

Update on FAA Environmental Research and Reauthorization Provisions

Presented to: Massport CAC

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Federal Aviation
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Outline

- HR302 (2018 FAA Reauthorization) Update
- FAA Research Efforts
 - Noise
 - Emissions

HR302 (FAA Reauthorization) Update

- Sec. 187. Aircraft noise exposure.—Conclude ongoing review of relationship between aircraft noise exposure and effects on communities around airports. Report within 2 years, including any appropriate preliminary recommendations for land use compatibility revisions. Release Survey Results.

Status: This section directs FAA, by October 2020, to publish the noise survey with any recommendations determined necessary related to land use compatibility guidelines in part 150. We are on schedule to meet that deadline.

HR302 (FAA Reauthorization) Update

- Sec. 173. Alternative airplane noise metric evaluation deadline.— Within 1 year. Complete the ongoing evaluation of alternative metrics to the current Day Night Level (DNL) 65 standard.

Status: We reviewed alternative metrics in line with this provision.

- Sec. 188. Study regarding day-night average sound levels.— The Administrator shall evaluate alternative metrics to current average day-night level standard, such as use of actual noise sampling to address community airplane noise concerns. Report within 1 year.

Status: The study is complete and the required report is drafted and in review.

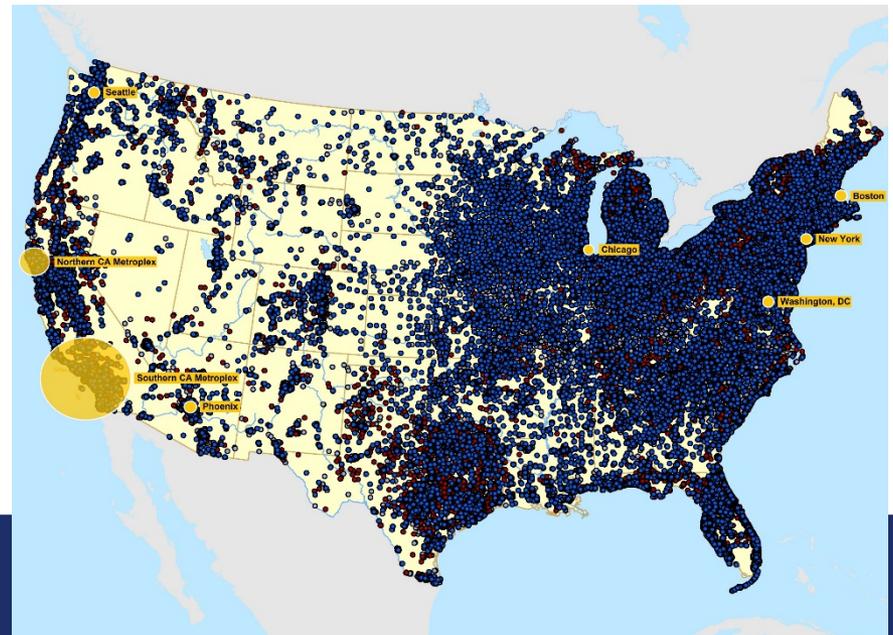
HR302 (FAA Reauthorization) Update

- Sec. 189. Study on potential health and economic impacts of overflight noise.—Not later than 180 days after enactment, the Administrator shall enter into an agreement with an eligible institution of higher education to conduct a study on health impacts of noise from aircraft flights on residents exposed to a range of noise levels from such flights, including sleep disturbance and elevated blood pressure for residents in Boston, Chicago, D.C., New York, NorCal/SoCal Metroplex, Phoenix, and Seattle. Report due 90 days after results.

Status: FAA has awarded a \$1.7 million grant to the university members comprising the FAA's Air Transportation Center of Excellence (COE) for Alternative Jet Fuels and Environment (AJF&E) in order to study the health impacts of noise from overflights. The universities conducting the research are Boston University (through their School of Public Health), and MIT. The research timeline is 3 years (2022).

Section 189 - Details

- Goal: Examine the potential incremental health impacts attributed to noise exposure resulting from aircraft flights.
- Leverage existing collaborations with well-recognized and respected studies that are tracking people through the course of their lives to understand factors that affect health
 - Nurses' Health Studies (NHS) and Health Professionals Follow-Up Study (HPFS)
 - Aligned with an ongoing NIH-funded effort to look at the Women's Health Initiative (WHI)
- These studies provide considerable geographic coverage of the U.S. including all of the geographic areas specified in Section 189



Section 189 - Details

- The research team will leverage aircraft noise data for 90 United States (U.S.) airports over many years
 - Generated using the Aviation Environmental Design Tool (AEDT)
 - Link noise exposure data to demographic, lifestyle and health data collected about the participants of the long-term health studies.
- The team will also consider the economic harm or benefits for businesses located underneath regular flight paths at selected U.S. airports

Section 189 - Details

- Health Impacts: Investigate relationship between aircraft noise exposure, accounting for other individual and area-level risk factors, and incidents of
 - hypertension in the some cohorts
 - cardiovascular disease in other cohorts
- Investigate whether there is a relationship between annual average aircraft noise exposure and general sleep length and quality in some cohorts.
 - Also evaluate the potential relationship between living under a flight path and measures of disturbed sleep in one cohort
- MIT aims to conduct an assessment of the economic impacts to businesses located underneath regular flight paths at selected U.S. airports

Slide 189 – Schedule*

Milestone	Planned Completion Date
Completion of review of existing studies analyzing the economic impacts of airports in the U.S.	End of August 2020
Preliminary results of analysis of aircraft noise and cardiovascular disease	End of October 2020
Preliminary results of analysis of annual aircraft noise and sleep quality	End of April 2021
Preliminary results of analysis of flight path data and sleep disturbance measures	End of September 2021
Preliminary results of economic impacts study	End of September 2021
Final Report Delivered to FAA	End of February 2022
Report to Congress	End of May 2022 (90 days after delivery of final report to FAA)

* Schedule is based on timely availability of necessary data to complete the analyses and is subject to change

For more information: www.ascent.aero. Navigate to Project 3.

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Efforts Relating to Aircraft Noise

Understanding Noise

- Improving modeling capabilities
- Examining relationship between noise and annoyance, sleep, cardiovascular health and children's learning
- Evaluating current aircraft, helicopters, commercial supersonic aircraft, unmanned aerial systems, and commercial space vehicles

Outreach

- Enhanced community involvement
- Increase public understanding

Reducing noise at the source

- Aircraft technologies and architecture
- Optimized operations and procedures
- Noise standards

Mitigation

- Noise Compatibility Planning (Part 150)
- Noise-based access restrictions (Part 161)



Efforts Relating to Aircraft Emissions

Understanding Emissions

- Particulate Matter (PM) measurements and modeling
- Improving atmospheric impact modeling capabilities
- Evaluating current aircraft, commercial supersonic aircraft, unmanned aerial systems, and commercial space vehicles

Reducing Emissions at the Source

- Aircraft technologies and architecture
- Modifications to fuel composition
- Vehicle operations
- Engine standard (NO_x and PM standards)

Mitigation

- Alternative fuel sources
- Policy measures (CORSA)



Particulate Matter

- Epidemiological studies link long-term exposure to fine Particulate Matter ($PM_{2.5}$) to increased risk of premature mortality

Dockery et al. (1993); Pope et al. (2002); WHO (2008); Pope et al. (2009); USA EPA (2011)

- Particulate Matter consists of particles and liquid droplets
 - Particulate Matter = PM_{10} = diameter $\leq 10 \mu\text{m}$ (could enter lungs)
 - Fine Particulate Matter = $PM_{2.5}$ = diameter $\leq 2.5 \mu\text{m}$ (could enter blood)
 - Ultrafine Particulate Matter = $PM_{0.1}$ = diameter $\leq 0.1 \mu\text{m}$ (could enter systems)

- Particulate Matter from aircraft engines:
 - Soot (a.k.a., non-volatile PM, black carbon)
 - Volatile organic compounds from engine sulfate and nitrates & atmospheric ammonia
 - Aircraft engine PM is sufficiently small to qualify as ultrafine particulate matter

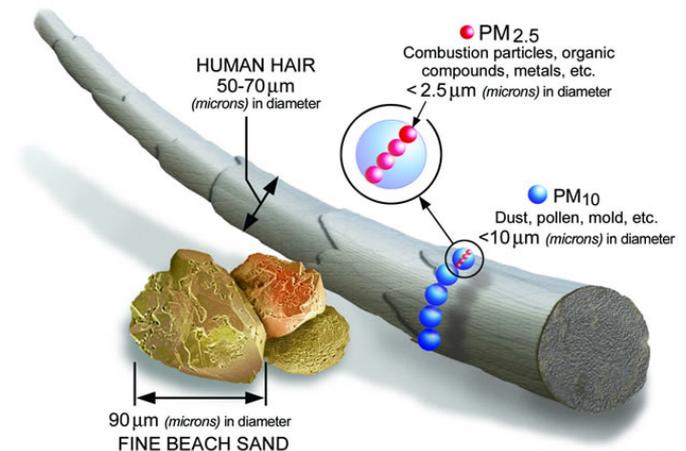


Image courtesy of the U.S. EPA

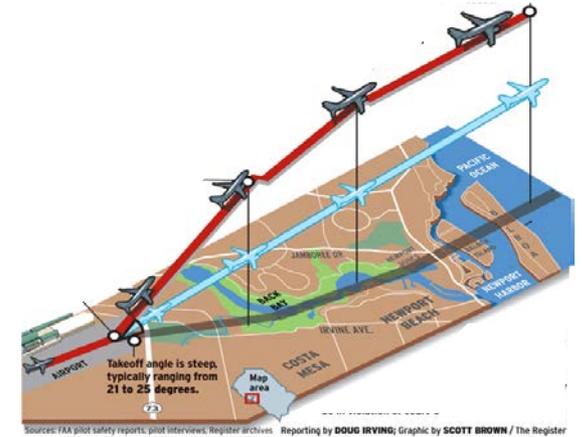
<http://www3.epa.gov/airquality/particlepollution/basic.html>

Aircraft Emissions in Perspective

- Based on analysis of top 66 airports in the U.S., aircraft operations contribute less than 1% of all ambient $PM_{2.5}$ in metropolitan areas.
 - UNC research - Boone, S. S. Penn, J. Levy and S. Arunachalam (2015). Calculation of sensitivity coefficients for individual airport emissions in the continental United States using CMAQ-DDM3D/PM, In Proceedings of the 34th International Technical Meeting on Air Pollution, Montpellier, France, May 2015.
- Aircraft activities contributes to 0.3% of the health impacts of combustion emissions in the U.S.
 - MIT research - Dedoussi and Barrett, "Air pollution and early deaths in the United States. Part II: Attribution of $PM_{2.5}$ exposure to emissions species, time, location and sector," Atmospheric Environment 99 (2014). <http://dx.doi.org/10.1016/j.atmosenv.2014.10.033>
 - MIT research - Yim et al., "Global, regional and local health impacts of civil aviation emissions," Environ. Res. Lett. 10 (2015). doi:10.1088/1748-9326/10/3/034001
- Based on measurements in Seattle area, road traffic produces more PM, relative to aviation, at all sizes down to 20 nm. Aircraft produce more PM, relative to emissions, at sizes from 10 to 20 nm.
 - $PM_{0.1}$ is 100 nm and road traffic PM
 - U. Washington research - Preliminary findings presented by Prof. E. Austin of U.W. to 2019 Aviation Emissions Characterization Roadmap meeting available for download at <https://deohs.washington.edu/mov-mobile-observations-ultrafine-particles-study>

Our Direction

- Utilizing a comprehensive approach to address environmental challenges
- Working with a broad range of stakeholders to understand issues and develop solutions
- Placing more focus on innovation to overcome noise and emissions challenges
- Continue to seek partnerships for our R&D efforts
- Continue to be responsive to priorities outlined in the FAA Reauthorization Act of 2018



ADDITIONAL INFORMATION

WHO Report
Additional Research Initiatives



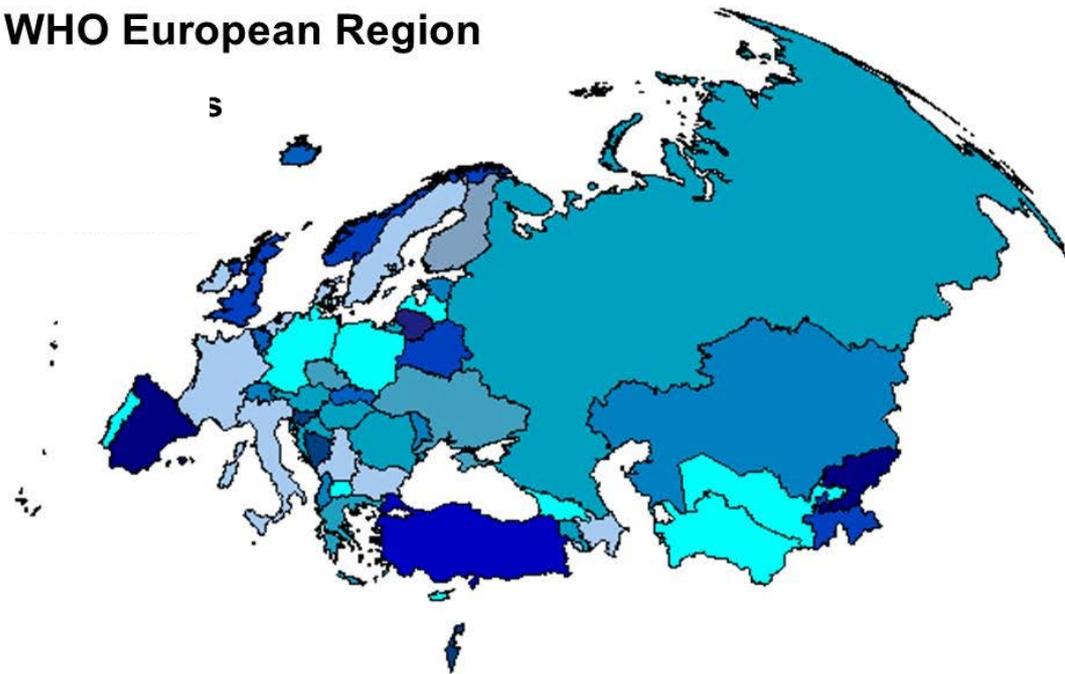
WHO and WHO Europe

- World Health Organization (WHO) is the authority responsible for public health within the United Nations (UN)
- WHO/Europe is one of WHO's six regional offices around the world
- WHO/Europe represents 53 countries from the Atlantic to the Pacific Oceans



World Health
Organization

WHO European Region



Concerns Regarding WHO Report

- Findings are not supported by robust data and analysis
- Findings rely on low quality evidence (defined within the document)
- No meaningful coordination with the International Civil Aviation Organization, the UN arm for international aviation, prior to publication
- Does not reflect technical consensus due to lack of coordination
- FAA does not support the recommendations in the report since they are not based on robust data and analysis
- Further research is needed

Further Research

- FAA does support further research to identify whether aircraft noise exposure can definitively correlated with specific health outcomes
- FAA is currently conducting research on sleep, cardiovascular disease, and annoyance with respect to aviation noise
- In some of these efforts, we are collaborating with WHO researchers

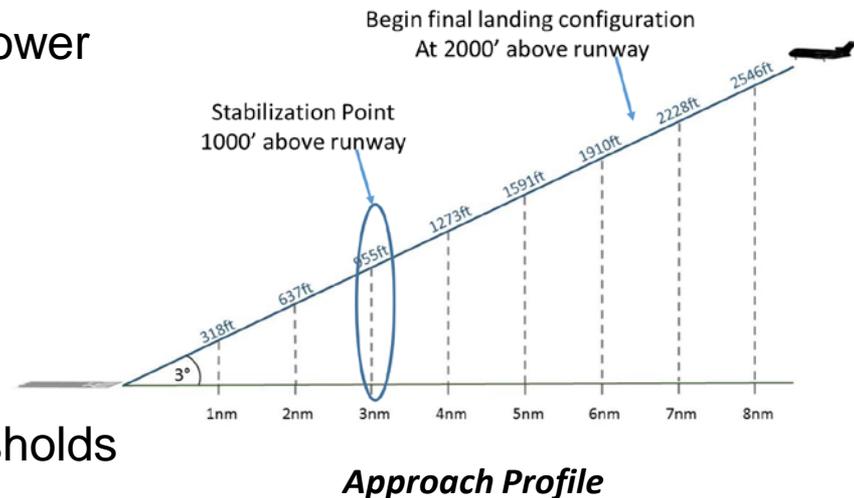
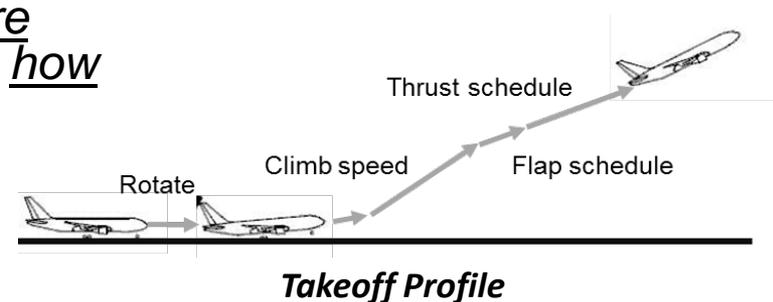
Efforts Relating to Aircraft Operations

Opportunities for noise reduction:

- Airlines determine what aircraft fly and when
- There might be opportunities to change where aircraft fly (through precision navigation) and how aircraft are flown

Concepts being evaluated:

- **Route changes**
- **Thrust / speed management**
 - Noise abatement procedures
 - Manage thrust and configuration to lower noise on takeoff and approach
- **Vertical profile**
 - Continuous climb operations
 - Continuous descent arrival
 - Modified approach angles
 - Staggered or displaced landing thresholds
- **Introduction of systematic dispersion**



Efforts Relating to Jet Fuel

Testing

- Support Certification/Qualification testing to ensure fuels are safe for use
- Improve Certification/Qualification process to reduce the time and resources required to ensure fuels are safe for use

Analysis

- Environmental sustainability to ensure fuels are properly credited under the ICAO Carbon Offsetting and Reduction Scheme (CORSA)
- Techno-economic analysis to understand how to reduce costs
- Future scenarios

Coordination

- Interagency
- Public-Private
- State & Regional
- International



Efforts Relating to Aircraft Technology

Continuous Lower Energy, Emissions & Noise (CLEEN)

- FAA led public-private partnership with 100% cost share from industry
- Reducing fuel burn, emissions and noise via aircraft and engine technologies and alternative jet fuels
- Conducting ground and/or flight test demonstrations to accelerate maturation of certifiable aircraft and engine technologies

	Phase I	Phase II	Phase III*
Time Frame	2010-2015	2016-2020	2021-2025
FAA Budget	~\$125M	~\$100M	TBD
Noise Reduction Goal	25 dB cumulative noise reduction cumulative to Stage 5 <i>and/or reduces community noise exposure (new goal for Phase III)</i>		
Fuel Burn Goal	33% reduction	40% reduction	-20% re: CAEP/10 Std.
NO _x Emissions Reduction Goal	60% landing/take-off NO _x emissions	75% landing/take-off NO _x emissions (-70% re: CAEP/8)	
Particulate Matter Reduction Goal			Reduction relative to CAEP/11 Std
Entry into Service	2018	2026	2031

*The information for the third phase of the CLEEN Program is notional as the FAA is in the process of developing the final solicitation.



For more information on CLEEN program: <http://www.faa.gov/go/cleem>

CLEEN III Industry Day: <https://faaco.faa.gov/index.cfm/announcement/view/32134>

CLEEN III Solicitation: <https://faaco.faa.gov/index.cfm/announcement/view/31885>

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