campus, where they help shape future Esri products to address customer's needs.

About Crown Consulting

Crown Consulting, Inc. (CCI), located in Arlington, VA, features a sophisticated technical infrastructure that provides capabilities important for **UAM – Economics and Global Markets**. CCI sports an analytics laboratory with an array of simulation, modeling, and statistical tools supporting aerospace, defense, space programs (NASA), FAA and aviation clientele generally. Serves both private and government organizations in enhancing their performance through providing analytics, information solutions and engineering services.

Authors and Editorial Board

The Editorial Board of **UAM - Economics and Global Markets** has seated three leading thinkers on aerospace trends, manufacturing and supply chain, and sector finance. The Editorial Board dictates the tone and direction of the editorial policy that **UAM - Economics and Global Markets** will take.

Michael J. Dyment, Editor in Chief and Managing Partner, NEXA Capital Partners, LLC

Michael is the Managing Partner of NEXA Capital Partners, an investment banking and corporate finance advisory firm. A highly experienced transportation, aero-space and defense industry consultant and trusted financial advisor to top management, he has over 40 years operational, M&A and corporate finance experience. Prior to NEXA, Michael was

Senior Managing Director with Pricewaterhouse-Coopers LLP, responsible for key aerospace and defense industry clients. He was also an Officer and Vice President of the Transportation Practice of A.T. Kearney, Inc. From 1996 to 2002 he served in the business consulting unit of Arthur Andersen LLP, where he was the global managing partner of its Aviation Industry Practice. He was an engineer at one time with Shell Exploration, developing advanced electronic and navigation systems for use in the High Arctic. Michael's work in the aerospace supply chain began with Canadian Marconi Company, for whom he was its first GPS Product Manager in 1979. He holds a Master of Science in Aeronautics and Astronautics from the Massachusetts Institute of Technology, and a B.Sc.Eng. in Geomatics Engineering from the University of New Brunswick.

Ed Hazelwood, Contributing Editor, and Editor-In-Chief Conferences, Aviation Week Network

Ed has spent the last 30+ years reporting on aviation, aerospace and defense. Currently, he creates the content for Aviation Week's multi-million dollar aviation/aerospace conferences that take place in the U.S., Europe the Mideast, Latin America and Asia. Chief among these are the MRO series of events that take place globally.

He has been chief correspondent for a national television news program devoted to aviation, editor of publications devoted to Air Traffic Management, aerospace in Russia and China and ballistic missile defense in the United States. Ed is co-author of the book, *"What Ever Happened to the Cold War?"* Planning for a New Era in defense," the definitive 1991 study of the U.S. defense industrial base and the strategies needed to enable industry to survive in the changing security environment.

Throughout the 1990s he conducted numerous studies that included research on European and Asia airports, an extensive analysis of the existing and unfolding airline market in Russia and the Commonwealth of Independent States.

Ed does significant public speaking at aviation and aerospace events and conferences around the world. He also routinely comments in the media on hot issues related to the industry. He has won numerous awards in journalism, including the International Award for Best Continuing Coverage of a news story by the Radio and Television News Directors Association, the Associated Press Regional Broadcast Award for coverage of the Walker espionage case, and Best Individual Effort by a Reporter from Associated Press for uncovering fraud, waste and abuse in Virginia government. Ed received his B.S. mass communications from Virginia Commonwealth University.

Mike Hirschberg, Contributing Editor, Executive Director of the Vertical Flight Society

Mike Hirschberg assumed the duties of Executive Director of the Vertical Flight Society (then known as the American Helicopter Society, Inc.) on June 1, 2011, after 20 years in the aerospace industry, primarily in vertical flight. As the Executive Director, he is responsible for the execution of the strategic direction set by the Society's Board of Directors.

He represents the vertical flight technical community and advocates for the advancement of vertical flight research and technology to the executive and legislative branches of the government. Mr. Hirschberg is the publisher of all society publications, including *Vertiflite*, the *Journal of the AHS*, and the Annual Forum Proceedings.

Mr. Hirschberg was previously a principal aerospace engineer with CENTRA Technology, Inc., providing

technical and program management support for over 10 years to the Defense Advanced Research Projects Agency (DARPA) and Office of Naval Research (ONR) on advanced aircraft and rotorcraft concepts. Prior to this, Mr. Hirschberg worked from 1994 to 2001 in the Joint Strike Fighter (JSF) Program Office, supporting the development of the X-32 and X-35 vertical flight propulsion systems.

He served as the Managing Editor of *Vertiflite* magazine from 1999 to 2011, and had been a contributing author since 1997. Mr. Hirschberg is an internationally-known lecturer, frequently presenting on vertical flight at short courses, meetings, conferences and universities, and is the author/co-author of more than 100 publications on helicopter, V/STOL and advanced aircraft developments, including three books.

Mr. Hirschberg holds a B.S. in Aerospace Engineering from the University of Virginia (1991) and a M.E. Mechanical Engineering from Catholic University of America (1996). He completed a Master of Business Administration at the Virginia Polytechnic Institute & State University (Virginia Tech) in 2013. He is proficient in German. He is an Associate Fellow of the American Institute of Aeronautics and Astronautics (AIAA) and a Fellow of the Royal Aeronautical Society (RAeS).

Ken Swartz, Aviation Journalist, Contributing Editor & Photojournalist, Vertical / Skies / AHS Vertiflite / Helicopter International – Canada, US and UK

Ken is one of North America's leading aviation journalists, well known for producing insightful in-depth reports on a wide range of aviation sectors and emerging markets. He regularly appear in leading aviation trade magazines and the World's leading vertical flight and helicopter journals. He is currently working with the Vertical Flight Society (AHS) to engage engineers and entrepreneurs developing electric platforms for the Uber Elevate urban eVTOL initiative. Ken is also a Subject Matter Expert - offering In-depth knowledge of commercial and military aviation, aerospace technology and manufacturing; aircraft and airline economics; aviation history.

Ken has published more than 1,500 articles and market research reports on the commercial aerospace sector covering commercial airlines, business aviation aircraft manufactures, aircraft finance, aircraft engines, avionics, systems, airports, special mission applications, helicopters and defence subjects for 20+ international publications, including Skies, Vertical, AHS Vertiflite, Helicopter International, Helidata, Wings, Helicopters, Canadian Aviator, Raincoast Chronicles, Canadian Business, Aviation Canada, Canadian Aviation, Air Transport World, Airliners, Airways, Aviation International News and Flight International.

Ken holds a BA – Political Science & International Relations, from the University of British Columbia, Vancouver, BC.

Dan Hubbard, Senior Vice President, Communications, National Business Aviation Association

Dan Hubbard joined the staff of the National Business Aviation Association (NBAA) on Dec. 1, 2004, as its new vice president, communications, and he was promoted to senior vice president in 2008. He also served as corporate secretary of the Association's Board of Directors from 2007 to 2010.

With experience in grassroots, governmental and political communications, he serves as the senior staff member providing leadership for the Association's tactical and strategic communications program. Hubbard also manages the cultivation and implementation of proactive media and press relations activities directed to NBAA Members, the aviation community and the general public.

Hubbard previously served as vice president at Fleishman-Hillard, one of the world's leading public relations firms. As the deputy director, public affairs for the firm's Washington, DC, office, he focused on political operations, coalition building and management, crisis communications, and media relations. While at Fleishman-Hillard, much of Hubbard's client work focused policies affecting the commercial aviation and aerospace industries.

Hubbard came to Fleishman-Hillard after six years of campaign and Capitol Hill employment. In each of his capacities, his work emphasized grassroots activation and third-party validation to highlight the issue positions and accomplishments by candidates and elected officials.

In his political positions, Hubbard provided media relations support for the George W. Bush 2000 Missouri presidential primary campaign, Senator Christopher Bond's (R-MO) 1998 re-election campaign, Senator Bob Dole's (R-KS) 1996 Missouri presidential operation and Senator Sam Brownback's (R-KS) 1994 congressional campaign. Hubbard's political work concluded with his service as communications director for Senator Bond.

Hubbard holds a Bachelor of Science degree in broadcast journalism from the University of Kansas.

Prakash Manglanathan, Director, Software Engineering, Crown Consulting Inc

Prakash has over 18 years of experience in implementing software projects for commercial and government customers. Experienced at analysis of complex customer business processes & requirements and designing robust, elegant, secure systems and communicating it with technical and non-technical audiences. He has extensive expertise in leading small and medium agile teams of software developers, DBA, Dev Ops professionals to implement software systems.

Prakash recently led system implementations for various aviation customers including FAA, Eurocontrol, Irish Aviation Authority, CANSO, Memphis Airports etc. He is experienced in exploiting FAA & Non-FAA aeronautical, geospatial data to improve safety by creating systems that improve collaborative & safe use of airspace.

Technology focus includes ArcGIS, Artificial Intelligence, IoT Sensor Networks, Geospatial Visualization, Mobile UI/UX, VR/AR & Cloud native implementations.

Brian J. Smith, VP Solutions, Gannett Fleming, Inc.

GeoDecisions, a division of Gannett Fleming, is an information technology company delivering strategic geographic information systems (GIS), information technology (IT), and intelligent transportation system (ITS) solutions and applications to empower transportation, state, county, municipal, and commercial clients. With more than 20 years of experience, Smith serves as a vice president of commercial solutions, and the Delaware office principal with GeoDecisions, an information technology (IT) company specializing in geospatial solutions.

Smith received a bachelor of science in regional planning with a minor in geography/GIS from Indiana University of Pennsylvania.

Other Editorial Board Members

As the next months proceed, the Editorial Board will be adding national and international experts with strength in the following areas:

- Transportation Urban Planners
- Infrastructure Finance Experts
- Experts in Regulations Affecting UAM in Selected Countries
- Aerospace Economists

URBAN AIR MOBILITY - PRELIMINARY TABLE OF CONTENTS

Below is a preliminary table of contents for **UAM - Economics and Global Markets**. As our research proceeds and as Charter Subscribers request additional topics for inclusion, we reserve the right to modify, and add to, this preliminary outline. For the latest version of the preliminary table of contents, please send an email request to administrator@nexaadvisors.com.

2.2.2.5.2 14 CFR Part 119 “Certification: Air Carriers and Commercial Operators”

2.2.2.5.3 14 CFR Part 135 “Operating Requirements: Commuter and On Demand Operations and Rules Governing Persons On Board Such Aircraft”

2.2.2.6 Pilot Rules

2.2.2.6.1 Pilot in Command Flight

2.2.2.6.2 Autonomous Flight

2.2.2.7 Airspace Rules

2.2.2.7.1 New Airspace Design, and coexistence/interoperability between UAM, UAS, General and commercial aviation

2.2.2.7.2 Dynamic and Static Corridors

2.2.2.8 UAM Traffic Management Systems, Needs and Modalities

2.2.2.9 Risk Management

2.2.2.9.1 Software Design Assurance

2.2.2.9.2 Safety Risk Management

2.2.2.9.3 UAM and Airports

2.2.2.10 Challenges Presented by Regulations and Policies

2.2.2.10.1 Ascension of Quality Programs and Alignment with Safety Programs

2.2.2.10.2 Safety Risk Assessment

2.2.2.10.3 Software Design Assurance for Automation

2.2.2.10.4 Pilot In Command

2.2.2.10.5 Detect and Avoid

2.2.2.10.6 Command and Control

2.3 Local Politics, Jurisdictions and Ordinances Likely to Affect UAM (Categorization by 72+ Metropolitan Centers)

2.3.1 Cities and Liveability Factors Such as Quality of Life

2.3.2 What are the Important Environmental Considerations of UAM? (Greenhouse Gas Reduction, Manufacturing Process Improvement, etc.)

2.3.3 Noise, Proximities, Corridors and Abatement

2.3.4 Privacy and Property Rights

2.3.5 Alternatives to Technologies and Bio Fuels

2.3.6 Evolving Strategies Addressing Environment, UAM Impacts

2.3.7 Country by Country Policy Inventories and Future UAM Implementation Outlook

3.0 Global Technology Survey and Assessment of Urban Air Mobility Industry, Vehicle Developers, Manufacturing and Support Supply Chain, and UTM Infrastructure

3.1 Existing UAM Development Programs and Vehicle Inventories (The “73++”)

3.1.1 Vehicle Development Companies: aeroG Aviation, Leonardo S.p.A., Airbus, AirisOne, AirspaceX, Alauda, Aston Martin, Astro, Autonomous Flight, Avianovations, Bartini, Bell, Boeing / Aurora Flight Sciences, Carter Aviation Technologies, Cartivator, chAIR, DARPA, Davinci, Dekatone, DeLorean Aerospace, Digi Robotics, Dufour, eHang, Embraer, EVA, FanWing, GEN Corporation, HopFlyt, Icon, Intel, JAXA, Jetoptera, Jetpack Aviation, Joby, Karem, KARI, Karman, Kenyan, KittyHawk, Lilium, MACRO Industries, ManDrone, Moller, Neoptera, NUS, Opener, Passenger Drone, Pav-X, Piasecki, Pipistrel, Pop Up Next, PteroDynamics, Rolls-Royce, Sabrewing, Samson Sky, Sikorsky, Sky-hopper, SKYLYS, Skypod Aerospace, Starling, Supervolant, Surefly, Swarm, Terrafugia, Transcend Air, Verdego Aero, Verdego Aero, Vertiia, Vickers, Vimana, Vision, Volocopter, VRCO, eVTOL Aviation, Workhorse, Xplorair, XTI Aircraft, Zenith Altitude.

3.1.2 Supply Chains Supporting Vehicle Developers (By Vehicle Development Companies)
3.1.2.1 Traditional and Physical Suppliers (Power Systems, Avionics, Composites, etc.)
3.1.2.2 Intellectual Property and Knowledge Sources (e.g. Universities, partnerships, etc.)

3.2 UAM Vehicle Technologies and Systems Needed for Industry Success
3.2.1 Batteries, Status, Developments and Their Economics
3.2.1.1 Who are the Leaders and Innovators?
3.2.1.2 Development Trends and Possible Breakthroughs
3.2.1.3 Barriers and Overcoming Them
3.2.2 Storage Capabilities and Charging Systems
3.2.2.1 Who are the Leaders and Innovators?
3.2.2.2 Development Trends and Possible Breakthroughs
3.2.2.3 Barriers and Overcoming Them
3.2.3 Electric Motors, Propulsion and Control Systems Including Hybrids
3.2.3.1 Who are the Leaders and Innovators?
3.2.3.2 Development Trends and Possible Breakthroughs
3.2.3.3 Barriers and Overcoming Them
3.2.4 Automation Systems and Next Generation Avionics for Flight
3.2.4.1 Who are the Leaders and Innovators?
3.2.4.2 Development Trends and Possible Breakthroughs
3.2.4.3 Barriers and Overcoming Them
3.2.5 Artificial Intelligence and Application to UAM
3.2.5.1 Who are the Leaders and Innovators?
3.2.5.2 Development Trends and Possible Breakthroughs
3.2.5.3 Barriers and Overcoming Them
3.2.6 Sense and Avoid Designs and Technologies
3.2.6.1 Who are the Leaders and Innovators?
3.2.6.2 Development Trends and Possible Breakthroughs
3.2.6.3 Barriers and Overcoming Them
3.2.7 Autonomous Flight
3.2.7.1 Who are the Leaders and Innovators?
3.2.7.2 Development Trends and Possible Breakthroughs
3.2.7.3 Barriers and Overcoming Them

3.3 UTM Architectures and Infrastructure for Urban Air Mobility
3.3.1 UTM Architectural Concepts, Standardization and Inter-Operability Among User Communities, and Relationships/Applicability to Metropolitan Areas Under Study, and Critical to Dense Air Vehicle Operations
3.3.1.1 Centralization and ATC, Pros and Cons
3.3.1.2 Decentralization Architectures and Designs, Pros and Cons
3.3.1.3 Hybrid Architectures and Designs
3.3.2 Emerging Concepts of RNP, Free Flight, etc. and Degrees of Integration with ATC Systems, Air Traffic Controllers, Etc.
3.3.3 Surveillance Systems, Radar Systems, ADS-B, Etc.
3.3.3.1 Who are the Leaders and Innovators?
3.3.3.2 Development Trends and Possible Breakthroughs
3.3.3.3 Barriers and Overcoming Them
3.3.4 Dispatching Systems
3.3.4.1 Who are the Leaders and Innovators?

Areas Examined in Each City

- Population and population density by urban zone (heat maps)
- Per capita income, demographics, education (knowledge economy), income disparities and crime
- Infrastructure in place and projected needs for vertiports, heliports, charging stations, airport modifications
- Corporate head offices and forecasted job creation sectors
- Number of commercial and business aviation airports, and factors such as departures, the number of business and commercial aircraft and helicopters based therein
- Profiles of passenger vehicles, taxi vehicle fleets, public transportation more generally UAM substitutes
- Emergency service providers, hospitals, and ambulatory vehicles
- Trade and commerce attributes that drive mobility value
- Measures of transportation congestion
- Critical UTM infrastructure including 5G, urban navigation systems and dynamic traffic management needs
- Regulatory propensities, privacy and property rights, at national, state, provincial and municipal levels
- Ability of national ATC systems to provide near and long term UAM vehicle traffic control

10.0 Selected Bibliography

11.0 Glossary of Acronyms and Regulatory Terms

12.0 Catalog of Current UAS and UAM Laws and Ordinances by Country, State and Urban Jurisdiction

CHARTER SUBSCRIBER ORDER FORM

Please detach these pages (pages 38/39) from their binding, carefully fill them out following the instructions provided, and forward it to NEXA Advisors, LLC.

Charter Subscriber Identification:

For the **UAM - Economics and Global Markets** Charter Subscriber Edition, please enter the company below as a Subscriber. The Subscriber agrees to the terms and conditions of purchase stipulated herein. Subscriber agrees that the publication is for Subscriber's sole and exclusive use, and is not to be transmitted, loaned, rented, sold, displayed or otherwise conveyed to other companies or to any individuals not employees of Subscriber without the express written permission of NEXA Advisors, LLC.

_____
Subscriber Name

_____
Address

_____
City State/Province Country

_____
Zip/Postal Code Telephone Email address

Authority:

On behalf of the Subscriber named above, I certify that I have the authority to place an order for **UAM - Economics and Global Markets**.

_____
Signature Name (printed)

_____
Title Date Tel

Enclosed Payment:

Enclosed is a ☐ check ☐ wire confirmation -- in the amount of $19,995. NEXA Advisors, LLC agrees to issue a receipt upon acceptance of this Subscription and of payment.

Confidentiality:

☐ We wish to have our company identity kept confidential as a subscriber to **UAM - Economics and Global Markets**.

Supplemental Topics: We hereby submit the following topics to be researched and analyzed for inclusion in **UAM - Economics and Global Markets**:

_____

Topic 1

_____

_____

_____

_____

_____

_____

_____

Topic 2

_____

_____

_____

_____

_____

_____

_____

Topic 3

_____

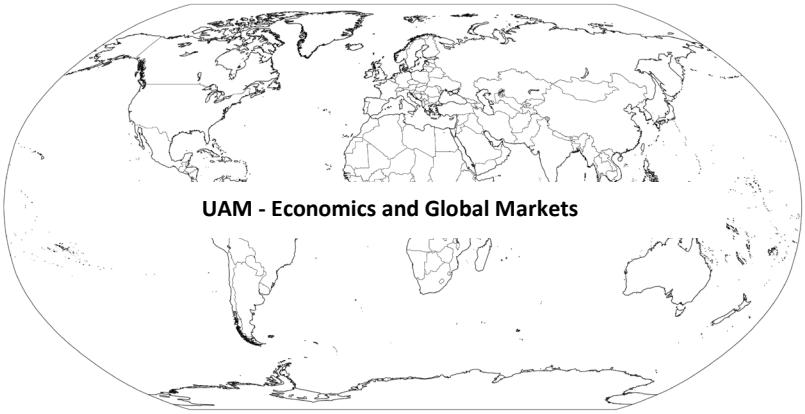
_____

_____

_____

_____

_____



UAM - Economics and Global Markets

NEXA Advisors
A NEXA Capital Company

1420 Spring Hill Road, Suite 600
McLean, Virginia 22102 USA

Tel: +1-202-499-5089