Terrafugia, Inc.
Testimony for the House Committee on Science, Space, and Technology

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CONTENTS

SUMMARY

Terrafugia was founded in 2006 to be part of the solution to the $160 Billion traffic congestion problem in the U.S. Its first product, the Transition® is a street-legal Light Sport Aircraft designed to be flown in and out of the nearly 5,200 public local airports around the country with true door-to-door transportation provided by its ability to drive like a car on roads and highways. Terrafugia has been flight testing full size Transition® aircraft since 2009 and anticipates first delivery in 2019. Following Transition®, Terrafugia is developing the TF-2 transportation system, a combination of a ground vehicle, passenger pod, and winged electric vertical takeoff and landing (eVTOL) flight vehicle. Providing a unique approach to urban and suburban transportation, TF-2 is leveraging developments in electric propulsion and vehicle control systems with a five to ten year commercialization timeline.

While Transition® is focused on the existing general aviation (GA) market, TF-2 and other eVTOL aircraft are creating a fundamentally new market referred to as urban air mobility (UAM). The key idea behind UAM is that new eVTOL aircraft can provide safe, reliable, quite, and convenient transportation by utilizing a network of vertical take-off and landing sites in and around our city centers. With a hybrid-electric propulsion system, TF-2 will have a larger range (around 200 miles) than other all-electric entrants, giving it the ability to service larger geographic areas. It's ability to seamlessly combine ground and air transportation for passengers, who don't have to leave the vehicle to from being driven to being flown, provides additional flexibility and safety as well. As electric technology continues to improve, an all-electric version is possible. A similar evolutionary approach is being taken to integrating autonomy: initially TF-2 vehicles will be driven and flown by appropriately trained and certificated drivers/pilots. As the technology and regulatory landscapes evolve, it is possible that the role of the human operators will decrease to allow the benefits (including potential increases in safety and reductions in cost) of autonomous operations to be realized.

The regulatory landscape in which TF-2 and other eVTOL aircraft are being developed is made possible by the Rulemaking, completed in 2017, that rewrote 14 CFR 23 to focus on safety intent language for general aviation (GA) aircraft airworthiness certification instead of prescriptive requirements. This shift opened a certification pathway for innovative technology that can increase the safety, utility, and desirability of traditional GA aircraft as well as for entirely new aircraft concepts like eVTOL and UAM. It is critical that the Federal Aviation Administration (FAA) continue this collaborative and innovation-focused approach in the other key areas: operations and operator training and air traffic control (ATC) and airspace access. Continuing this forward-leaning approach is critical for the success of this industry and the continued growth of the U.S. economy and technology leadership. Beyond the FAA, there are opportunities for the federal government to support this industry in addressing challenges in connectivity, infrastructure access, affordability, and technology development.

This is an exciting time in the evolution of our transportation capabilities as new technologies are being developed to bring us all closer together through the safe and innovative use of on demand personal air travel.

1 INTRODUCTION

Chairman Smith, Ranking Member Johnson and Members of the Committee, I appreciate the opportunity to appear before you today to discuss the topic of urban air mobility and its potential applications in our nation's transportation system. My name is Anna Mracek Dietrich, I am one of the original founders of Terrafugia and I lead our company's regulatory efforts with the federal government.

2 BACKGROUND

Highway traffic congestion has increased for the past three decades in all urban areas, costing the U.S. $160 Billion in 2014[1]. Meanwhile, the nation's general aviation airport infrastructure remains largely underutilized. The main reasons that personal aviation has not been a significant solution to transportation include significant training requirements, high cost of ownership, long door-to-door travel time, weather sensitivity, and lack of mobility at the destination airport[2]. An innovative combination of driving and flying in the same vehicle or transportation system, particularly in an on-demand or frequently scheduled operational model, coupled with reduced or eliminated pilot training requirements, address all of these barriers and has the potential to be a contributor to the solution to traffic congestion.

Terrafugia, Inc. is an MIT spin-off company that was incorporated in 2006 with the goal of increasing the practicality, convenience, fun – and of course safety – of personal aviation through just such an innovative combination of ground and air travel. Terrafugia's first product, the Transition® is a Light Sport Aircraft that carries a Sport Pilot[3] and passenger between any of the nearly 5,200 public use airports around the United States. Once on the ground, the wings can be folded with the push of a button and the street-legal vehicle can be driven home and parked in the owner's garage, or to their final destination. Terrafugia has been flying full-size Transition® prototypes since 2009 and is targeting deliveries in 2019. See Figure 1.

Over the course of developing the Transition®, Terrafugia has gained valuable experience working with both the Federal Aviation Administration (FAA) airworthiness requirements and the Federal Motor Vehicle Safety Standards (FMVSS) and applying them to innovative and new aircraft. Terrafugia has received two exemptions from the FAA and four from parts of the FMVSS where the requirements were either not appropriate for a vehicle like the Transition® or where they didn't contemplate the safety needs of a vehicle that could both fly and drive. Terrafugia has also been a leading participant in industry efforts to modernize the certification landscape for general aviation (GA) aircraft.

[1] Transportation Statistics Annual Report 2017, U.S. Department of Transportation, Bureau of Transportation Statistics (available at: https://www.bts.gov/bts-publications/transportation-statistics-annual-reports/tsar-2017)
[2] Downen, T. and Hansman, Jr., R. J., "User Survey of Barriers to the Utility of General Aviation", Massachusetts Institute of Technology, 2002-01-1509.
[3] The FAA's Light Sport Aircraft and Sport Pilot Rule in 2004 reduced the barriers to entry for both aircraft that meet certain requirements and for the pilots that fly them.

In that role, I served on the Federal Aviation Administration's Aviation Rulemaking Committee (ARC) that recently rewrote 14CFR23 and hold leadership positions on the ASTM industry consensus standards committees that are responsible for both Light Sport and General Aviation Aircraft (F37 and F44, respectively), including serving as the Vice Chair for F44. Additionally, I am leading the ASTM effort to create a standards framework for autonomous and complex aircraft systems under ASTM AC377.

The changes to the regulatory landscape are particularly important for Terrafugia's future products, which include an electric vertical take-off and landing (eVTOL) modular transportation system (discussed further in Section 4). This future product development and dramatic company growth has been facilitated by an infusion of capital that began with its acquisition in late 2017. Now a sister company of Volvo Car Group and other international automotive brands under Zhejiang Geely Holding Group, Terrafugia has access to the capital necessary to both take Transition® to production and to develop the next generation of innovative personal aviation solutions. The 2017 deal received approval from all relevant regulators, including the Committee on Foreign Investment in the United States (CFIUS), and has enabled Terrafugia to not only survive in the absence of willing U.S.-based capital but to grow from one location with around twenty employees to three U.S. facilities with nearly two hundred employees. This growth is continuing at Terrafugia's headquarters in Woburn, MA, a flight support center in Nashua, NH, and its Research and Development facility in Petaluma, CA.

3 What is Urban Air Mobility and eVTOL?

Urban Air Mobility (UAM) is, broadly, the idea that aviation can be used to address transportation challenges and congestion within an urban environment. While previously efforts have been made to accomplish this goal using helicopters, a combination of factors including safety concerns and noise prevented helicopter-based UAM from gaining a lasting foothold in the US. Other markets, like Sao Paulo, Brazil, have seen modest success with helicopter-based UAM solutions, but they cannot approach the volume of flight operations that are envisioned for eVTOL-based UAM, in part because of air traffic control (ATC) limitations, or the expected noise and safety targets enabled by emerging technology. The UAM construct requires that there be aircraft that can operate safely, quietly, reliably, economically, and in an environmentally friendly way near, around, and within our urban centers.

Urban Air Mobility is a subset of a broader transportation concept known as on demand mobility (ODM). ODM can be applied to any mode of transportation so long as the user can get the transportation they need when they need it. It is an alternative to the private ownership model that requires an individual to provide the capital to purchase a vehicle and be directly responsible for its operational, storage, and maintenance costs whereby the user simply pays for the transportation-as-a-service that they receive. Particularly for aircraft, this is appealing as it defrays their high purchase price and maintenance expenses over a much larger utilization fraction and multiple users, creating a more economical solution.

Electric Vertical Takeoff and Landing (eVTOL) refers to aircraft that use electric motors to provide the ability to take off and land vertically, without a traditional runway, utilizing existing heliport or other purpose-built vertiport infrastructure. This technology provides an opportunity to realize the goals of UAM. By leveraging the increased safety and reliability of electric motors while taking maximum

advantage of their extremely low noise profile and reduced operational costs, eVTOL aircraft can provide an economically viable means by which many urban and suburban residents could incorporate aviation as a solution to their routine transportation needs. Aircraft that use wing-borne flight to travel between take-off and landing locations as well as those which rely solely on powered lift are both included in the eVTOL umbrella, as are aircraft that use a hybrid propulsion system with a conventionally-fueled engine to recharge the batteries and/or provide en route propulsive power.

4 TERRAFUGIA'S APPROACH TO EVTOL

Terrafugia is currently working on conceptual design and subscale prototyping of an eVTOL transportation solution, the TF-2. A door-to-door three part transportation solution, TF-2 consists of a passenger (or cargo) pod that is connected to a ground vehicle for road use and a flight vehicle for winged eVTOL use. This allows for a seamless door-to-door experience for passengers, and can accommodate what could be a potentially slow roll-out of available landing sites within urban centers. See Figure 2 and Figure 3 for a schematic of the door-to-door operational concept and the three pieces of the vehicle system. Figure 4 depicts a possible solution to landing infrastructure with a TF-2 flight vehicle landing on a barge adjacent to a city center.

It is expected that the TF-2 flight vehicle will have a payload of approximately 1,000 lb, fly around 125 mph, and have a range of around 200 miles (while maintaining the current minimum reserve requirements). The anticipated cost for a ten minute flight is about $30 per person – during which time the user could be transported 15 to 20 miles – above the traffic.

TF-2 improves the operational safety and efficiency of vertical flight by keeping untrained people off of the landing pad (they will be seated in the pod during the loading/unloading process) – this will allow faster, safer operations while simultaneously improving the end-user experience because they do not need to get out of the pod until they are at their final destination.

TF-2 is being designed to accommodate expected rapid evolution in both technology and the regulatory and operational landscape. With a hybrid-electric flight vehicle, TF-2 can achieve a range sufficient to allow cross-city flights, such as from Santa Rosa in the north to San Jose in the south over the heart of the San Francisco Bay Area (about 100 miles) or at the outside of its range from the Boston, MA metro area to the New York, NY metro area (about 200 miles), as well as more local trips such as from San Jose, CA into downtown San Francisco[4], or shorter. This range would also allow underserved rural communities to have efficient access to regional airport infrastructure, hospitals, or other urban services. Electric motors provide the necessary low-noise operations and safety for vertical takeoff and landing while a conventional certified turbine engine provides cruise power and the ability to recharge the batteries in flight. As battery technology continues to evolve, it is conceivable that an all-electric version could be produced in which the engine and fuel tanks are replaced with additional batteries.

[4] These trips are provided for illustrative purposes only. Terrafugia has not committed to a geographic launch area at this time, though it is likely that testing will continue to be conducted near the company's facilities in the San Francisco Bay Area and in New England.

The ability of the passenger pod to be driven to a final destination means that if there is initial local resistance to landing these aircraft in city centers, or delay in expanding on the existing landing site infrastructure, significant benefit can still be obtained from their use. A human driver is anticipated and accommodated in the ground vehicle, but if autonomous driving capability (and the associated regulation) matures to the point where it would make sense to deploy an all-autonomous ground vehicle, necessary sensors and software will already be in place to make the shift safely and expeditiously.

Likewise, a commercial fixed-wing pilot will be operating the flight vehicle, at least initially, with the assistance of vehicle systems and software that enhance safety and simplify vehicle controls. Such systems include ground collision avoidance and automatically guiding the aircraft through the transition from vertical to horizontal flight, a maneuver which has traditionally proven difficult for human pilots to master. As progress in technology development, certification, and operational constructs with Simplified Vehicle Operations (SVO) and autonomy in aircraft advances, it will be possible to revisit this piece of the operations. Safely reducing the training required for a flight vehicle operator and/or ultimately removing that role may be necessary as adoption of UAM vehicles may outstrip the ability to train commercial pilots – a capacity that is already strained by the airline industry. Ultimately, safety may also be increased by moving to autonomous operations as 58% of fatal general aviation accidents are caused by either controlled flight into terrain or loss of control – both pilot errors and the top two causes of fatal accidents[5]. Data collected during piloted operations will facilitate this evolution.

These incremental approaches to technology implementation in the TF-2 system allow Terrafugia to bring a product to market without waiting for an undetermined, and difficult to control, technology and certification methodology development timeline. While it is still early in the development process, TF-2 is expected to be in commercial use in five to ten years. Production is anticipated to be in the low thousands of units annually.

5 Regulatory and Operational Landscape

There are three main pieces of the regulatory and operational landscape that need to be in place in order for eVTOL aircraft like TF-2 to be put into commercial UAM/ODM service: aircraft airworthiness certification, operations and operator training/certification, and air traffic control. Of these three, the aircraft airworthiness certification solution is the most mature.

In 2004 the FAA formally began working with industry consensus standards for aircraft certification with the Light Sport Aircraft Rule that uses standards developed by ASTM Committee F37. Building on the success of this new category and certification approach, an Aviation Rulemaking Committee (ARC) was launched in 2007 with participation from both industry and the FAA. The task of this ARC was to review and revise 14CFR23 Airworthiness Standards: Normal Category Airplanes, which cover general aviation aircraft up to 12,500 pounds and 19 passengers and are referred to in the industry as “Part 23”. Over time, Part 23 had evolved to contain detailed prescriptive requirements that drove very specific

[5] The General Aviation Joint Steering Committee Pareto Chart, 2008 (available here: http://www.gajsc.org/gajsc-pareto/)

engineering solutions, creating an environment that was not conducive to innovation and could not easily accommodate new technology in aviation, regardless of its potential safety benefit. The result of the efforts of the ARC is 14CFR23 Amendment 64, which was formally made available for use in August 2017[6].

Part 23 Amdt 64 is dramatically shorter than its predecessor with about a third of the number of requirements. These requirements are also written to be based on a "safety intent", in other words, to answer the question of what is it that makes a safe airplane, instead of to tell the manufacturer what exactly they have to do from an engineering perspective. This dramatically increases the flexibility of Part 23 to accommodate new vehicle configurations, technologies, and innovations that increase the safety and utility of general aviation. In order to not lose the knowledge and experience that had been captured in the previous version of Part 23, those prescriptive requirements were moved to the jurisdiction of an ASTM industry consensus committee (F44 General Aviation) that was initiated for the task of creating and maintaining a body of standards that could be used as an Accepted Means of Compliance for Part 23[7]. Those standards can be – and are – revised and created in response to new technological developments on a much shorter timeframe, 6 months to a few years is typical, than a Rulemaking. It is expected that eVTOL aircraft like TF-2 will be certified using Part 23 Amdt 64 and a significant number of the accepted ASTM standards. While work is ongoing and full Agency alignment has not yet been achieved, a clear and constructive airworthiness certification path is available for these aircraft.

Operations and Operator training and certification is particularly interesting for eVTOL aircraft because of the unique nature of on-demand mobility, the large number of anticipated operations/aircraft, and the safety-enhancing and enabling role of autonomous and complex systems in the aircraft themselves. From an operational perspective, 14 CFR Part 135 Operating Requirements: Commuter and On-Demand Operations and Rules Governing Persons on Board Such Aircraft is appropriate for these vehicles[8]. A detailed review of these Rules with simplified vehicle operations, autonomy, and other new technologies and operational constructs in mind is in its early stages. Some of the key questions that will need to be answered jointly between FAA and industry are how to mix traditional GA operations with the ODM model, and how to provide a certification framework for simplified, autonomous, and/or complex systems that allows their maximum safety benefit to be realized as either independent systems or in concert with a human operator or pilot.

Additionally, in the future, human operators and/or pilots will need to be trained and certificated under an updated version of the Airman Certification Standards now currently in use under 14 CFR Part 61 Certification: Pilots, Flight Instructors, and Ground Instructors that accounts for the increasing role of automation, autonomy, and other complex vehicle systems in aircraft operations. One possible way of approaching this change is to look at the required functional capabilities for the combination of the

[6] The final rulemaking notice was published on December 30, 2016 with an effective date of August 30, 2017 and is available through Document Citation 81 FR 96572.
[7] The first set of ASTM standards were accepted by the FAA on May 11, 2018. Document Citation 83 FR 21850.
[8] Transition® and other owner-operated GA aircraft fall under 14 CFR Part 91 General Operating and Flight Rules.

aircraft and pilot and accommodate a variety of ways of accomplishing and demonstrating the ability to safely accomplish those functions across a spectrum of human and machine control.

Air traffic control (ATC) and integration of new technology and vehicles into our National Airspace (NAS) is the third major component of the regulatory and operational landscape for eVTOL UAM aircraft. When thinking about the NAS, it is tempting to think about it as a segregated set of distinct operational areas both in terms of the airspace designations themselves[9] and in terms of the different users of that space, particularly small unmanned aircraft systems (sUAS), general aviation, and commercial airlines. While this strict segregation can be a useful tool for human controllers tasked with centrally controlling a large number of aircraft operations, it doesn't take into account the reality of how we need to be able to use the sky over our urban areas nor does it take advantage of the significant advances in technology that have been achieved since this structure was put into place.

For the U.S. to have a healthy aviation industry in the future, all types of aircraft, from sUAS through GA and commercial airlines, need to have an integrated, federally controlled airspace. This ATC construct will need to incorporate distributed aircraft-to-aircraft communication and move away from serialized central voice control in favor of higher bandwidth modern digital technology. Human controllers will still have a key role in this new paradigm, but it will likely be one that is more strategic and less tactical. It is also possible that the number of controllers needed may even increase despite incorporating new technology as the number of aircraft in the NAS – driven by sUAS and UAM aircraft – will increase by orders of magnitude over what exists today.

Updating the regulatory and operational landscape to accommodate eVTOL aircraft, UAM and ODM operations, and the increasing autonomy in the cockpit will not only benefit the existing and emerging facets of the aviation industry, but will set the stage for continued innovation and technological development. While the Part 23 ARC is an example of highly constructive FAA and industry collaboration, this type of future-looking effort needs to be applied across operational- and ATC-related issues as well. Lastly, in addition, it is important that the FAA collaborate and continue to harmonize its requirements with its international counterparts such as the European Aviation Safety Administration (EASA) so that products designed and built in and for the U.S. market can have streamlined international market access as well.

6 Government and Regulator Involvement

The autonomous automotive industry provides a cautionary example for what can happen when technology gets ahead of federal regulations. Since 2012, at least 41 states and the District of Columbia have considered legislation related to autonomous vehicles[10]. A similar fragmentation is happening now with oversight of sUAS being handled at a local level. While this localized approach can appear to be in the best interest of safety, it is not in the overall best interest of either the industry or the travelling

[9] See 14 CFR Part 71 Designation of Class A, B, C, D, and E Airspace Areas
[10] From the National Conference of State Legislatures Autonomous Vehicles report, published June 25, 2018. (available at: http://www.ncsl.org/research/transportation/autonomous-vehicles-self-driving-vehicles-enacted-legislation.aspx)

public. Without a central, federally-led regulatory and certification framework, manufacturers are left to sort through potentially conflicting requirements throughout the U.S., experts that could contribute the best perspective and create requirements that would obtain the highest level of safety are not centrally coordinated in one effort, safety-related lessons that may be learned in one jurisdiction are not efficiently propagated throughout the country, and operations that cross state lines – even more likely with aviation than with automobiles – can become overly complicated. All of this is to the detriment of safety, innovation, and economic progress. The FAA has an impressive record of providing federal leadership in manned aviation; to see this role diminished or its federal preeminence abdicated in any way would be a loss for the U.S. aviation industry and the travelling public.

As part of maintaining its regulatory leadership role, the FAA needs to continue to engage with industry in the same collaborative and open-minded fashion that contributed to the success of the Part 23 ARC. While the Part 23 ARC laid a crucial foundation for the airworthiness certification of eVTOL aircraft, the Agency must continue to build on that foundation by implementing certification programs with industry that meet the scheduling, safety, and international acceptance needs of the eVTOL aircraft programs. Beyond Airworthiness Certification, the Flight Standards and Air Traffic Control functions of the FAA need to fully engage with industry in a manner that will allow these pieces of the puzzle to be advanced in a constructive and timely manner. If it is determined as part of this process that additional Rulemaking activities are needed to support this industry (and it is likely that this will be the case), it is crucial that the government allow these efforts to progress at a pace that can keep step with the high levels of investment and progress that are being demonstrated by industry in this area. It is notable that this is an area where new federal regulation is likely to be a welcome enabling piece of creating a responsible and growing new industry, not a hindrance.

Beyond regulation and certification, the government has a valuable role to play with its funding of research through both NASA and the FAA. While NASA is often seen as exclusively focused on space exploration, the reality is that its aviation-related functions are also quite valuable. With research in electric aircraft and low-speed flight characteristics, NASA is in a position to be a major contributor to the ASTM Means of Compliance efforts for eVTOL aircraft. Their work into UAS-related ATC issues (referred to as UAS Traffic Management, or UTM) also has value as it relates to creating a new paradigm for integrated use of our national airspace. While the technology transfer timeline means that it is unlikely that any new hardware research funded today would make its way into the first generation of eVTOL aircraft, continued involvement in Standards generation is highly valuable in the short term. Taking a longer term view, future-looking aviation research today may help create the next revolution in aviation tomorrow so should not be discounted due to a perceived lack of short-term gains.

7 ADDRESSING CHALLENGES

While the future is bright for personal aviation, challenges of course remain. Together, industry and government at all levels will need to ensure that in addition to the regulatory and operational challenges discussed in Section 5 the following are addressed appropriately.

Connectivity: This is a cross-functional challenge in that it encompasses both the need for communication infrastructure (e.g., continued GPS availability, 5G cell data service, and appropriate

frequency band allocations – particularly insuring that transportation DSRC spectrum at 5.9 GHz remains available to transportation in general and aviation) and a well-constructed approach to security. There are roles for the federal government and its agencies as well as for industry consensus standards and best practices in addressing this challenge.

Infrastructure Access: This challenge will be diminished or amplified by how much societal value is perceived to be derived from these aircraft and by their success at mitigating their potential negative impact on the communities in which they operate. Towards this end, thoughtful placement of vertiport locations that could address "transit desert" locations and truly counteract congestion is key. Technical solutions like low-noise operations (facilitated by electric motors and noise-conscious propeller designs, noise profile-influenced flight path planning, and strategic placement of vertiports) and environmental consciousness are also extremely important and are high on the list of vehicle requirements. The solution to this challenge will necessarily span local, state, and federal government as well as industry and Regulators.

Affordability: While in some ways this is a subset of the Infrastructure Access challenge in that the greater number of people in an urban area that can afford to use an eVTOL UAM service, the less likely resistance to it will be encountered, it is a complex challenge with several facets of its own. Operating and amortized purchase costs are directly related to the regulatory and operational landscape in which these aircraft are certificated and flown. Slow, onerous, shifting airworthiness certification processes will increase vehicle cost. Hindrances to manufacturing, including lack of capital, barriers to accessing international markets, and necessary labor, will increase vehicle cost. Training and/or operational requirements that do not appropriately account for the safety advantages of autonomy and complex systems will increase operational cost. ATC practices that do not facilitate efficient, timely, high-volume flight operations will increase cost while decreasing the usefulness of the entire fleet. As such, the government does have an opportunity to partner with industry to address this challenge, and by extension increase the economic benefit of the eVTOL UAM industry.

Technology Development: While in many ways the technology for these vehicles is available and ready to be deployed, as with any new industry there may still be unforeseen technical obstacles. A high level of technical confidence is warranted, but it would be naïve to assume that no additional challenges, particularly in the electric propulsion and autonomy spaces, exist. Industry at large, including Terrafugia, is working diligently to address these challenges and find and address any lingering obstacles. Future-looking federal agency research funding is one way that the government can assist with this challenge.

8 CONCLUSIONS

In short, we stand at an exciting time in the history of transportation. New technologies, business models, and regulatory approaches are poised to dramatically increase our transportation capabilities. I appreciate being able to share my perspective on this industry and would like to thank you, Mr. Chairman, for the opportunity. I would be pleased to respond to any questions you or the other members of the Committee may have.

9 FIGURES

Figure 1: The Terrafugia Transition® in flight, folding its wings, and in a household garage

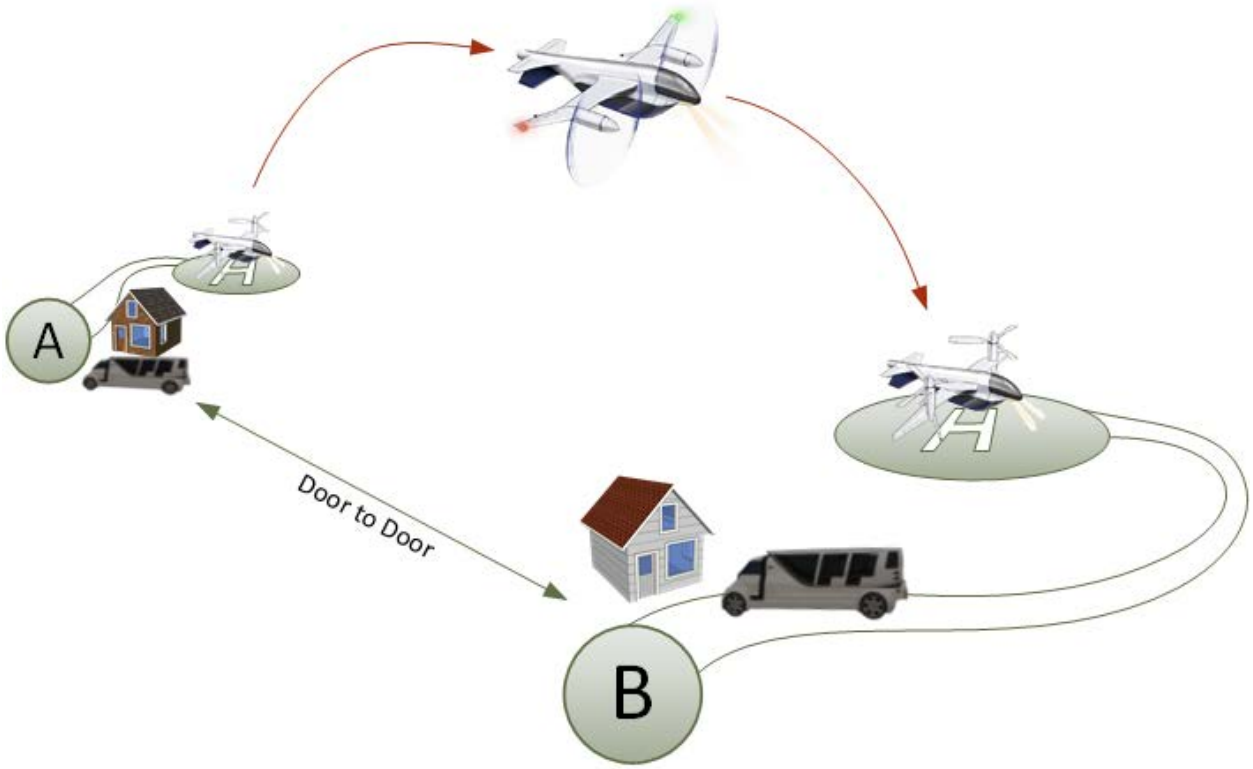

Figure 2: Terrafugia's TF-2 eVTOL door-to-door urban air mobility (UAM) concept

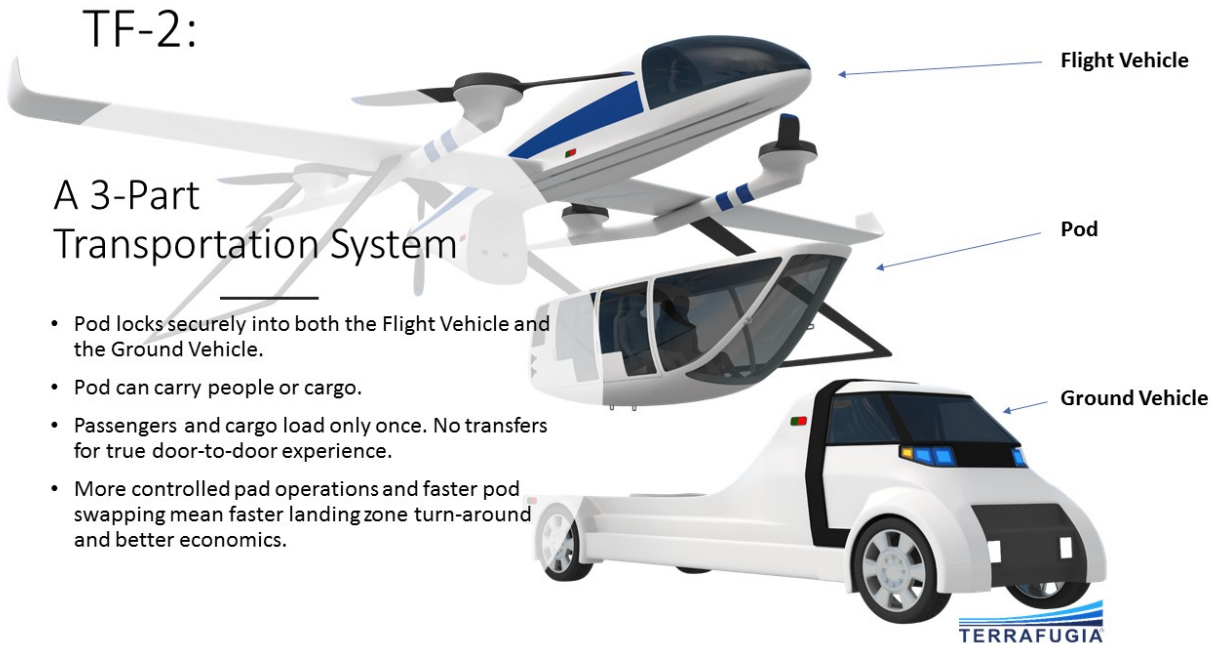

Figure 3: The TF-2 three-part transportation system

Figure 4: An artist rendering of a Terrafugia TF-2 flight vehicle landing on a VTOL barge near an urban center

10 ENCLOSURE: PRESENTATION MATERIALS

Urban Air Mobility: Terrafugia's Perspective

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Prepared for the House Committee on Science, Space, and Technology
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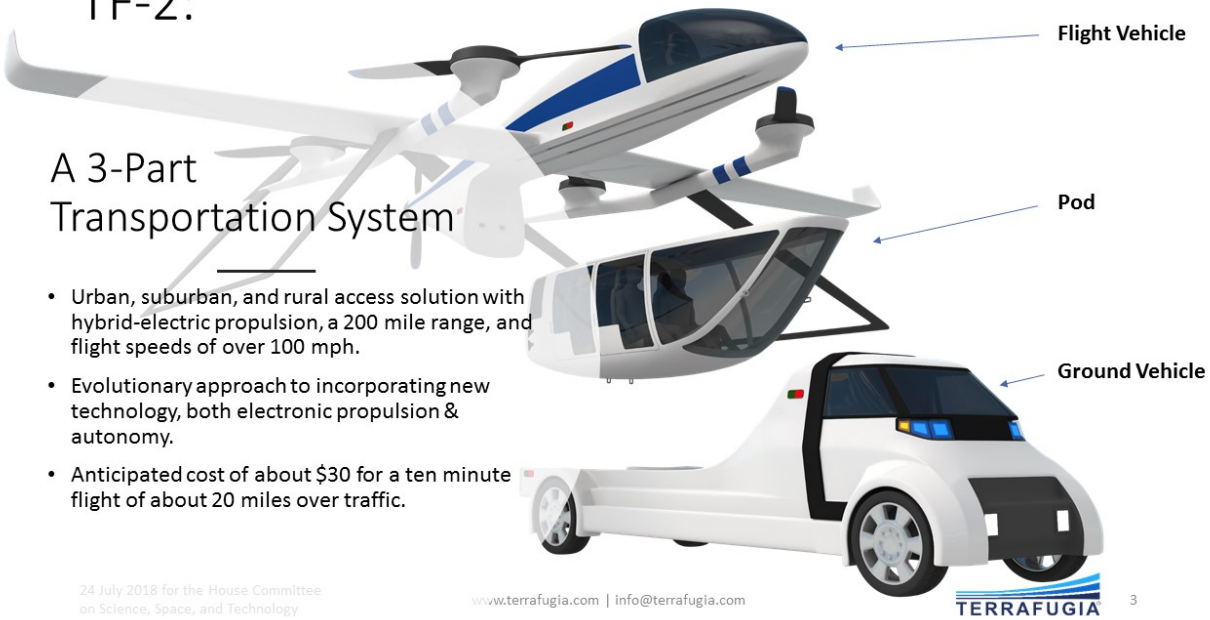
TERRAFUGIA

TERRAFUGIA

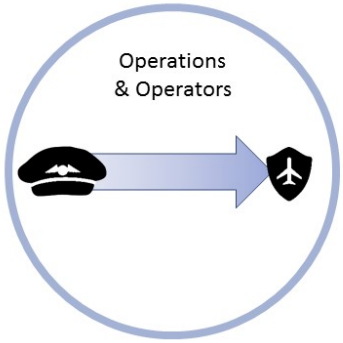
TF-2:

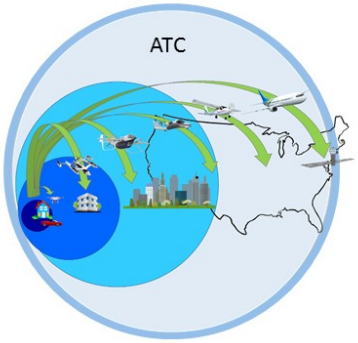
A 3-Part Transportation System

- Urban, suburban, and rural access solution with hybrid-electric propulsion, a 200 mile range, and flight speeds of over 100 mph.
- Evolutionary approach to incorporating new technology, both electronic propulsion & autonomy.
- Anticipated cost of about $30 for a ten minute flight of about 20 miles over traffic.

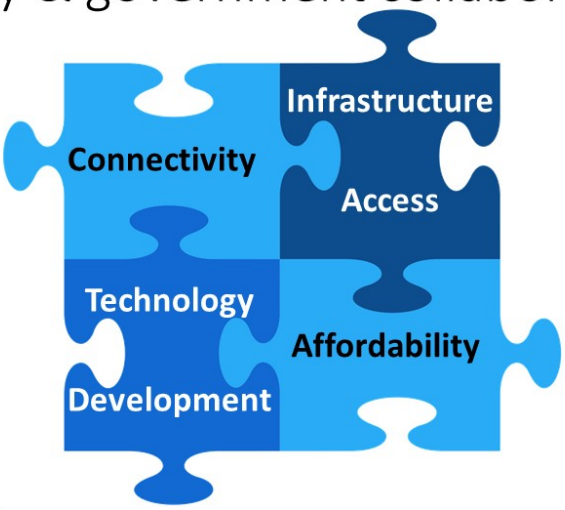


There are three pieces of the regulatory landscape that need to support this new technology:





There are also challenges and opportunities for industry & government collaboration:



24 July 2018 for the House Committee on Science, Space, and Technology
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TERRAFUGIA
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11 Enclosure: Biography of Anna Mracek Dietrich

Anna Mracek Dietrich is one of the five original co-founders of Terrafugia Inc., a spin-off company of the Massachusetts Institute of Technology in 2006 that has become a revolutionary transportation leader in urban mobility. She served as Terrafugia's first Chief Operating Officer from its creation until 2014 and she currently leads Terrafugia's U.S. regulatory policy engagement. In close collaboration with industry colleagues, Anna has served as a key member of the Federal Aviation Administration's Aviation Rulemaking Committee (ARC) during the agency's significant rewrite of the certification requirements for General Aviation Aircraft (14CFR23). She also holds leadership roles on the ASTM industry consensus standards committees that are responsible for both Light Sport and General Aviation Aircraft. She is currently leading the ASTM effort to create a standards framework for autonomous and complex aircraft systems.

Prior to co-founding Terrafugia, Anna worked with fellow experts to advance pioneering strategies and product development at GE Aviation and Boeing Phantom Works. As a recognized leader in aviation and innovation, Anna was named one of the Boston area's top 15 Innovators by the *Boston Globe*, was one of the 10 women selected for the annual Mass High Tech Women to Watch Award, and has been recognized by Engineers Week New England with their annual Achievement Award. Anna has served in leadership positions on the Board of Directors of Women in Aviation International (WAI) and is an established thought leader on the national and international speaking circuit addressing audiences at prestigious gatherings including TED Global and Uber's Elevate Summit. Anna is a featured expert lecturer at MIT, Embry Riddle, and other academic institutes and universities while promoting advanced careers in STEM.

Anna received her Bachelor's and Master's of Science degrees in aerospace engineering from the Massachusetts Institute of Technology. She also holds a private pilot license.

More professional information on Anna can be found online at www.annamdietrich.com/resume