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Air and Radiation Docket Information Center
Environmental Protection Agency
Mailcode: 2822T
1200 Pennsylvania Ave., NW
Washington, DC 20460
Attention Docket ID No. EPA-HQ-OAR-2008-0318

Re: Docket No. EPA-HQ-OAR-2008-0318 Regulating Greenhouse Gas Emissions under the Clean Air Act; Advanced Notice of Proposed Rulemaking

The Aircraft Owners and Pilots Association (AOPA) is a not-for-profit individual membership organization of more than 414,000 pilots. AOPA's mission is to effectively serve the interests of its members as aircraft owners and pilots to establish, maintain, and articulate positions of leadership to promote the economy, safety, utility, and popularity of flight in general aviation aircraft. Representing two thirds of all pilots in the United States, AOPA is the largest civil aviation organization in the world.

On Wednesday, July 30, 2008 the Environmental Protection Agency (EPA) issued an advanced notice of proposed rulemaking (ANPR) titled "Regulating Greenhouse Gas Emissions under the Clean Air Act." This notice seeks ways to regulate greenhouse gas (GHG) emissions from many sources, including aircraft, under the Clean Air Act (CAA).

These comments are designed to:

- Provide data that explains the impact of general aviation in comparison with other forms of transportation.
- Increase understanding of the cost sensitivities of general aviation.
- Emphasize to the EPA that safety must be maintained in any policy change proposal.
- General aviation is already taking steps to increase efficiency and reduce GHG.

General aviation (GA) is estimated to contribute less than one percent of all GHG emissions. Piston powered GA aircraft contribute an even smaller amount; slightly more than one-tenth of one percent *(0.13 percent)* of total GHG emissions and recent technological advancements are decreasing emissions even further. Any EPA requirement that would result in the installation of pollution controls on the cost-sensitive GA community or require a change in how GA aircraft are operated should be carefully considered. Aviation contributions pale in comparison to other GHG emissions sources. There are larger volumes of GHG emitters including those already regulated and those that are unregulated. Total emission, cost burden and aviation safety should be considered by the EPA before initiating a rulemaking.

General Aviation Important Part of U.S. Aviation System
The 600,000 plus pilots flying in the United States experience firsthand the safest and most efficient air transportation system in the world. GA aircraft are an integral part of the air transportation system that supports communities across the United States and provides communities essential air travel options that allow businesses to operate more effectively and efficiently with access to the over 19,000 landing facilities in the United States.

GA includes both business and personal transportation in aircraft that range from two seat piston-engine propeller aircraft to large business jets (excludes military and airlines flights). GA aircraft are involved in all civilian flight-training operations, medical evacuation and medical transport flights, law enforcement and firefighting operations, wildlife surveying and agricultural operations. Most of the nation's aircraft operate as general aviation aircraft. A typical general aviation aircraft is the Cessna 172, which has four seats, one engine, a 115 mph maneuvering speed and a maximum weight of 2200 pounds. While the Cessna 172 is a typical general aviation aircraft, the fleet varies widely in aircraft size and capacities.

General aviation comprises the majority of total aircraft operations in the U.S. According to the Federal Aviation Administration (FAA):

- General aviation constitutes over fifty percent of the flying done in the U.S. and almost eighty percent of all U.S. departures.
- On average a GA aircraft flies 127 hours annually.
- General aviation transports approximately 166 million passengers annually.

General Aviation's Impact on the Economy
General aviation has a substantial positive impact on the U.S. economy. The direct and indirect effect of general aviation on the national economy exceeds $150 billion annually.[1] Activities related to general aviation account for over 1.3 million U.S. jobs. The annual earnings of these employees are over $53 billion. Economic activity within the general aviation arena includes the purchases of fuel, maintenance services, aircraft and related manufacturing and piloting services. Those employed by the general aviation industry work as pilots, flight instructors, mechanics, line workers and aircraft refuelers, avionics technicians, aircraft salespersons and manufacturers.

GA is Focusing on Fuel Efficiency
The energy conversion process that occurs during engine combustion on jet and piston aircraft is about 99% efficient; therefore, any consideration to reduce GHG emissions from aircraft engines should center on increasing fuel efficiency. New engine and airframe technologies are helping to decrease GA's fuel consumption and emission contributions.

The current use of light weight composite material in airframe construction reduces aircraft weight and increases speed and range over traditional aluminum airframes. A traditional GA four-seat aircraft, such as the Cessna 172 (C172), uses 8.6 gallons of avgas an hour and cruises at

[1] Allen, W. Bruce, PhD. Blond, David L., PhD. Gellman, Aaron J., PhD. "General Aviation's Contribution to the U.S. Economy" May 2006. Feb. 25 2008 <http://www.gama.aero/PUBLIC/GAcontribution.pdf>

140 mph. A similar sized light weight composite aircraft with the same engine, such as the Diamond 40 (DA40), is lighter, has a cruise speed that is 20 percent faster than the C172. If these two aircraft went on a 45 mile flight the DA40 with its composite construction would use 11 percent less fuel than the aluminum C172.

Engine technologies that improve efficiency are slow to emerge due to the stringent FAA certification requirements that are in place to enhance safety. However, new engine technologies promise further increases in fuel efficiency and decreases in GHG emissions. Advancements such as the Full Authority Digital Engine Control (FADEC) offer increased fuel efficiency by automating the fuel delivery. These systems can increase fuel efficiency by 15 percent or more in new aircraft, and therefore decrease $C0_2$ emissions.

Changes in the GA fleet mix are also resulting in a more efficient fleet. Light sport aircraft (LSAs) are providing a replacement option for some small GA aircraft. LSAs are very light, weighing 1,320 pounds or less, and burn on average five gallons of avgas an hour. LSAs offer a replacement vehicle for older two seat GA aircraft, such as the Cessna 152. To continue with this example, most LSAs are 20 percent more fuel efficient than a Cessna 152. Additionally, single engine jets will provide similar performance and be more fuel efficient than some small twin turbo prop powered GA aircraft. This transition could further improve GA's already low GHG emissions contribution.

The FAA's Next Generation Air Transportation System (NextGen) promises further emission reductions by increasing the efficiency of the air traffic system and allowing more direct routing for aircraft. The cost-sensitive GA industry will have to bear an estimated $2 billion in cost to transition to this system. The recent spike in aviation fuel prices provides a good example of how cost-sensitive the industry is. Flight hours dropped almost nine percent after a twenty-five percent increase in fuel prices from August 2007 to June 2008. Any EPA regulation that results in a direct cost to GA will have a similar negative effect on the industry.

General Aviation Emissions Contributions Imperceptible Through 2050

The results of emissions inventories conducted on a national level by U.S. federal agencies such as the EPA, government appointed research groups such as the Transportation Research Board (TRB) and industry level organizations such as the General Aviation Manufacturer's Association (GAMA), shows that GA's contribution to GHG emissions relative to commercial aviation and other non-road sources is exceedingly minor. Moreover, analysis of statistics directly derived from the Department of Transportation's (DOT) Bureau of Transportation Statistics (BTS) and FAA shows that GA is negligible in the overall fuel consumption from the transportation sector. Data garnered from the Intergovernmental Panel on Climate Change (IPCC) supports these findings on a global scale, showing that GA contributes almost imperceptibly to long-range 2050 forecasts for global fuel consumption and GHG emissions over a suite of scenarios of varying severity. These results are presented and discussed both individually and comparatively as follows.

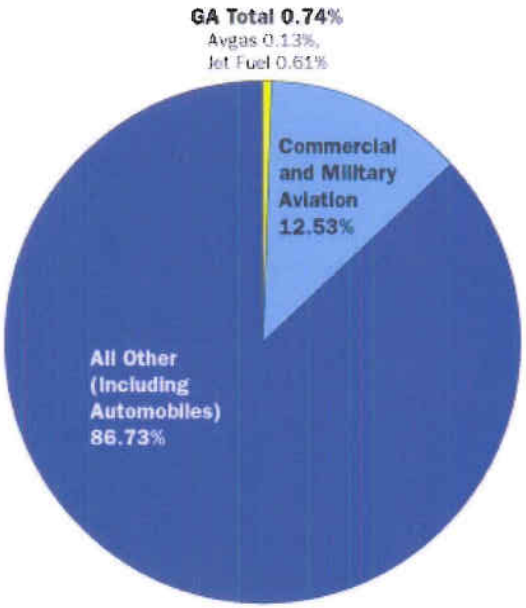
GA Emissions Compared to Aviation and Other Non-road Sources

CO_2, the principle GHG, is emitted as a "natural by-product" from the combustion of fossil fuel in

aircraft engines. The carbon stored in the fuel is oxidized, energy is released in the form of heat, and the aircraft is propelled by thrust (in the case of a jet engine) or rotating propellers (in the case of a piston engine.

According to the GHG emissions inventory conducted by the EPA[2] the total amount of CO_2 emitted from the U.S. transportation sector in 2005 was 1874.5 Tg CO_2e[3]. The entire aviation sector, a subset of transportation, contributed 248.7 Tg CO_2e to this total. GA, a further subset of the transportation sector, contributed very little to CO_2 emissions – a total of 13.8 Tg CO_2e [4] in 2005, 11.4 Tg of which resulted from jet-fueled GA aircraft and 2.4 Tg of which was emitted from avgas-fueled GA aircraft. To get a sense of perspective on GA's CO_2 emissions a comparison to other non-road sources is helpful. Locomotive contributions totaled 45.1 Tg CO_2e and marine sources[5] contributed 42.4 Tg of CO_2.

Based on these data GA comprised only 5.54 percent of the aviation sector's contribution to CO_2 emissions in 2005, and *only 0.74 percent of the overall total for the transportation sector*. Of this 0.74 percent, 0.61 percent was from jet fueled GA aircraft operations and *only 0.13 percent was from avgas fuel GA operations*, slightly higher than one tenth of one percent of total CO_2 emissions for the transportation sector. The general aviation industry transports approximately 166 million people annually and contributes less than one percent of the transportation sector's total CO_2 emissions.



EPA's Transportation Sector Greenhouse Gas Inventory for 2005

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[2] *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2006.* United States Environmental Protection Agency USEPA #430-R-08-005. April 2008

[3] Value does not include bunker fuels.

[4] Teragrams of CO_2 Equivalent, the measure by which carbon dioxide is usually reported in greenhouse gas inventories. One teragram equals 1,000,000,000,000 grams, or 1,102,311 tons

[5] Including recreational marine vehicles

A comparison of the aviation sector to other non-road sources in the inventory shows that locomotives contributed 2.4 percent to the total CO_2 emitted in 2005 while marine vessels contributed 2.26 percent to the total. Individually, these other non-road emissions sources emitted three times as much CO_2 in 2005 than GA. This information is summarized in **Table 1** below:

Table 1 – Results of EPA's Transportation Sector Greenhouse Gas Inventory for 2005

Emissions Source	Tg CO_{2e}	% Contribution to Total
On-road Motor Vehicles	1,524.5	81.33
Commercial and Military Aviation	234.9	12.53
Locomotives	45.1	2.4
Marine Vessels	42.4	2.26
General Aviation Jet	11.4	0.61
General Aviation Piston	2.4	0.13
Total Transportation Sector	1,874.5	100

The values reported in the EPA's GHG emissions inventory also show strong agreement with values from 2003 reported by the TRB[6]. According to this study, the transportation sector emitted 1702.5 Tg CO_2e in 2003, of which the aviation sector contributed 169.0 Tg CO_2e. Again, it is shown that GA contributes only a small amount to this total, equaling 9.4 Tg or 5.56 percent of the aviation sector's emissions. Of the overall total CO_2 emissions reported in this inventory, *GA's contribution is only 0.55 percent.*

Another GHG inventory compiled by the TRB also shows GA's negligible impact when compared to other non-road mobile emissions sources. Locomotives added 39.6 Tg CO_2e to the reported total while marine vessels emitted 28 Tg, corresponding to 2.33 percent and 1.64 percent respective contributions. Similar to the results reported by the EPA, these sources in the TRB report emit 3 to 4 times as much CO_2 as GA sources. For ease of comparison, these results are reported in **Table 2** below:

Table 2 – Results of TRB Transportation Sector Greenhouse Gas Inventory Report for 2003

Emissions Source	Tg CO_{2e}	% Contribution to Total
Motor Vehicles	1,462.7	85.91
Commercial Aviation	122.8	7.21
Locomotives	39.6	2.33
Marine Vessels	28.0	1.64
General Aviation (Jet and Piston)	9.4	0.55
Transportation Sector	1,702.5	100

[6] *U.S. Transportation Sector Greenhouse Gas Emissions: Trends, Uncertainties and Methodological Improvements.* 86th Annual Meeting of the Transportation Research Board, November 14, 2006.

Additionally, results from a recent GHG inventory conducted by GAMA suggest that GA has an equally negligible effect on total GHG emissions[7]. In this inventory *turbine-powered* GA aircraft contribute a scant 0.2 percent to GHG emissions in the U.S. annually, and burn approximately 1.6 billion gallons of fuel per year.

International Level Emissions and Fuel Consumption Data

Similar results are attained when evaluating global GHG and fuel consumption forecasts for the world-wide aviation sector. In their 1999 report[8], the IPCC presented aviation sector GHG emissions and fuel consumption forecasts for the year 2050, including five different scenarios of varying severity. It is concluded in this report that, depending on the scenario chosen, GA fuel consumption will comprise 1.14 percent to 3.28 percent of the global total for the aviation sector in 2050. Additionally, emissions forecasts derived from these fuel consumption estimates suggest that GA aircraft will emit between 1.14 percent and 3.30 percent of the global CO_2 for the aviation sector in 2050. An important characteristic to take into account when interpreting these forecasts is that as the forecast scenario worsens, GA's contribution to the aviation sector totals decreases; the lower values in the ranges reported above correspond to the worst-forecast scenarios. This implies that other aviation-related sources amount to *at least* 96 percent of aviations fuel consumption and GHG emissions, not GA. **Table 3** illustrates this relationship.

Table 3 – General Aviation Contributions to the Global Aviation Sector based on 2050 IPCC Aviation Forecast Scenario

Metric	Worst Scenario Contribution (%)	Best Scenario Contribution (%)
Fuel Consumption	1.14	3.28
CO_2	1.14	3.30

Nationally, GA operations contribute 0.55 to 0.74 percent to the CO_2 emissions and 0.19 percent to the total fuel burn of the transportation sector, or less than one percent. When compared solely to the rest of the aviation sector, GA accounts for approximately 5.5 percent of aviation sector CO_2 emissions. It is shown that locomotives contribute between 3 and 4 times as much CO_2 and burn approximately 3 times as much fuel annually. Marine vessels have been shown to emit 3 times as much CO_2 as GA aircraft and burn as much as 6 times the fuel annually.

It is estimated that GA will only contribute between 1 and 3 percent to the world-wide aviation sector's fuel consumption and CO_2 emissions in 2050. As is apparent in the national level data, this contribution to the global totals is likely to be orders of magnitude smaller when accounting for all transportation-related sources. Overall, it is inherently obvious when evaluating the data that GA's impact on the global climate is currently and will continue to be exceedingly small.

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[7] "The Greening of Business Aviation", *Aviation Week* http://www.aviationweek.com/aw/generic/story_generic.jsp?channel=bca&id=news/bca0508p1.xml, June 2, 2008

[8] *Aviation and the Global Atmosphere.* Intergovernmental Panel on Climate Change, prepared in collaboration with the Scientific Assessment Panel to the Montreal Protocol on Substances that Deplete the Ozone Layer. Cambridge University Press, UK, 373 pp., 1999.

Summary
Nationally, all GA operations contribute 0.55 to 0.74 percent to CO_2 emissions, or less than one percent, with recent technologic advancements potentially decreasing this number even further. Any EPA requirement that would result in the installation of pollution controls on the cost-sensitive GA community or require a change in how GA aircraft are operated should be carefully considered.

Any EPA requirement that would result in the installation of pollution controls on GA aircraft or require a change in how GA aircraft are operated would have safety and cost implications that cannot be ignored. Careful consideration will be required because the cost to comply with mandated changes combined with the effects on fuel efficiency would raise questions about the cost verses benefit for a small GHG emitter.

The ultimate authority over aviation in the U.S. is the Federal Aviation Administration. The FAA's in-depth approval process for any change to aircraft is designed to ensure aviation safety and protect the lives of pilots and passengers. Retrofitting the existing GA fleet with pollution control devices would require the approval of the FAA, significant aircraft "down time" and disruption to the industry. EPA should carefully consider any changes to the GA industry given the industry's minimal impact on GHG contributions. Any proposed change should be fully coordinated and considered to ensure aviation safety is not compromised and the industry is not financially burdened.

Sincerely,

Andrew V. Cebula
Executive Vice President
Government Affairs