



UNLEASHING THE UAS MARKET

AURA
NETWORK SYSTEMS

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Q1 2022

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INTRODUCTION: THE FUTURE IS NOW

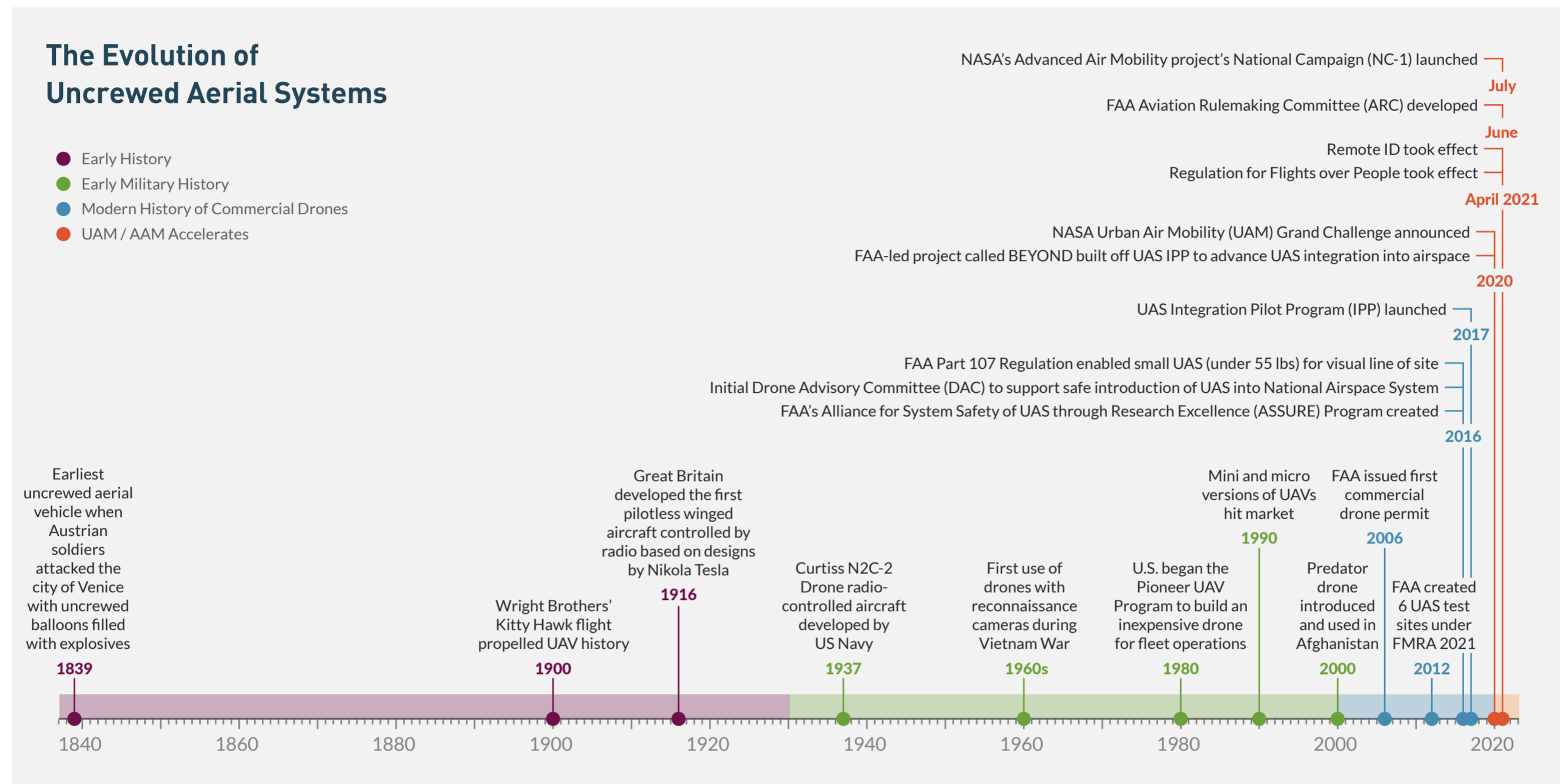


Figure 1: Timeline of major events in UAS history

The future of the aerospace industry is clearly in sight. We see it on the horizon.

Even amid a global pandemic, new public-private partnerships have been forged; regulatory standards have been fast-tracked; and rapidly evolving technologies have been tested – all with the goal of forever transforming not only the national aerospace industry but also our entire transportation infrastructure.

AURA has been in the middle of it all. Although still a relatively new company, our founders and leadership have been working on advancing uncrewed aircraft systems (UAS) technology and regulations in one capacity or another since 2012, and we can clearly envision scalable, affordable and safe integration of uncrewed aerial vehicles (UAVs) into U.S. airspace – within a matter of years, not decades.

Automated and commercial uncrewed aircraft, and the larger UAS ecosystem, are driving this evolution. Highly automated and remotely piloted large UAVs will dramatically change how we move both people and cargo. According to “Think Bigger: Large Unmanned Systems and the Next Major Shift in Aviation,” UAS in the United States will grow exponentially: “Through 2036, large unmanned aircraft are expected to drive nearly \$150 billion in total spending and sustain up to 60,000 R&D, manufacturing, and services jobs annually ...”¹

¹ The Aerospace Industries Association of America (AIA) and Avascent, [Think Bigger: Large Unmanned Systems and the Next Major Shift in Aviation](#) (March 2018)

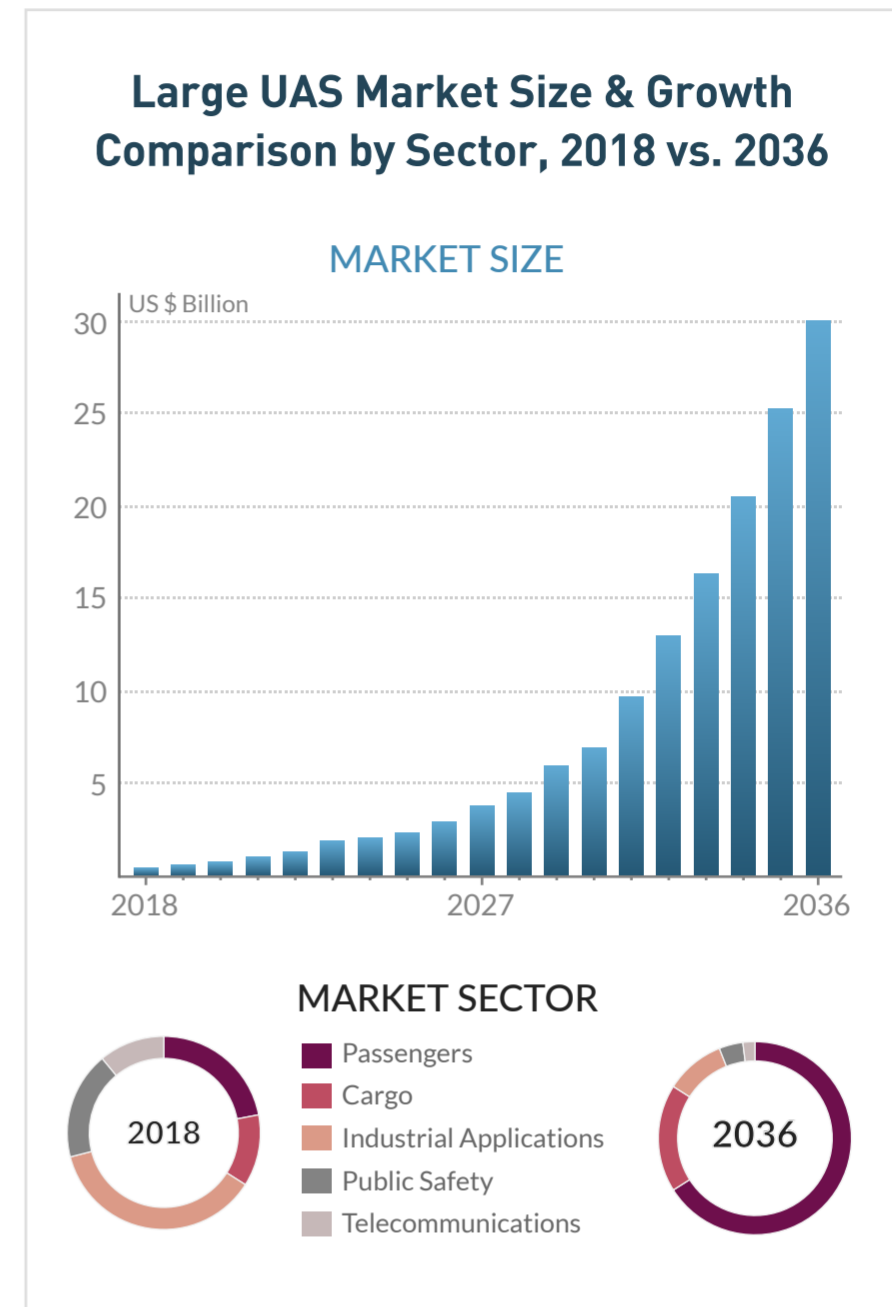
WHAT FUELS UAS GROWTH?

Over the past 10 years, spending on highly automated, large commercial UAS has been primarily focused on research and development, “with manufacturing and services focused on the industrial and public safety sectors ... Yet within the next decade, this figure is poised for breakout growth. By 2028, spending is expected to reach \$4 billion and by 2036 that number – driven by manufacturing and services for long-haul cargo and passenger aircraft – rises to nearly \$30 billion.”²

While industry applications, as well as societal benefits, are promising, the infrastructure and regulatory framework need to be in place before we can fully realize the vast potential of UAS. Will it take another decade? That’s highly unlikely due to recently implemented public-private partnerships focusing on regulation, safety and infrastructure ensuring the safe integration of UAS into the National Airspace System (NAS).



One driving force that has received substantial investor and consumer interest over the past year has been advanced air mobility (AAM), commonly referred to as “flying taxis.” Described as “transformative airborne technology to transport people and goods in new, community-friendly, and cost-effective aircraft in both rural and urban environments,”³ the futuristic images of vertiports and drones flying over them are compelling. AAM – often associated with autonomous, energy-efficient and affordable electric vertical takeoff and landing aircraft (eVTOL) – promises reduced traffic congestion in urban areas, greater mobility, more equitable access to resources in rural and underserved communities, lower carbon emissions, high-paying technical jobs and economic growth in cities, large and small.



Source: AIA, [Think Bigger: Large Unmanned Systems and the Next Major Shift in Aviation](#) (March 2018)

² The Aerospace Industries Association of America (AIA) and Avascent, [Think Bigger: Large Unmanned Systems and the Next Major Shift in Aviation](#) (March 2018)

³ Robin Lineberger, Aijaz Hussain, and David Silver, Deloitte Insights, [“Advanced air mobility: Can the United States afford to lose the race?”](#) (January 26, 2021)

WHAT FUELS UAS GROWTH? (cont.)

Deloitte⁴ estimates that the AAM market will “reach \$115 billion annually by 2035, employing more than 280,000 high-paying jobs.” This growth, notes Deloitte, will be propelled primarily by:

1. Passenger transportation from point A to point B within urban areas and from urban to suburban or rural areas; and
2. Logistics and cargo transportation services within and between communities.

A recent McKinsey & Company Report article is bullish, as well, noting that in 2021 alone, “The uptick has been so rapid, in fact, that total disclosed investments exceeded \$8 billion at the end of March 2021. People transport has seen the most recent investor interest, drawing more than 80 percent of total funding, but cargo-delivery drones might soon see an upsurge.”⁵

Urban air mobility (UAM) refers to AAM designed to transport cargo and people at lower altitudes within urban and suburban areas. We already see piloted air taxis that can take you to JFK Airport from Manhattan for under \$200 in less than 30 minutes, versus an Uber at over an hour and \$100+ depending on the car. Automated air taxis are next, and NASA and the FAA are partnering with companies like AURA, Joby, Raytheon, OneSky and many others to accelerate data gathering, testing and regulatory recommendations.

eVTOL manufacturers, including Joby and Wisk, are promising affordable and scalable aircraft to accelerate adoption of UAM and AAM – and investors are getting on board. According to Avionics International, “Private and public firms, companies, and government agencies are pouring billions of dollars of investments into the emerging electric vertical takeoff and landing (eVTOL) and broader Urban Air Mobility industry. In 2020, despite the impact of COVID-19, air mobility companies raised a total of \$1.3 billion in private investment, an increase of 80 percent from the pre-COVID year of 2019, according to venture capital research and data provider firm Pitchbook.”⁶

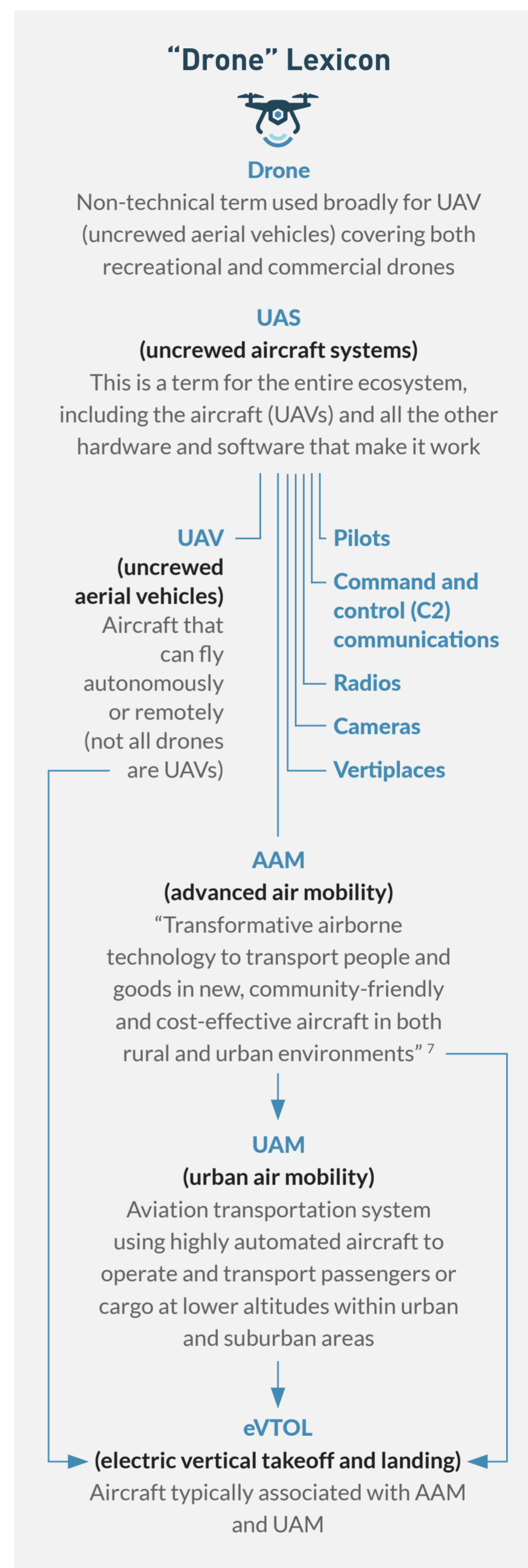


Figure 2: Common UAS industry acronyms

⁴ Robin Lineberger, Aijaz Hussain, and David Silver, Deloitte Insights, “Advanced air mobility: Can the United States afford to lose the race?” (January 26, 2021)

⁵ Benedikt Kloss and Robin Riedel, McKinsey & Company Report, “Up in the air: How do consumers view advanced air mobility?” (June 1, 2021)

⁶ Woodrow Bellamy III, Avionics International, “eVTOL Investments Will Continue Billion Dollar Trend in 2021” (Feb/Mar 2021)

⁷ Robin Lineberger, Aijaz Hussain, and David Silver, Deloitte Insights, “Advanced air mobility: Can the United States afford to lose the race?” (January 26, 2021)

WHAT FUELS UAS GROWTH? (cont.)



Why BVLOS is So Important

Critical to the commercial viability of the UAS market is the safety, societal and economic advantages made possible by beyond visual line of sight (BVLOS) operations – the ability for uncrewed vehicles to fly farther than pilots can see.

Regulations that will allow for safe integration of BVLOS aircraft into the National Airspace are being fast-tracked by the FAA, while testing has accelerated in private-public partnerships such as the NASA National Campaign. Once standards and regulations are in place, the overall potential benefits are tremendous with a few listed below.

- The world supply chain has been choked, faced with staff and warehouse shortages, as well as transportation back-ups due to lack of truck drivers. BVLOS commercial cargo drones would ease many of these issues now and into the future.
- There is also a great demand for additional pilots for commercial passenger and cargo airplanes, and a need for more air traffic controllers. BVLOS operations can complement crewed operations with autonomous uncrewed air taxis.
- BVLOS aircraft are being developed with the environment in mind, focusing on electric engines rather than those running on fossil fuels.
- Uncrewed BVLOS aircraft can be instrumental to public safety by conducting dangerous missions such as fighting wildfires.
- Infrastructure inspections, surveillance videos, data mapping and myriad operations spanning just about every industry can often be done more quickly and cost effectively using uncrewed aircraft that can fly beyond visual line of sight.

BREAKING DOWN BARRIERS

For the full potential of UAS to be unleashed, partners across public and private sectors must continue to come together to address barriers to making such flights repeatable, scalable and economically viable, including:

- Developing and implementing a regulatory framework,
- Testing and collecting data to inform performance-based standards and safe BVLOS operations,
- Educating the public about the economic, environmental and societal benefits provided by widespread UAS adoption, and
- Building an ecosystem to ensure key infrastructure availability and scalability.

There have been several recent and significant advancements. UAS pioneers are working in partnership with the FAA, NASA, private companies, nonprofits and investors to make what seemed like science fiction just a decade ago a reality in the not-so-distant future. A few key initiatives are listed below.

FAA Aviation Rulemaking Committee

In June 2021, [FAA Administrator Steve Dickson](#) announced a new, fast-tracked Aviation Rulemaking Committee (ARC) for unmanned aircraft in order to create a “regulatory path for routine Beyond Visual Line of Sight (BVLOS) operations.” He explained, “This committee will consider the safety, security and environmental needs, as well as societal benefits, of these operations. Within six months, the committee will submit a recommendations report to the FAA ... I think we can all agree this is a big step forward, and it will help pave the way for routine package delivery, infrastructure inspection, and other more complex drone operations beyond the visual line-of-sight of the remote pilot.”

[AURA was among 14 private companies chosen to participate in the rulemaking to help inform best practices and regulation for this new era in U.S. aeronautics.](#)



“Right now, there are several companies using limited Beyond Visual Line of Sight under existing regulations, with waivers, to conduct routine surveillance, inspection, and maintenance tasks for the railroad, electric, oil and gas, and communications industries ... We’re learning a great deal from this work, but the operations are not scalable or economically viable in the mid- to long-term under today’s rules.”

– FAA Administrator Steve Dickson

BREAKING DOWN BARRIERS (cont.)

NASA NC-1

In July 2021, [NASA announced](#) its Advanced Air Mobility project's [National Campaign](#), to integrate air taxis, cargo delivery aircraft and other new air-vehicle concepts into the NAS. Thirteen companies and one university are participating by “flying their innovative vehicles, developing future airspace system capabilities, or providing key infrastructure related capabilities.”

[As a partner in NASA's National Campaign, AURA is demonstrating its AAM communications infrastructure. NASA also selected AURA to illustrate its secure command and control \(C2\) communications technology, which is critical for UAVs to conduct safe BVLOS operations.](#)

FAA Test Sites

In 2014, the FAA launched six UAS test sites as part of the FAA Modernization and Reform Act of 2012, and in 2016, a seventh site was added. The test sites conduct crucial research to determine how to safely integrate UAS into the NAS.

North Dakota's [Northern Plains UAS Test Site](#) (NPUASTS), headquartered in Grand Forks, has been a pioneer among innovators, conducting the first flight at an FAA test site in 2014. North Dakota is also building an entire UAS ecosystem. Its UAS Network, [Vantis](#), received an initial investment of \$28 million from the state. That investment was followed by another \$20 million for fiscal years 2021-2023 for statewide buildout of ground-based infrastructure serving as a model for situational awareness and safety.

In early 2021, the North Dakota Department of Transportation (NDDOT) and NPUASTS announced a partnership with major players in the commercial UAS industry to execute the goals of the FAA's BEYOND program.

[AURA is enhancing its network in North Dakota to enable secure communications links that provide voice, data and navigation capabilities for UAS.](#)

NASA'S NATIONAL CAMPAIGN PARTNERS

Flight Demonstrations

Joby Aviation

Reliable Robotics Corporation

Wisk Aero LLC

Infrastructure Demonstrations

AURA Network Systems

Raytheon Company

Robust Analytics Inc.

SkyGrid

University of North Texas

Airspace Simulations

ANRA Technologies Inc.

ARINC Incorporated

Avision Inc.

Metro Aviation Inc.

OneSky Systems Inc.

SkyGrid

Unmanned Experts Inc.

[AURA was also chosen for additional communications, navigation and surveillance flight testing activities.](#)

BREAKING DOWN BARRIERS (cont.)

BEYOND

A nationwide FAA-led project, BEYOND builds off the success of the 2017 [UAS Integration Pilot Program \(IPP\)](#). In October 2020, the [FAA announced](#) BEYOND's work with eight lead partners to "tackle the remaining challenges of UAS integration" and to help streamline the approval processes for UAS integration. The FAA listed the following challenges:

- BVLOS "operations that are repeatable, scalable and economically viable with specific emphasis on infrastructure inspection, public operations and small package delivery."
- Leveraging industry operations to "better analyze and quantify the societal and economic benefits of UAS operations."
- Focusing on community engagement efforts.



The list of BEYOND partnerships and projects is certainly impressive, which is why AURA remains engaged in the development of use cases based on the project's testing.

Lead participants in BEYOND are working with several partners that span industries and help illustrate UAS potential. For instance:

- The **Choctaw Nation of Oklahoma** is focused on missions involving agriculture, remote infrastructure inspections, public safety and other areas.
- **Virginia's Center for Innovative Technology** is partnering with **Wing, Dominion Electric and State Farm**, with a focus on package delivery, inspecting power lines and other infrastructure, as well as assessing damage caused by weather events.
- The **Kansas Department of Transportation** is partnering with **Iris Automation and Kansas State University-Polytechnic** with projects including public safety operations, proper infrastructure and certification support, and the production of new and innovative communication infrastructure.
- With **FedEx** as its primary partner, the **Memphis-Shelby County Airport Authority's** goal is to develop public policies, guidance and procedures for FAA approval of regular, routine on-airport UAS flight operations supporting aircraft inspections, security surveillance, FOD detection and aircraft-parts delivery.

ABOUT AURA

AURA (which stands for **Advanced Ultra Reliable Aviation**) is on a mission to deliver an FAA-compliant nationwide network utilizing unique, licensed aviation spectrum to accelerate advanced levels of autonomy in the National Airspace System (NAS). Our vision is to empower the aerospace industry's pioneering technology solutions that improve accessibility and safety, drive economic expansion and further environmental sustainability – while transforming the concept of aviation for crewed and uncrewed aircraft.

Why the AURA Network is Truly Unique

AURA is currently testing technology that the aviation industry assumed was several years away. We have the only coast-to-coast network transcending state boundaries with coverage in Alaska and Hawaii, as well as Puerto Rico and substantial portions of offshore waters. As the exclusive operator of our 454/459MHz aviation band spectrum, our site locations ensure a nationwide, interference-free service over a secure, private network.

Our signal serves the National Airspace System (NAS), providing pilots with predictable, reliable command and control (C2) and air traffic control (ATC) voice services.

Over the next few years, we will continue to engage with our partners, including NASA, to test, gather data, fine-tune concepts and work toward standards and certification of our technology, including RTCA-approved radio prototypes and FAA-compliant ATC capabilities. Our technology solutions will help unleash the economic and societal benefits promised by the UAS market.

AURA is the Critical Link Between Pilots and Aircraft



Regulated Airspace

FAA's strict rules and regulations deconflict the NAS to provide a safe air traffic service for 45,000 flights a day

+



Dedicated Aviation Spectrum

AURA's FCC-licensed aviation spectrum (450MHz) deconflicts the communications signal within the NAS to enable safer operations

+

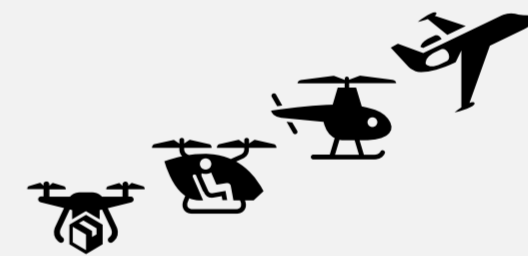


RTCA

Standards Compliant

AURA's nationwide network is purpose-built to comply with FAA regulations, RTCA-standard radios and FAA-compliant ATC capabilities

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Safe Skies

AURA's network provides pilots with a secure, reliable, private air-to-ground radio service

ABOUT AURA (cont.)

The Team

AURA embraces its role as an industry leader. As well as having many licensed, experienced pilots, our team has worked for decades in both the aviation and communications spaces. Aerospace isn't just in our blood. It's also baked into our network.

Chief Executive Officer **Bill Tolpegin** has a unique understanding of how AURA's aviation-approved spectrum will transform the UAS market. With more than three decades of experience in the communications industry, he was a driving force behind freeing up a record-breaking amount of C-Band spectrum to advance 5G technologies across the U.S.

President & CTO **Tamara Casey** has been intricately involved in the development of standards designed to safely integrate UAS into the NAS. She has served on numerous RTCA working groups and helped develop minimum operational performance standards for command and control (C2) data links utilizing aviation-allocated spectrum resources.

AURA's Chief Network Officer, **Mike Gagne**, leads the nationwide network buildout. Over his 25-year career, he has deployed thousands of site locations across every state in the nation. Mike and his engineering team are spearheading the company's flight-testing program to support safe and reliable communications between pilots and aircraft.

Jim Williams, AURA's FAA Regulatory Affairs Director, worked at NASA Mission Control for the initial U.S. Space Shuttle flights and led efforts at the FAA to integrate UAS technology into the NAS. Jim was also the architect of the FAA's Part 107 Regulation to allow small drones to fly in civilian airspace.

Chip Hultman, AURA's Chief Financial Officer, has more than 25 years of accomplishments in the telecommunications industry. His vast experience includes serving as CFO for the C-Band Alliance, a coalition of global satellite companies advocating for next-generation wireless deployment in the continental U.S.

AURA's growing team has developed a one-of-a-kind C2 solution using aviation-approved spectrum across a nationwide network allowing for scalable, safe and efficient integration of uncrewed aircraft into the NAS. The technology is also being adopted by crewed aviation to support existing communications needs and enable innovative new research.



Figure 3: AURA recent milestones

CONTACTS

Partnerships

AURA is helping build the partnerships that will build aviation's future. If you or your firm would like to receive notices of upcoming AURA project-specific requests for proposals (RFPs) or requests for information (RFIs), please email inquiries@auranetworksystems.com

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