

## The New Age of Plane Engines

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### History of Plane Engines

- Jet engines are one of the most transformative technologies of the last century accelerating the pace of transportation beyond anything previous.
- Aeronautical engineers have been fortunate in that airplanes were recognized as essential war machines with Two world wars, numerous "regional conflicts," and a 50-year Cold War, gave aerospace development several major boosts.
- According to Hannifin the Wright brothers plane engine was a, "12-hp, four-cylinder engine that weighed 170 lbs., including the radiator, water and fuel tanks, and 1.5 gallon of gas. It had no throttle. The four-stroke engine always ran at about 1,000 rpm."
- The General Electric I-16, also known as the J-31, was the first jet engine produced in quantity in the U.S.
- The Newest engine is the GE9x which is the largest production engine to ever be made and is designed to be used on new Boeing 777s and other large aircraft.

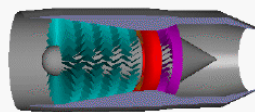
### Different types of Engines

- The turbojet consists of a compressor stage in which air is squeezed together and made denser, before being rammed into the combustor stage. Once there, the dense air is combined with fuel and ignited. This combustion creates the force that spins the turbine at the rear of the core.
- The turbofan engine comes in either a low bypass or high bypass models used to have extra air go around the engine and combine with the heated exhaust upon exiting the engine.
- Afterburners are fitted downstream of the engine core and reheat the exhaust gases by dumping fuel into the exhaust stream. This consumes fuel very quickly, which is why afterburners are usually found on aircraft capable of supersonic flight.

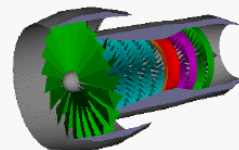


### Types of Gas Turbines

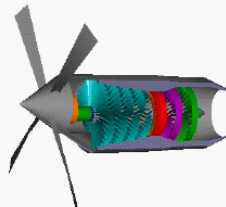
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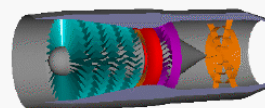
Turbojet



Turbofan



Turboprop



Afterburning Turbojet

## Emissions

- Aircraft emit gases and particles which alter the atmospheric concentration of greenhouse gases, trigger the formation of condensation trails and may increase cirrus cloudiness, all of which contribute to climate change; and
- Aircraft are estimated to contribute about 3.5% of the total radiative forcing by all human activities and that this percentage, which excludes the effects of possible changes in cirrus clouds, is projected to grow.
- Total CO<sub>2</sub> aviation emissions is approximately 2 % of the Global Greenhouse Emissions
- Little is understood about what the exhaust does to the chemistry of ozone and gases in the higher altitude that planes fly at.
- NO<sub>x</sub> and SO<sub>2</sub> are the main contributors from aircraft exhaust

## Future

- In the past, hydrogen was the fuel commonly used on ram and scramjets. And it is still being considered as an aviation fuel. But most engineers believe it will have to be in the form of cryogenic slurry to give it the power density needed.
- The new GE9x is the most efficient engine working at a 30% margin to the Committee on Aviation Environmental Protections standard.
- NASA and DLR have been researching whether using such a biofuel is more eco-friendly. Initial results from previous studies have already shown that between 50 and 70 percent less soot particles form with a 50 percent biofuel mixture with 50 percent normal kerosene.

## Sources:

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