

## ***Dark Skies?***

Air Pollution and the Private Jet Industry

By Jon Hatcher

The recently publicized international concern over Global Warming has caused much speculation over current vehicle emission standards. However, even before Global Warming was a major political issue, the United States Environmental Protection Agency, or EPA, has been regulating the emissions of land, air, and sea vehicles in order to cut down on the world's air pollution. While the aviation industry in total only contributes about 3.5% of the world's air contaminants<sup>1</sup>, it still needs to continue developing new technology in order to curb air pollution.

The International Air Transport Association's Director and General CEO, Pierre J. Jeannot, has stated that "The environmental challenge which we face as a society is in fact an energy challenge but unfortunately, at this point in time, aviation has no viable alternative. Thus our efforts must be intensified to ensure that our current energy is used more cleanly and efficiently." For the most part, in order to create energy we burn fossil fuels, the by-product of which is air pollution. The world's dependence on fossil fuels is not something that can be halted overnight. New technologies to replace oil and natural gas must be discovered and refined in order for humanity to move forward, but unfortunately, that kind of technology is not right around the corner. Besides researching new methods of creating clean, safe energy, we must work to conserve the world's remaining fossil fuels. This process begins with the development of fuel efficient machines.

Fuel consumption is directly proportional to air pollution. The more fuel an engine consumes the more air pollution it puts out. To reduce the air contaminates that exhaust from a motor, the easiest step to take is increasing the motor's fuel efficiency. Taken directly from the EPA's Office of Compliance Sector Notebook on the Air Transport Industry, "Engine manufacturers are being encouraged or required to research and develop cleaner, quieter, and more fuel efficient aircraft"<sup>2</sup>. While the government mandates certain regulations on current production engines in order to increase efficiency, it should also be the goal of the manufacturer to create a motor with enhanced characteristics to better serve its customers.

Obviously, running a fleet of efficient engines and aircraft is a savvy financial decision for an air travel corporation. A private jet charter company that updates their fleet with newer, more fuel efficient engines would definitely be able to save money through a lower fuel bill and cleaner burning engines. Leasing or purchasing new, reliable aircraft that meet strict emissions requirements while retiring or retrofitting older equipment is an excellent way to increase revenue and decrease operating costs. Unfortunately, with today's economy, a fleet-wide upgrade is probably not something that many company owners are currently considering.

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<sup>1</sup> *Aviation and the Environment*, IATA, 2000

<sup>2</sup> *Profile of the Air Transport Industry*, EPA Document Number 310-R-97-001, 1998

There are other ways to increase fuel efficiency of an aircraft without replacing its engines. One of the most effective means of achieving this is through improved aerodynamics. When designing an aircraft, engineers spend hundreds or maybe thousands of hours designing and testing components and models through software programs and wind tunnel testing. As new discoveries are made, older aircraft can benefit from an upgrade to their existing features.

One of the most fascinating advances was the addition of wingtip “winglets,” a device that reduces the aircraft’s drag by altering the airflow near the wingtip. Winglets increase the wingtip lift and reduce lift-induced drag by caused by vortices at the wingtip, which are low-pressure tubes of spiraling air that cause drag on the end of an aircraft’s wing. Winglets can decrease an aircraft’s take-off distance, enabling the aircraft to land at smaller airports, or allow a plane to fly to a higher cruise altitude, which can further reduce fuel consumption depending on the aircraft. Winglets are a relatively inexpensive improvement to aging aircraft, but most private fleets have already been installed with this upgrade.

Other developments to today’s aircraft will come from technology that does not rely on aerodynamics. Tighter running clearances, improved seals, and more effective cooling methods can bolster an engine’s performance<sup>3</sup>, but these enhancements require new, innovative manufacturing techniques. We are always waiting for technology to catch up with our ideas.

In late 2003, the EPA began a new regulatory process for aircraft emissions to bring US aircraft engine emissions certification standards into alignment with the International Civil Aviation Organization, ICAO, a division of the United Nations. ICAO develops the principles and systems of international air travel and develops air transportation with safe and methodical growth. While the EPA has been regulating the aircraft industry for years, alignment with ICAO’s standards was another step in the right direction. This allowed the US aviation industry to coordinate with international efforts to evaluate aviation’s contribution to global greenhouse gas emissions to determine the best course of action for addressing appropriate limitations and reductions being asked of the industry<sup>4</sup>.

Although aviation only uses about 12% of the oil consumed by the entire transport industry (Light- and Heavy-Duty road vehicles accounting for 75% of transport industry oil usage)<sup>5</sup>, it is still responsible to maintain and update ever-more fuel efficient aircraft. Research from the International Air Transport Association, an international trade group of commercial airlines, shows that fuel efficiency in aircraft has doubled over the last thirty years, and further improvements are expected to reduce emission growth by up to 3% per year.

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<sup>3</sup> *Energy Efficient Engine Flight Propulsion Systems* N70-30189 , United Technologies Corporation, 1979

<sup>4</sup> *Critical Issues in Aviation and the Environment*, Transportation Research Board, Aug 2004

<sup>5</sup> *Aviation and the Environment*, IATA, 2000

The major component of today's air pollution comes from the emission of Carbon Dioxide (CO<sub>2</sub>), Dihydrogen Oxide (H<sub>2</sub>O), and Nitrous Oxide (NO<sub>x</sub>). CO<sub>2</sub> is the most significant by-product of any fossil-fuel burning engine, and the aviation industry produced 514 million tons of it in 1992, which accounted for only 2% of man made CO<sub>2</sub> emissions<sup>6</sup>.

Already, the clean technology of modern motors has almost eliminated Carbon Monoxide and Hydrocarbons from engine exhaust, as well as dark smoke billowing from behind a jet engine's exhaust nozzle. Just as the railroads eliminated the extremely filthy coal-burning engines of the past for cleaner, extremely efficient locomotives, the aviation industry has also started to move towards proficient machinery and technology.

The elongated, narrow smoke clouds trailing behind a lumbering aircraft have long since disappeared, although sometimes people mistake contrails for smoke. A contrail, short for "condensation trail," is nothing more than ice crystals formed by the cooling water vapor pouring from an aircraft's exhaust. As the hot gases cool, it forms water vapor, and if it is cold enough, at elevations usually above 26,000 feet, that water vapor turns into ice crystals, forming contrails that sometimes crisscross our skies.

Contrails may also have a small impact on the Earth's climate. The contrails basically act as clouds, which affect the planet's radiation balance. Like clouds, contrails can help to trap heat in beneath them, causing slight warming to occur on the planet. Studies have shown that night flights are the main cause of this warming effect, as the contrails trap heat beneath them while the sun's energy is not radiating towards the surface. An interesting study was done directly after the events of September 11, 2001, when air traffic was halted in the United States for three days. Studies concluded that without contrails, the air temperature immediately differed by up to one degree Celsius, quite an astonishing change for something as seemingly irrelevant as ice crystals left behind by aircraft. While insignificant, the effects of this phenomenon only add to the consideration of air pollution from the aviation industry.

Some people believe that contrails are a government conspiracy to affect climate change or cover populated areas with mind-altering chemicals. Some of these conspiracy theorists believe that the government sends tankers full of chemicals up into the air to dump it on the population for experimentation or weather control. Whatever the case of these beliefs, contrails are collections of frozen ice crystals, drifting harmlessly above the Earth until they dissipate into the atmosphere. Nevertheless, the other effects of aircraft exhaust gasses still present a danger to the world's climate.

CO<sub>2</sub> emitted by an engine builds up in the atmosphere and creates the greenhouse effect, which in turn causes Global Warming and climate change. While we have already stated that engine efficiency is the trend we are currently pursuing while the technology to eliminate fossil fuel usage develops, there are some other areas where a private jet company can make a difference in its emissions.

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<sup>6</sup> *Aviation and the Environment*, IATA, 2000

The EPA's *Profile of the Air Transportation Industry* outlines a few operations dealing with environmental impacts within an aviation company that may be overlooked. While the aircraft engine emissions themselves are the biggest factor in the discussion on the private jet industry and air pollution, these processes can create quite an impact on the company's individual carbon footprint. The document states, "Some companies have creatively implemented pollution prevention techniques that improve efficiency and increase profits while at the same time minimize environmental impacts. Airlines and airports are reducing material inputs, re-engineering processes to reuse by-products, improving management practices, and employing substitution of toxic chemicals"<sup>7</sup>.

The document also summarizes a few maintenance and refurbishing procedures with potential environmental impacts and a few ideas on how to solve or diminish these impacts. These points include lubrication and fluid changes, battery repair and replacement, parts cleaning, metal finishing, and painting or depainting. These common maintenance procedures are usually overlooked in a company's emissions details but can have a massive impact on the pollution output of an individual business.

Let's take parts cleaning as an example. Chemical solvents and cleaners have the most significant impact on the environment, both through the air pollution from aerosols and possible ground pollution from spills or irresponsible use or disposal. Many aircraft maintenance facilities have substituted solvent-based cleaners with water-based cleaning materials. Now, many components are cleaned with soap and water.

The document goes on to list parts cleaning methods and ideas for keeping pollution from the process to a minimum. This includes switching to non-hazardous substances, keeping lids closed when not in use so that vapors do not escape, reusing and recycling chemicals, proper disposal of chemicals, and using good housekeeping techniques such as labeling chemicals to prevent misuse and creating leak control and containment areas where the chemicals are used and stored.

Ground personnel can be trained in new procedures and equipment can be updated for efficiency as well. Aircraft idling times can be reduced by better airport management, better systems, and newer Air Traffic Control procedures. Modifications to landing and take-off phases and cruise altitudes can also be adjusted for further emissions reductions. The private jet companies and the airport managers must work in conjunction in order for these changes to take place.

The EPA's document goes on to suggest that one of the biggest contributing factors to the regulation of air pollution is the Clean Air Act. The Clean Air Act and its amendments are designed to "protect and enhance the nation's air resources so as to promote the public health and welfare and the productive capacity of the population." Among many, many other things, it outlines air quality standards, emissions standards, and the reduction of the formation of acid rain by creating less Sulphur Dioxide and Nitrogen Oxide.

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<sup>7</sup> *Profile of the Air Transport Industry*, EPA Document Number 310-R-97-001, 1998

The Clean Air Act created a larger demand for efficiency because it was government mandated. Thankfully, manufacturers are realizing their impact on the Earth and are starting to create more efficient motors without provocation or mandates from the government. Also, the manufacturers now understand the need for new technology that does not require large quantities of fossil fuels to produce energy and many support the initiatives to find other sources of alternative power.

Fuel efficiency has come a long way since the invention of the engine. A study by the Boeing Company states that “since 1976, the introduction of more fuel efficient aircraft has reduced fuel consumption per passenger mile by approximately 50%”<sup>8</sup>. This number continues to grow every year. We have recognized the need for change and we are researching and developing ways to reach our goals.

In the mean time, we have cut back on our fossil fuel use. Private jet companies are optimizing and developing new operating practices in conjunction with Air Traffic Controllers and Airport management, introducing and implementing new technologies as they become available, and reducing consumption of natural resources. Upgrading to lighter, less demanding aircraft reduces costs and increases fuel efficiency and profits. Large corporations with giant company jets are downsizing for smaller, more cost-effective private aircraft. The industry is working towards a cleaner tomorrow.

Eventually, we will be able to do without fossil fuels but until then, we just have to make sure we can use motors as efficiently as possible. Improvements get better every day, and we are much closer to that goal than ever before. Maybe the skies aren't so dark after all.

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<sup>8</sup> *Airline Fuel Consumption*, The Boeing Company, 1997