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POLICY BRIEF

Planepooling: It's Time to Reinvent Regional Air Travel

Robert F. Graboyes and Brent Skorup

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COVID-19, recent technological advances in the taxi and aviation industries, and demographic shifts have created ideal conditions for the introduction and mass adoption of a new system of regional air transportation. Since the commercial aviation sector was deregulated in 1978, flights have mainly been based on a hub-and-spoke system involving large airplanes, large airports, and rigid schedules. More than two decades ago, federal officials explored an alternative system based on small planes, small airports, and on-demand scheduling. We refer to such a system as *planepooling*. At the turn of the 21st century, conditions were not favorable for such a shift, but in 2021, they have improved. In this brief, we discuss such a system, its increasing feasibility, and the technological and regulatory innovations needed to make it work.

The current hub-and-spoke system works well for passengers traveling 1,000 miles or more. However, only about 23 percent of flights and 41 percent of passengers travel such long distances; about half of flights link cities that are between 50 and 500 miles apart.[1] Nevertheless, those traveling shorter distances must still spend two to four hours in airports and ground transportation in addition to their time in the air. Some opt out of flying—traveling instead by automobile or other ground transportation—or forgo trips altogether. Direct flights by charter or private small planes are sometimes an option, but this mode of travel is currently too expensive for most travelers. For those who wish to travel between two nonhub cities, flights are expensive, time consuming, inconveniently scheduled, or nonexistent. The COVID-19 pandemic has worsened the situation, because some airlines have canceled regional flights and a few carriers have gone bankrupt or fallen into deep financial stress.[2]

We call this the *Nashville-to-Asheville problem*. In a hypothetical example we show later, a present-day traveler wishing to go from the suburbs of Nashville, Tennessee, to downtown Asheville,

North Carolina, can spend 6 hours and 20 minutes traveling by airplane or 4 hours and 21 minutes going by automobile. However, an alternative commercial aviation system such as planepooling can potentially reduce the trip to 3 hours and 20 minutes. Additionally, in the present-day system, the traveler must worry about missing the Nashville-to-Atlanta flight and the Atlanta-to-Asheville flight. With planepooling, there is little chance of missing the flight, and no change of planes is involved.

Planepooling describes a system of 8- to 10-seat aircraft flying in and out of America's thousands of underused small airports. It would be an airborne version of Uber Pool, a ridesharing service in which drivers pick up and drop off passengers along routes drawn by coordinating algorithms. The National Aeronautics and Space Administration (NASA) and the Federal Aviation Administration (FAA) worked jointly on these ideas in the late 1990s. Aviation visionaries Burt Rutan and Bruce Holmes elaborated on the idea in the late 1990s and early 2000s in a series of lectures titled, "Life After Airliners."[3] Some regional air taxi companies began service but failed a few years later.[4]

Making planepooling convenient and cost-effective will require some technological advances and some changes in public policy. We recommend that federal, state, and local authorities begin preparing for planepooling. In particular, regulators should consider reforming the existing federal Essential Air Service subsidy program to provide flexible grants to small airports and help develop a market for regional aviation aerial corridors.

ORIGINS OF PLANEPOOLING

Planepooling originated with NASA and the FAA in the 1990s and early 2000s.[5] The stated goal was to "enable people to move, faster and farther, anytime, anywhere," and "reduce inter-city doorstep-to-destination transportation time" by over 50 percent.[6] Rutan and Holmes developed a vision of small aircraft dropping off and picking up passengers at America's plentiful and underused small airports. They called their idea a Small Aircraft Transportation System (SATS), and that became NASA's term for the concept.[7]

Thanks to terrestrial-bound ridesharing apps such as Uber and Lyft, the concept is intuitive today. With Uber Pool, for example, Uber's algorithms match a single driver with multiple passengers, all of whom are summoning a ride via Uber's app.[8] The passengers enter and exit the car in sequence along a route that likely includes some zigzags to make access and egress more convenient for each rider. As Uber's website notes, the ride will take longer than an ordinary Uber trip, but the benefit is a lower cost or more convenient trip. Planepooling would work the same way.

When Rutan and Holmes first presented their ideas, however, mobile apps were in their infancy, and Uber was still more than a decade away. Even if the ridesharing technology had been in place at that time, the cost of shifting a sizable portion of passenger travel from the hub-and-spoke system

to planepooling likely would have been prohibitive. Doing so would have meant loss of business for traditional air routes and airports and would have necessitated mass construction of small planes, upgrades of small airports, and the addition of many air traffic controllers. These potential transition costs still exist, but demographic changes, recent technologies, and the COVID-19 pandemic could shift aviation away from traditional air routes and toward some regional routes through planepooling.

The market for private on-demand and private commuter flights is niche and has characteristics and regulations that differentiate it from both the general aviation industry and regional airline industry. Today, only about 7,000 planes are certified for private commuter and private on-demand aviation.[9]

NASHVILLE TO ASHEVILLE: FOUR SCENARIOS

The Nashville-to-Asheville problem occurs all over the country. According to recent market analysis, there are hundreds of nonhub city pairs that have at least 30 passengers flying between them daily, but none of those flights are nonstop.[10] Figure 1 (page 4) illustrates the current dilemma and the use of planepooling as a solution. This figure shows four ways to travel from the Nashville, Tennessee, suburb of Smyrna to Asheville, North Carolina.

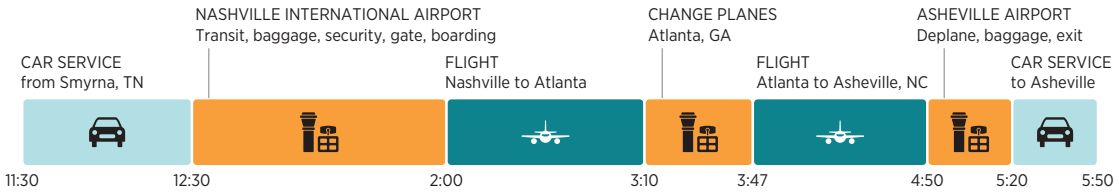
In the figure, scenario 1 (flying from Nashville to Asheville via Atlanta) and scenario 2 (driving by automobile) are the current options for most travelers. Scenario 3 involves planepooling from tiny Smyrna Airport with two stops along the way to pick up and drop off passengers, and scenario 4 involves the same trip with no intermediate stops. Scenario 3 can be thought of as conservative but more common, whereas scenario 4 can be thought of as a better but perhaps unusual—passengers could get lucky by happening to planepool on a day when fewer stops need to be made.

CHANGING CIRCUMSTANCES

When Rutan and Holmes offered their ideas around the turn of the millennium, conditions were not conducive to planepooling. But intervening changes may have tipped the balance toward making this idea economically feasible: first, except for a few well-known exceptions, there is a long-term trend of households migrating from demographically dense city centers to suburbs and even rural areas; second, the COVID-19 pandemic accelerated these trends and added some new reasons to avoid large airports and large airplanes; and third, advances in aircraft electrification, ridesharing, automation, and aircraft design could sharply reduce costs of regional aviation and increase traveler convenience.

Figure 1. Four Modes of Travel

(#1) Present-day airliner: Nashville to Atlanta to Asheville (6 hours, 20 minutes)



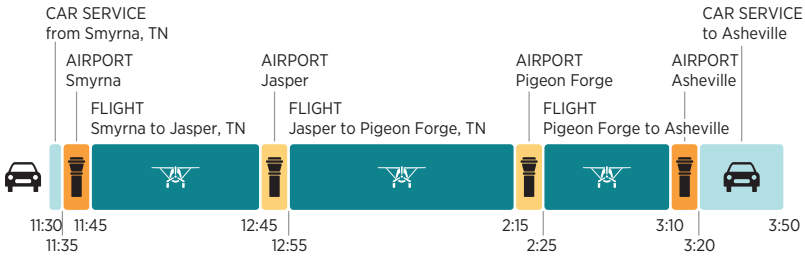
Source: Travelocity

(#2) Drive Self from Nashville to Asheville (4 hours, 21 minutes)

Car travel takes 2 hours less than airlines, plus no fears of missed connections. But the traveler driving himself cannot work, rest, or read.

Source: Google Maps

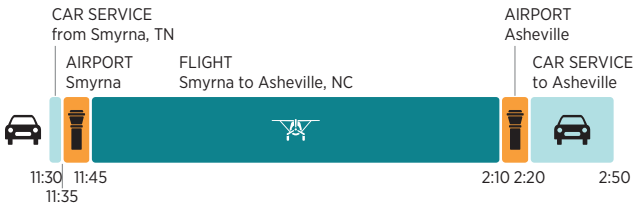
(#3) 8- to 10-seat planepool from Smyrna to Jasper to Pigeon Forge to Asheville (4 hours, 20 minutes)



Planepool passenger gets from Smyrna to Asheville in an 8- to 10-seat plane as quickly as by automobile and can work, rest, or read almost nonstop. The traveler never changes planes. Stops are only to pick up and drop off other passengers. Enplaning, deplaning, and getting to and from ground transportation are brief processes.

Source: Estimate by authors

(#4) 8- to 10-seat planepool, nonstop from Smyrna to Asheville (3 hours, 20 minutes)



In scenario 3, the plane makes stops to pick up and drop off other passengers in Jasper and Pigeon Forge. The authors expect that many trips would have only one stop or none. In scenario 4, there are no stops between Smyrna and Asheville.

Source: Estimate by authors

Note: In 2009, roughly half of flight departures, carrying 30 percent of passengers, were flights of under 500 miles. Of course, this does not measure the number of prospective short-haul passengers who choose not to fly because of inconvenience and inefficiency.
Source: Robert F. Graboyes and Brent Skorup, "Planepooling and Air Taxis for Post-COVID Aviation" (Mercatus Working Paper, Mercatus Center at George Mason University, Arlington, VA, forthcoming).

Demographic and Behavioral Changes

Holmes described planepooling in 2003, listing six trends favoring the small-plane-small-airport model:[11] (a) hub-and-spoke system operating at capacity, (b) highway gridlock, (c) out-migration from hub cities, (d) baby boomers' travel demands, (e) increasingly customizable services, and (f) increasing value of human time. With some notable exceptions, these social trends are still in effect. In March 2021, for instance, the Federal Reserve Bank of Cleveland documented domestic migration numbers and found that people still tend to move toward less populated areas.[12] In November 2020, McKinsey predicted that the hub-and-spoke system would survive, but with an increased traveler preference for direct flights.[13] That same month, Bill Gates suggested that 50 percent of business travel would vanish after the pandemic.[14]

COVID-19-Pandemic-Related Changes

In at least six ways, the pandemic has made the idea of planepooling more appealing:

- *The pandemic has made urban living more unpleasant*. For many urban dwellers, the pandemic meant a claustrophobic existence in small apartments and difficult social distancing in the streets and on public transit.
- *The pandemic has decreased the benefits of urban living.* The pandemic has accelerated the acceptance of remote work and the technologies for doing so. Urban amenities—restaurants, theaters, museums, and shopping—have been largely shut down during much of the pandemic. Some will not reopen. Others may return but in a diminished way. It remains to be seen whether a taste for more socially distant venues is permanent.
- *The pandemic has made people uncomfortable with big airports and airliners.* Airports and airliners do not appear to have been significant vectors for the spread of COVID-19. But for Americans now accustomed to social distancing, flying means long hours in close proximity to many people and, for now, long hours wearing masks. The aviation mask mandate scheduled to expire in September 2021 has been extended to at least through January 2022. Some anticipate that aviation will be disrupted for years to come.[15]
- *The pandemic has made people worried about ground transportation*. For many people, getting to and from airports requires considerable time in trains, buses, or other mass transit vehicles—closed metal containers filled with other people.
- *The pandemic has lessened the appeal of visiting big cities.* Those interested in visiting big cities experience the angst of the four previous problems: more unpleasant urban living, decreased benefits of urban living, discomfort with big airports and big airliners, and worries about ground transportation. The rise of virtual conferences also means less travel to and from big cities for business purposes.
- *The pandemic has increased the appeal of smaller localities.* With pandemic-induced outmigration, more people—especially more affluent people—will likely move to smaller

places, generating the development of small-town amenities and, in turn, generating greater demand for living in and traveling between such places.

Technological Changes

Private aviation has largely been an endeavor for the wealthy.[16] But technologies developed over the past 20 years offer the possibility of affordable planepooling. These include the following:

- *Ridesharing technology.* Car ridesharing systems such as Uber and Lyft use enormous geographical databases and algorithms to match drivers and riders and to optimize routes. A key factor to their success has been an app-based customer interface that simplifies the tasks of requesting a ride, tracking the vehicle's progress, estimating costs, and making payments. Although still an expensive niche market, airborne ridesharing options do exist.[17] As with Uber or Lyft, demand for such services is growing, thanks to increasing convenience, including the convenience offered by Uber-like airborne ridesharing apps.[18]
- *New aircraft designs.* New aviation technologies and designs may make planepooling more economical. New designs will likely have lower maintenance costs and less manufacturing complexity than current jet or propeller shuttle aircraft. Some companies, such as MagniX, are designing electric powertrains for flights of up to 1,000 miles; others are working on hydrogen electric fuel cells.[19] Bye Aerospace aims to produce an eight-seat battery-electric plane.[20] Still others are designing vertical takeoff and landing (VTOL) aircraft and highly efficient diesel aircraft.[21]
- *Autonomous aerial vehicles.* The investment in and industrial adoption of small commercial drones has led to the possibility that autonomous or remote-operated drones will one day carry passengers. FAA Administrator Steve Dickson at a May 2021 congressional hearing noted that the FAA is working with several advanced air mobility companies, including autonomous aircraft companies, and he anticipates some to be certified in 2023 and operations to begin as early as 2024.[22] In the first months of 2021, "investors have committed to pouring more than $4.5 billion into the advanced air mobility industry."[23] Some companies, such as China's EHang, have tested passenger drones and hope to commercialize them in the next few years. The US government is also hoping to make passenger drones a reality.[24] Military and civilian agencies are providing assistance to passenger drone companies, including access to military airspace and government research facilities. Several firms are working toward aircraft certification in the United States.[25]
- *Airspace design and management.* A thriving planepooling market will require a much greater air traffic control (ATC) capacity. Automating the ATC and traffic management process will be crucial to accommodating a sharp increase in the number of flights each day. NASA and the FAA have proposed a new system of unmanned aircraft system traffic management (UTM) to handle drone and passenger drone traffic.[26] The FAA has suggested separate air corridors for passenger drones and short-hop flights.[27]

In addition, the United States has thousands of underused small public and private airports dotting the rural and suburban landscape.[28] Holmes notes that plenty of airspace is available to accommodate a jump in small-plane usage.[29] More details are covered in an April 2021 NASA white paper on Regional Air Mobility—i.e., planepooling—in detail.[30]

POLICY RECOMMENDATIONS

We offer a menu of options for lawmakers and regulators wishing to smooth the way for planepooling:

- *Explore the contingencies.* The US Department of Transportation should explore the possibility of mass-market private aviation and regional planepooling. The department's Non-Traditional and Emerging Transportation Technology Council would be a good forum to explore questions of planepooling policy: Can existing small airports handle the projected increased traffic owing to planepooling and air taxis? What would be the financial effect of planepooling on existing airports and airlines? Can small planes be outfitted to minimize the spread of COVID-19 and other contagions, and can today's large airliners also be so outfitted? What would be the personnel needs of planepooling, including pilots, air traffic controllers, maintenance personnel, and so on? Can the aviation workforce be expanded rapidly enough? Are communications technologies adequate for an era of planepooling? What are the economics of small-plane manufacturing, and can that industry ramp up production rapidly enough? Will passengers accept remotely piloted airborne vehicles? What are the collision risks of significantly larger numbers of small aircraft and drones?
- *Liberalize the FAA's Essential Air Service program.* Congress currently subsidizes regional aviation companies to provide service to small airports around the country through the Essential Air Service program.[31] A few years ago, Congress introduced the Alternate Essential Air Service Program, a novel amendment that allows the FAA to provide funds to cities that can contract for their own air services from private and nontraditional air carriers—a break from the traditional method of federal regulators selecting air carriers for small airports.[32] Congress limited the subprogram to only 10 cities, however. Currently, seven cities participate and have significant freedom in using the funds. Critically important is that each participating city has chosen to use those funds to contract with operators and create a public charter service.[33] The program allows cities and operators more flexibility in their subsidized air operations,[34] and Congress's shifting of more Essential Air Service funds into this alternate program would allow more small airports to contract with planepooling and advanced air mobility companies.
- *Test and expand the corridor traffic-management model.* The FAA should expand its corridor-based traffic management system to include regional private aviation.[35] In summer 2020, the FAA issued a document proposing the demarcation of aerial corridors for urban air mobility.[36] Regulators should embrace the corridor idea for new regional aviation routes

because doing so would enable the development of an UTM system and keep urban air and regional air services safely separated from legacy air users.[37] This approach would also avoid adding congestion to the existing air traffic control system.

Finally, if the FAA does put forward a plan for corridor-based regional aviation and autonomous aircraft, it should consider market disposition of those corridors rather than delegating corridor sharing to industry, as currently proposed.[38] Specifically, the FAA should consider a public auction or lease of corridors to operators, much like the government leases spectrum to telecommunications operators and leases offshore sites to wind energy and oil companies.[39] The benefit of market disposition is that it avoids undue first-mover benefits and route squatting on popular regional corridors.[40] Leases of aerial corridors allow iterative improvements to UTM and ensure that new UTM and planepooling companies can gain access to airspace, something that has proven difficult in traditional aviation once incumbents have established their routes.[41]

CONCLUSION

Policy and aviation entrepreneurs have envisioned a system of mass-market private aviation for decades. Those business plans failed in the past, but two societal developments—COVID-19 and aviation technology advancements—require a reassessment of that vision. The United States has hundreds of underserved aviation routes, and private firms are beginning to plan for serving those markets. Many high-net-worth families have tried private aviation for the first time because of the COVID-19 pandemic, and aviation and tech companies in the planepooling market have expanded. Furthermore, technologies such as autonomy, networking, and UTM could drive down the cost of planepooling and increase flying convenience. For these reasons, federal and state lawmakers should examine and prepare for regional aviation and planepooling. Regulators should, among other things, consider liberalizing small-market airport subsidies so that planepooling companies and customers can participate. Furthermore, aviation authorities should explore the proposal for market disposition—auctions or leases—of regional air routes to ensure competition and innovation in regional aviation.

ABOUT THE AUTHORS

Robert F. Graboyes is a senior research fellow and healthcare scholar at the Mercatus Center at George Mason University. Previously, he was senior healthcare adviser for the National Federation of Independent Business, an economics professor at the University of Richmond, a regional economist and director of education at the Federal Reserve Bank of Richmond, and sub-Saharan Africa economist for Chase Manhattan Bank. His degrees include a PhD in economics from Columbia University; master's degrees from Columbia University, Virginia Commonwealth University, and the College of William and Mary; and a bachelor's degree from the University of Virginia. Author of the paper "Fortress and Frontier in American Health Care," Graboyes focuses upon making healthcare as innovative in the next 25 years as information technology was in the past 25.

Brent Skorup is a senior research fellow at the Mercatus Center at George Mason University. His research areas include transportation technology, telecommunications, aviation, and wireless policy. He serves on the Federal Communications Commission's Broadband Deployment Advisory Committee, on the Texas Department of Transportation's Connected and Automated Vehicle Task Force, and as a drone law adviser to the Virginia Department of Aviation. Skorup has a BA in economics from Wheaton College and a law degree from the Antonin Scalia Law School at George Mason University.

NOTES

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7. National Aeronautics and Space Administration, "NASA Exhibits Preview Second Century of Flight," news release no. 00-64, July 25, 2000, https://www.nasa.gov/centers/dryden/news/NewsReleases/2000/00-64_pf.html.
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22. "Federal Aviation Administration Safety Oversight Hearing (EventID=112593)," House Appropriations Committee hearing, May 12, 2021, video, 1:42:00, May 12, 2021, see specifically an exchange between Dickson and Rep. Mario Diaz-Balart, https://www.youtube.com/watch?v=UrVHy_9jKAE.

23. Warwick, "Vertical Ambition."

24. FAA Administrator Steve Dickson at a May 12, 2021, hearing of the House Committee on Appropriations noted that the FAA is working with several advanced air mobility companies and that he anticipates some to be certified in 2023 and operations to begin in 2024. "Federal Aviation Administration Safety Oversight Hearing (EventID=112593)," exchange at 1:42:00.

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27. Federal Aviation Administration, *Urban Air Mobility*. NASA researchers had described this "management by closed trajectory" method as a way to automate air traffic management. It is unclear how long the separation of aviation users will last, though NASA and the FAA hope the separation will be temporary.

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29. Holmes, "Life after Airliners II"; Holmes, "Life after Airliners VII."

30. National Aeronautics and Space Administration, *Regional Air Mobility: Leveraging Our National Investments to Energize the American Travel Experience*, April 2021.

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32. 49 U.S.C. § 41745.

33. The seven participants are Beckley, WV; Crescent City, CA; Macon, GA; Manistee/Ludington, MI; Page, AZ; Parkersburg, WV/Marietta, OH; and Tupelo, MS. Congressional Research Service, "Essential Air Service (EAS)," (report no. R44176, Congressional Research Service, Washington, DC, December 19, 2018), 12.

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37. Robert F. Graboyes, Darcy Nikol Bryan, and John Coglianese, "Overcoming Technological and Policy Challenges to Medical Uses of Unmanned Aerial Vehicles" (Mercatus Research, Mercatus Center at George Mason University, Arlington, VA, January 2020); Robert F. Graboyes and Brent Skorup, "Medical Drones in the United States and a Survey of Technical and Policy Challenges" (Mercatus Policy Brief, Mercatus Center at George Mason University, Arlington, VA, February 2020).

38. Graboyes and Skorup, "Medical Drones in the United States"; NASA researchers currently propose industry-led sharing of corridors: "Prioritization and sequencing models will have been developed based on fleet operator business models and the FAA-approved [community-based rules]. The specifics have been informed by research into the efficiency and impartiality of a variety of methods such as 'first-come, first-served,' aircraft performance-based, or based on the service being provided . . . . Process and criteria are consensus-based and consider the needs of key stakeholders (federal, state and local agencies, airspace users, public, etc.) to ensure equitable service and safe operations." National Aeronautics and Space Administration, UAM Vision Concept of Operations (ConOps) UAM Maturity Level (UML) 4, version 1.0, December 2020, 35.

39. Brent Skorup, "Auctioning Airspace," *North Carolina Journal of Law and Technology* 21, no. 1 (2019): 79.

40. Skorup, "Auctioning Airspace," 79.

41. Skorup, 79; Graboyes and Skorup, "Medical Drones in the United States."