Committee on Transportation and Infrastructure
U.S. House of Representatives
Washington DC 20515

Peter A. DeFazio
Chair

Katherine W. Dedrick
Staff Director

Sam Graves
Ranking Member

Paul J. Sass
Republican Staff Director

May 17, 2022

SUMMARY OF SUBJECT MATTER

TO: Members, Subcommittee on Aviation
FROM: Staff, Subcommittee on Aviation
RE: Subcommittee Hearing on "Preparing for Take-off: Examining Efforts to Address Climate Change at U.S. Airports"

PURPOSE

The Subcommittee on Aviation will meet on Tuesday, May 17, 2022, at 1:00 p.m. EDT in 2167 Rayburn House Office Building and virtually via Zoom for a hearing titled, "Preparing for Take-off: Examining Efforts to Address Climate Change at U.S. Airports." The hearing will examine the different infrastructure, technologies, federal programs, and other initiatives U.S. airports and airport stakeholders are utilizing to mitigate and prepare for the effects of climate change. The subcommittee will hear testimony from witnesses representing Alaska Airlines, Alleghany County Airport Authority, Dallas-Fort Worth International Airport, General Aviation Manufacturers Association, Portland International Airport, SkyNRG Americas, and ZeroAvia.

BACKGROUND

I. AVIATION AND CLIMATE CHANGE

In 2018, commercial, business, and general aviation aircraft (including passenger and all-cargo flights) accounted for nine percent of the U.S. transportation sector's carbon emissions and approximately three percent of all carbon emissions in the United States.[1] Between 1970 and 2016, the energy intensity of air travel decreased by 75 percent due to improved aircraft fuel efficiency, air traffic operation initiatives, and aircraft configuration changes.[2] However, additional steps are

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[1] Environmental Protection Agency, *Fast Facts: U.S. Transportation Sector Greenhouse Gas Emissions 1990 –2018*, *available at*: https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100ZK4P.pdf. These figures do not include emissions from international flights departing the United States.
[2] Environmental and Energy Study Institute, *Fact Sheet: The Growth in Greenhouse Gas Emissions from Commercial Aviation*, (Oct. 17, 2019), https://www.eesi.org/papers/view/fact-sheet-the-growth-in-greenhouse-gasemissions-from-commercial-aviation.

needed to reduce the growth in commercial aviation's carbon emissions and to comply with international reduction and offsetting requirements.

For instance, since 2009, aggregate carbon emissions from all aircraft types have grown steadily, increasing by almost 22 percent between 2009 and 2018.[3] This increase makes aircraft one of the fastest-growing sources of carbon emissions in the U.S. transportation sector over the past decade.[4] As of 2019, global aviation emissions were on track to triple by 2050, potentially accounting for as much as a quarter of all carbon emissions.[5]

As carbon and other greenhouse gas emissions from aviation have grown, the international civil aviation community has made significant strides in recent years to address the impact of its emissions on the global climate. International advancements are being led by the International Civil Aviation Organization (ICAO), including the adoption of the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), which began in 2021 and is a market-based mechanism for offsetting future carbon emissions from aviation, and the adoption of the first-ever global design certification to measure carbon emissions from aircraft engines in 2017, to name a few.[6] It is estimated that airport operations directly account for approximately two percent of the U.S. aviation sector's total carbon emissions.[7]

Furthermore, airports' roles as critical transportation hubs make them particularly vulnerable to severe weather events. According to the 2017 National Climate Assessment, 13 of the nation's 47 largest airports have at least one runway with an elevation within the reach of a moderate to high storm surge.[8] The increasing intensity and frequency of severe storms, higher temperatures, and more frequent heat waves pose a significant risk to airports and have the ability to delay flights, interrupt supply chains, and disrupt airport operations if resiliency efforts are not properly undertaken in a timely manner.[9]

II. EFFORTS TO ADDRESS CLIMATE CHANGE AT U.S. AIRPORTS

A. <u>Initiatives to Mitigate Airport Emissions and Increase Resiliency</u>

The Airports Council International (ACI) World and five ACI regions, which together represent airports worldwide, committed to supporting the Intergovernmental Panel on Climate Change's call to reach net-zero carbon emissions by 2050 by implementing a number of measures to

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[3] *Aviation, Air Pollution and Climate Change* (CRS Report No. IF11696; 2022). Retrieved from Congressional Research Service website: https://crsreports.congress.gov/product/pdf/IF/IF11696/2.
[4] *Id.*
[5] ICCT, CO2 Emissions from Commercial Aviation, (October 2020), *available at*: https://theicct.org/wp-content/uploads/2021/06/CO2-commercial-aviation-oct2020.pdf.
[6] Federal Aviation Administration, *2021 United States Aviation Climate Action Plan,* (November 2021), at 8, *available at:* https://www.faa.gov/sites/faa.gov/files/2021-11/Aviation_Climate_Action_Plan.pdf.
[7] Airports Council International (ACI), *Sustainability Strategy for Airports Worldwide,* (November 2021), at 10, *available at*: https://aci.aero/2021/11/16/aci-world-launches-inaugural-sustainability-strategy-report-for-airports-worldwide/#:~:text=In%20June%202021%2C%20ACI%20member,management%20certification%20standard%20for%20airports.
[8] FAA, *supra* note 6 at 27.
[9] *Id.*

help their members decarbonize their operations.[10] Below is a short description of a few of these decarbonization measures:

- **Implementing Airport Energy Efficiency Measures**. These include improvements in building design and materials, lighting upgrades, artificial intelligence-enabled control systems, and heating, ventilation, and air-conditioning upgrades.[11]

- **Implementing On-Site Power Generation**. This includes combined heat and power plants, which recover waste heat from the generation of electricity, or on-site renewable energy, such as solar power or wind energy.[12]

- **Low and Zero Emission Airport-Owned Transportation and Ground Support Vehicles.** This can include the purchase or leasing of low and zero emission passenger buses, automated people mover systems, and ground support vehicles.[13]

In addition, U.S. airports—particularly those located near a coastline or large bodies of water—are susceptible to rising sea levels, flooding, and more intense, frequent severe weather patterns.[14] In order to effectively prepare, prevent, and respond to extreme weather events, airports are investing in a wide range of resiliency measures.[15] Such resiliency measures may include:

- **Performing Climate Change Risk Assessments**. This includes an assessment of climate risks, their impacts on airport infrastructure and operations, and incorporating response plans into an airport's master plan.[16]

- **Flood Mitigation Measures.** This includes increasing drainage capacity, infrastructure improvements to runways and taxiways, and the construction of sea walls to protect against the risk of flooding.[17]

- **Building Resilience to Extreme Temperatures.** This includes the installation of improved cooling systems for airport buildings and airfield changes, such as new tarmac materials and extensions to runways to accommodate the reduction in aircraft engine thrust that can result from high temperatures.[18]

- **Protection of Biodiversity**. This includes the prevention of deforestation and supporting the appropriate forest management practices to limit soil erosion and excess water runoff.[19]

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[10] ACI, *Net Zero by 2050: ACI Sets Global Long Term Carbon Goal for Airports*, (June 8, 2021), *available at*: https://aci.aero/2021/06/08/net-zero-by-2050-aci-sets-global-long-term-carbon-goal-for-airports/.
[11] ACI, *supra* note 7 at 18.
[12] *Id.*
[13] *See Id.*
[14] *Id.* at 17.
[15] *See Id.*
[16] *Id.*
[17] *Id.*
[18] *Id.*
[19] *Id.*

B. Initiatives to Address Airport Stakeholder Emissions

Sustainable Aviation Fuels (SAF) and Other Alternative Fuel Infrastructure

In order to further reduce their carbon footprint and help achieve the aviation industry's goal of net zero greenhouse gas emissions by 2050, U.S. airports are collaborating with airlines and renewable fuel manufacturers to help facilitate the storage and distribution of low and zero emission aviation fuels.[20]

SAF, a type of jet fuel refined from biomass, waste streams, or gaseous carbon oxides, has emerged as a leading contender to reduce aviation emissions.[21] Depending on the feedstock, SAF offers a carbon lifecycle reduction of up to 80 percent when compared to conventional jet fuel.[22] Unlike other lower emissions proposals, SAF is a drop-in fuel that works in existing aircraft and can utilize most of the fueling infrastructure already in place.[23]

Several U.S. airports and airlines have started collaborating on expanding the use of SAF for commercial aircraft. For instance, SAF is currently being delivered to Los Angeles International Airport, where United Airlines has committed to using SAF for all departing flights.[24] San Francisco International Airport has signed a recent memorandum of understanding with several airlines and fuel producers to work cooperatively on expanding the use of SAF at the airport.[25]

While SAF holds tremendous potential to help reduce carbon emissions in the aviation industry, significant barriers to widespread adoption remain. For instance, SAF is significantly more expensive to produce and purchase than conventional jet fuel.[26] These high costs lead to SAF being produced in smaller quantities, resulting in limited availability.[27] Today, SAF is estimated to account for just .05 percent of jet fuel use.[28] Additionally, SAF must currently be blended with conventional jet fuel, although the low availability of SAF mitigates this issue in the short term.

In order to fulfill President Biden's goal to reduce aviation emissions by 20 percent by 2030 and achieve a long-term goal of zero-carbon aviation by 2050, the administration initiated a

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[20] *See Id.* at 18.
[21] FAA, *Sustainable Aviation Fuels*, (March 10, 2021), *available at*: https://www.faa.gov/about/office_org/headquarters_offices/ang/redac/media/environment/2021/march/envandenergy_mar2021_SAFUpdate.pdf.
[22] IATA, *Developing Sustainable Aviation Fuel (SAF), available at*: https://www.iata.org/en/programs/environment/sustainable-aviation-fuels/.
[23] IATA, What is SAF, at 1, *available at*: https://www.iata.org/contentassets/d13875e9ed784f75bac90f000760e998/saf-what-is-saf.pdf.
[24] Los Angeles World Airports, *LAX Welcomes World's Most Eco-Friendly Commercial Flight as United Commits to LAX 'Eco-Hub- with Purchase of Biofuel*, (June 5, 2019), *available at:* https://www.lawa.org/news-releases/2019/news-release-52.
[25] San Francisco International Airport, *SFO Announces Landmark Agreement for Use of Sustainable Aviation Fuels,* (September 5, 2018), *available at*: https://www.flysfo.com/media/press-releases/sfo-announces-landmark-agreement-use-sustainable-aviation-fuels.
[26] Christina Brooks, *Sustainable Aviation Fuel Still in Short Supply Due to Cost,* HIS Markit (July 7, 2021), *available at:* https://cleanenergynews.ihsmarkit.com/research-analysis/sustainable-aviation-fuel-market-still-in-infancy-due-to-cost-.html#:~:text=SAF%20prices%20are%20currently%20about,issues%20even%20more%20prominent%20today.
[27] *Id.*
[28] Elan Head, *Understanding the Path to 100% SAF,* The Air Current (April 13, 2022), *available at*: https://theaircurrent.com/technology/path-to-100-saf-sustainable-aviation-fuel/.

government wide "SAF Grand Challenge" to scale up production of SAF to at least three billion gallons per year by 2030.[29]

In addition to SAF, there are several other technological approaches currently being considered to help decarbonize the aviation sector. One of these approaches includes the development of full or hybrid electric aircraft, which operate using battery-powered electricity for power, rather than standard liquid fuels.[30] Several airlines and advanced air mobility (AAM) companies are seeking to use this technology for smaller aircraft operating shorter flights.[31] It is expected that existing airports and airport infrastructure, such as general aviation airports or heliports, will be utilized by these new, technologically advanced aircraft once deployed.[32]

However, because battery-powered technologies aren't as energy dense as liquid fuels, and thus require additional bulk and weight to achieve a comparable amount of energy, battery-powered aircraft face significant aerodynamic challenges.[33] Such design and operational challenges are likely to affect the range and speed of battery-powered aircraft.[34] Therefore, further technological developments are needed before electrification can be safely and economically adopted for medium and long-haul flights.[35]

Hydrogen is another alternative fuel source being considered as a long-term option to help decarbonize the aviation sector. Hydrogen-powered aircraft produce zero carbon emissions and, depending on the technology used, can substantially reduce or even eliminate air pollutants such as nitrogen oxide (the primary byproduct of hydrogen combustion is water instead of carbon dioxide).[36] A recent report on the potential of hydrogen-powered aviation found that such planes could enter the market as soon as 2035.[37] Airbus committed to such an idea in September 2021, announcing its plans to field such an aircraft by 2035, with a technology demonstrator as soon as 2025.[38] Then, in October 2021, Alaska Airlines announced a new partnership with ZeroAvia to develop a hydrogen-electric propulsion system capable of flying a 76-seat regional aircraft with a range of 500 nautical miles.[39] However, reaching these goals will rely on a number of factors,

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[29] Department of Energy, *Memorandum of Understanding Sustainable Aviation Fuel Grand Challenge*, (September 8, 2021), *available at*: https://www.energy.gov/sites/default/files/2021-09/S1-Signed-SAF-MOU-9-08-21_0.pdf.
[30] Elissa Garay, *Electric Planes Are Coming Sooner Than You Think,* AFAR (March 2, 2022), *available at*: https://www.afar.com/magazine/electric-planes-are-coming-sooner-than-you-think.
[31] *Id.*
[32] Community Air Mobility Initiative, *Airports and Advanced Air Mobility: Integrating the Third Dimension into Metropolitan Transportation Systems,* (September 3, 2020), *available at:* https://www.nctcog.org/nctcg/media/Transportation/Committees/ATAC/2020/Website-Presentations_9-3-20.pdf?ext=.pdf.
[33] Garay, *supra* note 30.
[34] *Id.*
[35] *Id.*
[36] Eurocontrol, *Are Hydrogen-Powered Aircraft the Future of Sustainable Aviation?*, (May 18, 2021), *available at*: https://www.eurocontrol.int/article/are-hydrogen-powered-aircraft-future-sustainable-aviation.
[37] *Id.*
[38] Bellamy, *Airbus CEO Keeps Commitment to 2035 Zero Emissions Airliner Timeline*, Aviation Today (Feb. 19, 2021) *available at*: https://www.aviationtoday.com/2021/02/19/airbus-ceo-keeps-commitment-2035-zero-emissions-airliner-timeline/.
[39] Alaska Airlines, *Alaska Air Group Collaborating with ZeroAvia to Develop Hydrogen Powertrain for 76-Seat Zero-Emission Aircraft,* (October 26, 2021), available at: https://news.alaskaair.com/newsroom/alaska-air-group-collaborating-with-zeroavia-to-develop-hydrogen-powertrain-for-76-seat-zero-emission-aircraft/.

including developing effective storage technologies and new ways of transporting hydrogen to airports so planes can be refueled on the tarmac.[40]

While electric and hydrogen-propulsion, along with other alternative fuel technologies, have the potential to play a significant role in decarbonizing short and regional commercial flights in the coming decades, it remains uncertain as to the role they will play in reducing carbon emissions for the medium- and long-haul commercial flights that are projected to generate most of the aviation sector's carbon emissions in the coming years.[41] Moreover, airports may need to invest in new infrastructure if many of these new options are to become viable. In fact, the committee recently reported favorably to the House H.R. 6270, the *Advanced Aviation Infrastructure Modernization* (AAIM) *Act*, which seeks to establish a pilot program to assist with the planning, development, and deployment of infrastructure necessary to facilitate AAM operations in the United States.[42]

Other Initiatives

In addition to facilitating the storage and delivery of alternative fuels for aircraft, U.S. airports have made necessary investments in infrastructure to help reduce emissions for airline-owned ground support vehicles, taxiing and parked aircraft, and other sources of emissions generated by an airport's stakeholders. Below is a brief description of these initiatives.

- **Gate Electrification.** Electric pre-conditioned air and ground power converter units can significantly reduce aircraft emissions associated with aircraft auxiliary power unit (APU) usage.[43]

- **Alternative Fuel Infrastructure.** This includes providing charging stations and other refueling infrastructure for compressed natural gas, electricity, hybrid technologies, hydrogen, and other alternative fuel vehicles.[44]

- **Remote Ground Power Units.** This includes electric ground power converter units that reduce aircraft APU emissions by providing clean electricity to remote parking positions.[45]

- **Improved Airfield Design.** Improved airfield design can minimize aircraft taxi-times and minimize fuel burn.[46]

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[40] Jonathan O'Callaghan, *Quiet and Green: Why Hydrogen Planes Could be the Future of Aviation*, Horizon (July 8, 2020), *available at*: https://ec.europa.eu/research-and-innovation/en/horizon-magazine/quiet-and-green-why-hydrogen-planes-could-be-future-aviation.
[41] *See* Garay, *supra* note 30.
[42] U.S. House Transportation and Infrastructure Committee, *Transportation and Infrastructure Committee Leaders Release Statement On Passage of Aviation Bills,* (April 28, 2022) *available at:* https://transportation.house.gov/news/press-releases/transportation-and-infrastructure-committee-leaders-release-statement-on-passage-of-aviation-bills
[43] *See* FAA, *Voluntary Airport Low Emissions (VALE) Program*, *available at*: https://www.faa.gov/airports/environmental/vale/media/VALE-brochure-2020.pdf.
[44] *Id.*
[45] *Id.*
[46] ACI, *supra* note 7 at 18.

- **Airspace Design.** Airports can collaborate with the Federal Aviation Administration (FAA) and airlines to provide fuel efficient standard departure and arrival routes for aircraft.[47]

III. FEDERAL AIRPORT PROGRAMS AND INITIATIVES

A. Voluntary Airport Low Emission Program and Airport Zero Emission Vehicle and Infrastructure Pilot Program

Through participation in the Voluntary Airport Low Emissions (VALE) program, U.S. commercial airports can use FAA Airport Improvement Program (AIP) funds and Passenger Facility Charge (PFC) revenue to finance low-emission vehicles, refueling and recharging stations, gate electrification, and other airport air quality improvements.[48] The program is limited to commercial airports in "non-attainment" or "maintenance" areas for one of the National Ambient Air Quality Standards.[49] Since its creation in 2004, VALE grants have funded 133 projects at 59 airports and are expected to reduce ozone emissions by 1,703 tons per year for the next five years.[50]

Similar to the VALE program, the Airport Zero Emissions Vehicle (ZEV) and Infrastructure Pilot program helps to reduce greenhouse gas emissions by facilitating the use of zero emissions technologies at airports.[51] The program allows U.S. airports to use AIP funds to purchase zero emission vehicles and the necessary infrastructure to accommodate these vehicles.[52] Since 2015, the program has funded 22 projects valued at over $60 million at 15 airports across the country.[53]

B. Energy Efficiency Grants

The FAA administers AIP funding to airports for energy assessments to identify and implement energy reduction measures to reduce energy consumption across airport operations.[54] Typical projects include light-emitting diode lighting or other energy efficiency measures.[55]

C. Sustainability Planning

The FAA administers AIP funding to airports for the development of airport sustainability plans.[56] These plans address a broad array of environmental and energy activities, including recycling, green infrastructure, energy efficiency, renewable energy, water quality, and climate resilience, among other things.[57] To date, the FAA has provided grants to 44 airports under the program.[58]

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[47] *Id.*
[48] FAA, *supra* note 43.
[49] *Id.*
[50] FAA, *Voluntary Airport Low Emissions Program (VALE),* (April 22, 2022), *available at*: https://www.faa.gov/airports/environmental/vale/.
[51] FAA, *Airport Zero Emissions Vehicle and Infrastructure Pilot Program,* (April 22, 2022), *available at:* https://www.faa.gov/airports/environmental/zero_emissions_vehicles/.
[52] *Id.*
[53] *Id.*
[54] FAA, *supra* note 6 at 28.
[55] *Id.*
[56] FAA, *Sustainability Plans,* (April 22, 2022), *available at*: https://www.faa.gov/airports/environmental/sustainability/.
[57] *Id.*
[58] *Id.*

D. NextGen

The FAA continues to develop and implement NextGen technologies and procedures to modernize the air traffic control system.[59] NextGen programs include Performance-Based Navigation procedures (GPS-satellite based flight paths) and Terminal Flight Data Manager (TFDM) deployment (a surface management solution), which will reduce aircraft fuel burn and create a more predictable and efficient flight and ground transportation system at airports.[60] The TFDM system alone is expected to create 313 million gallons of fuel savings and reduce more than three million metric tons of carbon emissions over the life of the system.[61] While the FAA is primarily responsible for deploying these NextGen programs, the agency coordinates with airports and other affected stakeholders on implementation.[62]

E. Continuous Lower Energy, Emissions, and Noise Program

The FAA's Continuous Lower Energy, Emissions, and Noise (CLEEN) program is the agency's principal environmental effort to accelerate the development of new aircraft and engine technologies.[63] It has been instrumental to the certification of alternative jet fuels for safe use in civil aviation.[64] In coordination with ASTM International, which oversees criteria for aviation jet fuels, CLEEN's combined efforts have led to the approval of seven alternative fuel types for use in civil aviation, as of April 2021.[65] The next phase of the CLEEN program aims to continue the testing and qualification of new alternative jet fuels, with a focus on supporting blend levels of at least 50 percent.[66]

F. Infrastructure Investment and Jobs Act

The *Infrastructure Investment and Jobs Act* (IIJA) was enacted on November 15, 2021, and provides $25 billion over a five-year period for airport development and air traffic control projects.[67] Specifically, the bill included $15 billion in formula allocated funding for airport infrastructure projects, $5 billion in competitive grants for airport terminal projects, and $5 billion to upgrade and modernize FAA air traffic control towers and facilities.[68]

While the *IIJA* has no dedicated funding for airport environmental projects, it does *allow* airports to use *IIJA* funds on an array of projects that could help airports meet their climate goals. For instance, the bill allows airports to use their airport infrastructure funding on VALE, ZEV, and

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[59] FAA, *Next Generation Air Transportation System (NextGen),* (March 8, 2022), *available at:* https://www.faa.gov/nextgen/.
[60] United States. Cong. House. Committee on Transportation and Infrastructure. Subcommittee on Aviation. Hearing on Putting U.S. Aviation At Risk: The Impact of the Shutdown Feb. 13, 2019. 116th Congress 1st sess. p. 12 (statement of Paul Rinaldi, President, National Air Traffic Controllers Association).
[61] *Id.*
[62] *See* FAA, Office of NextGen, *available at:* https://www.faa.gov/about/office_org/headquarters_offices/ang.
[63] FAA, Continuous Lower Energy, Emissions, and Noise (CLEEN) Program, (September 10, 2021), *available at:* https://www.faa.gov/newsroom/continuous-lower-energy-emissions-and-noise-cleen-program#_Toc80621753.
[64] *Id.*
[65] *Id.*
[66] *Id.*
[67] Pub. L. No. 117-58, Div. J (2021).
[68] *Id.*

other AIP eligible environmental projects.[69] Additionally, under the *IIJA's* airport terminal program, the FAA will consider projects that improve energy efficiency, including upgrading environmental systems, upgrading plant facilities, and achieving energy efficient building design accreditation standards.[70]

Finally, the *IIJA* requires that any amount of unobligated funding remaining in fiscal year 2026 in excess of $100 million be used to provide competitive grants for airport projects that "reduce airport emissions, reduce noise impacts to the surrounding community, reduce dependence on the electrical grid, or provide general benefits to the surrounding community."[71] However, because this program relies on the availability of a specified amount of unobligated funding, its implementation cannot be guaranteed.[72]

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[69] *Id.*
[70] *Id.*
[71] *Id.*
[72] *Id.*

WITNESSES

Ann Ardizzone
Vice President, Supply Chain
Alaska Airlines

TBD
Allegheny County Airport Authority

Robert Horton
Vice President of Environmental Affairs
Dallas-Fort Worth International Airport

Pete Bunce
President and CEO
General Aviation Manufacturers Association (GAMA)

Jennifer Bies
Director of Environmental Operations
Port of Portland

John Plaza
President and CEO
SkyNRG Americas

Val Miftakhov
Founder and CEO
ZeroAvia