

Green Aero Engines

With the expansion of both civil and military aviation, environmental aspects and fuel savings are becoming increasingly important which lead to the Green Transport initiative. Green Transport system aims to provide society with a transport system that leaves a smaller physical carbon footprint, uses less energy and produces less CO₂ and other harmful pollutants. Global aviation contributes 2% of global CO₂ emissions [1] apart from other sources and the greenhouse gases emitted from the engine are shown in Fig 1. Emissions with local air quality impacts (NO_x, UHC, CO, smoke and SO_x) are regulated by the International Civil Aviation Organization (ICAO), a United Nations body.

Careful planning and design are key elements in achieving Green Transport by increasing energy efficiency through operational improvements and reducing harmful pollutants. New engine development is the most important as by changing the design both noise and emissions can be reduced.

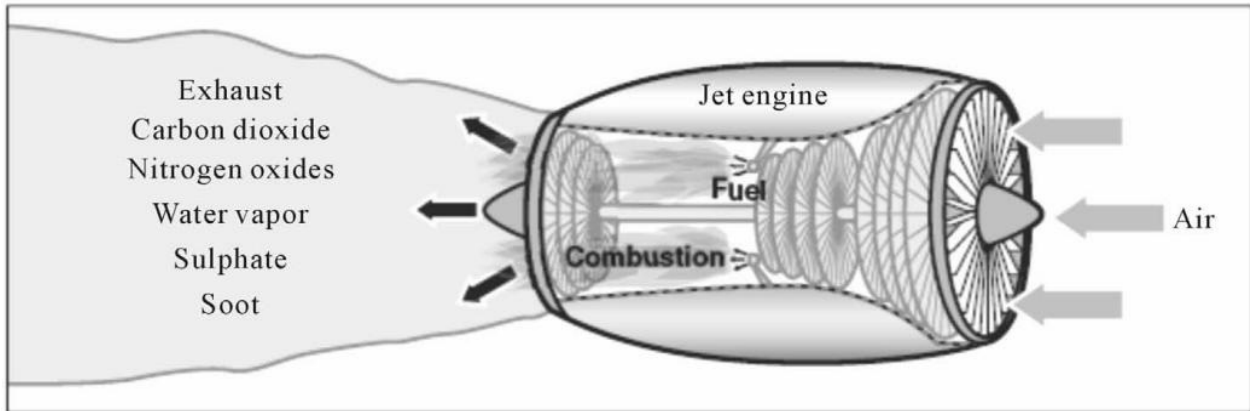
Various organizations are working to reduce the environmental impact of aviation. The main goals of all these organizations are to achieve technological capabilities to reduce noise, emissions, fuel consumption and increased mobility through a faster means of transportation. These led to some new ideas to introduce alternative fuel, advanced aero engine design, all electric engines, materials, changing the aircraft design etc. Some of the alternate fuels like hydrogen, alcohols etc require both the fuel system and the aircraft design to be modified Haglind and Hasselrot [2] and [3]. The advantages of the alternate fuels and design changes are discussed in [3]. The other is in the combustion process Fig 1, air and fuel are mixed, ignited, and burnt to release heat. An ideal combustion process generates CO₂ and water (H₂O) in proportion to the amount of fuel burnt in the engine. Meeting customer demand for reduced fuel burn is already a key driver for the industry, and could outpace legislation. Achieving high combustion efficiencies (ie. fully extracting the energy from the fuel), is conditioned by achieving high gaseous residence time in the combustor.

NASA is leading the green aerospace charge among American aircraft manufacturers. It may be new engine which can use alternate fuels like liquid hydrogen or alcohols efficiently. Already various concepts have been raised about this topic like open rotor engine, ultra high by pass ratio and turbofan engine. Some companies have already developed few engines like PW1500G by Pratt and Whitney, ADVENT by U.S. Air Force, and E3E by Rolls Royce [1].

References

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3. http://www.icas.org/media/pdf/ICAS%20Congress%20General%20Lectures/2010/ICAS-2010-0.2_BARBAUX.pdf.



Source: GAO.

Fig.1 Selected Greenhouse Gases and other Emissions from Aircraft at Cruising Altitude